

OECD/CERI ICT PROGRAMME

ICT and the Quality of Learning

A Case Study of ICT and School Improvement at
Albanischule, Primary School, Göttingen, Germany



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1. Introduction

The following study was carried out within the scope of the OECD/CERI qualitative research project *ICT and the Quality of Learning* during which one pilot study and four case studies in schools were investigated. This report describes the second school investigated between November 27 - November 30, 2000, the Albani School, a primary school in Göttingen. The goals of this study are to examine the different ways that ICT relates to school innovation and improvement and under what conditions it functions as a catalyst for these. Secondly to uncover the critical variables that relate to successful implementation of school improvements and effective ICT and thirdly to detect undesirable impacts of ICT upon school functioning and student learning.

- [1. Introduction](#)
- [2. Overview](#)
- [3. The past](#)
- [4. The Present](#)
 - [4.1 Organisation of Evidence](#)
 - [4.1.1 Diffusion Patterns](#)
 - [4.1.2 Staff development & involvement](#)
 - [4.1.3 Role of Leadership](#)
 - [4.1.4 ICT-Innovation Connections](#)
 - [4.2 Outcomes](#)
 - [4.2.1 ICT Infrastructure](#)
 - [4.2.2 Effectiveness](#)
 - [4.2.3 Academic Rigour](#)
 - [4.2.4 Equity](#)
 - [4.3 Projections](#)
 - [4.3.1 Sustainability and Scalability](#)
- [5. Conclusion to the Hypotheses](#)
- [6. Projection to the Future](#)
- [APPENDIX A: METHODOLOGY](#)
- [APPENDIX B: ICT PRACTICES SURVEY FOR TEACHERS1](#)
- [APPENDIX C: DOCUMENTATION](#)
- [APPENDIX D: BIBLIOGRAPHY](#)
- [APPENDIX E: PROMOTION PROJECTS FOR EQUIPPING SCHOOLS WITH MULTIMEDIA](#)

2. Overview

The Albani School is a state-controlled primary school in the university town of Göttingen in the center of Germany in the federal state of Lower Saxony. The Albani School is situated in the center of town. The catchment area of the school comprises a well-off residential area housing professional and business people, but also a women s house of refuge and council flats.

Figure 1: School building



The primary school teaches students from grade 1 to 4 and currently has nine forms with average 25 students each. The school has a total of 220 students of which about 20% are the children of immigrant parents from 12 nations. The school employs 15 women teachers and one male teacher. There is also one native speaker for Turkish. The average age of the teaching staff is late Forties.

Since the summer of 1998, the Albani School set-up a *Volle Halbtagschule (VHT) (100% half-day school)* where students can be at school every day from 7.50 a.m. to 1.00 p. m. even when there are no lessons. There exist an *offener Anfang (open beginning)*, during this time the students can play or occupy themselves as they want and can stay in the classroom or group room. Also the school has an *offener Schluss (open ending)* so that students can remain at school when lessons have ended until 1.00 p.m. During the open times a teacher look after the children. There is no school bell at the Albani School to end the lessons after 45 minutes, so that the teacher partly divides up the lessons as required depending on the subject being taught. As foreseen in the *100% half-day schools*, the educational authorities stipulate additional teacher and lesson hours for this type of school. These general conditions occasional make it possible to have Teamteaching in lessons. Two Grades together has a group room as well as an own classroom.

In the last three years, numerous innovative projects in the ICT sector have been carried out at the school. For example, classes have created 3 CD-ROMs. Among other things, the students worked on "SUSI", a wooden hippopotamus which stands on the school playground, two stories with inter-cultural contents using ICT. ICT is often integrated in project-based lessons. Furthermore, the school has a large number of partner schools in other countries with whom it works on mutual projects via email. For example, the school has good contacts to primary schools in Switzerland, Eastern Europe and Finland.

Figure 2: "Good Morning" is hanging in at least twenty languages in the school

Also in the past three years, project work involved the inter-cultural area based on the diversity of languages and cultures the children bring with them. For example, different cultural and religious festivals were celebrated with songs, customs and language allowing the students to make the acquaintance of other cultures. Parents were also involved in the planning and execution of such events. English is taught at the Albani School from early on. The school has an inter-cultural action room used for projects and work groups and international festivals and celebrations. Furthermore, there is an inter-cultural workshop where the students can get to know works in foreign languages and the languages as well.



In the last three years, the Albani School has made more use of teaching methods such as day plans, week plans, multi-week plans as well as project work and free work. Work can also frequently span grades or topics. There are group tables in the classroom. Planned lessons mean that at the beginning of the day or the week a number of tasks are written down for all the students in one grade. The students must then deal with these tasks on their own within a given time period of time. The students determine themselves in which sequence and in what time the tasks are done. Each day there is one hour of the weekly planned lesson. As the lessons are occasional taken by two teachers more attention can be given to low-ability children with coaching as a part of the lesson. The new teaching practices allow students to move at will around the school buildings. Desks and benches are placed in the corridors and serve as work places. But work can also be done on the stairs or in the computer room.

It is quite common here that doors are open and the children are whizzing around from the computer room through the corridor into the classroom. Then one of them will sit down to write something or another one runs down the stair to fetch something from someone. For me, it is an open atmosphere and open learning. No-one says, sit down in rows of two and now all of you look to the front while I tell you what to do. There is a lot of communication among the children themselves. (Mother)

The school is a member of the Bertelsmann Stiftung network *Innovative Schools*. Similar to the *Network Media Schools* (cf. Appendix E), concepts for innovative work is developed in cooperation with other schools. The school Head and the teachers attach great importance to involving the social environment. There are good contacts to the surrounding kindergartens and other institutions such as the Goetheinstitut or the County archives who supported the production of the CD-ROMs.

In general, all students and parents spoke in positive terms about the school. It was repeatedly emphasized how much the children liked going to school here. The parents welcomed the new ways of teaching, the frequent group work which supported social learning and team work and practical hands-on projects and ICT work. Proof of the school's popularity is the high number of registrations and not all children can be accepted. The parents described the teachers and the Head as very committed.

3. The past

History of the origins of school innovations and improvement

In 1996, during an in-school further training, it was decided to turn the school into a *Volle Halbtagschule*. In order to implement this decision, it was essential to define the focus of contents. A group, including the Headmistress, suggested the Montessori methods but this was rejected by the majority of the teaching staff. The atmosphere among the teachers at that time was described as difficult as there were groups with differing interests and communication had been problematic. The Headmistress and the teachers expressed the need for action:

At this stage, the staff was aware that nothing would change if nothing was done to remedy both the general feeling of dissatisfaction about our behavior towards one and the existing structures. Many were generally not satisfied with anything or with things which made or could make school life tedious. There were criticisms for example about the in-transparency of decisions taken, too many appointments, too little reliability, conferences leading nowhere etc. (School's homepage).

Upon the initiative of the Headmistress, two of the teachers who had a mere wait-and-see attitude towards the matter participated with the Headmistress in a further training course regarding the development of school programs. This course changed the attitudes of the two teachers and they suggested taking a critical look at the school. This led to a renewed discussion concerning the *Volle Halbtagschule*. A new point of focus became necessary.

At this time, in August 1996, the Albani School was joined by a new deputy headmistress, who had taken part in a supplementary study of Pedagogy and Foreign Students. And then started on a study course for a diploma in *Inter-cultural Communication and Consulting* which she had almost completed. On the basis of these facts, she suggested making inter-cultural education the focus of the school. Her proposal was discussed by the staff and finally accepted partly because the proportion of foreign children at the school made integration a particularly important issue for the school.

A work group of teachers formed around the Deputy Headmistress and met privately in the evenings to discuss and deal with the question of inter-cultural pedagogy: *"and this group proved to be so attractive that more and more people joined in and this had a positive influence on the atmosphere at school. Well, looking back, I can say today that it did a great deal to change the way we behaved towards one another (Deputy Headmistress).* What was important were the group's endeavors to achieve some sort of transparency in the matter. They informed the rest of the staff about the contents of their discussions and received confirmation for their further work.

Parallel to all this, was the idea of applying to become an EXPO school at the World Exhibition 2000 in Hanover. The Albani School made an application in 1997 emphasizing inter-cultural education and ICT. In 1998, the school was certified as an EXPO school and the teachers began in five groups to plan the Albani School concepts for projects and their implementation. Spokespersons from the Work Groups met in an *Organization group* with the Headmistress. Since the school had been certified, an outside moderator had supported the school development

process which had commenced. Project work and daily, weekly and multi-weekly plans for lessons and every-day school life were increasingly adapted.

