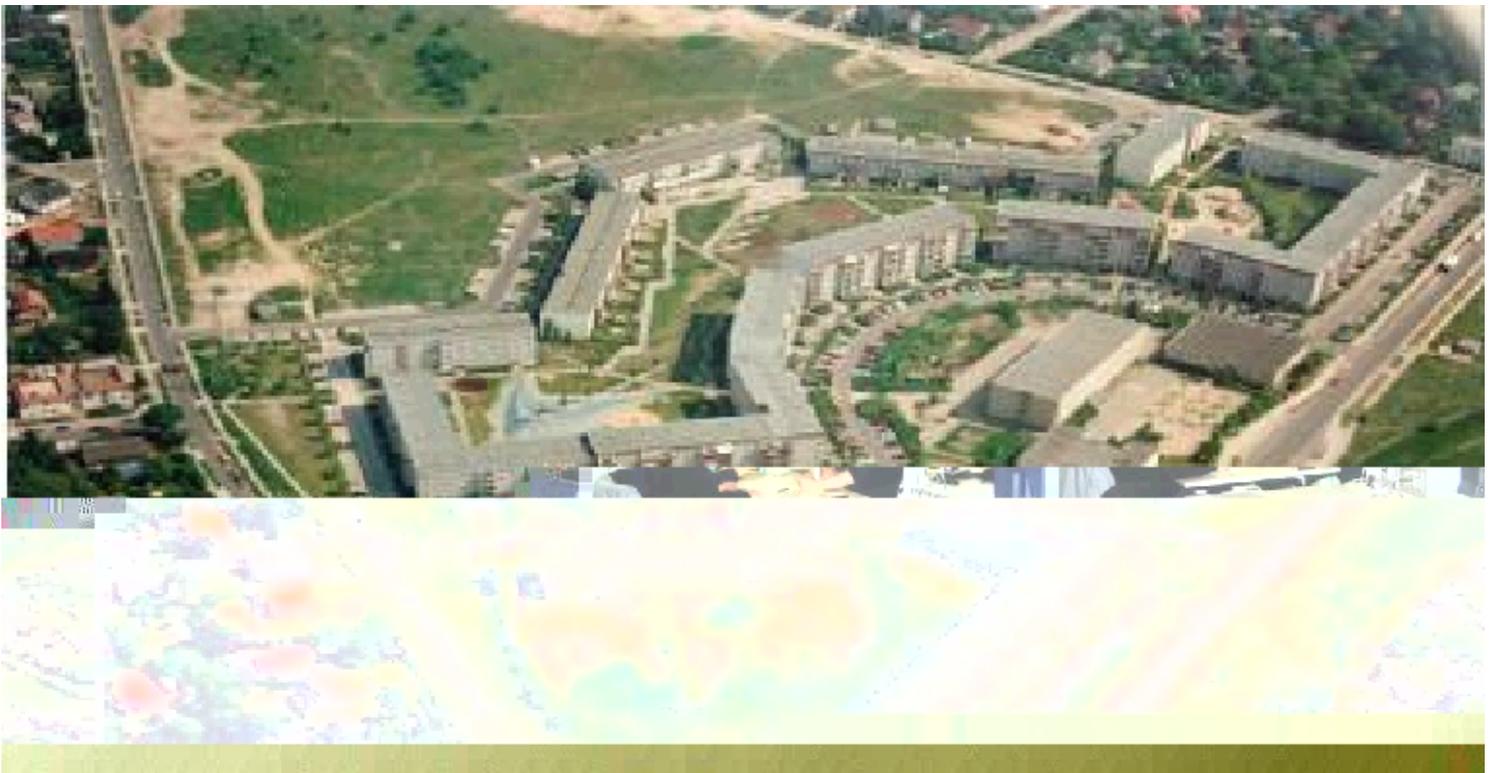


OECD/CERI ICT PROGRAMME

ICT and the Quality of Learning

A Case Study of ICT and School Improvement Jules-Verne-School
in Berlin, Germany



January 8-11, 2001

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1. Introduction

The following study was carried out within the framework of the qualitative research project *ICT and the Quality of Learning* from OECD/CERI, during which a pilot school and four case study schools were investigated. The following report describes the fourth school, a comprehensive school in Berlin, the Jules-Verne School (JVS).

Study goals were first to examine the different ways that ICT relates to school innovation and improvement and under what conditions it functions as a catalyst for these, second to uncover critical variables that relate to successful implementation of school improvement and effective ICT. The third one is to detect undesirable impacts of ICT upon school functioning and student learning.

2. Overview

Brief description of the school

The Jules-Verne Upper School in Berlin is a state-controlled comprehensive school with a senior grammar school level located on the eastern perimeters of Berlin, the capital of Germany. The JVS lies in the eastern part of the formerly divided city so that students, teachers and parents are still marked by the events experienced in the former German Democratic Republic. The area of town where the school is situated is called Hellersdorf which boasts, on the one hand, a residential area consisting of well-kept detached family homes and, on the other hand, blocks of high-rise concrete panel constructions. The catchment area of the school brings in therefore, as to be expected, students from all social levels. On the whole, this part of town can be said to be low-income level.

The comprehensive school was founded at the end of the Eighties and today has 870 students and a total staff of about 70 persons. The average age of the teaching staff is middle to end of thirty, according to estimates. Parents are apparently satisfied with the school as the number of registrations greatly exceeds the possible contingent. Some praise the pleasant atmosphere, the positive social contacts and the school's involvement. The school's extensive offer of ICT attracts students from beyond the normal surrounding area.

The comprehensive school system has a controversial reputation regarding the form of education practised here. It is often seen as a receiving school for weaker students and there are no fixed class formations as the students are divided up according to their performance. Only very few German schools are comprehensive schools. Teachers at JVS, however, chose this form of school out of conviction after the fall of the GDR. Students in the comprehensive school attend the grammar school level (Gymnasium) from the 7th to the 13th grade (secondary levels I and II), in the secondary modern school level (Realschule) up to the 10th grade and in the general secondary school level (Hauptschule) up to grade 9 (secondary level I). Comprehensive schools are intended to take in each level a third of children recommended for Hauptschule, Realschule and Gymnasium thus covering all ranges of academic performance. Experience at JVS has shown, however, that performance tends to be on the general secondary level as parents with children recommended for grammar school prefer to send them to a grammar school as they expect their child to be given better promotion here instead of sending them to a comprehensive school to be educated with children with weaker learning abilities. In the seventh grade at the JVS there are currently approximately 10% students recommended for Grammar school, 15% for secondary modern and 75% for general secondary level. The seventh grade classrooms are situated about a quarter of an hour on foot from the rest of the building complex which is particularly stressful for the teaching staff.



Figure 1: School building

At first glance, the school buildings look rather depressing - a concrete block and inside, the walls are sparsely decorated with pictures or students' work. However, in the afternoons, there are numerous voluntary activities for sport, art, handicrafts, music, theatre and suchlike. Furthermore, there is a wide range of remedial teaching in languages and mathematics as well as computer science. The Headmaster particularly praised the active cooperation of the students' spokespersons.

Aspects School Innovation

The major pedagogic focus is placed on the Team-Kleingruppen-Modell (TKM) (team mini-group model). TKM has designated stable reference and work groups for teachers (teams) and students (small groups of 4-6 students). The students sit together and work in small groups and lessons are designed according to a variety of methods. Social learning objectives and meta-communication are both components of the learning process. To make working together in teams easier for the students, they are given one to two-week project days in weekly core group lessons in the 7th grade team training, in the 8th grade methods training and in the 9th grade communication training, which is based on the KLIPPERT pedagogy.

