# OECD/CERI ICT PROGRAMME

# ICT and the Quality of Learning



A Case Study of ICT and School Improvement at a Grammar School
in Bavaria, Germany

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# 1. Introduction

The following study was carried out within the framework of the OECD/CERI qualitative research project *ICT and the Quality* o*f Learning.* The objects of the study were a pilot school and four case study schools. The report presented here describes the second school investigated as a case study in the period from 6 November to 19 November 2000. The Grammar School is situated in Bavaria; however for reasons of data protection, the name and location of the school cannot be given.

The data was compiled from interviews held with the school management, teachers, students and parents; from observations made during lessons, the evaluation of a questionnaire filled in by teachers and from a collection of school documents. This information forms the basis of the report. The instruments of the survey, hypotheses and the structure of the investigation were implemented according to the OECD/CERI draft.

The aim of the study was to clarify a variety of ways in which information and communication technology is related to school innovations and school improvements. In addition, explanations were to be found to establish under what conditions ICT[1] functions as a catalyst. Critical variables were to be detected which would lead to a successful introduction of school innovations and an effective implementation of the new technology. Any undesirable effects of ICT on the daily course of school life and learning were to be determined.

# 2. Overview

### Brief description of the school and aspects of ICT use and school innovation

The case study school, the O. Grammar School is a state-controlled school in a community in the suburbs of a large city. It is located in the Free State of Bavaria in the South of Germany. The area is characterised by companies working in the technical and scientific sector and has a high level academics (70%) which accounts for the social catchment area of the school consisting of a high percentage of children from families where the parents are academics and highly salaried, working in the nearby companies. There is an above-average number of engineers. The parents  high interest in the school life of their children is accompanied by great expectations.

The co-educational Grammar School was founded at the end of the Sixties and today has 1082 students in 33 grades. The teaching staff consists of 91 persons, male and female. The average age lies between 50 and 55. The Grammar School teaches Grades 5  13, comprising lower, middle and upper levels. Grade 13 ends with students sitting their final school leaving examination  the *Abitur*  which qualifies them for university entrance. Classes are divided up into the Lower School (classes 5 and 6), the Middle School (classes 7-10) and Upper School (classes 11-13). Normal teaching hours are from 8.00 a.m. to 1.00 p. m, whereby Upper School has lessons up to until 5.00 p.m. at the latest. There are numerous out-of-school activities available to all students in the afternoons on a voluntary basis. The number of foreign students at the school is low. There were no indications of social problems at the school.

*Figure 1: School building Figure 2: Main entrance*

This international study focussed on investigating a major innovation which affects the whole school and the influence made by ICT. In the O Grammar School such striking innovations on the pedagogic side include the establishment of methods and team training and a drugs prevention programme (called *ALF*[2]) in the Lower School which involved setting up teacher teams for this sector. In the ICT sector, recent innovations included a comprehensive media and sponsoring concept with *goWEB*, the setting up of an intranet system and the embodiment of a media curriculum for the whole of the Lower and Middle School, with pedagogic and technical innovations being afforded the same importance. Furthermore, the school has experience with a long-term school development programme which is continually being re-started, actively supported and purposefully implemented by parents. According to the results of several opinion polls directed at the parents, teachers and students, all are very satisfied with the school and emphasise the pleasant environment there.

### Larger context of the educational system and national policies for ICT

In recent years, national and regional sponsoring initiatives undertook a series of endeavours to equip schools with ICT and to link them with the networks (cf. Appendix C). This resulted in practically all Bavarian grammar schools installing at least one ICT room and an internet connection. The Grammar School was able to make profitable use of some of these programmes.

## 3. The past

# *3.1 School history and school innovations*

The Grammar School was founded at the end of the Sixties on the initiative of a sponsoring association. The current Headmaster joined the school in 1991. Since 1992, there have been a series of teacher initiatives concerned with implementing new social demands. In addition to the working group *Schule 2000*, which was concerned with inter-subject teaching and *Corporate Identity* (CI), which was devoted to issues concerning profiling, internal and external communication and the use of ICT under the leadership of the art teacher at that time, the working group *Schule gestalten (School organisation)* used the money available between 1993/94  1996 mainly for comprehensive further training of teachers in the subject of *Action-oriented student-activating teaching methods*. At the end of the school trial, a group of 12-14 teachers continued to work together in joint further education and supervisions.

In 1997, contact was established with a university professor of psychology who, together with his team, drew up and evaluated a questionnaire for parents of students at the school on the subject of *Satisfaction with the O Grammar School*. It had two aims   to adapt the school according to parents  needs and to collect ideas from the parents. The results of the questionnaire were discussed by the Parents  Council, the Staff-Students Council, the teachers from the working groups in the school trials and the advisory team. Consideration was given to fields of action to be dealt with on the basis of the results of the questionnaire. Eventually, the considerations resulted in approximately eight mixed working groups

comprising students, parents and teachers. They worked out their plans in 1997/8 and in 1998 invited parents, students and teachers to a *think tank* in the school assembly hall where they presented their ideas, making the concerns of each individual group public, convincing the audience of their ideas and gaining new members to relieve from time to time those who had hitherto been active.

Finally, eight fields of action were defined in which working groups comprising students, parents and teachers worked in the following year (1998/99). They concerned themselves with subjects such as *Innovative forms of teaching* and *Social competence as a pedagogic target* with reference to the Lower school (cf. *ALF*, methods training, introductory days and class contract, team hours, teacher teams), with the establishment of a culture of productive, self-responsible method of dealing with conflict situations by means of an *Arbitration programme* designed by students for students and with the planning of *School-internal further teacher training.* Furthermore, there was one working group which went under the name of *goWEB* (go = Grammar School O.) and accelerated the intensification of learning and working with *ICT* in daily lessons.

The variety of activities led to an improvement in the school environment but also to an increased workload for particularly those teachers in charge. In order to continue the process effectively and to accompany the development of individual work fields, the school succeeded in gaining the sponsorship of a management consulting company who met with a control group consisting of one member of each of the eight working groups and assisted in the structuring of further work during 1999/2000.This is seen as a major factor for the progress made in the school. There was special focus on embodying the innovations among the whole of the teaching staff. Therefore several conferences were held in which individual fields of activity were discussed, amended and their acceptance by staff vote was documented. In the meantime, evaluations of activity sectors were carried out. In July 2000, the most recent vote taken in the Teachers Council clearly approved of further continuation of the project. In the meantime, neither students nor parents are working in the working groups, with the exception of the *goWEB* group.

## 3.2 History of ICT use

Computers first were introduced to the O Grammar School as early on as 1974/75 and from 1982 Commodore computers were being used in optional subjects. Projects took place particularly in art education which led in 1885 to an internet linkup on one stand-alone computer via the ICT Centre at the university and finally to promotion through the initiative *Schulen ans Netz (cf. Appendix C).* The sponsoring allowed all computers in the ICT room to be linked up to the Internet and new hardware was purchased. In 1997/98 three persons  an interested father, the former arts teacher and the current Technical Administrator contacted a technology company which sponsored schools with hardware and further training for teachers. This was followed by the establishment of the *goWEB Group* in 1998, comprising two students, five parents and five teachers who in the following year recruited further supporters outside of the school for their aim to establish ICT learning at the school. The whole group was finally formed into a committee consisting of representatives from various national and local enterprises, an administration union, the sponsoring association, the local evening School and the project leader in the person of the former arts teacher. The committee is an informal amalgamation formed for the purpose of providing advice on the contents of the project and, when necessary, on appropriating financial aid in compliance with the targets of the initiated projects. In the autumn, the school was included in the *Netzwerk Mediendienschulen* of *Bertelsmann-Stiftung* (cf. Appendix C), who in autumn 1999 selected the best 12 schools in Germany working with ICT. Since then these schools have been sponsored and accompanied in their projects. The twelve schools are in constant contact with one another and work together in meetings at six-monthly intervals to develop concepts for ICT application.