More focus was laid on the parents who were explicitly asked to involve themselves in e.g. inter-cultural festivals and projects and in normal lessons. Co-operation with parents of foreign origins was also increased. A "work group theme corner" was initiated in which around 10 parents, two teachers and the Headmistress participated with the aim of working out inter-cultural projects for the EXPO. Among others, so-called "theme corners" were

organized in which large photos showing the cultures and home countries of the parents were displayed in the school. Foreign parents were also actively involved in the lessons. Additionally, so-called "country days" were held in which parents

Figure 3: Theme corner "Brazil"

could attend classes and tell the children about their homeland or show games etc. Involving the parents was seen by teachers and the Headmistress as a significant contribution to integration in primary school.



Many teachers emphasized that they were currently very happy at the school and had personally profited from the changes that had been made there. Particular mention was made of the open atmosphere at school which had led to increased understanding among the teaching staff and brought them closer. The teachers' range of contents and methods had also been extended and the Headmistress said work satisfaction at school was of a very high level and the number of teachers absent through illness was low. The school was also afforded much recognition for the innovations both by parents and the general public.

However, negative criticism came from teachers complaining of the enormous amount of work involved in the innovations, for example, work on the EXPO project took two years. Work group meetings, a vast number of projects in the inter-cultural and ICT field regularly exceeded the normal working hours and required an enormous amount of time and planning:

Many of us here work more than the normal lesson times; everyone is involved in several groups and the work is very time-intensive so there are times when everything just becomes too much and you have the feeling that all your life simply centers around the school. But we all have families and children and they sometimes have to take second place (Teacher).

In some cases, there were problems with some teachers who felt they were being pressurized to support and take responsibility for innovations.

The History of the Origins of Information and Communications Technology (ICT)

The first computer in the Albani School was given to an interested teacher in 1996 by a father who donated an old one. In 1997, the Albani School took part in the competition *Modern School*, winning DM 9,800. As a result of the Headmistress's efforts, a savings bank donated a further DM 1,000. With this money, the school bought its first three multi-media PCs and three printers, the whole process being initiated, supported and accompanied by the school's Head. The equipment went to two women teachers interested in ICT and to the above-mentioned teacher's classroom.

The EXPO certification attracted new sponsors and in 1998, money was available for eight further PCs. One classroom was redecorated and converted into a computer room with the help of committed teachers, some parents and students as well as the *Kompetenzkreis Internet (KKI) (internet competence circle)*. The KKI is an honorary group founded 5 or 6 years ago with the aim of introducing ICT into the school and to provide support for any problems resulting from this. The KKI comprised mainly students and schoolchildren who began to network the school in Göttingen and to instruct and support teachers in the administration. In 1998, internet was installed. One Albani School teacher had this to say about the KKI:

In the beginning they were a great support as no-one had the knowledge to work in a computer room. Also the colleague who was responsible for the maintenance was in constant contact with us and when you remember they were all people working in an honorary capacity - that was simply super! I reckon, without them nothing would have got off the ground as, at that time, no thought has been given to an assistant for this work in the school (Teacher).

The Headmistress is of the opinion that schools in Germany have been let down by the politicians. The town of

Göttingen was an exception as it was one of the first towns in Germany to link up its schools to the *Town School Network* with the help of the KKI. The Albani School, too, received financial aid from the town for the technical pre-requisites necessary to introduce ICT. The Albani School had received no support from any other official authorities. On the contrary, teachers had frequently been delegated to other schools *"You get a telephone call in the morning and you are told 'please send a colleague with such and such subjects to this or that school tomorrow!"* (Headmistress). Delegations of this nature always mean changing the timetable around and missing one teacher in the innovation process.

An additional problem was the handling of technical equipment: *"All the repairs have to be carried out by a teacher. In spite of the fact, that this colleague had PC experience, it was time-consuming to become familiar with this, for him, completely new network and hardware technology."* (Information sheet: Installation of the computer room) It was not always possible to cope with the administration work, the teacher needed a lot of time to gain his expertise in the administrative area. The other teachers and the Headmistress also had to invest a lot of time in order to acquire ICT skills and to work on concepts for lessons.

4. The Present

4.1 Organisation of Evidence

4.1.1 Diffusion Patterns

In every case, innovations came from a group of teachers. Working together in these groups led to a positive change in behaviour and communication with one another. This again increased the staff's willingness to cooperate and so innovations were adapted and diffused. At the beginning there was much resistance due to lack of transparency. Later contents were rejected and teachers refused to cooperate because of the extra work load. Some teachers even left the school. Early adapters display a willingness to try out new things and to further their own education

School innovations and improvement

The initial stages of creating and diffusing many pedagogical innovations at the Albani School depended on the willingness of the staff to change its ways of communication and behavior towards one another. The Deputy Headmistress can be seen as the initiator of innovations in the inter-cultural area as it was she who proposed this new special area. She brought fresh ideas and experience to the school and attached great importance to decision-taking and development processes being made transparent for all. Communication became open and transparent so it was comprehensible to all and could effect changes.

The following is said of the working group which formed around the person of the deputy Headmistress *"bit by bit, the positive atmosphere of the working group infiltrated the rest of the staff and in spite of the conflicts which still existed the colleagues expressed the wish to get to the bottom of the problems and to look for new solutions"* (Article in example 1/99). This group was responsible for the willingness of the teachers to tackle something new and to change behavior towards the whole staff. The decision to take part in the EXPO also triggered off changes and led to the founding of working groups and a diffusion of inter-cultural strategies throughout the whole of the Albani School. The new teaching methods were also widely diffused.

ICT

As already mentioned, the introduction of ICT at the Albani School was mainly initiated by three people, two women teachers and a male colleague. They were all very committed to the idea and began to carry out the first projects in their classes. The results of this work gave rise to great enthusiasm amongst themselves and the students. *"These colleagues were always talking about it in the staff room and really infected the others. They produced work, they had seen what could be done"* (Headmistress). In the EXPO project three teachers worked out the first ICT concepts and projects. They, and many other teachers, began to attend further training. The Headmistress said: *"In the meantime, all of the staff except for those who have nothing to do with PCs in their subjects, for example, the sports teachers no-one said 'PC- No, thank you!'"* They are all so keen that they even spend their time at home with PC! . Some teachers however said there were still some reservations regarding ICT amongst the staff. The Technical Specialist however modified this by saying

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Well, regarding the computer room and that is where I spend most of my time - I can only say I see these three colleagues frequently and others hardly at all. At least, not with their grades. We have got to a point where at least some of them come and collect their e-mails but hardly ever use the room with their grades. They simply do not know how to handle a computer. (Technical Specialist).

The Technical Specialist was of the opinion that many of the other colleagues were afraid of using the computer although he emphasized the strong wills of some teachers to gain ICT skills and to use ICT in lessons, in spite of the enormous amount of time needed to do so. However, all except one of the teachers interviewed, and the headmistress have used ICT in lessons or the computer room.

Resistance

At the Albani School there was strong cases of resistance towards the innovations. Some of the teachers rejected strongly the suggestions and work methods put forward by the working group. The call from the working group for more transparency and opinions among the staff simply revealed existing conflicts and quarrels among them.

I can still recall the statement of one colleague who said: "I am doing nothing more at this school. I won't lift a finger if it looks like you are going to get us to work and then reject everything." They constantly forced the staff to put their cards on the table and this led to two colleagues leaving the school saying it was no longer the school they knew! (Headmistress).

Some colleagues protested vehemently against the school becoming an EXPO school because they could see how much work it would bring with it and they really wanted to have nothing to do with it (teacher). They left the school together with another teacher who viewed the whole of the inter-cultural focus and ICT introduction with great scepticism. It was said that the one colleague who left because of ICT thought that she could not combine her artistic interests with ICT *"I think, she had no idea of what can be done with it. She just wanted no part of it. There was really strong resistance."* (Teacher)

Six months after certification by the EXPO society, the Albani School had to give up one teacher, as the number of students had dropped. As the school was in the middle of an intensive development program they did not want to do without a teacher who had been actively engaged in work groups and projects and supported the innovations. The organisation group proposed to make the teacher's leaving the school dependent on commitment to the school and her involvement in work groups. This was accepted by the staff and one teacher who had not been active in the process of change had to leave the school. One teacher thought this a very extreme measure, however, this particular colleague had always acted counter-productively and boycotted innovative efforts.