Larger context of the educational system and national policies for ICT

The Federal State of Berlin pursues its own framework curriculum and is currently making intensive efforts in the form of a promotion program to increase the use of ICT in Berlin's schools (cf. appendix C).

3. The past

3.1 School history and school innovations

The JVS was founded at the beginning of the Eighties as a *Polytechnische Allgemeinbildende Oberschule (POS) (Polytechnical General Secondary School)*. On November 9, 1989 the Wall dividing East and West Germany fell and with it the GDR and the old school laws. There were no new ones to replace them so that new ideas could be put into practice almost without restriction. Under the leadership of one teacher, the JVS began an initiative whose objective was to develop a concept for the restructuring and new structuring of the old GDR educational system. In January 1990, the then headmistress was forced by students, parents and teachers to hand over the management of the POS to this innovative teacher. His idea was of a *one school for all children* from the first to the last grade of all types of schools and he supported the TKM. He soon found followers. Those involved described the time as a *euphoria of a new beginning, a new awakening*. The new Headmaster called about 20 new teachers to the school whilst others left as the school no longer fulfilled their wishes. *The newcomers were all people who wanted to change things and do things in new way* said the Jubilee commemorative publication in 2000.

On September 1, 1990, the comprehensive school was unofficially founded, the first in East Berlin since the fall of the Wall. In November of the same year, teachers, parents and students jointly occupied a building for a short time and declared it to be the new school as the old building was no longer big enough. *well, they didn't ask, they just opened a window, occupied the building and declared it to be a school* (Headmaster). It was subsequently officially approved and from then on the primary school and lower school remained in the old buildings and the Middle School and Upper School moved into the newly-conquered building. Teachers still go into raptures about the time *it was a grand community of students, teachers and parents all wanting a new beginning*.

Problems soon began to appear. The Headmaster at the time had to give up the management of the school in 1991, as he officially did not fulfil the formal academic qualifications necessary for the position. Many committed teachers left the school with him which was a great loss for those who remained. New teachers joined the staff who did not always support the innovations. In the course of assimilation in the educational scene, East Berlin adopted West Berlin School Law from September 1991 which meant that some of the innovative model ideas had to be surrendered. A new Headmistress took over provisional leadership of the school but was replaced at the beginning of 1992 by another Head who introduced a bi-lingual branch in French and early teaching of French in the Primary School.

Teachers based their pedagogical strategies during this period of upheaval on reform pedagogy. Experiments were made with concepts for weekly and yearly work planning, epochal lessons, inter-subject projects and particularly TKM. However, a summer seminar with two experienced and convinced comprehensive school teachers from West Germany did not suffice to qualify their inexperienced colleagues for the completely new TKM teaching methods. There were differences of opinion among the staff, teachers complained of the huge amount of time and effort which had to be invested in preparatory and follow-up work. There were also complaints that they were no longer *in charge* of their classes. It was too stressful for students to work in this way and lack of discipline led to bad marks which meant dissatisfied parents demanded a return of *the old order* (cf. commemorative publication 2000). Academic performance declined and there was no convincing success. Little by little, the teachers began to distance themselves from TKM and went back to the old *chalk and talk* methods although the new ideas remained a talking point the whole time.

In February 1995, the school chose the name it bears today: the Jules Verne School. After the Headmaster of the time had left the school, the current deputy headmistress managed the school alone for one year until the present Headmaster took over in September 1996. In July 1997, the integration between primary school and secondary school was dissolved, one reason for this being the fact that the schools were located in different places. Whilst the Lower School (grade 7) remained in the primary school, grades 1-6 were officially separated. The failure of the original dream of *one school for all children* is still regretted by many teachers and is considered to be a defeat. It did, however, trigger the Headmaster to initiate a discussion in 1998 regarding the development of a new profile for the school. The question posed was: *What does our school offer that no other school in the vicinity has?* (Headmaster). This appeared to be two main issues – art and music and the field of communication. Art and music was evident in numerous theatre productions and the field of communication was represented by the bi-lingual section, projects in ICT and a revival of group education. The Headmaster is particularly interested in the TKM aspect and is the reason for controversial discussions in the grade teams. In the meantime, former intensive cooperation with parents has been limited to regular meetings of the parents' representatives where new educational ideas and concepts are introduced and jointly discussed.

3.2 History of ICT use at Jules-Verne-School Berlin

In 1990, the school was given its first 286-computer as a present and this basis was continually built up. In 1992/3, JVS participated in the British computer project *Campus 2000* for which they were sponsored with a modem allowing electronic contact to school and educational facilities throughout the world. Initially, only a very few teachers and students were interested in participating. From 1993, all students had access to email and newsgroups from all PC work stations via the communication centre from a UNIX server. From 1995 to 1997, JVS took part in the communication model project *Comenius* in which four schools were connected via a network and worked on joint projects. According to the Technical Specialist^[1] there was no real cooperation as the technology did not function

reliably enough. The Technical Specialist saw one advantage in the project: *at least, the colleagues gained some experience and took part in some further training which they probably would not have done otherwise (Headmaster).*



Figure 2: ThinClient Server

Since 1995, the school has had its own homepage and since 1997, an internet leased line via fibre optic cable which is presently deactivated. A further EU project followed in 1998/9 called SUSIE for which cooperation with partner schools in Switzerland, Ireland and Canada were planned. Every two months, the students were to present a teaching project about a defined subject via video conference. A group of approximately 20 students from different grades was involved. The Technical Specialist was in charge of the technical side of the project and a woman teacher of English was responsible for the language matters. However, she felt she was under time pressure and, disappointed, gave up the project after one and a half years. Furthermore, lack of support and technical defects also contributed to the annoying situation. The school profited from the project in that since then it has been possible to hold video conferences and the technology required for this was sponsored. Since October 1999, JVS is the only school in East Germany to be a member of the *Netzwerk Medienschulen* of Bertelsmann Stiftung (*Bertelsmann Foundation Network of Media Schools*) (cf. Appendix C). Although the school does not receive any material or financial support from Bertelsmann it does profit from the contacts made through it. In October 2000, the school thus received through generous sponsoring the complete equipment and networking with ThinClients.

4. The present

4.1 Organisation of Evidence

4.1.1 Diffusion Patterns

The school is organised around a group of dissenters among the teachers. Impulses can be traced back to individuals but are soon spread throughout these small groups. Characteristic for all of those willing to adapt is their striving for something new. Resistance was due to the imbalance between the quality of existing old and new teaching materials.

Initiators and principle responsible persons

Due to the special political situation in which JVS was newly formed, the first major impulses for innovation came from a wide basis among the teaching staff. The opening of the Berlin Wall had triggered off great uncertainty and apprehension among the staff as the teachers had no idea of what to expect and fears for their jobs characterised their daily life. Amidst this uncertainty, about 6 teachers from a staff of 40 presented their new ideas together with the newly-elected Headmaster. *The situation simply gave them an opportunity for action, to dominate and, in a way, convince the others (...)* It was an uncertain time in which colleagues were prepared to do more than a Civil Servant would normally do (Headmaster). Supported by teachers who specifically applied for positions in the school wanting explicitly to implement something new, there was at first a concentration of people vehemently pursuing innovative educational objectives and determining what was happening at the school. Some of them left the school with the first Headmaster, others went back to their old roles. But the ideas and individual colleagues remained. As one woman teacher says today, *they were willing to work more than was normally required of them, they were committed and quite simply, they were good*. Thus, TKM was revived after an interval of several years, a revival forced by the current Headmaster and a few teachers after being re-motivated by a further training.