One project initiated by the *goWEB Group* is the *InGO*, which stands for *Intranet Grammar School O* aimed at implementing a freely accessible Intranet Café for the students which was to be a place of communication, learning and play. The contents of the Intranet concept were developed by students, teachers and some of the parents in a workshop in March 1999. The setting up of the network and the development of a database was implemented with the help of professionals from outside and carried out by 12 persons made up of students, teachers and, in some parts, parents whereby teachers as well as students took part in the qualifying workshops. The Intranet Café was finally opened in April 2000 and since then the activities have been assessed in an internal evaluation.

*Figure 3: Opening of the Intranet Café*

The working group *goWEB* gave rise to a further development of a *Curriculum for media and methods,* which aimed at embedding basic training in information technology, media education and methodology into several subjects in Lower and Middle School according to a determined syllabus, so that a compulsory fixed basic knowledge would be available in the Upper School. The curriculum for media and methodology was first used in the school in the 2000/2001 school year. In July 2001, it is planned to hold a pedagogic meeting of the Teachers  Council to present the final version of the curriculum, including the evaluation of the test phase, to the teaching staff.

## 4. The present

# *4.1 Organisation of Evidence*

## 4.1.1 Diffusion Patterns

Originally, the innovations came from a small group of teachers including an arts teacher who took on a prominent role. It gradually spread to other, younger teachers who, in some cases, took over from the initiators. After initial resistance in the pedagogic sector and passive reservation towards ICT, the innovations increasingly found their way throughout the whole staff. Obviously, teachers are much more willing to become engaged in something when they are prepared to admit their failings and are willing to learn.

**Initiators and the principle responsible persons**

Everyone agreed unanimously that the former arts teacher was responsible for the innovative impulses at the O Grammar School. Since the beginning of this school year, he has however no longer been at the school as he has been delegated to the Ministry of Education for one year. The Headmaster said that when he took up his post at the Grammar School that the arts teacher  *had been the leading personality in the school* . The arts teacher with a doctor s degree had arranged for the installation of several of the first Atari computers in the school at the beginning of the Nineties and had started on the project *Art and Computer* financially supported by the sponsoring association. While the arts teacher was accelerating the progress of the arts side of things, a mathematics/ physics teacher, who still functions as Technical Administrator today, took over the technical side, helped by a few interested students. The arts teacher first worked out the *Corporate Identity* project at the school, thus taking an important step towards school development. Together with two women language teachers responsible for the school trial *School organisation* the Technical Administrator and one other teacher, who in the meantime left the school, too, they formed a kind of basic unit which introduced further initiatives into the school. This development was assisted by an outside management consulting company and by interested parents, who helped with contents and practical work, particularly in the *goWEB* group.

In the meantime there are signs of change among the areas of responsibility as those who were once responsible are now giving up areas of competence. As the former arts teacher is currently absent, responsibility is being shared among new, mostly younger, teachers. One woman teacher reported,  *Last year, everything was in the hands of Mr. X [the arts teacher],*

*now, suddenly, everything has been passed on to us* . This year s art project will be under the leadership of a young trainee teacher who is only at the school for this year. A young teacher for mathematics, physics and computer science, who has only been teaching at the school for not quite a year, was specially requested by the Headmaster for the project *Curriculum for methodology and media.* He is currently working on a concept for it together with the former arts teacher and a woman teacher from the *InGo.*

The responsible mathematics teacher has deliberately given up a part of the administration as he is not involved in any way with the contents or technical side of the set up of the intranet project *InGo* so that it can develop in complete independence of his teaching and administration networks. This is not only for time reasons, as he explains:

*I think if I were to involve myself, my colleagues would most likely be put off. They would be saying that s the man who already knows everything and then others would not trust themselves to take part. That s why I am keeping out of it for the time being, for good reasons. I would like other people to take part, to get acquainted with the material.* (Technical Administrator)

A woman teacher of English and History has now taken over the responsibility for the project together with a group of approximately 15 students from grades 7 to 11. The young teacher had to work her way into the whole of the subject matter and admits that she learned a great deal firstly from the students and then in companies at various training sessions. However, she looked upon the whole task as a challenge and was glad of the opportunity to tackle the new technology

## Characteristics of early and late adapters

There would appear to be a connection between the willingness to accept ICT and the age of the teacher. Older teachers have less motivation to work their way into the new technology. They see it as being either too complicated or their long years of experience suggest there is no need for changes. However, at the Grammar School apparently more and more older teachers are beginning to take a closer look at the matter. One woman teacher thought: *It s not just a matter for young teachers, it s a matter for committed teachers* . Those who do involve themselves with the subject of ICT and other innovations have common characteristics e.g. receptiveness and openness towards innovations, the willingness to learn, the courage to admit failings, self-criticism and an above-average commitment.

Another important factor would appear to be the willingness to dissolve conventional student-teacher relationships. It was also observed at the school that the male teachers and those teaching scientific subjects had stronger tendencies to tackle the technical and conceptual aspects of ICT. The Technical Administrator who is currently responsible for the media curriculum and three of the six teachers involved with *goWEB* are mathematics and physics teachers. Five of the six *goWEB* teachers and all the other principle responsible persons in the ICT sector of the school are male. The only exceptions are the former arts teacher relating to his subject and the woman InGO teacher in both regards. However, no connections could be made in this respect to the utilisation of ICT in lessons.

## Diffusion Pattern

Regarding ICT diffusion in the school, those questioned estimated that of 90 teachers approximately 20 are very active, 20 30 are slowly working their way into the subject matter and about half of the teachers still harbour reservations towards ICT. A small group of about 10 teachers openly or secretly resist the innovation. However, ever-increasing pressure from students, parents and society to use ICT in the preparation of lessons and in lessons themselves give reason to believe that sooner or later, this group , too, will adapt themselves to it. More and more teachers are occupying themselves with the matter, exchanging ideas and discussing problems with each other so that the whole issue is slowly becoming a true part of school life. The Headmaster and other responsible teachers try to *motivate, advise, support, contribute ideas, remove fears* of teachers by setting good examples or holding numerous discussions. The official implementation of projects such as the media curriculum continues to force teachers to concern themselves with the subject as it is the same as a school internal implementation of a syllabus.

For many responsible teachers in pedagogic and technical innovations, their commitment is connected in the end with professional or financial advantages. Such teachers have the opportunity to take over functions thus acquiring a claim to promotion or higher income. The headmaster, too, can honour above-average commitment with early promotion, one-off performance payments or by giving a reduction in teaching hours. Such incentives lead to increased commitment particularly among young teachers but simultaneously to jealousy and mistrust from those teachers who are less involved:

*That is a factor which must not be ignored. New projects offer young colleagues the opportunity to put themselves in a favourable light and to climb up the career ladder more quickly (...) That is not something to keep quiet about. On the other hand, we should say what the deeper motivations are (teacher).*

The pedagogic innovations have, in the meantime, been widely received by colleagues in Grades 5 and 6. Following a decision in the previous school year, agreement for all project areas lay between 70 90% in individual subjects. This is already a great step forwards towards complete implementation of the innovations in the school.

**Resistance**

The Technical Administrator reported that there was no mentionable resistance against the implementation of ICT at the school not even when money from other subject areas was channelled off into the establishment of a ICT room. On the contrary, most teachers observed the activities with scepticism from a distance, preferring to wait passively in the wings. The only point which met with resistance from most teachers was the immense amount of time which was spent on further training and preparation for ICT.

For a long time, the two women colleagues in the pedagogic innovative group suffered under the opposition of other colleagues. Just a few years ago, they had seen their new way of working the object of hostility, insinuations and obstructions. It is assumed that at that time jealousy and the fear of competition played a role as the Headmaster always supported the activities in an extremely positive and unconditional manner, even during the difficult phase. This and the support given by the project group helped the two women teachers to overcome this period. Toady, opposition has disappeared and the innovations are endorsed from all sides. One woman teacher explained:

*If someone brings in a new idea, it simply makes people afraid (...) If someone makes any sort of changes, the first interpretation is profile neurosis. This colleague wants to put himself/herself in a good light, he/she wants to take over a functional position, or is terribly ambitious (...) It makes people feel anxious, you are open to prejudice: he/she is creeping up to the Head wants to make career. And what else? Oh yes, the others say you are inconsiderate towards your colleagues.*

## 4.1.2 Staff development and involvement

Teacher training, a major factor when introducing ICT successfully, turns out to be a problem, The teachers complain of too many hours spent as further training is mainly autodidactic or is given by colleagues on a voluntary basis. It would be desirable to offer training by an expert on site under didactic aspects.