Parents also discussed the introduction of ICT intensively. Some parents criticized the fact that some students could not yet write properly and were already supposed to work with PCs. However, one father described the discussions as being very fruitful and he succeeded in minimizing fears and apprehensions. According to the teachers, resistance against the innovations dropped considerably or had even completely disappeared after the changes had been firmly implemented in the school.

Early/Late Adapters

It was said that those who had quickly taken up the innovations at the Albani School were flexible and were personally prepared to take on something new. These teachers were willing to work harder. In principle, the changes were viewed openly. The Headmistress said that early adapters were inquisitive and:

They are prepared to look at new ways of presenting a lesson. They are very student-oriented, straight-forward, consistent and friendly. They are willing to test their own opinions, to listen to other arguments. They accept parents as equals, i.e. a group which is important for the school, and not as opponents. And they do not gossip about others as much. ... They continuously keep themselves informed, attending further training sessions which makes them repeatedly uncertain and gives them new ideas. About the other group: they seldom, or never, go to teacher training sessions. They are convinced their lessons are good and are wonderful at criticizing other people's lessons. They often use "we have tried that before, but..." as an argument. They see the parents as opponents. I don't think they prepare their lessons so well. The students are often frustrated and this leads to a certain kind of atmosphere in the classroom. They do not face up to conflicts but repress them. (Headmistress)

Some of the teachers said that age was a sign that colleagues were slowly approaching the issue of ICT. Even late adapters said they were afraid that ICT would lead to a loss of social competences. For them social processes had top priority in the primary school and computers and internet ought to play a secondary role. Nevertheless, the late adapters emphasized that ICT was a part of the comprehensive learning process.

4.1.2 Staff development & involvement

Systematic further training of the whole staff is a considerable factor in anchoring ICT throughout the whole school. At the Albani School, there is great readiness to take part in ICT training. Most of the teachers have already gained their first ICT skills in external courses. An in-school course and autodidactic acquisition help to consolidate this basic know-how. This could be further increased by the necessity of qualified training for functional positions.

ICT

Almost all of the teachers and the Headmistress have taken part in external ICT courses providing the staff with basic ICT skills. Teachers reported that they had been personally very motivated by them to continue use of ICT in the school. Some of the teachers and the Deputy Headmistress attended in the last three years external courses on email, internet and Power Point use. Since January 2001, one very committed colleague and the Deputy Headmistress have been participating in a longer term training via the D21 Initiative, which is called N21 in Lower Saxony (cf. Appendix E).

The committed male teacher is also taking part in external training, especially concerning equipment maintenance. Moreover, through the KKI and autodidactic means he gained a wide spectrum of knowledge regarding the handling of ICT which he now makes accessible to his colleagues. For about the last two years, he provides once a week an in-school computer course in the Albani School in order to give the teachers a basic training in information technology, email and internet. Between 5 to 8 colleagues, the Headmistress and a new colleague take part regularly in this in-school course. In the beginning, the male teacher accompanied the new woman teacher into the classroom to help with working with ICT. The Headmistress emphasized that because of the very high level of the in-school and autodidactic training, she preferred them to external courses. In addition to training and courses, many teachers, the Headmistress and the Deputy Headmistress taught themselves ICT skills at home.

Approximately 8% of the teachers judged their computer skills as good, 33% as fairly good and 58% as bad. Their skills were mainly to be found in the area of word processing and emailing. The teachers described themselves on the whole as users. Many teachers used the PC to help with lesson preparation (cf. Appendix B).

As a rule, the Technical Specialist is usually called in to help informally when there are problems with the computer or the internet. He can usually be found in the computer room so that he is always available for colleagues who are taking a class in the PC room. Many teachers appreciate this help very much and one of them said: *"If we didn't have this assistant at school, even fewer colleagues would use the computer room. Many of them wouldn't even go in there. And when he is there, they feel more confident, me, too."* But the Technical Specialist is not only there to help. The teachers emphasize that through him they have increased their ICT skills. *"I learn such a lot from him. I must say that through the daily contact with him in the computer room, I am constantly gleaning little items of information; it's almost like a continuous form of training. Well, without him, things would be very, very difficult."* (Teacher) The teachers also still turn to the teacher who initially was responsible for the maintenance in the computer room because of his high level of skills. In addition to his teaching job, he has, in the meantime, become an advisor for primary schools in Göttingen who wish to develop an ICT area. But other, more-experienced teachers are also willing to help colleagues in difficulties and the open atmosphere among the staff supports this form of assistance.

One problem of teacher further training is the amount of leisure time it consumes. As a rule, the teachers even have to pay for this training themselves. In spite of this, the Headmistress still likes to see colleagues participating in such courses.

ICT training does bring some incentives with it – namely proof of qualifications when applying for a functional position as, in the meantime, the school authorities demand such proof. *"that is, of course, a strong incentive for the people who are seeking to make further progress in their career"* (Deputy Headmistress). One teacher mentioned that she thought she was under a moral pressure not to ignore ICT.

The Deputy Headmistress evaluated current training opportunities as inadequate. She would like to see a fundamental training for teachers especially in ICT which is tailored to school requirements whereby the Initiative N21 could bring changes. In general, the teachers and the Headmistress emphasized that all colleagues were willing to attend training and that they intended to participate in ICT training in the future.

School innovations and improvement

Teachers at the Albani School are also participating in further training in the pedagogical field. Particularly regarding the school's inter-cultural focus, many teachers took part in both in-school training given by the Deputy Headmistress and in external conferences. Many teachers and the Headmistress acquired their knowledge of innovative teaching methods in external courses. The Headmistress and two other colleagues completed a Montessori training course with a diploma. Furthermore, the Headmistress also participated in long-term training organized by the Lower Saxony Association of Head Teachers regarding school management and the development of school programs. She is currently attending a job-related supervision group.

4.1.3 Role of Leadership

In a team where the members complement one another, the Headmistress and the Deputy Headmistress provide very great support to the innovations. Both Headmistress and Deputy Headmistress want to provide impulses for change. The innovations have given the Headmistress a new understanding of school management. In the meantime, the staff is involved democratically in decision-taking processes and much importance is attached to transparency.

In an evenly matched team with differing task diffusion, the Headmistress and the Deputy Headmistress share the management of the school between them. Parents and teachers of the Albani School who were interviewed emphasized that the school development process and the associated innovations with ICT and in the pedagogical area were strongly accelerated and supported by the school management. The Headmistress is particularly receptive to the ICT area and is always trying to support it. Regarding ICT, the Headmistress said: *"It was clear to me relatively early on that this was a field the primary school could not ignore"*.

It is said that the Headmistress supports innovative ideas and encourages people to try new methods going to great pains to ensure transparency and a good cooperation with parents and also has built up good contacts to local kindergartens. She attaches great importance to including local institutions.

Summary: My role as Headmistress is to provide impulses, to create a reliable framework and to prevent conflicts from arising. However, if conflicts do occur which is always the case when people work together, then it is my job to make them a point of debate. (Headmistress)

According to the teachers, one of the Headmistress's concerns is the representation of the school in public. She maintains contacts to the outside and endeavors to raise money from donations. She also tries to carry out regular evaluations of the implementation of planned objectives and projects among the staff. She describes herself and her role within the innovations as uncomfortable *"I am quite strict and I demand, or expect from my colleagues that certain things are adhered to."*

Colleagues remarked critically that the Headmistress had been too quick in her desires for change at the beginning and that she *"wanted to push a project on to us now and then"* The Headmistress also admitted this failing and said that she had learned by it to *"work in a team and, well, not to take decisions alone. I fell on my nose more than once doing that. I've learned to involve many people"* (Headmistress). She had revised her idea of school management although she was still responsible for adherence to legal and administrative regulations, she now includes the competence of her colleagues in all other decision-making processes. *"Decisions are no longer made in a two-woman team, but are taken mutually by all"* (Headmistress).