There are several teachers involved in the field of technical innovations. The main initiator was the Technical Specialist who works part time for the Senate advising schools on ICT. As he has numerous contacts and is up-to-date on current promotion initiatives, he has taken over the acquisition of promotions and sponsors for JVS. He is supported by the Headmaster. The Technical Specialist was the one who gave the *go-ahead* for ICT, who canvassed his ideas and dissolved fears and scepticism among the teaching staff. One colleague even referred to him as *the computer god* of the school. There are four other teachers also involved in computer science and impulses for ICT came from students and parents some of whom have been intensively committed. .

Who embraced it first/ last? Characteristics?

The age of the teacher would appear to be critical for him or her to be willing to adapt innovations as older teachers have been pursuing their educational methods for a long time and see no reason to change them or to begin something new. Little was said about gender among those asked at JVS However, it was observed that six male colleagues offer courses in ICT and involve themselves with the technical aspect whilst women teachers, when at all, use it in lessons.

A more considerable factor than age or gender would seem to be the person's character. Persons who were first to take up innovations were characterised as being people who see setbacks as an opportunity for a new beginning, who keep to their ideals, who are willing to invest time, to embark on new ideas and to question their own roles and opinions. In contrast, those late adapters are described as people who find innovation frightening, who cannot let go of old ways, who hold on to their authoritarian roles as leaders and who are

less inclined to take risks and work in a team. The deputy headmistress explained that these were teachers who taught under the old GDR system and who were of the opinion that not everything about those times was bad and that students had performed successfully.

Diffusion Pattern

At the beginning, many teachers came to the school because they wanted consciously to change things the proportion of those supporting and promoting innovations in the educational sector was relatively high. According to one woman teacher, those actively implementing group education today represent not even one half of the teaching staff. She estimated the figure at about 20 persons. Although the rest do not offer any resistance, neither do they support it.

It is estimated that, in the meantime, all teachers work with the computer, at least for preparing their lessons at home. Many get rid of their fear of the computer by working in their home environment with one. There are, however, clear differences concerning the extent to which they use a computer for lessons. One teacher estimated that about 10 colleagues used the PC a lot for project work, a further 20 for finding information in lessons whilst the others were still waiting to see what happens and were undecided. JVS has an advantage in that the teaching staff is very young so the willingness to accept and work with ICT is high and teachers do not want to miss catching up with new technology. The teachers of computer science are helping to establish ICT more and more among the teaching staff as they go to a lot of trouble to *acquaint their colleagues with ICT* and are there for them should problems arise. As the school is so well equipped, teachers develop an interest in the numerous opportunities existing. *When the technology available is so overwhelming and you have such great opportunities all at once, then you simply just want to get involved with it* (woman teacher). Innovations also spread among the grade teams where there is an extensive exchange of ideas.

Resistance and problems

Following the fall of the GDR, initial experiments with TKM were given up because of immense resistance and difficulties. Some of the teachers pulled out and have remained disappointed until today, whilst others kept the idea in their minds striving to make another attempt. Since its revival two years ago, there still has been no consensus regarding TKM among the staff. Group education is the subject of controversial discussions and the attitude of many teachers is reserved. There is therefore no consistent form of TKM and each grade team has found its own consensus. Current discussions concern the advantages and disadvantages of the size of student groups (4-6 students) in arranging the table groups in the classroom and a concept for marking group work.

Resistance against ICT flares up usually around financial issues. The school has modern technical equipment thanks to external sponsors but the maintenance of the installations takes up about 20% of the total budget. Many teachers complain that so much money was invested in ICT which was already more than averagely well-equipped, whilst text books and other technical equipment such as OHPs and video sets were completely antiquated. *There are some inconsistencies; the TVs just stand around, broken but we can surf in the internet for sure. There are simply contradictions which we have to tackle* (teacher). According to the Technical Specialist, there was envy and aggression from other schools in the region regarding the over-privileged technical equipment and international attention. Apparently there was no resistance to the technology itself within the school, at the most *reservation and fear. I think that is the crux of the matter. That you are not sure how to deal with the new media or how to use it* (Woman teacher).

4.1.2 Staff development & involvement

The presence of a system administrator who is available to answer teachers' individual questions is seen as particularly helpful. Furthermore, the exchange of experience between colleagues in other schools is of major importance.

Informal learning system and in-school training

The comprehensive technical opportunities at the school acted as incentives to many teachers to involve themselves in ICT and to take up independently further training. This auto-didactic *learning by doing* found support and help in mutual assistance from colleagues who were described as friendly and open. One woman teacher found that conversations with her fellow staff and the exchange of information with them even more important than computer training courses. Teachers who were familiar with ICT functioned as propagators of information within their teacher teams. Informal assistance also came from students themselves and one technical colleague for computer science. Many teachers particularly appreciate the presence of this colleague, a former TV technician who holds an ABM^[2] position in the school as technical support. His post is limited to June 2001 and can only be extended to a maximum of two years.

I would say he is the one who shows the teachers what to do. When we have a free period, we can always go to him and - assuming there is no other urgent problem to deal with - he sits down with us, explains everything, tells us how to do things and practically, he is running the whole in-school training (Deputy Headmistress).

Formal learning system

At the beginning of the school year 200/2001 all teachers had to take an obligatory introductory training on the PC. Each of them had their own email address. For the Headmaster, teacher training *is a major issue, which must still be speeded up*. As knowledge in this field is very quickly out of date, continuous schooling is essential. This takes place mainly in-school via one of the three computer science teachers and is attended by about 60% of the teachers. Regularly, 15-20 teachers get together and work out topics with the person responsible for further training. Training requests are collected beforehand from the notice board in the staff room. The Bertelsmann Group arranged for a questionnaire to be completed by the staff and the results showed that teachers prefer *to be briefly*

introduced to one topic individually (Headmaster) instead of attending long training sessions. In such sessions they frequently learn so much that they cannot evaluate the information and are more likely to be confused by such a wealth of information. Therefore, *Short, fast training sessions* have been planned for the future. That means that teachers will be able to get advice and answers to their questions from competent teachers or from the ABM colleague. In so-called NetNights, interested teachers can exchange experiences with their colleagues by wine and candlelight and become acquainted with the internet. The evenings take place at irregular intervals and are attended, on average, by 17 people. Most of the teachers are motivated to take training but time is often an obstacle.

According to one teacher who was asked about the opportunity for training at school *Well, I think what is offered at school is very good. We have the equipment and we have the people*. Training is also given at JVS by former students. This form of *Teach your Teacher* is very popular both with teachers and interested parents. It is important for teachers not only to gain knowledge about technical applications but to find concepts for the educational use in their lessons something a student cannot impart and which is also difficult to acquire autodidactically.

External training and meetings

The JVS teaching staff can also attend courses at the *Berliner Institut für Lehrerfort- und Weiterbildung* training centre. (Berlin Institute for Teacher Training and Further Training). The Technical Specialist at the school also offers pan-regional courses in Berlin himself. He likes to train himself in cooperation with companies and is keen on enabling interested students to do so, too. The *Bertelsmann-Stiftung* also organises a meeting every six months to give teachers the opportunity to exchange know-how and experience. In addition, participating teachers also profited from training which took place within the scope of one of the computer projects and the resulting exchange of information with colleagues. This took place at national and international level.

The *Gemeinnützige Gesellschaft Gesamtschulen* (non-profitmaking organization comprehensive schools) supported JVS teachers in group education establishing contacts with experienced teachers throughout Germany who have been working in the sector for a long time and offered training. During the first training session at the beginning of the Nineties, the teachers organising the training were able to enthuse the JSV participants to such an extent that these began to put their knowledge into practise as soon as the training ended. Later on, useful congresses, training sessions and exchanges of experience were repeatedly arranged.