### Teacher education

Complaints were heard concerning deficits in teacher education. They are meant to qualify the coming generation of teachers in pedagogic and technical fields at school. However, teacher education for grammar school teachers deals mainly with the subject, whilst didactics are neglected. Basic training in technology and the media remains a matter for the personal initiative and personal preferences of each individual teacher. A compulsory basic training for everyone is neither given nor promoted.

### Self-educated learning

In professional life, teachers are likewise left to their own initiatives when it comes to gaining knowledge about ICT. Most of them are self-taught, having had access to it privately or via students and colleagues. Mathematics teachers often appear to have come into contact with ICT via the language of programming. The Technical Administrator is totally self-taught as no further training is provided at a qualifying level for schools. He took his information from specialist journals and by exchanging experience with other system administrators.

### Informal support and in-school training

One group from the school development initiative dealt with the subject of *In-school teacher further training* whereby regular afternoon courses are held for 15 teachers at a time dealing with a variety of basic software. The demand for, and participation in, such courses was always very high. It is estimated that about 30% of the teachers take part regularly in this further training. The subjects dealt with in the courses are tailor-made to meet the teachers requirements, the information necessary to arrange this had been previously obtained by means of a questionnaire. Officially, the Technical Administrator and an economics or law teacher are responsible for in-school teacher further education. They act as contact persons when problems arise and by means of informal support give their colleagues a feeling of security in using the technology. The Technical Administrator plays a particularly important role here and is always available with individual assistance. However, many teachers, realising the amount of time he spends on the new technology are hesitant to take up his time with their problems. One woman colleague criticises the lack of support from the government:

*And now something is happening and I think the teachers are being simply exploited. How is the training to be done? By taking one of our colleagues at school, our systems administrator, who got his knowledge in his own private time and now he has to teach the rest of us. He doesn t get reduced teaching hours, he doesn t get paid for his extra work. That means colleagues teach colleagues so that the state has no costs! The state does not want to invest anything in training. And I simply have to say it   that is exploitation of our colleagues. (...) And that is simply disgraceful!* (woman teacher)

In the meantime, an increasing number of other teachers are also offering to help and a mutual exchange system has been

created. Teachers of individual subjects organise internal basic ICT training combined with teaching applications under the leadership of technically knowledgeable teachers or experts from outside. In addition, students from the Upper School and former students offered training called *Teach your teacher*. There is a lot happening on the side and the Headmaster welcomes the increased social learning amongst the staff. His wish is to promote it further by providing a protected room in which teachers can learn and practise together.

Another institutionalised form of in-school training is the *pedagogic days* organised mainly by two women teachers. Training is external and provides an opportunity for practical work and personal experience in new methods of teaching supported by experts from the outside.

### External training

In addition to in-school training, teachers at the state Grammar School have the opportunity to attend seminars and courses at the appropriate Training Institute for state-employed teachers in Bavaria or the municipal training institute which have increased the number of ICT courses in recent times. Some teachers take part in training as teams. This is welcomed by the Headmaster and he approves all staff requests put to him concerning training. He prefers teams or groups of teachers with the same subjects to attend training together instead of sending individual after individual who are then expected to teach the rest of the staff what they have learned. One woman teacher stated she would prefer to be taught by in school by a technical advisor who could give her assistance in lessons than to attend an external training.

### Training in companies

The companies comprising the committee support the school not only in financial matters in the form of material donations but also by allowing teachers and students from the school to participate in their own in-company training. Particularly students and teachers from the Intranet group participated in such courses. Although the offer was gratefully taken up, it became clear later on that the contents of the course were beyond them or that the knowledge could not be implemented for school purposes.

## 4.1.3 Role of leadership

After initial difficulties resulting from his authoritarian behaviour, the Headmaster today counts on individual motivation through discussions and honest, democratic voting. Parents and teachers praise his receptiveness for ideas and for the support he gives them for their projects.

### Self-image

The Headmaster is self-critical regarding the beginning of his term of office and attributed the mistakes he made then to being too authoritarian in ruling that innovations were to be made These difficulties between staff and the Headmaster were not solved until an anonymous poll had been taken and the staff gave an honest feedback to the Headmaster. Today, the Headmaster tries to involve teachers in innovations by discussing them, by asking staff to take on various responsibilities, thus transferring the tasks to them. When they are approached directly, they seldom refuse. He supports the commitment of the teachers by giving them free space, e.g. with further training or reduced teaching hours. He sets a good example in new projects, by taking part with his form. A major aspect of his leadership style is one of honesty. *That is why I say honesty and motivation among the staff, supporting them, even when they make mistakes, is important* (the Headmaster). For him it is important that all those concerned participate in making decisions on the basis of honest information, i.e. teachers, parents and students. All decisions concerning the further course of action at each stage of school development were taken in joint agreement with the whole of the teaching staff.

### External assessment

According to the students, the Headmaster is strict and thorough, but liberal. He knows practically all students by name and he is a person *you can speak to freely (*student*)*. The teachers agree that the Headmaster is always receptive for new ideas, readily supporting committed members of staff and giving them breathing space as far as possible. Particularly younger teachers were astonished at how much responsibility they were given from the very beginning. Parents also confirmed with appreciation the support given by the Headmaster. *Perhaps it ought to be said once that the freedom the Headmaster gives us is extremely beneficial for these activities. (…) There is a lot happening here and everything is given positive support*. In the yearly report of the Grammar School, the former arts teacher and Chairman of the Control Group wrote *By integrating the whole of the school management in the process (….) exemplary support was given to the project*.

## <u>4.1.4 ICT-Innovation Connections</u>

As ICT up to now has only played a marginal role in the curriculum up to now, the school tries to combat this by introducing a methodology and media curriculum in which pedagogic and medial contents are embodied. In normal lessons, ICT is used for individual projects or research with medium frequency. Many teachers up to now have seen only a limited use for their subject.

### The role of ICT in the curriculum

ICT is hardly represented in the curriculum of Bavarian grammar schools. Only in the science sector of Grades 9. and 10 is an additional lesson of mathematics planned for *Basic Computer Science*, in which the computer language PASCAL is taught. Most of the students find this outdated. In other subjects, ICT plays only a marginal role. Revised curricula taking ICT into consideration have not yet been set up. For reasons of the quantity of teaching matter in the curriculum, particularly in the Upper School, there is often too little time to use the new technology as it has shown itself to be very time-intensive and, in parts, has very little to do with the subject, as one woman teacher explained, *I hardly dare to waste such a lot of lesson time with it with little results. They all want to make their Abitur[3] at some time with a numerus clausus[4]* .

### Media and methods curriculum

As the official curriculum is noncommittal it is to be counteracted by the newly drawn up media curriculum at the O Grammar School. It contains compulsory modules which follow a successive course of training in *Basic IT* during Grades 6 to 10, so that students entering the Upper School should



all have the same basic computer knowledge The media curriculum was however extended by a methods curriculum that did not stop at ICT but also took into account that the ICT link affects ways of thinking and working. Accordingly, the aim of the methods and media curriculum is to interlink ICT to innovative pedagogic forms of learning. The students are to acquire not only *Figure 4: Media curriculum lesson in Grade six*

long-term basic concepts and knowledge but also short-term technical details which will be dealt with in-depth from year to year on a spiral principle. The modules will be divided up over several subjects to lessen the workload, added on to the contents of regular lessons and worked on independently of the other subjects. The modules will finally be used in a cross-subject project in each year from Grades 7 to 10. Grade 6 will be given an additional lesson every three weeks in Basic Computer Science which is to teach them how to present and structure information. The *Methods and Media Curriculum* was used for the first time in this school year with one project class per grade in Grades 7 to 10. All Grades 6 however took part in the *Basic IT* course.