The democratic and transparent form of decision-making at the Albani School is supported by the Deputy Headmistress, too. The Deputy Headmistress is described by teachers and the Headmistress as a person with many ideas whose professionalism lies in the field of inter-cultural issues. One teacher remarked on the school's inter-cultural focus: *"Ms Y (the Deputy Headmistress) is firmly behind in the idea with 197%"* and one father said as far as the Deputy Headmistress was concerned, working in the Albani School was *"her life's work"*. The Deputy Headmistress is seen as the driving force behind innovative change:

Well, our Deputy Headmistress brings many new ideas to school. She is enormously creative, has proposals for many projects and also has a way of getting other people interested in them and in the end, we find ourselves enjoying them. Well, I have worked in a working group with her and it was great. I think, she is really the central figure at this school who has got lots of important things moving. (Teacher)

The personality of the Deputy Headmistress has had a compensatory effect on the Headmistress which promoted the innovation process: *"I think that X.Y. (the Deputy Headmistress) and myself complement one another quite*

well. I certainly have the more male role to play in the school management, and X (the Deputy Headmistress) the more female role, the understanding role." (Headmistress) The Headmistress criticized herself for not praising her staff enough and in this respect the Deputy Headmistress who went to a lot of trouble to create good relationships had been very important and helpful. In the meantime, the Deputy Headmistress is the Ministry's representative at schools for the area of inter-cultural learning. For this she had been given a reduction of ten hours in her teaching time at the school.

The Headmistress endeavors to offer incentives; thus two teachers involved in developing an ICT curriculum were given a reduction of one lesson per week in this school year. Moreover, the Headmistress tries to support those persons who require assistance in introducing ICT into their lessons by providing a co-teacher to teach the students computer basics.

4.1.4 ICT-Innovation Connections

Up to now, ICT has not been established as a firm part of the general guidelines for primary schools in Lower Saxony, all the same, the Albani School strives to teaching its students ICT basics. It was observed that ICT was frequently used in project-based teaching. It is assumed that there is a connection between ICT and new teaching practices which do away with the frontal teaching methods.

The Headmistress reported that the general guidelines for the school curriculum in primary school were very old and that those for primary schools in Lower Saxony did not include ICT. The utilization of ICT is not prescribed. One very committed woman teacher said: *"Today, everyone wants schools to go into the network, but there are absolutely no didactic strategies on how to do it."* So, she and another equally committed woman teacher, began working out an ICT curriculum for her own school, defining learning and working stages and putting together a collection of materials to enable other not so experienced teachers an easier start. The curriculum is to be used in future for the first to fourth grades in the Albani School. Two teachers are currently testing and extending the curriculum.

There is already one objective for the students and that is *"to bring them step by step into the using the PC, internet and the sending of e-mails properly."* (Locum 64/99) and to provide them with a basic training in information technology. In the first grade, the students are taught basic computer skills and learn how to use the computer with the help of educational programs in the classroom. In the second grade, students are split up into small groups and learn how to handle the computer in five to six lessons. In the third grade, the students are introduced to Word, internet and e-mails.

Particularly the two very committed women teachers and one male teacher use ICT competently, innovatively and for a wide range of subjects. in lessons. At the time of our investigations, one of the women teachers was working with students in the third grade in a project-based lesson creating a school newspaper. The students had to use the computer, internet and learning software to write and design a newspaper describing the students excursion to a farmyard. The students spent several hours a day in the computer room. This teacher frequently carried out similar projects in her classes She has also used the CD-ROMs with her classes. The headmistress reported that this teacher had begun systematically to introduce ICT in lessons regularly right from grade 1 independent of special projects. All the other teachers who we interviewed said they had already worked with learning programs and internet researches with their students. In particular, teachers and their students maintain contact to other foreign schools, working with them on joint projects. ICT was most widely used in Elementary Science and German. In addition to the partner projects, learning programs are frequently used. This year in the German lessons, a learning program called *"Pusteblyume"* (dandelion) was used in combination with a text book from the first to the third grade. In Mathematics, a program called *"Blitzrechnen"* (rapid arithmetic) was used from the first to the fourth grade. The students were able to work with the computers and learning programs in the classroom during the school day, the beginning and close of which is open. For the first grade there exist the *"Junior Schreibstudio"* (junior writing studio) where the students could practice simple graphic design with an audio feedback. The students also worked on the internet using special search machines for children. As a rule, the students are given no set homework to do for which a computer would be necessary as not all of them have access to a computer at home. However, they can prepare reports and essays on a voluntary basis with a computer and search for information in the internet to be used later in a lesson

The Technical Specialist thinks that more use could be made of the computer room. He estimates that about 25% of the teachers at the Albani School regularly work with ICT in lessons. He and a woman teacher thought that

there was too little teaching of basic computer skills and applications. Too much importance was attached to dealing with the contents of topics. One woman teacher criticized that the timetable did not foresee lessons for the specific acquisition of ICT skills.

The Technical Specialist was of the opinion that those teachers with little ICT knowledge only rarely used the computer room as firstly, they preferred traditional methods and secondly their ICT skills were limited. *"And of course, that is not easy to have a chaotic bunch of 12 children hanging around with none of them knowing either how it works and shouting for help and you yourself have no idea either how it functions"* (Technical Specialist)

Relation of educational innovations and ICT

Figure 4: Teacher with students in the computer room

Pedagogical innovations and ICT have an equal footing in school life at the Albani School. ICT is used in inter-cultural sectors and in new forms of teaching. For example, internet is used for searching material about foreign countries or the email is used for communicating with the partner schools. The Deputy Headmistress sees a links between contents *"because we have taken into consideration that the opportunity of working nationally and internationally with the network has logical advantages for inter-cultural work."* (Deputy Headmistress). The Headmistress was also of the opinion that ICT would facilitate the students access to inter-cultural learning. Some of the teachers thought that changes in the form of teaching had been brought about by the school s form of organization, *Volle Halbtagschule* which had created more liberal general conditions and structures for innovative teaching practices. In lesson audits, it was observed that those lessons where ICT was used were replacing the old *"chalk and talk"* methods. Apparently, ICT requires new forms of learning and teaching, The Headmistress also assumes that ICT has a positive effect on teaching methods. She writes in the Nomination Form for a School Site: *"On the whole, regular use of ICT in lessons is changing frontal teaching in favor of project-oriented lessons in which the students tend to work independently on the special areas they have chosen."* Other teachers also confirmed that there was such an effect.



Assessment of working with ICT

Even though some teachers described the computer and internet as additional tools and peripheral issues which were not essential for lessons, they did comment that they would not like to miss them as they made many work steps easier. Furthermore, ICT represented *"the trend of the times"* (Teacher) which ought not to be opposed. Teachers and parents saw skilled handling of ICT even in primary schools as a necessary key qualification for students who, intrinsically motivated, wanted to learn to handle ICT.

Nevertheless, the teachers emphasized that the computer ought not to be seen as an ends to the means in imparting ICT skills but should be imbedded into contents and projects. In general, the use of ICT depended on the contents of the lesson. It was not always a good idea to use the PC and the internet.

4.2 Outcomes

4.2.1 ICT Infrastructure

The Albani School has a modern infrastructure. Maintenance and Servicing is carried out by a permanently employed Technical Specialist. The infrastructure was financed in particular by EXPO funds and sponsors resulting from this support. However, money for maintenance work is often scarce.

Figure 5: Computer room



The Albani School has in all 26 computers, of which 25 are linked up to the internet. There is one large computer room with 14 PCs for the students and one computer station for the Technical Specialist with a PC, CD-burner and scanner. Three laser printers are installed in the computer room. In each classroom is at least one computer with printer. A PC and a printer are in the school office. The school has a 10M bit leased line. 220 students and 14 networked computers in the computer room means a ratio of 16 students to one computer; based on all the computers available to the students, a ratio of 9 students to one computer.

The Albani School was a partner school to Microsoft from the EXPO certification to the end of the EXPO and received a vast amount of software and educational programs free of charge. They also have many educational programs from the publishers of school text books. Reference programs are installed in the computer room, e.g. ENCARTA. The computer equipment was described by all those interviewed as modern.