4.1.3 Role of leadership

The role of the Headmaster is characterised by the fact that he encourages and enables teachers to innovate, with the Deputy Headmistress acting as his critical counterpart.

The Headmaster took up his position four years ago at JVS. Before that he had been a teacher at the school for five years, a fact he describes as being not quite without problems as *Relationships with some colleagues were considerably closer than with others. Some I liked, some I didn't that's clear* (Headmaster) He sees himself as someone allowing colleagues good ideas, of encouraging and motivating teachers *to be active themselves and, in principle, to bring together all the positive aspects*. One woman teacher describes him as *an innovator and creative and capable of enthusiasm*. Parents who were questioned said he was *open, a very active and convincing headmaster, who has created a good atmosphere*.

Those questioned said the Headmaster had played a leading role in the introduction of ICT and in implementing group education. He stuck with the idea of TKM even during the time it was not being practised in lessons. When he became Headmaster, he used the opportunity to motivate the teachers once again to group work, to arrange for training and to renew the discussion. He sees himself as the initiator of the revival of this idea. One woman teacher described his method of re-initiating group work as *a little bit dictatorial, (...) he said, OK now do it!*. *He was simply pleased that we were interested and then he went around telling everyone: they do it. We all felt we were under a bit of pressure. Like it is sometimes when you have a great idea, you find it super but you have to be careful not to run people over with it* (woman teacher).

In his conception as how he sees himself, he emphasises that he does not want to be a *head master* in the sense of someone *mastering* other people but would like to work out guidelines jointly with colleagues in constructive dialog so they have parity in their development and implementation.

Regarding the introduction of ICT he describes himself as someone who *mediates and makes things possible*, supporting the Technical Specialist's good ideas because the Technical Specialist has a negative effect on the teaching staff due to how he is *he lives in the clouds and no-one understands him, he antagonises the others*. The headmaster then tries to get the colleagues *to participate and to support him* (Headmaster). One teacher said the Headmaster had given the whole issue a new impulse when he became headmaster. Even if the group education was primarily his *hobby* in the beginning, the field of ICT has become one, in the meantime. One woman teacher said the Headmaster used ICT intensively in his lessons and spent a lot of time on it with the Technical Specialist.

Deputy Headmistress

The Deputy Headmistress managed the school alone for one year whilst the position of headmaster was still vacant and today she gives an impression of functioning as a counter-balance to the Headmaster. She describes herself as *the one who first questions everything, in contrast to Mr X. (the Headmaster) who can quickly become enthusiastic about something, I am usually quite reserved to start with (...) I need a while until I can enthuse about anything* (Deputy Headmistress). However, when she is convinced of something, or something has been agreed upon by the school management, then she resolutely supports it externally. However, before she does so, she likes to consider *all the reservations* (Deputy headmistress) she can possibly think of, *People used to tell me that I categorically rejected anything new; I admit, maybe I did at the beginning.* (Deputy Headmistress) However, it was confirmed that she has become more receptive in the meantime.

One father reported that he was particularly impressed by the open and self-critical ways of the Deputy headmistress and registered his child for the school *I found there someone who could openly express their faults. That can't be a bad thing. She had nothing to hide, she handled her weaknesses quite openly and I was very impressed by this. So I thought that's the right school for my child.*

4.1.4 ICT-Innovation Connections

Relation of Innovation and ICT use

Educational and medial innovations complement and support one another in a variety of ways. Importance is attached to the application when using ICT in lessons.

Figure 3: Group teaching in Chemistry

Educational innovations and medial innovations were introduced separately from one another. Nevertheless, they overlap and complement each other and in both fields most of the work is done in groups or is project-orientated. Group work prepares students for social learning, the ability to work in a team and social competence and independent working are trained. Students bear the responsibility for the learning process which they themselves determine, in contrast to the widespread consumer behaviour of the students. Possible isolation among students from concentrated work on the computer in lessons or at home can be compensated by TKM as a firmly anchored working method in everyday school life as here stable reference groups exist. When working in small groups, the students continually make use of the PC independently for researching information. There is also an integration of educational and technical contents in the school's special areas: bi-lingual lessons can be sensibly supported by e.g. email, chat and video conferences. In music and art the theatre and music groups profit from digital recordings of their projects and presentation in internet.



Both strategies accommodate the social reality of the students and have an educational effect on it. Media pedagogy catches the interests of the students and group pedagogy serves to counteract increasing social problems of the students and to have a social-pedagogic influence on them. The teacher has the opportunity to speak to each student individually which leads to a different type of relationship than the one resulting from teacher-centred lessons in the classroom. In both cases, the role of the teacher changes and he/she becomes increasingly *advisor, coordinator, organiser and inspirator*, he need no longer be the one who knows everything, but rather he gives up control. For low-performance students group work and work with the PC both offer opportunities to achieve a good performance which they would otherwise not have been able to do. Quiet students who contribute little to teacher-centred lessons, can be integrated into the learning process and achieve success which in turn is motivating.

Role in the academic program

The outlining guidelines for computer science are badly in need of reform according to the Headmaster. This is one of the reasons why a working group from the *Bertelsmann-Stiftung* is involved with the topic of *media curriculum*. At JVS, students in grade 11 work in the optional compulsory subject of choice *Computer Science* with a functional program language (LOGO) which displays the programming graphically. Furthermore, the Technical Specialist prefers the students to work with applications and not simply programming for the sake of it but practically, e.g. for the further development of the school's homepage, or for building up a web server or an information system based on a data base. This type of project-linked work is not meant to be something *which must first be explained as something ideologically important, but (...) it ought to be serious.* (Technical Specialist) In addition, the Technical Specialist attaches great importance to each student being encouraged according to his/her individual interests and skills.

Basic IT knowledge e.g. word processing, spread-sheet analysis and data bases is taught the students in grade 8 in a course called ITG "*Informationstechnische Grundlagenbildung*" (*Basic IT Training*). This special field of *work instruction* is held for half of a class over a period of six months. A longer course in this field would include e.g. the simulation of founding a company with cost calculations, drawing up of concepts and brochures on the computer. Students in grade 9 10 can attend the subject of computer Science as an optional subject.

Use of ICT

According to the Headmaster, JVS has made it its objective as a media school to install ICT in lessons in addition to Computer Science. A study made by the *Bertelsmann-Stiftung* showed that every fifth teacher had surfed the internet and every 14th. uses it in lessons (cf. New Germany 11.11. 2000). Our own investigations from the return of only 16 questionnaires showed that a quarter of the teachers are *not familiar* with searching for information in the internet and half of them had no experience of emails but all of them were able to write texts using *Word*. Some are shy of using computers in lessons because they think *you have to be able to master it perfectly before using it with students.* (Headmaster) Some teachers depend entirely on the skills of their students, which makes the students very proud of themselves.

As already mentioned, students use the internet during group work very much as a matter of course and in their own responsibility to get the information they need for their tasks. Teachers often offer specifically different stations with varying sources of information.

Furthermore, the PC is used in lessons e.g. to publish topics on the home page or to use a teaching program. Students use the computer nowadays as a popular tool for writing essays or doing their homework.



Students in grade 7 have an additional opportunity to participate in a special optional compulsory subject of choice Computer Science. In co-operation with the Stadtteil-Jugend- Medienzentrum *Helliwood* a teacher is carrying out a comprehensive media project there. In *Helliwood* there are four competent staff members and 60 networked computers. There has been close cooperation with JVS for a long time. The *Seventh Grade Project* with the JVS took place last year as an open working group and from this year will be carried out as a school commitment with work being marked. The students are working on topics such as *Gewalt voll uncool* which translates roughly into *Violence is totally uncool!*. For their project, students interview people on the street, meet with local politicians or create a questionnaire for other students. The results are then published in the internet. Further projects included the creation of a virtual childrens town plan for Berlin or the recording of a video discussion in the internet. Technical computer skills are gained on site directly on the object of application. The project is managed by one JVS teacher and one member of *Helliwood*, whereby the latter is responsible for computer matters.