### Relation of Innovation and ICT use

*Figure 5: Method Curriculum in Grade 5*

The O Grammar School emphasises that technical and pedagogic sectors are of equal importance and both components of the *Media and Method Curriculum* are to be considered as equals. It is a fact that both sectors are closely interconnected with one another as the Basic IT course in Grade 6 shares an additional lesson per week with *Method Training* and *Team Hour/ ALF*. This was added to the curriculum with the agreement of the parents. The *Team Hour* is planned as an additional lesson for the class in order to work on themes which are not related to the subject of social cooperation and/or to carry out training in *ALF* which aims at methodical variety by teaching general life competences, contributing to the strengthening of personality and class community and using targeted information to prevent drugs abuse. In *ALF* and the *Team Hour* the whole class comes together every fortnight while in the between time, half of the class has either Methods or Basic IT in alternation. This leads to a close interlink underlined by connected methodical and communicative aspects regarding lesson contents.

## Use of ICT

The use of ICT in lessons at the O Grammar School is limited as only one ICT room is available for teaching purposes. The room is used to 60% of its capacity for various computer science courses. The quality of the equipment is good, but the quantity is insufficient to allow increased utilisation of the room. Practically all of the teachers questioned, however, reported their experiences with classes in the ICT room. The technique is popular for researching current information, for observing simulations in Internet, for accessing educational CD-ROMs or to fill in for relief lessons, which, according to one teacher *is the most common irregular use* .
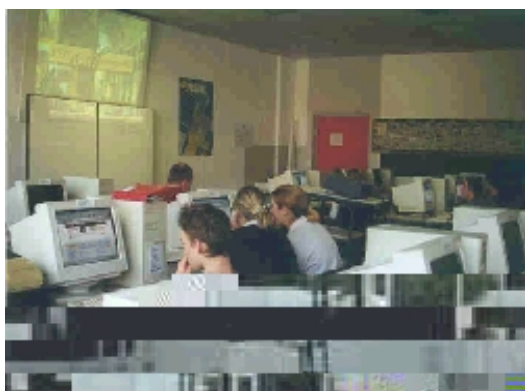


On the whole, the computer is used mostly for such occasions. One teacher pointed out *I would estimate that, at the most, only 30% really use the computer in a meaningful and sensible way for teaching purposes* . Recent innovative projects were mainly such where students, e.g. deal with information for a certain theme and then prepared it for the intranet. Some of these projects were led by teachers who admitted themselves to be uncertain in working with ICT but nevertheless good results were achieved due to competent technical assistance from students or colleagues. Students comment that they would like to see ICT used in lessons on a more matter-of-course basis and with more variety.

*Figure 6: Class in the ICT Room*

## Assessment of working with ICT

Teachers and parents are of one opinion that ICT literacy is part of the basic skills which a school should impart in a basic alphabetisation. There are however differences of opinion concerning the time and value afforded to ICT. Several teachers emphasised particularly a meaningful, functional embodiment of media use in teaching, *ICT as a medium which is and should be used sensibly, selectively and very critically* . It should serve as a means of transporting contents and not be degraded as an end in itself; *An end in itself means for me that basically handling a computer becomes the most important thing and not what can be achieved with it* (teacher). ICT should be rooted in pedagogic concepts so that the media can be gainfully employed in lessons, not taking into account the use in researching information. *On the bottom line, it s a lesson wasted. They learn how to use the media and that is a chance for those who do not have the opportunity at home. That s really the reason why it s done, but as for learning (*woman teacher). Another teacher emphasised that tackling issues on a personal and human basis must not be neglected and that mental work must take place in the head regardless of which medium it is transported with.

# *4.2 Outcomes*

## 4.2.1 Infrastructure

The school has three stations equipped with up-to-date software and hardware. However it is not enough for consistent integration into day-to-day teaching. A particular problem is maintenance which lies entirely with the teachers and the financing, which is ensured by private sponsoring, for the most part.

## Equipment

The school has three rooms equipped with ICT which can be used by the students. One ICT room with 16 PCs, all of which have Internet access. Net software is NovelNetWare. The system is protected by a recovery programme Windows NT Domain Control. The Intranet Café has eight computers networked via a Lotus Domino Server which are linked to Internet via a Linux communications server (ODS) They operate on software from Lotus Notes and are currently installed in the school corridor near the Assembly Hall behind a site fence. A further ICT room in the basement contains the old Amiga computers and eight further networked PCs, which are used for student projects. On the whole, the hardware and software facilities at the school are deemed by students and teachers to be good and up-to-date. Further specific technical equipment is available to teachers for their subjects and for administration purposes as well as three to four mobile computer beamer stations. The administration network is a third independent net next to the ICT room and the Intranet which does not provide access to Internet.



*Figure 7: Intranet Café located in the Corridor*

The school is a Microsoft partner school therefore in the software sector it is equipped with the usual word and data processing software. In addition to this, the school has a simple graphics programme and CD-ROMS for special subjects. In the subject-relevant data base of the Intranet café there is commercial educational software for modern languages, grammar and vocabulary trainers and programmes to accompany text books, digital dictionaries for English and French, encyclopaedias, Microsoft *Encarta* and a digital atlas.

At the O Grammar School, one critical threshold with basic technical equipment has not yet been crossed as the technical possibility to implement innovative projects such as the media curriculum consistently are still missing neither is the infrastructure sufficient to allow all teachers to use the ICT room regularly for teaching. Currently, there are 30 computers installed and networked for 1085 children and a further 10 single computer workplaces. That means a ratio of 36 students per networked PC or 27 students per computer, taking into account all the computers. A further five Internet compatible computers are available for teachers and the school administrative staff.

## Support to keep it working

Technical maintenance of the ICT teaching and administration network has been in the hands of the mathematics and physics teacher since 1988/89. The teacher is known as the Technical Administrator although he is a normal teacher who simply has taken over the maintenance of the computers on the side having gained his knowledge during his student-days. Only recently has his work been seen as an important function at the school and he has been given a functional position recognising this, which means he can claim a reduction in his teaching hours and a promotion. Approximately five hours are taken into consideration for technical administration although this figure is by no means sufficient to cover the extent of the work. The Technical Administrator sees the current situation with mixed feelings. On the one hand, he enjoys the recognition afforded him by his colleagues for his work, he enjoys the work and sees that the teacher-student relationship has taken a positive turn because of his work. On the other hand, he finds it dissatisfying that he must spend so much of his own free time at the school without any financial reward.

He would welcome cooperation with a full-time administrator who would take over the technical side so that he could once more concentrate on the pedagogic aspect of IT applications. His main overwhelming interest is in pedagogic innovation and he is a member of the teaching teams in the Lower School and the application there of new teaching methods such as individual learning, group work and method training in class. He says, *I don t want to be at school walking around all day or sitting in the basement with a screwdriver and nobody even realising I am here* .

Some of the students who were involved in the initial stages of building up the Internet in the ICT room pointed out that the Technical Administrator could obviously have had more support from students, but did not take advantage of it. One student said, *he doesn t let anyone interfere* . Team work with the students at that time was only temporary and was not continued, no permanent cooperation resulted from it, *We only helped because he needed the help, because he would never have managed on his own; because he needed a few students to help him, so we volunteered* .

The woman teacher responsible for the Intranet café was able to count on competent support from students but she too would prefer to have an external systems administrator as she needs too much time to keep her technical know-how up-to-date and to eliminate faults. She has in mind co-operation with a company.

## Resources

As the Grammar School is a state-controlled school it receives approximately DM 150,000 per year form the school authorities for administration purposes. From this sum, the school spends about DM 35,000 per year on information and communications technology. Large financial resources in the last two years came from a software company in the form of training (approximately DM 80,000) and from the O Grammar School s sponsor association (approximately DM 35,000).

In addition to efficient management of the funds and the willingness to repeatedly invest some of it in ICT, state promotion initiatives and private sponsoring from the business sector were needed as there is no provision in the school s budget at present for ICT. At the beginning, material donations from companies were organised by parents and today numerous companies in the Committee cooperate in the fields of licences, running costs, maintenance, net access, hotlines and teacher training. The way was long and tedious, as the Technical Administrator reports; *That means we have never been so equipped that we could say we have a well-running system. We had to keep on their heels constantly, we had to beg until we had everything we needed and we even had to screw everything together ourselves sometimes* .