Technical Maintenance

In the beginning, maintenance at the school was carried out by teachers committed to ICT supported by the KKI. One year ago, the Regional Government approved the position of a school assistant, who functions as the Technical Specialist and is permanently employed for 19.25 hours per week at the Albani School. Before his studies in *Social Pedagogy* he had completed a state-examined study course *Business Management in Computer Science*. Considerable parts of his qualifications were acquired auto-didactically. He is mainly responsible for administrating the network. He is described as being very skilled and carrying out his duties well. *"Well, problems crop up every day and we really need him a lot. And, if we didn't have this person whose real position here is as School Assistant - then the whole system would simply collapse. It's as simple as that."* (Deputy Headmistress)

Financing

The annual budget for 2000 was DM 39,180 of which DM 6,000 was a one-off payment made by the EXPO Society. The average share of the budget for ICT in 2000 was about 26%. Finance resources for the Albani School are the town of Göttingen and the EXPO Society who provided financial aid from 1999 to 2000 some of which was spent on technical infra-structure. The EXPO was important for the computer equipment at the Albani School: *"All of these things and the many computers, all down to the EXPO. Without the EXPO we would have nothing."* (Technical Specialist) The Albani School also received money and material donations from sponsors and parents. The internet link-up costs the school DM 30 per month, according to the Technical Specialist.

Problems

Many of those interviewed said that finding money for essential repairs, acquisitions and modernization work in ICT was the biggest problem. The Technical Specialist himself had no problems with maintenance but mentioned that he thought his position as School Assistant was not appropriately reimbursed. The Deputy Headmistress encountered this remark with the wish that the Technical Specialist would be given a full-time position at the Albani School as *"he often does not have time to solve all the problems which crop up"*. (Deputy Headmistress)

4.2.2 Effectiveness

ICT has a positive effect on learning motivation as it requires independent and self-controlled work from the students. A normal contact with ICT from an early age is seen as a great advantage. Nevertheless, teaching basic ICT skills to young students and showing them to operate ICT is difficult and time-consuming.

Learning motivation/Learning behavior

Figure 6: Boys in front of the computer

Both parents and teachers remarked that ICT has a positive effect on learning motivation and work behavior of students. The children carry out work on computers as in a game and show a certain inquisitiveness towards ICT. It was observed that the students were very enthusiastic and fascinated when dealing with ICT particularly when working with software and designing texts. ICT would appear to increase the students joy to learn, they were more motivated and were prepared to cope with a certain amount of effort which they probably would otherwise have avoided.

Teachers reported that working with ICT allowed the students to learn more independently as the students could work with educational programs without the help of the teacher. The students did not for help so frequently and were not afraid of breaking something. The learning process was self-controlled and adapted to the student s personal learning speed.

ICT has most certainly led to a higher level of learning motivation. Well, the children find it extremely interesting and they experience success relatively quickly. For example, they always get a positive feed-back from the learning software straight away. Or, if something didn t work out, they can handle it in a different way as when the teacher simply says That s wrong . Well, the children find it very positive to learn on their own, they like doing it.
(Teacher)

ICT work is often project-based und adapted to current topics. It is easier to create a personal reference to the child s world. Working on a class newspaper or CD-ROM on the child s native country focuses more strongly on their interests and some teachers said this led to more involvement and cooperation from the children.

All the same, one teacher said that in the past three years not all children were necessarily motivated by working with ICT but in the meantime, handling computer and internet *"was no longer anything new for most children."*
(Teacher)

Figure 7: Students working with the computer

It was observed that the students mostly worked in groups of two or three on one computer. They discussed the division of tasks, procedure methods and occurring problems amongst themselves. The teachers held this type of exchange to be very positive. It promoted social



processes as it was necessary for the students to discuss the various activities and to come to a conclusion themselves. Moreover, students were seen to support and help each other. In general, the teachers pointed out that the learning process using a computer promoted communication.

Many teachers admitted that sometimes the students knew more than they did and that they often turned to them for help in an emergency. *"that means the children notice in this way that we are all still learning and this is a situation which gives them self-confidence."* (teacher) Many teachers said that their contact to students had

become more one of a partnership and they saw themselves more as a moderator who was there to provide impulses. But not all teachers interviewed thought that the changes in teacher/student relationships and roles were to be put down only to ICT but also to project-based work in the school.

Working with ICT, which is usually integrated into project lessons and normal weekly lessons, has led to changes in learning behavior:

Working in very small steps with the students progressing together from one step to the next is not possible if you are using ICT. Lessons are on the whole much more open and the children have more scope to make decisions. The child works independently and takes over more responsibility for his/her own learning (Headmistress)

Advantages/Benefits

It has been emphasized that innovations and changes have had a positive effect on student behavior: *"When I am working with the children and I compare it to ten years ago, I see that the atmosphere at school has changed for the better. There is less violence, less quarrelling and less destruction. (Headmistress)*

All teachers, parents and the Technical Specialist saw that the major advantages of ICT at the Albani School was that the children learned to handle ICT as a matter of course from a very early age, enabling them to deal with ICT in a very uninhibited way and to acquire important skills for the future.

Also seen in a positive light was the rapid access to current information from the internet and the facilitated contact to partner schools via e-mails.

The opportunities for teachers to give students individual tasks to perform with ICT was often observed in the lessons. The learning programs used at the Albani School are adapted to the students' abilities. It is easier to promote students, both low and high achievers, according to their ability level.

It is also a positive factor that the children can work in some cases according to their abilities, e.g. in Mathematics. In the second grade, in such phases, there are two to four children working with material from the third grade, and not the second. That is possible and I do not have to keep looking for additional material as it is all there on the CD-ROM. Even the primary schools cannot behave as if there was no such things as ICT (Headmistress).

Low-ability students can try out for themselves what they can do with learning programs. They can work independently without fear of having to show what they have done in front of a class. Students who are not particularly recognized by their fellow-students can achieve recognition with their ICT skills and thus more self-confidence.

Problems/Disadvantages

One disadvantage is that there are not always enough computers for all the students who would like to work on them. The computer room cannot always be used as it is often occupied by classes and there are often bottlenecks regarding space.

Another problem at the Albani School is the age of the students. For the children it is even a problem for them to train the hand and finger movements necessary to be able to use the mouse. Computer language is also not suitable for small children according to the Technical Specialist. The children often had problems logging in to the computer and the many terms in English were too difficult for children to understand and thus the teaching of ICT skills took longer. As children were only just beginning to learn to read, word processing on the computer was also difficult. This could be especially observed when the children were using the keyboard as they often took a long time to find the letters as they did not yet know all of them!. The Technical Specialist also criticized that the children had to adapt to the logics of how a computer "thinks".

Is that really a sensible thing to do at that age? Well, if children are to work with the computer then they must realize that they must do what the computer tells them to do and not what they want. I am not sure if that doesn't limit things unnecessarily. (Technical Specialist)

One difficulty mentioned was the variety and incomprehensibility of information from the internet. It was not easy for students to search for and select information in the internet although the students often used a child's search tool. The students themselves said *"you have to know where you want to go and what you are looking for"* (Student). Several teachers remarked that it was important to prepare searches in internet well.

Controls/Misuse

There has been, in general, as good as no misuse at the Albani School. There had been one case of a student secretly installing software and changing set information and sometimes the students surf the internet during lessons. Besides, a password has been integrated into internet use via the *Stadt Schulnetz (town school network)* so that undesirable pages cannot be accessed. The computers are so arranged that the Technical Specialist can see all the monitors at once and he is responsible that no misuse occurs.

As a rule, teachers supervise the students when they are working in the computer room. As there are always two teachers to a class, one teacher can remain in the class room and the second goes with a group into the computer room. Furthermore, during school hours the Technical Specialist can always be found in the computer room to help teachers and students with ICT problems. The students have no access to the computer room without supervision.

Responsible handling

Parents reported that their children had acquired a positive attitude towards using computers and internet and the computers at home were not used for games so often any more. The students had learned that the PC and the internet had other uses. As a pre-requisite to responsible handling of ICT at the Albani School would appear to be the conceptuality which teachers displayed when working with ICT. The children are supposed to work and not play on the computers at school *"We want to set up clear differences between working at school and working at home."* (Teacher) Furthermore, all teachers pointed out that they always used ICT sensibly and with certain objectives and that students were given certain tasks which they had to implement.