Figure 4: Students of the 7th grade in Helliwood

At the school itself, six different teachers offer courses in the optional subjects sector among others on the topics of *Multimedia and Music, Video and Image Design, Software Application, Home Pages, Computer Hardware and Meeting Point Webmaster*. The school s home page documents numerous projects from the annual project weeks with pictures and in some cases, video recordings. The Technical Specialist emphasises that he is not principally interested in a professional home page *all our pages look chaotic in a different way, but it is the process which is in the foreground (...) the joint work (...). We simply say we are a school and we are here to learn, we are not a place of employment where the product is the main thing.* (Technical Specialist) To the reader, the school s home page looks very versatile and it has clearly been designed by students which makes it very authentic and lively.

Assessment of working with ICT

The Technical Specialist and some parents are agreed that the PC is an essential cultural technology which should be taught just like reading, writing and mathematics. The computer should not however be used for itself but as a tool to be used when it would appear to be meaningful for the learning process. It is another learning medium which should not oust other forms completely. Some teachers think that ICT is already being used in a variety of ways at school and this use should not be increased. One woman teacher sees a problem of the curriculum being too full and ICT is not helpful enough for imparting contents.

It is not effective enough. If you have the space to use it in and want to work with the children then you need to have ideas about solutions which I don t yet have. You need a few suggestions on how to make more intensive use of it. Training would be very helpful here (woman teacher)

4.2 Outcomes

4.2.1 Infrastructure

Recently the school has been equipped with top-grade technology via the ThinClient networking. Most was provided by sponsors. Students, a TV technician and a commissioned company supported the responsible teacher in the administration.

Equipment

Figure 5: The smaller ICT-room

The school has two, large networked computer rooms. One is equipped with 11 older computers and one with 21 ThinClients. There are three computers in the school library and others in various classrooms. A so-called Literature Café serves as a recreation room for students in the Upper School and contains three computers. In an external building for grade 7 are two computers. In the school there is a total of 53 computers with internet access and seven without. Some of them are installed for special subject fields (e.g. a microscope with computer link-up, a music computer with recording facilities and a CD burner), in the staff room (three ThinClients) or in administration. This results in a ratio of 18 students to one computer.



A speciality in JVS is the equipment with ThinClients Network. Contact was made to an American company through the Bertelsmann Stiftung who together with two other project partners sponsored the school with three servers and the ThinClient terminals for a computer room for a total value of DM200,000.00. The old computers in the school were revamped with ThinClient terminals so that all 53 computers in the school can use the three servers. The terminals are not full-grade PCs but serve simply as terminals to call up data from the main server and to calculate the graphic representations on the relevant monitor. They do not have their own CD-ROM or disk drive so they are cheaper to buy, less prone to failures and require less maintenance. A further advantage is that each computer has the same software which only needs to be installed once, teachers and students can access the server with a password from home and the network allows teams to work together. Although initial costs were very high, (the three school servers cost DM 50,000.00) the investment



will pay off in the long run. JVS is currently the only school throughout Europe with this system.

Figure 6: ICT-room with ThinClients

The ThinClient requirement is obliged to use Microsoft Windows NT; previously LINUX was used. As a Microsoft partner school, the school has all the usual word processing and data processing software. On the whole, teachers, students and parents say the hardware and software is top-grade and above-average. At present, there would appear to be no more obstacles caused by bottlenecks in using the installations in lessons because of a lack of

technical capacity.

Support to keep it working

As in all German schools, all repair and networking of the computers and system maintenance as well as overall administration remain, on the whole, in the hands of committed teachers and parents. At JVS this is the task of the Technical Specialist and two other technically versed teachers, who are each freed for one teaching unit per week for the work. However, all three *computer science* teachers do more than the hours they are supposed to. One father was of the opinion that *these teachers were not in a position to master and administrate the technology as they lacked the necessary qualifications*.

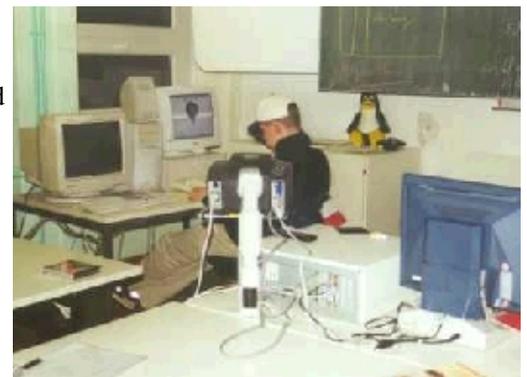
Figure 7: Student Administrator

The students themselves therefore play an important part in the maintenance system and the Technical Specialist admits that in many issues he knows less than his students and so he leaves it to them to configure complete computer installations, seeing as they also have more time. The Technical Specialist spoke specifically with students and asked them to form ICT web teams in which students take on the responsibility for maintaining the home page, network administration and training. There is currently a group of approximately 25 students of which five have taken over special maintenance tasks. One father found that this had both advantages and drawbacks:

They have to find out a lot of things because after all, it is up to the students or some of them that they are able to do these tasks. What they really do is another question because a 13 or 14 year-old student is not mature enough as a person to administrate the whole school. You need more than technical know-how to do that (Father).

Contrary to other schools, JVS has support from two other sources. One is from the ABM employee who looks after the hardware fulltime guaranteeing that the computer room is open to the students every day until 6.00 pm, holding work groups with the students and maintaining the installations so that the computer science teachers can concentrate on software maintenance.

The other source of support for network and server maintenance of ThinClients is provided by a company which was responsible for the installation. Employees from this company come to the school regularly every month for about 5 hours, the costs, about DM 1500 are paid for by the Regional Office. This is the first and only time this has happened in Berlin and was negotiated with the sponsoring company in the run-up to the sponsoring agreement which ensures the necessary maintenance of the installation provided.



Resources

According to the Headmaster, in addition to careful budgeting with financial means available and the willingness to continually invest in ICT, state sponsoring initiatives and sponsoring from the private economy were necessary in order to reach the current level of ICT equipment as there is no provision for computers in the schools' budget. As JVS is a state-controlled comprehensive school it is provided with a yearly budget of about DM 95,000 of which it spends approximately DM 4,000 a year on ICT. Income for computer equipment in the last ten years amounted to about DM 80,000 from the State and the Region whilst private investors have contributed an estimated two to three million in the last ten years whereby the technical Specialist emphasises that the school did not beg for this money rather the focus was on the work on contents which awakened the interest of the investors. The school also was given some financial support from the JVS Promotion Association which has existed since 1993.

4.2.2 Effectiveness

Teachers can observe motivating advantages in their students during lessons incorporating ICT. At the same time, there is an increasing superficiality in the learning process when tasks are dealt with.

Main values, advantages, positive aspects and impacts of learning with ICT

The school's image has been positively strengthened by its national and international successes and finds recognition in the surrounding area. Teachers see one learning effect for their students from working with computers is that they learn to work on their own and can extract information from the internet more easily and quickly which results in increased success and enjoyment when researching. Access to the latest information is open and the topicality of the subject adds greatly to the discussion of the subject. Several teachers have observed that by using the PC, homework is done more regularly and with more motivation, including mathematics and text work. Students say themselves that they enjoy working with educational programs which present a topic in an enjoyable way. One woman teacher has observed that students in the secondary level were more motivated by ICT than those in the secondary level II *In the secondary level II I would say it is easy, it is normal for them in some way. But they are not more strongly motivated because they can just have a look from time to time*. Differences in interests also influence the student's learning behaviour and speed on the PC.