## 4.2.2 Effectiveness

The most positive aspect of working with ICT in lessons is that the students are participating actively, practice-related and together. However, for many of them, motivation depends on the type of use. Problems with the Internet is handling information, the time factor and abuse of the medium.

## Positive effects of the innovations

On the whole, the teachers report of the positive effects of learning with ICT on the learning motivation among students in the lesson. They mainly put this down to the fact that the computer is a novelty in the lesson and it awakens curiosity and the interest in discovering something new. Students also can use their experience with ICT from their leisure time and it rings the changes in the daily routine of school-life. According to the students themselves, it is of major importance for them that they can take an active role in the lesson. They welcome the mutual help, independence, self-control and the dissolution of the usual  chalk and talk  teaching methods. During lessons, it was observed that the students are concentrated and motivated, working either alone or in pairs on a subject. They find lessons more practice-relevant and the atmosphere more casual as they can talk to one another. It is accordingly of importance that ICT is used for its own quality and not simply part of the conventional frontal teaching as was observed in an audit to one lesson.



*It ends in frustration because the teacher says,  Right, now we ve got a lovely new machine, let s try it out a bit . He stands in front of the class saying,  Press this button, now press this one and now press that one etc.! And in the end, the computer simply becomes a discouraging experience (*Technical Administrator)

*Figure 8: Class in the ICT Room*

To avoid frustration, it is necessary to have structured instructions and clear targets, but these must be set in team work. That changes the teacher-student relationship and allows partner work, which students find particularly pleasant, as do most of the teachers. *Yes, I find there is more team work going on in the ICT room. Both teacher and students are moving around the classroom. Not  the teacher at the front, the students at the back. It is real team work* (student). However, there are teachers who have a problem with this new role situation, because they think they have to be the one *who knows everything* and they find it extremely difficult not to be the person in control in the lesson.

The teachers also emphasise the positive effect of the teacher team in the Lower School in connection with pedagogic innovations. It has led to greater job satisfaction and a better working atmosphere among the staff. The exchange of ideas and agreements concerning disciplinary problems in classrooms had resulted in less stress for the *lone warriors* . This positive development at teacher level was reflected positively to the students as they could perceive all the teachers as a whole and observed how team work was put into practice.

## Problems and disadvantages of the school-innovations

However, ICT does not always have a positive learning effect. One woman teacher says; *If they don t feel like learning, you can give them what you want, a text in the computer or whatever, they are just not interested* (woman teacher). It depends on the task, among other things. *To be quite honest, I find it all rather boring. We spent two lessons last week in the Internet without the necessary content references. We spent a total of three hours without finding anything useful (*student from the Upper School). It is possible that enthusiasm for computer work depends on the class level and is higher in the Lower School.

*Because the end in itself and the playful character is in the foreground. For older students it is perhaps higher, I don t know. For them it s not such a big difference, perhaps, whether they look something up in a dictionary or they find it in the*

*Internet (*teacher).

Working in the Internet is for some students a problem as it requires a level of education which they do not have, *to put it bluntly, the Internet expects educated people to work on it and yet at the same time, claims to educate people. In some ways, that is contradictory. In order to educate myself via Internet, I must be already be educated* (teacher). Information from the Internet is not always scientifically backed or presented in a way which students can understand or is suitable; *Apart from a few good projects, Internet is not necessarily understandable or suitable for children. A good specialist book or a good text book also has a value and a purpose (*teacher).

In addition to the pedagogic use of ICT, teachers complain of the enormous amount of time which has to be spent on further training and preparation as well as the difficulties with the technology due to insufficient technical equipment or server capacity. In one lesson, it was observed that a lot of time was wasted (for example on setting up the beamer, loading graphics etc.) The children became therefore bored and began to occupy themselves with other things. In particular, it is the older teachers who are repelled by the technology as usually they are using it against their will. *Then they find out they cannot have the ICT room at the time they need it, and if they get it maybe nothing runs as they planned. Some of the students have much more knowledge than the teacher and he/she finds this frightening (Technical Administrator).* One woman teacher talked about her own fears of being in an ICT room with her class and not really feeling confident with the technology; *And besides, there is a big difference between working at home on my own computer and being amongst 30 students sitting together in pairs, producing nothing but crap .*

There have been no cases of serious abuse of ICT at the O Grammar School. Minor nuisances such as swapping key caps or stealing mouse balls or messing up work surfaces have occurred. The Technical Administrator commented on this, telling the students that such occurrences caused him extra work and only meant disadvantages for the students, whereupon the number of incidents dropped. The students know and recognise that the Technical Administrator spends a lot of his free time with the system and this fact is obviously respected and not sabotaged. One common form of misuse is that students often surf around the internet for their private use during lessons, *In ICT lessons, you have to watch like hell to stop the girls from girls chatting in the web and the boys from watching porno. That s the negative side (*teacher). Filters have been installed to prevent this from happening. A further form of misuse is taking ready-made reports from the Internet, a method of making work easier which through ICT has increased enormously.

## Advantages and disadvantages of the Intranet

A positive effect of the intranet is that quality assurance of the contents can be better guaranteed as in Internet as the information to be found there has been pre-selected according to pedagogic aspects. One father sees special opportunities for the future; *The Intranet should be seen in the light of this tradition. It is not protective, but only protects in the same way as an editor does before a book is published. That is being protective .* However, the question arises as to who should be responsible for quality control or whether compulsory contents or formal quality criteria should be introduced. There should be a guarantee that contents are correct and free from errors if Intranet is to be offered as an official source of information.

The Intranet café in the O. Grammar School was conceived with the aim of offering students freely accessible opportunities to use the computer as a source of information, learning and playing. In the beginning, the play factor became so rampant that it was forbidden due to the amount of noise generated for the surrounding classrooms.
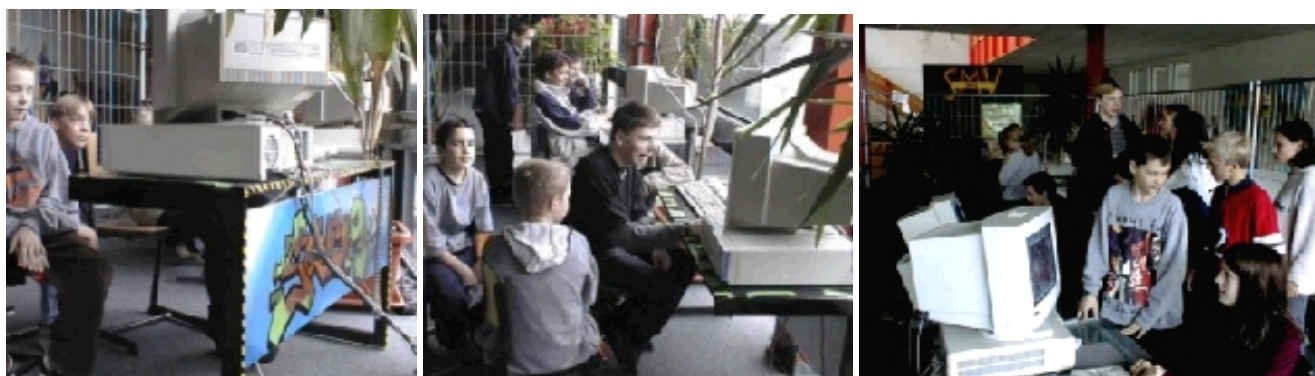
*Figure 9: Opening of the Intranet Café*

In principle, it is possible to access Internet through Intranet. Not all students can do this however and access is protected by a password which only responsible members of the Intranet group were given. As this was abused, the whole issue of future developments have to be put to discussion. The students had not kept to an agreement they had signed, not to open certain sites and had downloaded violent computer games on to the PC although this had been forbidden. The woman teacher in charge said; *We trusted them completely and thought we could give it a try. But, looking back now, we see that not all of them kept to their side of the agreement (...) Our trust and confidence have been misused.* Now, in addition to permanent pedagogic measures and self-obligations on the side of the student, external regulations, supervision and control via an open architecture are to come into effect. Discussions arose concerning Intranet access by the other students but they are more interested in Internet than in Intranet.