Well. They must learn to use ICT sensibly and I try to show them that. Or, if we write simple texts with Word then this must have a purpose. Why shouldn't a text be written simply by hand? Well, because we want to publish it. Or because we want to store it on a disk so that we can process it later on, etc. (Deputy Headmistress)

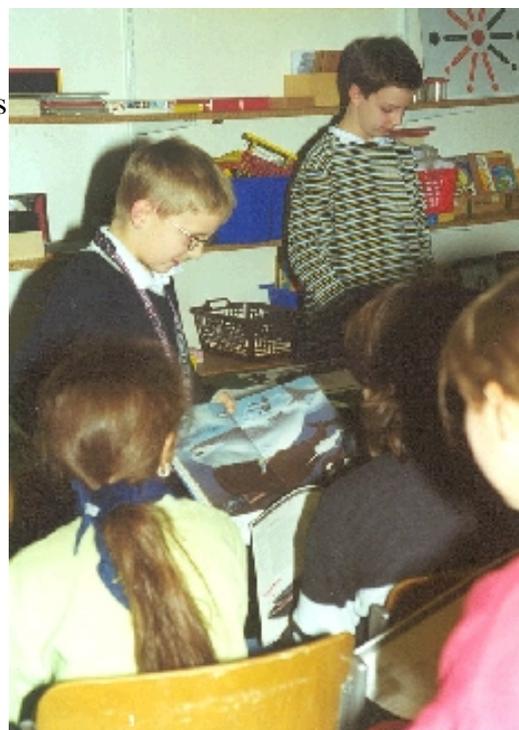
In addition, two teachers said that they supported responsible student ICT handling by setting up rules like the ones used in class which then also apply when working with ICT. Anyone violating these rules would answer directly to the teacher.

School innovations and improvement

All teachers, parents and the School Management described project work in daily or multi-week timetables at the Albani School as very effective as this form of lesson promoted key qualifications. The students learned to work in a team, to design and construct their learning process themselves and to take on responsibility. They were also able to view longer processes better and this method of teaching increased student motivation; all skills and abilities held in high esteem by those teachers and parents interviewed.

Figure 8: Students presenting an essay of whales

The new form of teaching also led to a change in the role of the teacher. Teachers now see themselves as moderators and partners to their students and not as a lecturer as in the traditional role. However, some teachers had problems to work with a second teacher in class: *"many of my colleagues had great problems with this at the beginning, suddenly to have a second teacher in the classroom and to have to teach in cooperation with her. We have never been taught how to do this"* (Teacher). The new teaching practices meant that the teacher is involved in what is happening in the lesson and some found this a problem: *"You are working the whole time as there is more to do than just writing on the board and letting the children copy. That used to always be a moment of calm! Today, you are moving about the whole time."* (Teacher). Another problem in connection with new teaching methods is the difficulties of evaluating the student's work behavior and work results. As individual students were doing a variety of tasks it was often a problem to make comparisons. Furthermore, the teacher finds herself in a conflict situation because she must either teach traditionally according to official guidelines; e.g the student writes an essay which is marked or she can observe the individual behavior of a student during the course of a project and give a mark for performance. A



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further problem described was the preparation of lessons *"It must be said that it is not easy for the teacher. They need a good overview, they must plan for the long term and must try to make individualized plans. Whatever they do, they must always take into consideration whether there is something in their plan for everyone."* (Teacher)

Figure 9: Country day New Zealand

The focus on inter-culture at the Albani School has had many positive consequences on the students' learning and behavior. Almost all teachers and parents and the School Management emphasized that inter-cultural pedagogy gave children from foreign backgrounds much more self-confidence. As the origins and cultures of foreign students was a part of the lessons at the Albani School, the children were made aware of their "being different" and were able to learn to accept this. Particularly the parents of such children welcomed this positive aspect because the children did not have to deny their mother tongue, culture and nationality. The teachers and parents of German students reported that the inter-cultural work led to increased tolerance and consideration towards their foreign schoolmates and other cultures. One mother wrote an enthusiastic letter to the teaching staff after the EXPO to express her thanks:



You are giving our children and their parents a great present. And more: you are setting a sign to the outside world for humanity, for vitality and the joy of living far beyond the what is prescribed. The frankness and tolerance which you impart to the children, the awareness that they are all citizens of the world will remain anchored in their minds and feelings and help them to construct the future (Mother).

4.2.3 Academic Rigour

As ICT is not officially integrated in the school curricula of Lower Saxony there are no official regulations for teaching ICT. Although two teachers are currently working out an ICT curriculum it is not binding for all teachers. The strict inclusion of ICT is still dependent on the teachers and their ICT skills. No consistent inclusion of ICT is fully implemented throughout all schools.

All teachers who completed the questionnaire *ICT Practices Survey for Teachers* said that ICT work is not taken into consideration when marking. This could be due to the fact that at the school the learning process within a project or the weekly scheduled lessons are evaluated as a rule. Apart from the fourth grade, there are no more half-yearly reports as they have been replaced by talking to the parents and the child together about the child's learning development. Reports are made in writing up to the end of the third grade and teachers find it very advantageous not to have to award marks for students so early on. In general, this method of evaluation would lead to more valid evaluation *"because we do not have just tests with so many points, but we evaluate the child over the whole process."* (Deputy Headmistress)

Both low-ability and high-ability students profited from learning programs and increased their academic performances. The programs provide for very effective practice work and an individualization of the learning process. One teacher thought that students were better able to grasp the connection between facts because of the extended opportunities of procuring information via internet. The Headmistress and the Deputy Headmistress were of the opinion that more time, good software, enough space, money for educational materials, training and, first and foremost, motivated and qualified staff were needed to improve academic rigor. One teacher thought it was necessary to include social pedagogy and psychology in teacher training as social conditions and demands had undergone many changes.

4.2.4 Equity

Students at the Albani School are allowed to make frequent use of the computer room and during the open begin and close of the school day to work with the computer. This means that also students from socially deprived

backgrounds can acquire basic ICT skills. Nevertheless students with computer access at home are seen to be at an advantage. ICT work can also give lower-ability students an advantage. Girls are more apprehensive about working with ICT whereas the boys are more explorative and more interested in the technology itself.

Parents and teachers estimate that around 50% of the students have access to a computer at home and around 25% to the internet.

Students are allowed access to the PCs in the computer room only during lessons. A timetable shows which class can use the room at what time. During the daily lessons laid down in the weekly timetable, the computer room is reserved for one class at a time. When the computer room is not fully occupied, the students could use it provided the technical Specialist was present. This was usually not possible in the breaks and at the beginning and end of the school day. Any student who so wished could have an email account at the Albani School. As a rule, these were students from third and fourth grade. The teachers, too, have email accounts and use the computer room to search the internet. The computer room is not available for use beyond lessons, either for students, parents or other institutions.

Teachers and parents said that students at the Albani School used ICT very regularly. Normally, the students were working with ICT *"for a certain time every day."* (Teacher) The Technical Specialist guessed that 75% of the students regularly use ICT.

Some teachers described the students level of ICT skills as high: *"Some children have a higher level of skills than the teachers, apart from three top teachers. Many of them can do much more than the teachers can, even at primary school."* (Headmistress) According to teachers and parents, students have mastered the basics of computer techniques. Many of them could handle Word, a text processing tool, were able to research the internet especially on a child's search machine and some could even write and transmit emails. They can also work independently with educational programs.

Differences between students

Teachers reported that boys and girls approach ICT in different ways. The girls are initially more apprehensive towards ICT than the boys who quickly venture into computer and internet operation. The boys display an explorative behaviour with the computer which is due to the fact that they like to tackle unknown territory quickly. They are more technically interested than the girls:

At first, the boys are all big-mouthed although they don't necessarily know much - usually they don't, but anyway they are always loud and have a lot to say. They bash around on the keyboard, pressing anything which moves (...) the girls are at first more reserved although there are always a few who act quite differently but I would say the majority are not so loud-mouthed claiming Yes, I know that already and this is how you do it and then it doesn't work. (Technical Specialist).

Nevertheless, one teacher said that these initial differences between boys and girls gradually level out when the girls notice that they are just as good as the boys in dealing with ICT.

Teachers were of the opinion that lower-ability students had, as a rule, less experience with ICT. And differences in academic performance were not necessarily made transparent through ICT *"lower ability students experienced the same frustration in front of the computer as they do at the school desk."* (Teacher) Many students, however, showed positive changes in their academic performance through ICT, particularly in Mathematics (cf. Effectiveness). Rapid and positive, or negative, feedback from the learning program regarding the tasks dealt with was said to be important for lower-performing students. One teacher reported that high-ability students acquired a more networked way of thinking by working with internet and were able to learn contents in a wider and more global connection.