Figure 8: Teacher with two students

Self-determined ICT work has an effect on co-operational work with the students helping each other instead of waiting for the teacher to help. They like working together as partners a fact which could be clearly observed during our lesson audits. Most of the students work on the subject with great concentration and the teacher has the opportunity to deal intensively with individual students. Some teachers see advantages for themselves in the computer work because it motivates them to think of other ways of presenting a lesson, gives them increased opportunities and allows them a different kind of relationship with their students.

Problems, disadvantages and negative aspects/ impacts of learning with ICT

In addition to financial, spatial and technical problems, there were other difficulties. Teachers complain about the amount of time needed for preparations or they feel insecure because of the reversal in roles and their lack of concepts for dealing with the matter. One parent found this discrepancy between the knowledge of the teacher and that of the student where computers were concerned as a disadvantageous *loss of authority and respect* and something which teacher training should deal with. One of the problems faced by students is that they either do not have the competence or the will to look critically at the information they extract from the internet. One teacher thought *you need to have an immense background knowledge and many skills in order to be able to work selectively or to know what to ignore. The students are normally overwhelmed with details without any overall connection to be able to recognise the whole*. Sometimes, they are not even interested in reading the texts they have found. *For them the job is over once they have found the information which is then dealt with in a rather uncritical manner. They have the technical skills but they have problems to make further use of the text* (teacher). Practically all teachers criticised this problem. The Technical Specialist regretted that there was a lack of good concepts at the school for working with ICT and that project work in every-day school life was restricted by external regimentation. Another teacher said there was a lack of good, top-quality educational software.

Abuse and responsible handling

Students at JVS have relatively free access to the computer rooms in the school. Up to now there has been no major forms of abuse. Hardware is seldom damaged. Early on, there were some cases of theft of technical accessories. The rooms are secured against break-ins of which there were some cases at the beginning - only during school time. Students treat the computer as a valuable object and do not want to damage their opportunities to work with it so they take care to see that it functions.

Surfing around pages considered harmful for young persons is to be blocked. As each student logs in to the computer with his/her own password, in any cases of doubt, it is easy to trace back to see who did not keep to the arrangements. Those students who have the necessary skills to manipulate the system are involved in the administration. The teacher tries to prevent students looking in on chat and play pages during the lessons by talking to them about it. Students also refer to ready-made texts to make work for essays etc.

easier but the Headmaster views this as abuse when the student does not understand the contents and pretends to the outside that the work is their own. However, if they have really involved themselves in the subject matter, then he finds researching for information in this way to be appropriate.

4.2.3 Impact on Academic Rigour

Impact of ICT on academic rigour

For reason of the type of school it is, JVS has to combat a variety of problems concerning academic rigour as more and more low-performance students are attending the school. The Headmaster reported that parents of children who have not been recommended for a grammar school often hoped that the comprehensive school would open the way for their child to Abitur (German school-leaving examination which qualifies the child for university entrance). The Abitur results at JVS are below the state average. Teachers hope that the development at JVS will be positively influenced by its good reputation in the field of ICT. This could attract children who would normally be registered at a grammar school. On the whole, one woman teacher supposed that the technology would have a positive influence as it increased the desire to learn, a more intensive involvement with subject matter and thus improved performance *and because fun and the willingness to invest time always go hand in hand, I can imagine that it would have an advantageous influence on results.* (woman teacher)

Impact of school innovation on academic rigour

The Headmaster made one observation *the gap between very good students (...) and students who come to us who have been recommended for the general secondary level with very weak performances is increasingly widening*. Various tests have shown that the students abilities in reading, writing and mathematics are worsening. Teachers and parents who were asked about this point were of the opinion that an increase in leisure-time activities offered and less stringent curriculum after the fall of the GDR have led to a decrease in a child s willingness to learn.

Group work at the school is an attempt to counteract lack of motivation and social problems among the students. Confrontation of students in each of the grade 7 classes leads each year to great problems. The students are just entering puberty and at the same time have to cope with a new school. In addition, they are confronted with a working method which requires a high degree of social competence from them. Training of social competence, finding a place in a group, communication and group training, meta-communication and organisation of work division take up a lot of time and the learning of contents suffers. Students do not learn to work successfully in groups until they have had increased experience but until then it is a burden for teachers, students and parents. The parents are dissatisfied because their children perform badly and make no progress and teachers are truly stressed by negative feedback from the parents and the difficulties of the students among themselves in the classroom.

There were reports that particularly low-performing students appear to hide themselves in groups, whilst high-performers prefer to learn alone as they often feel they are taken advantage of in a group and carry the responsibility for the results. This situation makes it difficult for the teacher to give a fair mark. Because each student works in a different way in a group, it would be unfair to give all of them the same mark and not take into consideration the individual performance of each student. One way of dealing with this situation is that student and teacher each determine one half of the mark or the teacher determined a total number of points for the group work and the students distribute these among each individual as they see fit. The problem is that personal likings could influence the mark, a fact which should not be.

In spite of all the initial problems the deputy headmistress reports that TKM was judged positively by all those involved in the long term. One parent emphasised particularly the social side of the learning effect *I find this aspect much more important than effective imparting of information*, whilst others emphasised the positive influence of group work on the atmosphere at school and in class and the higher learning effect brought about by the student s own efforts.

4.2.4 Equity: who gains most/ least from it?

Computer access at home and at school

Figure 9: Smaller ICT-room



The students have free access to both computer rooms between 8.00 am and 6.00 pm as long as they are not being used for teaching, In the larger and newer of the two rooms, the ABM employee is present for supervision and is also in charge of the keys. Sometimes, Helliwood employees or students take over the post. In the smaller room, teachers supervise whilst in the Literature café and the library the students can use the computers unsupervised. The students use the computers in each break, stay behind in the afternoon after school hours and sometimes come back to school again later. The computers are therefore almost in constant use. Access to the computer is controlled by a password which the student is given on attending an optional computer science course, a work group or ITG. Depending on their account, the students have a variety of rights. If these are abused, the account can be

withdrawn which represents a major punishment for the student. Those questioned assumed that depending on the age, 40-80% of students had access to a computer at home, but less than half to the internet. It was estimated that each student spent an hour with the computer after school.

ICT-use of students

Some students with insular talents spend all of their leisure time on the computer and display accordingly high performance. They are, however, the exception. When students leave JVS they have normal PC know-how and handle it in a matter of fact way. They know how to deal with a mouse, a keyboard, an operating system and are able to research for information in the internet. They have had at least six months' contact in ITG with standard software. Many use ICT mainly for private surfing, chats or games. The PC is used for school purposes to do homework and to find information in internet or educational programs.

Differences between boys and girls

Most teachers find no difference between boys and girls regarding their handling of PCs in lessons. Both groups handle the PC as a matter of course and without aversion. Differences occur however concerning application. Boys are more interested in hardware technology and software programming and spend more time on the two whilst girls prefer the communication aspect of the PC such as chats, mails and text creation and are apparently more apprehensive of dealing with computers as a science. The Technical Specialist also pointed out that the two groups tackle ICT problems in different ways:

The girls (...) have first to stabilise their somewhat different way of approaching problems so that they can gain positive experience and then simply realise my thorough pre-considerations, my way of thinking give me so much more than Oh- I'll- give it-a-try, I-can-do-anything and I-am-the-master-of-the-universe attitude! (Technical Specialist)

The Technical Specialist finds girls to be *self-determined, more self-confident and more thorough in many ways* and thought they often achieved much better results than the boys. At first, JVS held courses only for girls to cater for their own way of working but in the meantime, the Technical Specialist finds them unnecessary because it afforded the girls special treatment. In his opinion, the overall requirements must be so defined so that each can develop his/her own strengths and the girls should find out during joint lessons where their strengths lay.