The Intranet is currently not used very much as the contents for teachers and students are not yet attractive enough and the system s technology does not provide stable conditions. Those responsible admit in self-criticism that they are still fighting with the technology. *We are still in the initial set-up stage and none of us have that much time. After all, we are still students. The setting-up process just drags along and it is clear that such problems will occur again and again (*student). Those responsible do not allow themselves to become discouraged but endeavour further to create appropriate pedagogic concepts for use and a suitable atmosphere for teaching and learning.
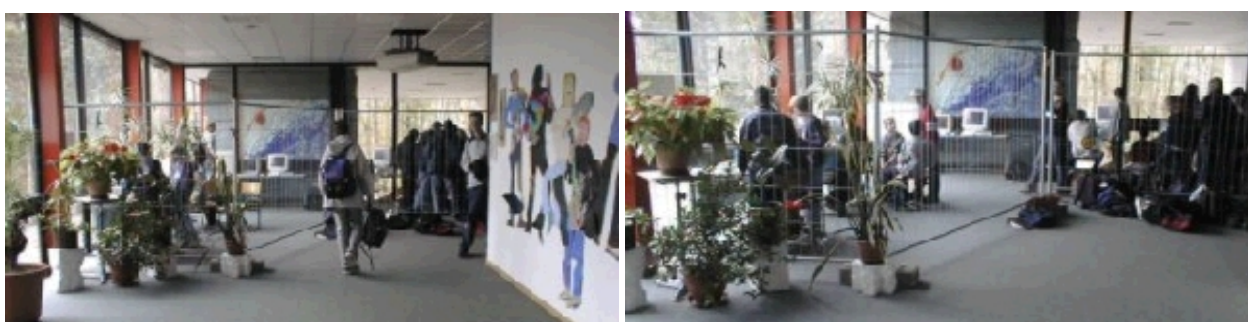


*Figure 10: Opening of the Intranet Café*

## 4.2.3 Impact on Academic Rigour

At the end of all this, the Headmaster expects better academic results from all these pedagogic innovations, particularly from intensive commitment in the Lower School. The Headmaster is of the opinion that non-teacher led lessons result in a higher level and proudly reports that academic results at his school are higher than the average for Bavaria. However, it must not be forgotten that the students at the O Grammar School mostly come from privileged backgrounds where the education level of the parents is also above average.

The Deputy Headmistress expects the changes brought about by ICT to lead to changes in the measurement and differentiation of academic performance. In awarding marks, not the learning by heart of facts but the utilisation of applications and transfer knowledge should be taken into a account and thus revise the value of *encyclopaedic knowledge* in relationship to key qualifications. On the whole, the school attaches a high value to academic performance and the promotion of gifted children. It is expected that the use of ICT will lead to greater academic performance as the students are more motivated and motivation usually leads to increased academic performance. One teacher reported on the use of ICT in a German lesson in the Lower School, *the children enjoy doing it and the poems also improve a little because of the attraction of the computer. I have observed that the poems are better than when they write them by hand into their exercise books. They make greater efforts* . Another woman teacher however pulls on the brakes regarding the optimism placed in ICT and their contribution to increased academic performance; *The sum of intelligence does not increase and knowledge has to be gained by hard work. The computer is not a panacea.* Working with multi-media is also being encouraged by a wide percentage of the public. As the school cooperates with sponsors, it feels forced to account for its projects in public. The implicit performance control promotes the formation of a school profile and self-representation which functions as an incentive when looking for and acquiring new sponsors.

## 4.2.4 Equity

A large number of students have access to ICT at home so they are not dependent on the facilities at school. There are therefore no noticeable differences between more affluent and disadvantaged students. Apparently, weak students also get enormous advantages from ICT. Differences were observed between boys and girls mainly in the method of application.

### Computer access at home and at school

Students are not allowed to use the ICT room without a teacher being present. In this way, students are prevented from altering adjustments and settings so that the computers can be fully available for use in lessons. Every student has in principle access to the Intranet café as along as he/she is formally registered with an *InGo* ID card. Access to Internet is blocked. As the computers in the Intranet café should allow the students to work there completely freely and unsupervised, it was decided not to allow Internet access for reasons of supervisory obligations towards the parents. The parents are thus assured that their child does not have access to harmful sites at school which at home would be forbidden.

Most of the students say they would rather work on their computer at home than stay after school. It was estimated that between 60% and 90% of students have access to a computer at home. The students who were questioned all had access to computers at home. There was a tendency in the Lower School for fewer children to have their own PC whilst in the Final Year, the average was almost 100%. The Headmaster has offered to provide children form the Lower School with old school PC s if they would like one. The figures of those with their own Internet link is lower. Teachers estimate that one third of the students have Internet access at home; students themselves estimated that up to 80% have this. The Internet use is often conscientiously controlled by the parents.

With increasing age, ICT knowledge among students is accordingly quite homogenous. Some of the students are only interested in computer games whilst others invest the whole of their free time in the technology. Both types are however in a minority and on the whole skills in the Upper School become increasingly more homogenous.

### Differences between boys and girls

The Technical Administrator has defined that the differences between boys and girls regarding their interest in ICT have become fewer in recent years. However, all teachers confirm that boys and girls display different characteristics in handling ICT. One difference is the approach to the PC, *The boys first press all the keys, the girls first ask what could happen if they press a key (*Technical Administrator). Furthermore, the girls handle their knowledge more modestly.

*In principle, the boys simply say they know everything and click around on the keys. The girls know it too, but they don t make such a fuss about it. I have the impression, the boys make out that they know everything and the girls simply do it, quietly. (*teacher)
*Figure 11: Class in the ICT Room*



Apparently, girls have other interests regarding computers than the boys. This leads to differences in the way the computer is applied. The boys tend towards *gun-shooting games* , extensive website searches and system construction whilst the girls prefer the chat rooms, emailing and surfing for certain information. One woman teacher explained that the girls have less interest in the technical aspects of ICT but more in its applications:

*I think I can say it s the same with the car. Women just want it to run. Why and how is not important. Main thing is the crate runs. For many boys it is important that the crate stands there and they can tinker around on it.* (teacher)

This image is confirmed by the fact that it is mostly boys who become involved in the administration activities in school computer projects. The girls who were asked found programming with PASCAL too difficult, boring, out-of-date and meaningless whilst some of the boys became very enthusiastic about it and some of them even worked on it in their free time.

### Differences between strong and weak students

The ratio between good and weak students displayed contrary connections. Some of the weaker students displayed very good skills in handling ICT although their academic performance in other subjects was weak. These students can compensate difficulties in normal lessons and involve themselves positively The connection was observed both in language

and mathematical subjects.

*For example, I have had three to four students in Grade 10 who were weak to very weak in maths   between 4 and five in our marking system. Three of them were responsible for an EDP project and carried it through extremely well. I found it a comfort, but also a critical factor, that we require things of them in mathematics which they cannot fulfil.* (Teacher)

A new more positive aspect has entered the classroom and shows it is not always the same students who give a good academic performance. The group structure has been torn apart and the roles are newly distributed. Formerly neglected students can achieve recognition and a new sense of self-confidence.

### Differences between high and low poverty students

The social and financial background of the children at the O Grammar School plays only a very minor role as most of them come from an homogenously well-situated and well-educated social level. But still there are some children who have no computer access at home. Although they are at a disadvantage compared with other students in that they have no technical equipment at home and no chance to practice, one teacher would not see it as an overall disadvantage; *Quite the opposite, I know a few cases where children naturally have the latest in computers at home but do much less with it than a child who has managed to get a computer from somewhere or other and makes full use of it and gains much more from it .*

# 4.3 Projections

## 4.3.1 Sustainability and Scalability

### What must be done to complete it? Expansions and plans?

Whereas the Headmaster would like to recruit new parents into the working group in order to reanimate an intensive commitment in the sector of pedagogic innovations the teachers with most responsibility would prefer to embody these innovations more deeply into the daily school-life before advancing the development any further.