Many teachers reported that students with no access to computers at home did not have the level of those who could train ICT at home and it was a problem to eliminate such existing disadvantages. However, the Headmistress had noticed that there were families who disapproved of ICT and it was not always a question of money when children had no opportunity to train at home. Although teachers said students from high-poverty backgrounds were shy of ICT, they did emphasize that they and foreign students were able to use ICT at the Albani School and to acquire basic ICT skills. One teacher reported of two foreign girls in her class who came from unfavorable social backgrounds who always went at the flexible close of the school day to the computers and thus had greatly increased their ICT knowledge. Socially under-privileged students could also take advantage of the opportunities at the Albani School *"And when you see, as a teacher, how they try once more a certain step on the computer and we can help them to succeed then they really blossom out. We can really observe lovely instances*

of success here." (Teacher) Many students had improved their self-confidence in this way.

4.3 Projections

4.3.1 Sustainability and Scalability

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Some teachers thought that further maintenance of innovations in the ICT sector depended on the Technical Specialist. *"if he left, that would be a nightmare. Many things would come to an end."* (Teacher) Fears were expressed that the existing infrastructure would not be adequately maintained as teachers had neither the knowledge nor the time for such activities. The Headmistress fears also that the Technical Specialist could leave the school for a better position as he is underpaid for his qualifications. Then it is uncertain whether they would find someone as competent to take over maintenance and administration and who could function as a contact person for teachers and students. Nevertheless, many of those interviewed assumed that ICT is so firmly established at the school that it would continue even if the Technical Specialist were to leave *"it is completely undisputed that ICT would continue and would be expanded."* (Headmistress) But it would be essential for the school to acquire a full-time Technical Specialist. Many teachers, the school management and parents expressed the hope that the staff would increase its ICT skills and that ICT would find increased utilization in lessons.

The most important resources for maintaining ICT use at the Albani School are financial and material means emphasized the Headmistress and the Technical Specialist and the school management want to continue with their efforts in this sector. As the Albani School greatly profited from sponsors and funds they get from the EXPO, new ways must now be taken. The Microsoft partnership ended with the end of the EXPO which means the Albani School no longer has access to free up-to-date software. Little financial aid is to be expected from the town of Göttingen, either. The further existence of the KKI who were turned to in times of maintenance problems in the past was also not clear. As it also looked after the *Stadt Schulnetz (town school network)*, this could also have an indirect impact on the Albani School

Some teachers emphasized the need for teaching concepts regarding ICT and would like to be given official prescriptions. The current ICT curriculum is said to be very positive and helpful by those teachers with fewer ICT skills. Many teachers and students would like to see more computers in classrooms and group rooms. They envisage at least two to three additional PCs installed in the corridors to provide students wishing to work open access to them

Two teachers per class coupled with the *Volle Halbtagschule* system - was named as a significant condition for working with ICT. Parents and teachers would like to see smaller class sizes. There could be a problem in the future as the Lower Saxony Ministry of education would like to change the *Volle Halbtagschule* into a *Verlässliche Grundschule (reliable primary school)* which would mean that children in the open beginning and ending phases of the school day would no longer be under the supervision of teachers but would be looked after by mothers, students or social workers who cost less than qualified teachers. In addition to fewer teaching hours, which would do away with two teachers per class in primary schools in the future, teachers fear the professionalism will be taken out of their jobs. From 2003, the Albani School will very likely become a *Verlässliche Grundschule* a step which could endanger the maintaining of innovations in the medium or long term.

Many teachers fear that the secondary schools to which their students go after completing the primary school are not able to consider the ICT skills the students bring with them and might also have problems with their independent way of working. They would like to see better co-operation with secondary schools.

At the beginning of 2001, it is planned to network the whole school. Each of the computers in the classrooms is to be equipped with internet. When this networking has been completed *"we will have got to a point where we can say, our EDP equipment is now adequate."* (Technical Specialist) That is now realised. It is also planned that students cooperate in a work group to design the school's homepage.

School innovations and improvement

The teachers interviewed did not doubt the maintenance of innovations and changes as, in the meantime, they have all become firmly integrated into the school-life: *"work is still going on here quite intensively as these projects were not only developed for the EXPO but they are school concepts. We simply continue with them, they will not*

be thrown overboard." (Teacher)

The Headmistress and the Deputy Headmistress are striving for an even better integration of inter-cultural strategies into the primary contents in the future. Furthermore, work with the parents will be continued and cooperation with schools in other countries will be expanded whereby it is planned to include more foreign language training in lessons. The Albani School has already received a positive reply to its application to become a UNESCO project school which would mean inter-cultural work in the sense of UNESCO. Inter-cultural work and project lessons, and multi-week lessons are supported by almost the whole of the teaching staff at the Albani School not only currently but also for the future, whereby it will be important that the school is helped financially and materially, an issue which the Headmistress is further pursuing.

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

Educational innovation and improvement in the Albani School take up a very independent position and were not created by ICT. ICT is to be seen as one innovative change among others even if it has had a catalytic impact. Thus, it is possible to accelerate projects to international partner schools by e-mail and internet whereby ICT promotes innovative and inter-cultural work. ICT is used in the Albani School comprehensively for project-based and inter-subject lessons as well as in weekly planned lessons. The educational innovations would appear to provide better general conditions for working with ICT than frontal or instructional lessons.

- Hypothesis: The diffusion of innovation/ improvement (and thus of ICT) followed the traditional diffusion patterns for innovations, as outlined by ROGERS (1995). The rival hypothesis is that technology functions differently from traditional innovations and that therefore different patterns occur.**

The diffusion of changes at the Albani School were made for the most part according to the diffusion theory. As the initiator, the Deputy Headmistress triggered the changes in the educational innovation sector and in the ICT sector it was due to two women teachers and one male colleague. Changes in communication with one another brought about by the work group around the Deputy Headmistress led to the whole of the teaching staff becoming willing to try innovations. Although it would appear that there has been a diffusion of inter-cultural strategies and new ways of teaching throughout the school, ICT still has not been totally established. Further training for teachers and the inclusion of ICT in lessons is essential if the use of ICT is to be spread over a larger circle at the Albani School.

- Hypothesis: Successful implementation of ICT depends mostly on staff competence in the integration of ICT into lessons and the learning process. 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 it is the school's technical infrastructure and student ICT competence rather than staff competence that determine ICT implementation outcomes.**

The ICT infrastructure is necessary but not sufficient for successful implementation at schools. ICT skills in primary school students cannot guarantee ICT implementation at school, either. It is of greater importance that the teacher's ICT skills are on a high level. Only when teachers feel at ease with ICT will they feel able to use it in lessons. Although the teachers have begun to acquire ICT skills they must still be increased and there seems to be a lack of training in the definite use of ICT in lessons. Also of major importance for a successful implementation is servicing by a Technical Specialist who in the best case is in full-time employment at the school and, in particular, there is money available to pay him to do his job. Another important issue seems to be transparency in decision-taking.

- 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 student increasing the performance gap with disadvantaged (high poverty)**

students.

It was observed in the Albani School that high-poverty students could obtain great advantages from ICT in lessons and in the open beginning and ending phases of the school day. There were cases of high-poverty students acquiring good ICT skills because of this. Nevertheless, it was noted that students who had computer access at home were at an advantage. The gap could be lessened by increased ICT use in the Albani School.

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 contents.**

In the Albani School, the positive impact of ICT on students' work behaviour was observed. Self-controlled and independent learning is promoted by ICT. In particular, the individualizing of the learning process led to improved academic rigor among both low-ability students and high-ability students. Communication and social processes were also promoted as the students normally worked in pairs on one computer. It is especially difficult for young users to carry out internet searches because of the unselected information. This activity must be well prepared by the teacher in advance. Observations were made here regarding the dependency on teacher skills which are linked to the expectations of the Albani School to use innovative teaching methods. This can only be achieved by teachers investing more time and effort. As lessons had been carefully prepared, no superficial processing structures were observed as the teaching of contents was integrated into ICT work.