Differences between high and low poverty students

One teacher is convinced that differences between the students lie not in their gender but in the technical opportunities at home. Students from more wealthy environments with access at all times to a PC at home, have the advantage of being able to work with a PC more quickly, more spontaneously and more relaxed and this was the reason why they involved themselves more with it and had a higher level of skills. The Headmaster commented: *well, I would say it is obvious (...) that the best-informed students all have their own PC at home. That is so.* One woman teacher saw a connection between the parents' education, financial background and the student's performance. The school can at least equalise the situation with the opportunities provided at school. Although inexperienced students initially handle the computer with some nervousness and have to remain longer at school in the afternoons, the opportunities at school are a good equaliser for those from socially weaker backgrounds. The school's objective, and all those questioned agreed, is to provide access to a PC and the internet for all social levels, if they so wish.

Differences between strong and weak students

Some of the low-performance students in other subjects achieve excellent results in Computer Science and this boosts their confidence enormously. Some students are also prepared to research matter for topics which would otherwise not interest them simply because of their enthusiasm for the PC. In this way, some weaker students profit in some subjects due to their general interest in the PC. However, several teachers pointed out that although students in the lower grades or low-performance students had the same technical knowledge to find information in the internet, contrary to high-performance students they were often content with just that and did not process the information in any way. Low-performing students were often those who only printed out the texts but did not read them because processing the text was a challenge they did not want to face. High-performing students apparently use the PC privately for homework, research and are interested in application programs. Superficial handling and more intensive use of games remains another difference between low and high-performing students. This is partly due to good students taking the lead in group work and on the PC.

4.3 Projections

4.3.1 Sustainability and Scalability

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

One of the most important plans for those responsible at JVS is to take up quarters in a new school building. On the one hand, they would like to have a more appealing organisation of the building, on the other hand it is particularly important that the grade 7 is integrated into the school so that it can be included in the normal day-to-day life of the school and the teachers are spared the trouble of the distance to travel between lessons. More space is to be created for computer technology and group work. Furthermore, the Headmaster is interested in group educational strategies and would like to see an increasing decline in rigid lesson times and a trend towards project work and smaller classes. Most of these wishes on the technical side have been fulfilled since the latest investment in

the ICT sector at JVS. Still under discussion is the question of extension towards laptop classes and PCs with beamers in each classroom. Some teachers however would do without any further highly-specialised computer technology and instead would be grateful for additional, technically simple equipment such as OHPs and video recorders. Further plans for the future depend on the utilisation of the existing installations. They envisage video conferences and contacts to other schools and states and the transmission of theatre productions and concerts by the school band in the internet. Some parents would like to see the curriculum revised so that the subject of Computer Science would be upgraded and more strongly integrated into regular lessons.

Required resources and support?

According to the Headmaster, what the school needs most of all is money for personnel resources for teaching and technology, for teacher training, specialist literature and the maintenance and upkeep of the technical installations. Some teachers would appreciate not having to appear as beggars when they ask for investments to be made. The biggest source of annoyance at the school is maintenance. Although JVS has an ABM employee as a responsible administrator, it is uncertain as to how long he can remain at the school. Teachers also need time for further training and for an exchange of experience.

The Headmaster and several teachers emphasised that they would particularly appreciate well-thought out didactical concepts specifically targeted to individual subjects. A pre-selection of appropriate internet addresses would be helpful as well as ideas on how to use the computer in lessons other than for internet research. One possibility would be a special journal or a personal advisor for schools who would be on site as contact person. One teacher mentioned the necessity for improved teaching software.

Dependence on a single person?

Maintenance of the TKMs depended to a large extent on the Headmaster. Although there are other colleagues who want it *the basis is relatively small* said one teacher. On the other hand, one woman teacher sees a growing circle of users and supporters. Originally, everything depended on the Technical Specialist concerning technical innovations *but there are colleagues, who are involved in many subjects and do it really well* (teacher) and he is most certainly the one who pulls the threads for new sponsors but in the meantime, several teachers use the existing installations intensively

Appearance in three years?

In the long term, this part of town reckons with a drop in the number of children in the next four years so that the further existence of some schools is endangered. JVS hopes with its activities to set itself apart from other schools and to survive the competition, therefore it is likely that the school will continue with its commitment. A further fact is that those responsible for the technical sector are well aware of their obligations towards the ThinClient sponsor. The project has been conceived for three years and the Deputy Headmistress emphasised that the advance payments made must now be followed by concrete school projects which must not be limited only to internet searches in lessons. Cooperation with Helliwood and competent employees will cease next year due to closure of the facility which students and teachers very much regret.

Cost/ benefit ratio. What effort and resources are required for full implementation and what benefits can result?

In order to better utilise the existing installations it would be sensible to use the existing computers to their full capacity. This can be ensured by maintenance, teacher training and utilisation concepts and thus prevent the expensive equipment gathering dust in cupboards until it is antiquated.

5. Conclusion to the Hypotheses

- 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 school-wide 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.**

Observations made at JVS confirm the hypothesis that ICT requires a completely new form of learning. Teachers working with it discover that conventional teaching concepts must be changed in order to integrate ICT appropriately into lessons. This leads to the formation of extended forms of group work and the role of teacher and student changes. ICT functions as a catalyst to the formation of new and innovative learning forms. A good example of this is the project a work with *Helliwood* at JVS.

Changes brought about by ICT run in many cases analogue to educational changes but in principle they concern varying teacher and interest groups, a fact that contradicts the counter-hypothesis. It is strengthened, however, by the fact that the school began primarily with educational objectives. ICT use is only possible later and as additional auxiliary equipment in group work.

- 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.**

Many reasons speak for the teaching staff accepting the innovations according to ROGERS: relative advantages which the teacher has for his involvement would be first of all the security of his/her work place which is still a strong feature as teachers want to be sure of a future, safe position at school as most of them are young and cannot ignore ICT. The complex technology is at first an obstacle to

many although fears can be overcome by first practising on a home computer. Consolidation in a team of teachers promotes the spread of ICT use in schools as the teachers are used to exchanging ideas in a team and in this way can pass on knowledge of ICT well and quickly. Time is bringing an increasing number of teachers into normal distribution motivated by a few pioneers. No other forms of distribution were observed.

- 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.**

This hypothesis is supported by the fact that it was shown that teachers who only approach ICT without confidence are not keen on using it in lessons and if they do, then only to get students to search for information. For innovative projects such as Helliwood, teachers must have a comprehensive knowledge or the support of helpers from the outside.

The rival hypothesis is supported by the observation that teachers at JVS were first animated to work with ICT by the new technical equipment as they had the impression that there were now sufficient opportunities to use the computer room and that the equipment was functionally reliable. Control of the software gave additional assurance to go into the computer room with a complete class. Some teachers then rely on the skills of their students to compensate for their own failings.

- 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.**

The open access to all of the computer technology offers high-poverty students sufficient opportunities to compensate for their disadvantages situation. In principle, it is possible to eliminate differences and failings. However, the rival hypothesis showed that students who have a computer at home, increase their advantage even more by having spontaneous access. In addition, privileged students tend to have parents with higher education and are given more support by them so that the differences become even more crass

- 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.**

As a result of motivation combined with independent processing of subject matter it is thought that ICT can increase the academic performance level of students. The hypothesis indicates this to be so. The rival hypothesis however is supported by the fact that quite a lot of teachers complain that ICT takes up too much time without producing any meaningful results. Moreover, students often use information from the web without criticism or they do not seriously make any efforts to examine it at all.