Yet there are many current plans and targets in the technical sector, the installation of ICT in daily lessons is to be further intensified and media projects in the media curriculum be extended to all classes. Up to now, the technical pre-requisites have not been available and there exists a whole set of ideas for extensions with ICT classrooms, laptop classes and mobile computer-beamer stations. In connection with the school building extensions, there are plans for large classrooms, big enough to contain the complete equipment for a media station. Furthermore, there are plans for roofing the atrium and providing room for the old library and the Intranet café. The new central library for old and new media is to be installed in this central position among glass and light. It is expected to provide a new incentive for innovative, technological projects. The Technical Administrator hopes that 30% of teaching time will be taken up with these projects and the rest of the time spent on conventional or pedagogically innovative measures.

### Required resources and support?

In order to extend an innovative pedagogic handling of ICT it is first necessary to find numerous financial sources for further technical infrastructure. Equipment must be available in sufficient quantities and reliable so that it can be used without problems in lessons. To guarantee such reliability, a realistic solution must be found regarding technical maintenance as the increasing number of computers cannot possibly be serviced by one teacher alone on the side. A full-time system service is required. Teachers would be happy to have enough teaching hours to plan and lead innovative projects not only at their own cost. Furthermore, external experts should be available to the school for the training of teachers and students. Additional lessons -without duress from the subject nor in the normal 45 minutes rhythm   are necessary in order that the subject of ICT is not taught at the expense of the teacher s subject. Some teachers would appreciate more suitable ready-made software, cross-subject use of the media in lessons and the construction of an intranet using material provided by the teacher.

### Dependence on a single person?

The innovations have been relatively widely embodied in the meantime and supported by most of the teachers. This was apparent in the last vote taken in which the majority were for a continuation of innovations whereby some motivation work is still outstanding and more teachers are to be involved in the active work. Current projects are closely connected with certain persons. The past has shown that if a responsible teacher leaves the school, another person will take over the project. In that way, innovations can survive the pedagogic innovative sector when the initiator leaves the school as was the case when the gap left by the main initiator, the former arts teacher, was filled by his successor.

**Appearance in three years?**

The Headmaster of the school plays a crucial role in maintaining innovations. He is currently fully integrated in the innovations but will probably retire within the next few years. However, due to the school s lobby, a successor will very likely be found. In addition to the Headmaster, many of the school s teachers will be retiring in the next five years so that massive upheavals are to be reckoned with. On the one hand, there is the danger that experienced persons will leave the school, leaving personnel bottlenecks behind them if the positions are not filled and on the other hand, there is a chance that young teachers will come to the school bringing new innovative potential with them. From 2004, it is expected that all school levels will have a two-hour computer science lesson per week. The media curriculum can thus be kept to in this form even if the direct future course depends on its evaluation and the contingent of teaching hours.

# 5. Conclusion to the Hypotheses

1. **Hypothesis: 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 pan-school improvement is found, technology served only as an additional resource and not as a catalyst, that the forces that drove the improvements also drove the application of technology to specific educational problems.**

The survey held at the O Grammar School clearly supports new technology as simply a further source in the learning process and is not seen as a catalyst for innovation. The first innovative forms in handling ICT began jointly with the CI school trial in connection with an arts project and later was only a part of a targeted pan-school development. The close link between the media and method curriculum also points in this direction. The Technical Administrator, as a key figure in the ICT sector is integrated both in pedagogic as well as technical innovation which partly develop separately and partly in mutual exchange.

1. **Hypothesis: 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 patterns occur.**

Everything points towards ICT innovations spreading according to the diffusion theory outlined by ROGERS. Acceptance of the technology is greatly prevented by relative disadvantages occurring regarding time, comfort and the complexity of the technology. Little by little, teachers are trying things out at home on their own PC s and thus finding their way to creating a lesson. Those who have longer experience with ICT have relative advantages from recognition or admiration from the headmaster and their colleagues. This is expressed in increased job satisfaction. These pioneers transfer their positive experiences to the subjects and pass them on to colleagues, so that these teachers contribute to the formation of opinions in their team. In this way and because of the open atmosphere at the school ICT finds an enormous degree of acceptance and can spread in so far as the technical prerequisites allow.

1. **Hypothesis: 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.**

Initially, it is not the teacher s competence in ICT which determines its use. An important prerequisite to a certain degree is an adequate technical infrastructure to ensure that teachers do not lose interest when they are repeatedly confronted with breakdowns, or long servicing times and to ensure that they can use a computer in a lesson according to their own ideas and wishes. Acting as a partner to the students and making use of their knowledge can fill considerable gaps in the technical expertise of the teacher. Teacher competence, however, is most decidedly sought after in issues concerning the integration of ICT in lessons and in the creation of learning scenarios. This however does not depend on the teacher s EDP skills but on his ability to put the specific qualities of ICT to full pedagogic use, integrating it into his lesson.

1. **Hypothesis: 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.**

This hypothesis does not have much foundation for the school in the study as the social structure there was homogenous and well-situated and secondly, the difference in free computer access was not large enough to warrant a differentiation.

1. **Hypothesis: 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.**

Many teachers are apparently under the impression that working with ICT in lessons is a loss of precious teaching time at the expense of expected academic performance, and quite a few teachers have reservations particularly regarding searches in the Web. That is the reason why teachers often prefer to use the ICT room for lessons towards the end of the school day or for relief lessons because they do not expect any decisive progress for their subject from ICT work, merely a motivational kick or an exemplary illustration of a certain point.

# 6. Projection to the future and extension to other schools

Because of its social structure, location and environment, the school has very special resources available to it. The (social) infrastructure stimulates in particular the technical sector as the school can profit from the technical know-how of those parents in the engineering profession. Also the vicinity to the high-tech companies brought ideas and financial assistance. This resulted in a whole series of factors which simply cannot be applied to other schools. There are however a few general conditions, according to those responsible, which a school ought to fulfil if it wishes to achieve something similar. First of all, the technical equipment should have reached a certain threshold value so that it can be integrated sensibly and naturally into day-to-day school life. Furthermore, motivated and committed teachers, training for the whole staff, breathing space for the project leaders in the form of reduced teaching hours, fixed schedules and target, a coordinator for development and the support of the headmaster. An exchange of experiences with other schools is also helpful because *you don t have to keep on re-inventing the wheel* as one father put it. Such exchanges can be used to communicate difficulties and solutions, knowledge and experience and to hear of new ideas. In the sense of *self-help groups* schools could achieve a great deal together.

# APPENDIX A: METHODOLOGY

### Size of research team? Amount of time spent at the school

The school was selected via the Homepage according to the criteria regarding the selection of schools prescribed in the OECD workbook. The research team consisted of two women researchers from the *FWU Institut für Film und Bild in Wissenschaft und Unterricht* from Grünwald near Munich working for the OECD Study and two women researchers from the *Institut für Schulentwicklung* from the University of Dortmund, working on the SITES M2 Study. The school was audited on 5 successive days from 6 November 2000 to 10 November 2000. The researchers from SITES M2 Study participated only on the first four days. Although the school is a half-day school, interviews and audits in lessons were held well into the late afternoon.

### Amounts and types of data collected

A total of 22 interviews were held with the Headmaster, teachers, parents and students. Furthermore, 33 questionnaires regarding *ICT use by teachers* were returned for evaluation as well as *Selection form for schools* which was filled in by the Headmaster. During observations, the proposed observation protocol from Norway from the OECD Workbook was used. Seven lessons were observed in the subjects computer science, English, economics and law, art, *ALF* and method curriculum with pedagogic and medial contents. The lessons took place in Grades 6 to 13. During the study, photographs were taken, photographs made at a later date by *FWU* were used as well as pictures from the Internet about the school. The Homepage from *GoWeb* and the students and the official school homepage were visited. Information reports about the school and its activities, the yearly report, two different school newspapers and a research report about the school were also taken into consideration.

### Numbers and average length of interviews for each type of participant

Interviews were conducted on the basis of combined IEA/OECD instruments. The amendments made by OECD to their questions at the end of August were included and the interviews were translated into German. Some questions were summarised as a result of experiences made in the pilot study and abbreviated for reasons of time.