6. Projection to the Future

Vast financial resources must be tapped if innovations are to be transferred, especially in the ICT sector, to guarantee a high ICT infrastructure and its maintenance. The Technical Specialist is of the opinion that if it were transferred to other schools, consideration must be made that procurement costs would make up the smallest part of the total costs:

It is assumed that one third of the costs are for procurement and two thirds are for running costs, training and all sorts of things. Well, a lot of money must be raised, the first third for buying equipment, they usually manage to get this sum together but, as a rule, not the other two thirds (Technical Specialist)

Through the EXPO certification, the Albani School had financial means which were not available to all schools. There must therefore, be one person, or the Head, in the school who has the necessary skills to raise financial and material resources. The second major basic condition was to have a full-time employed network administrator. Maintenance work is not something a teacher can do "on the side." (Technical Specialist) In this case, a comparison with other schools is difficult as in Germany there are no official provisions for such a post. Teachers who take on this responsibility therefore require qualified ICT skills which are time-consuming to acquire. Maintenance also takes up a lot of time so the person responsible should have the number of lessons reduced. A further important factor for a diffusion throughout all schools would be a firm acceptance of ICT in the teaching staff. Many teachers must be willing to deal with ICT and to use it which means they must be systematically trained to acquire ICT skills. In addition to teacher commitment, the school management must be receptive to innovations, enable changes to be made and support the teachers. Parent support and involvement and opening the school to the outside public are important in creating resources and a better understanding for the school's policies. Teachers must be prepared "... to work more than the normal hours" (Teacher) regarding innovations and changes and their transferability to other schools. They must be convinced of these changes otherwise they will soon be uncomfortable with them. To do this it is necessary "to create a climate in which everyone has the feeling that he/she is taken seriously. That is the most important ... Because you do more than you must if you want it to work." (Deputy Headmistress) In times of stress, only a good working atmosphere in the school can maintain the involvement and efforts of the teachers. It would be desirable to guarantee qualified teacher training which would teach ICT skills and didactic concepts for implementing these skills in lessons.

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APPENDIX A: METHODOLOGY

The research team comprised two women researchers from the FWU Institut für Film und Bild in Wissenschaft und Unterricht from Grünwald near Munich and four research workers from the Institut für Schulentwicklung der Universität Dortmund, who were working on the SITES M2study. The school was audited on four consecutive days from November 27 to November 30, 2000.

The combined instruments of IEA/OECD were used for the interviews. Interviews were held with the headmistress (for 2 1/2 hours), with the Deputy headmistress (2 hours), with the Technical Specialist (about 1 hour) as well as with teachers. The teachers taught as a rule all subjects with the exception of Sport and Music. Three individual interviews with teachers lasted about an hour each and one group interview with three teachers took about 1 1/2 hours. Three mothers were interviewed individually (about 1 hour) and two fathers and two mothers together (about 1 hour). The students were interviewed in groups. A group of three and two groups of five boys and girls were interviewed, a total of eight girls and five boys.

All interviews were recorded on a mini-disc recorder. The researchers used the proposed observation protocol from the OECD workbook for their observations. A total of ten lessons were audited. Three lessons from the weekly planned timetable one each in the second, third and fourth grade during which tasks were carried out in the computer room and learning programs were also used. Three hours of project-based work was also audited in the fourth grade on the subject of "*Whales and the Oceans of the World*" whereby an essay on whales was presented, in the fourth grade on the subject of "*We celebrate a festival*" for which the computer room was used and two hours in the third grade on the subject of "*The class newspaper*". In the latter, the students worked only in the computer room. Additionally, two hours of "*country days*" were observed, given by two mothers (one from New Zealand and one from South Africa) in a third and second grade class. We also participated in an inter-cultural workshop in which students were introduced to Chinese characters.

During the investigations, 13 questionnaires *ICT Practices Survey for Teachers-I* and the *Nomination Form for a School Site* were completed by the Headmistress and included in the evaluation. Further material included articles on the school development process and the use of ICT in the Albani School written by the school management. Three CD-ROMs, students' work, photographs of the school and the school's homepage gave further insights into innovations at the Albani School.

The interviews were transcribed from the mini-discs and coded by the OECD research team using WinMAX, a German software program for analysing qualitative data.

APPENDIX B: ICT PRACTICES SURVEY FOR TEACHERS^[1]

Table 1: Teachers feelings regarding different ICT tasks

How comfortable are you with using a computer to do each of the following?	Very comfor-table	Comfor-table	Somewhat comfortable	Not at all comfor-table	M.D. ^[2]
Write a paper	6	5	2		
Search for information on the World Wide Web	2	3	4	4	
Create and maintain web pages	1		1	11	
Use a data base	1	1	1	8	2
Send and receive e-mail	6	4	2	1	
Programming	1	1	2	9	
Draw a picture or diagram	1	3	4	5	
Present information (e.g. with Power Point)		2	2	9	

Overall self-assessment	good	fair	poor	M.D.
How would you rate your ability to use a computer?	1	4	7	1

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	no Compu-ter
How often did you use a computer at home for preparing for teaching?	5	4	2		2

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	11	1

Communication via e-mail	More than 12	6-11	1-5	none	M.D.
How many e-mail messages total do you send each day on average?		1	7	5	

Table 3: Carrying out programming and installation tasks

Have you ever done any of the following?	Number	No	M.D.
Made changes to a computer's hardware	2	10	2
Updated an application program (word processor, graphics program, etc.)	10	9	3
Recovered a damaged file	1	9	3

Created a web site	2	9	3
Developed a data base		10	3

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		3	3	7	
Create web pages			3	10	
Send or receive e-mail		3	4	6	
Use a word processing program	2	4	3	4	
Use a computer to play games	3	2	3	5	
Use a spreadsheet			1	12	
Use a graphics program		1	1	10	1
Join in an on-line forum or chat room			1	12	
Use a presentation program		1	1	11	
Use an instructional program	3	5	3	2	

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?		12	1
Did you create or modify a Web site with any of the classes that you taught?	3	9	1
Did you participate as a student or instructor in a virtual course through the Internet/ World Wide Web?	3	10	
Did you involve your students in collaborative learning over the Internet/ World Wide Web with students from other classes?	2	11	

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?		2	5	6

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?	4	3	2	3	1
What portion of the computer use that you assigned was done by students individually?		2	5	5	1

APPENDIX C: DOCUMENTATION

Documents:

- EVANGELISCHE AKADEMIE LOCCUM (64/99). Welche Schule braucht die Zukunft unserer Welt? Niedersächsische Schulen entwickeln Ideen und Projekte zur EXPO 2000. (Projektdokumentation 1; Albanischule Göttingen; Heidrun von der Heide, Waltraud Zubke) *What sort of schools do we need in the future? Schools in Lower Saxony develop concepts and projects for EXPO 2000*
- VON DER HEIDE, H. & SCHANZ, C. (1999). Start frei für die Schulentwicklung. Motivations- und Konsensfindung in einer Grundschule. In: Beispiele 1/99.18-23. (*All clear for school development, Motivation and consensus finding in a primary school*)
- HACKLER, J. (1998). Computer und Lernen. Die CD-Rom des Monats 1998. Susi. Albanischule und Kreisbildstelle Göttingen. (*Computer and learning. The CD-ROM of the month*)
- CD-Rom: Albanischule Göttingen, EXPO-CD
- Informations- und Faltblätter von Räumlichkeiten und Projekten für die EXPO (*Information sheets and leaflets on rooms and projects for the EXPO*)
- Fotografien von der Schule (*Photos of the school*)
- Schulhomepage: <http://www.albi.goe.ni.schule.de/> (*School homepage*)
- Unterrichtsinstruktionen für Wochenplanstunde und Projektunterricht *Lesson instructions for weekly scheduled lessons and project lessons*
- Bastelbogen der Albanischule (*Handcrafts sheet from the Albani School*)

Students work:

- CD-Rom: "Susi", Schuljahr 1997/98
- CD-Rom: "Göttingen: Von der ersten Siedlung zur Stadt", Schuljahr 1998/99 (*Göttingen from the early settlement to the town*)
- CD-Rom: "Susi Reise in die Zukunft", Schuljahr 1999/2000 (*Susi s trip into the future*)
- Bearbeitung des Namens einer Schülerin mit dem Textverarbeitungsprogramm Word (*Processing the name of a schoolgirl with a text processing program*)

APPENDIX D: BIBLIOGRAPHY

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APPENDIX E: 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 pupils, as well as holding lectures and annual conferences. *SAN* is a member of the EUN *Europäisches Schulnetz*. (<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. (<http://d21.fujitsu-siemens.com/d21/index.htm>)
- The *Bertelsmann-Stiftung* 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*. 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. (<http://www.netzwerk-medienschulen.de/dyn/1668.asp>).

[1] All results based on the responses of 13 teachers.

[2] Missing Data