6. Projection to the future and extension to other schools

In order to implement such innovations at other schools, a minimum of technical equipment is required. Resources must be found and maintenance must be guaranteed. The Technical Specialist thinks that advise on educational and technical projects would be of great help, that there should be someone at the school who is responsible for talking to the teachers, giving them ideas for their lessons and, in cases of doubt, be there to prepare the technical environment. One teacher indicated the significance of motivating the teaching staff: *If you manage to get the staff to want it, it is, in principle, transferable. The problem is to get them that far* (teacher). The Headmaster pointed out that the implementation of new ideas was linked to an awareness of the teacher's own basic attitude to education. If, at last, the teaching staff is aware of the problems and can understand the need for innovation, are willing to make changes and to face new challenges then it depends after that on time and opportunity for teacher training and an exchange of experiences among the colleagues. An exchange of ideas with colleagues from other schools can also be of great help.

In spite of agreement regarding a common innovative concept, it is seldom that there is complete consensus among the staff. *Everyone has had different experience, has a different educational background and therefore different opinions. It is difficult to get them all to pull together* (woman teacher). Then it is essential *to be tolerant of different ways of looking at things* (deputy headmistress). Open and constructive discussions among the teaching staff increase the probability that innovations will receive support from the wide majority. It is also an essential pre-requisite to be able to endure failures:

Then you have to be able to live with the failures (...) and not let yourself be dissuaded from doing what you want to do. That means, maintaining a certain degree of optimism. Of course, that is not easy. But I think it depends simply on the colleagues you have. (Deputy Headmistress)

The project on which this survey was based was financed by the *Bundesministerium für Bildung und Forschung* (BMBF). The authors are responsible for the contents of this publication.

APPENDIX A: METHODOLOGY

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

The research team consisted of two women researchers from the *FWU Institut für Film und Bild in Wissenschaft und Unterricht* in Grünwald near Munich working on 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 four consecutive days from January 8, 2001 to January 11, 2001

Amounts and types of data collected

A total of 16 interviews was carried out with the Headmaster, teachers, parents and students. In addition, 26 questionnaires on *IKT Nutzung von Lehrern* (ICT use by teachers) were returned for evaluation as well as the *Selection form* for schools which was completed by the Headmaster. Photos of the school made during the audit and photos of the home page were used in the documentation. In addition to the home page, a commemorative publication on the occasion of the school's tenth anniversary and numerous newspaper articles about the school were used as further information. All the results shown in this report have been obtained directly from the data collected. Instruments of the survey, hypotheses and investigation design were applied according to OECD/CERI draft.

Numbers and average length of interviews for each type of participant

IEA/OECD guidelines revised and combined by national researchers from IEA and OECD were used for the interviews. The interview with the Headmaster lasted for about three hours, with the Deputy Headmistress about 80 minutes and with the Technical Specialist about two hours. Both headmaster and headmistress are teachers of chemistry and biology, the technical Specialist is a teacher of mathematics and physics. Individual interviews with seven other teachers lasted each about 30-60 minutes, three were male, four were women. The teachers in question taught the following combination of subjects: German/History, Music, Chemistry/Mathematics, Mathematics/Physics/Computer Science, English/Russian, History/Social Science/Work instruction and Biology/Chemistry. They included those responsible for pedagogic coordination, teacher training in ICT, advisory teacher and head of special faculties. The teachers interviewed had been working at the school between two and eleven years, on average nine years. Two interviews with three fathers and two mothers each lasted for about 60 minutes. All parents interviewed are active as spokespersons for the Parents' Council. Three interviews with eight boys and four girls each lasted about 30 minutes. The students were from grades 7, 9 and 10.

All interviews were recorded on a mini disc recorder and then transcribed and coded. Evaluation was carried out by means of WinMax, a German software program for analysing qualitative data. During observations, the suggested observation protocol from Norway from the OECD book was used. Lessons in Computer Science, ICT and the *Helliwood* project were audited as well as small group lessons in English and Chemistry.

APPENDIX B: ICT PRACTICES SURVEY FOR TEACHERS^[3]

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	7	7	1	1
Search for information on the World Wide Web	3	4	5	4
Create and maintain web pages	-	-	4	12
Use a data base	1	1	7	7
Send and receive e-mail	3	2	3	8
Programming	-	-	1	15

Draw a picture or diagram	1	1	5	9
Present information (e.g. with Power Point)	1	-	4	11

Overall self-assessment	Good	Fair	Poor	M.D. ^[4]
How would you rate your ability to use a computer?	1	4	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?	10	3	2	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)?	2	14	-

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?	-	-	4	12

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	17	8	5
Updated an application program (word processor, graphics program, etc.)	17	7	5
Recovered a damaged file	5	10	4
Created a web site	1	11	4
Developed a data base	24	6	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.
Use the World Wide Web	1	5	6	3	1
Create web pages	-	-	3	12	1
Send or receive e-mail	1	2	4	8	1
Use a word processing program	3	4	5	3	1
Use a computer to play games	3	2	3	6	2
Use a spreadsheet	1	1	5	8	1
Use a graphics program	-	2	5	8	1
Join in an on-line forum or chat room	-	2	5	8	1
Use a presentation program	-	1	6	14	2
Use an instructional program	-	2	5	8	1

Table 5: Teachers about their use of ICT in classes

Answers based on experiences or policies from the last school year.	Yes	No	M. D.
Was student computer use ever evaluated for grading?	5	11	-
Did you create or modify a Web site with any of the classes that you taught?	-	15	1
Did you participate as a student or instructor in a virtual course through the Internet/ World Wide Web?	4	12	-
Did you involve your students in collaborative learning over the Internet/ World Wide Web with students from other classes?	3	13	-

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?	8	5	-	3

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?	3	7	3	-	3
What portion of the computer use that you assigned was done by students individually?	2	4	7	-	3

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>).
- The *Federal Land of Berlin* has made it an objective to link up all schools in Berlin by the end of 2000 to the Internet. This has obviously succeeded although in some schools there is merely just one PC with an internet link. According to the Headmaster, not only is there a lack of equipment but also there are no pedagogic concepts for integrating ICT into lessons. The Technical Specialist emphasized the following, *Unfortunately in Germany, the emphasis is on quantity, i.e. money, when it comes to support programs and not quality*. Up to now, 70% of all Berlin schools have a computer room but a lower percentage an internet link. On average, there are 15 computers per one of the 1000 schools in Berlin. In 2001, it is planned to invest an additional DM 7.5 million from the state budget in computer training for teachers and in the servicing and maintenance of installed systems in schools. The maintenance situation is for most schools a major problem, jeopardizing the technical facilities. It is for the schools to negotiate individual solutions for themselves or to rely on the competence and skills of other individuals. The Land Berlin is reacting to the failings in the maintenance sector by planning school posts for a total of 60 trained ABM personnel and 10 specialists for 2001 (cf. Berliner Morgenpost 18.09.2000).

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Register of Figures

All figures are taken of own photographs made during the stay.

[1] The term *Technical Specialist* in this report refers to the teacher who was mainly responsible for establishing ICT at the school.

[2] ABM = Arbeitsbeschaffungsmassnahme: a work placement organised by the German Employment Office to provide work for unemployed persons

[3] All results based on the responses of 16 teachers.

[4] Missing Data