The Headmaster, the Deputy Headmistress and the Technical Administrator were each interviewed for an average of 2.5 hours. Ten interviews were held with a total of 14 teachers, eight of them male, 6 of them female, each of approximately 70 minutes duration on average. Three were teachers of mathematics and physics, seven taught English, French. social science, history, religion and German. The remainder taught art, chemistry/biology and economics and law. The interviewees included those responsible for the media curriculum, the Intranet, pedagogic innovation as well as persons from the Teachers Council and Upper School organisers. Most of the interviewed teachers had been at the school for 18-27 years, four of them having joined the staff only in the last year. Interviews with parents from the *goWEB*-Team lasted 105 minutes and six students were interviewed for each between 30 and 45 minutes. Thirteen boys and 10 girls participated, of these eleven from Lower and Middle School and 12 from the Upper School.

All interviews were recorded on mini-disc and transcribed by student assistant. The interviews were coded via the German software programme WinMax and analysed under qualitative aspects.

# APPENDIX B: ICT PRACTICES SURVEY FOR TEACHERS[5]

## Table 1: Teachers feelings regarding different ICT tasks

| How comfortable are you with using a computer to do each of the following? | Very comfortable | Comfortable | Somewhat comfortable | Not at all comfortable |
|---|---|---|---|---|
| Write a paper | 27 | 5 | 1 | - |
| Search for information on the World Wide Web | 6 | 14 | 10 | 3 |
| Create and maintain web pages | 1 | 1 | 8 | 23 |
| Use a data base | 3 | 6 | 9 | 15 |
| Send and receive e-mail | 15 | 5 | 9 | 4 |
| Programming | 3 | 2 | 7 | 21 |
| Draw a picture or diagram | 4 | 10 | 7 | 12 |
| Present information (e.g. with Power Point) | 5 | 8 | 7 | 13 |

| Overall self-assessment | Good | Fair | Poor |
|---|---|---|---|
| How would you rate your ability to use a computer? | 10 | 13 | 10 |

## Table 2: ICT use of teachers

| Frequency of using a computer at home to prepare for teaching | Several times a week | Several times a month | A few times | Never |
|---|---|---|---|---|
| How often did you use a computer at home for preparing for teaching? | 22 | 7 | 3 | 1 |

| Collaboration with other teachers | Yes | No | M. D. |
|---|---|---|---|
| Are you currently using technology to collaborate with other teachers (professional chat rooms, forums, or the like)? | 10 | 23 | - |

| Communication via e-mail | More than 12 | 6-11 | 1-5 | None |
|---|---|---|---|---|
| How many e-mail messages total do you send each day on average? | - | 2 | 18 | 13 |

Table 3: Carrying out programming and installation tasks

| Have you ever done any of the following? | Average Number | No | M.D. |
|---|---|---|---|
| Made changes to a computer´s hardware | 19 | 16 | 5 |
| Updated an application program (word processor, graphics program, etc.) | 27 | 13 | 5 |
| Recovered a damaged file | 19 | 17 | 8 |
| Created a web site | 27 | 21 | 6 |
| Developed a data base | 9 | 17 | 5 |

Table 4: Frequency with which teachers assigned different types of ICT work

| During the past school year, how often did your students on average do the following for the work you assigned? | Several times each week | Several times each month | A few times | Never | M. D.[6] |
|---|---|---|---|---|---|
| Use the World Wide Web | - | 5 | 20 | 7 | 1 |
| Create web pages | - | - | 3 | 29 | 1 |
| Send or receive e-mail | - | 2 | 9 | 22 | - |
| Use a word processing program | 2 | 10 | 15 | 6 | - |
| Use a computer to play games | 1 | - | 8 | 23 | 1 |
| Use a spreadsheet | - | 3 | 5 | 24 | 1 |
| Use a graphics program | 1 | 1 | 11 | 19 | 1 |
| Join in an on-line forum or chat room | - | - | 2 | 30 | 1 |
| Use a presentation program | - | 1 | 7 | 24 | 1 |
| Use an instructional program | - | 7 | 8 | 18 | - |

Table 5: Teachers about their use of ICT in classes

| Answers based on experiences or polices from the last school year. | Yes | No | M. D. |
|---|---|---|---|
| Was student computer use ever evaluated for grading? | 2 | 28 | 3 |
| Did you create or modify a Web site with any of the classes that you taught? | 1 | 31 | 1 |
| Did you participate as a student or instructor in a virtual course through the Internet/ World Wide Web? | 4 | 29 | - |
| Did you involve your students in collaborative learning over the Internet/ World Wide Web with students from other classes? | - | 32 | 1 |

Table 6: World Wide Web searching restrictions

| | No restrictions | Some restrictions | Designated sites only | M.D. |
|---|---|---|---|---|
| If you assigned World Wide Web searching, how much freedom did you allow students in locating sites to visit? | 10 | 8 | 4 | 11 |

Table 7: The portion of computer use in class

| | All | Most | Some | Very little | M.D. |
|---|---|---|---|---|---|
| What portion of the computer use in your classes was directly related to the course content? | 10 | 12 | 5 | 1 | 5 |
| What portion of the computer use that you assigned was done by students individually? | 1 | 14 | 10 | 3 | 5 |

# APPENDIX C: PROMOTION PROJECTS FOR EQUIPPING SCHOOLS WITH MULTIMEDIA

- The promotion project *Schulen ans Netz (SAN)* is a joint initiative of the *Bundesministerium für Bildung und Forschung (BMBF)* and the *Deutsche Telekom AG*. Aimed at embodying ICT and Internet use in everyday school life. Between 1996 and 1999 a total of 10,000 German schools which were considered to be worthy of support in particular because of their *project activities for teaching and learning via the networks* were linked up to the Internet with *Deutsche Telekom AG* providing 36 Mio. DM and the *BMBF* 23 Mio. DM which covered the cable work and a start-up credit. The financing of subsequent costs was not satisfactorily clarified. After 1999, the *Telekom AG* increased their commitment by 60 million DM and the *BMBF* by 40 million DM. The support for the schools included a multimedia computer with an ISDN connection, Office software and , in some cases, teacher training. Since January 2000, the *Deutsche Telekom AG* has been providing all schools in Germany with a free Internet access on the basis of ISDN or DSL. *SAN* is further seeing to various online services and information platforms for teachers and students, as well as holding lectures and annual conferences. *SAN* is a member of the EUN *Europäisches Schulnetz* (cf. http://www.san-ev.de/default.asp).

- A further promotion initiative for the whole of Germany is the *Initiative D21* which was initiated by the amalgamation of 100 leading enterprises and institutions in Germany from all business sectors in Germany 1999 as a consequence of the serious lack of IT specialists in Germany. Together with representatives from the central and regional governments, committees are working on concepts to qualify Germany for the Information Technology Era. Technology, media and Internet are to be both contents and medium for education whereby work is being carried out on an effective link of entrepreneurial and private initiatives with governmental programs in order to introduce IT equipment and teacher training into schools (cf. http://d21.fujitsu-siemens.com/d21/index.htm).

- The *Bertelsmann-Stiftung (Bertelsmann Trust)* is a private foundation of the *Bertelsmann* company which has set its targets on promoting and accompanying *"best-practice-schools"* over a period of three years. In a competition in the fall of 1999 the twelve *best* were selected from 110 schools and taken into the *Netzwerk-Medienschulen (Network of Media Schools)*. Since then, these schools have been in contact with each other working on joint concepts for ICT use in schools. They meet every six months and are financed by the *Bertelsmann-Stiftung*. Each school has five working groups in which teachers participate who work on the following subjects after the six-monthly meeting: media projects in lessons, learning with laptops in class, setting up Internet in schools, teacher training and professionalism, development of a media education curriculum. The aim of the initiative is to publish the joint work by 2002 as guidelines for future ICT work in other schools. The three-year project is financially supported by the *Bertelsmann-Stiftung* with 500,000 DM (cf. http://www.netzwerk-medienschulen.de/dyn/ 1668.asp).

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## Register of Figures

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[1] Information and communication technology (ies)

[2] ALF = Allgemeine Lebensfähigkeiten *(General Life Sciences)* (Vgl. 4.14)

[3] German school-leaving certificate and qualification for university entrance

[4] Necessary high score in the *Abitur* results to be allowed to study a subject with entrance limitation.

[5] All results based on the responses of 33 teachers.

[6] Missing Data