

**OECD/CERI ICT Programme**

**A Case Study of ICT and School Improvement  
at**

**Aurora Primary School, Finland**

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# **1 Overview**

## **Brief description of the school**

Aurora school is a primary school (ages from 7 to 13) located in Lippajärvi, a northern suburb of the city of Espoo in the capital area of Finland. The socio-economic status of the district is slightly above the average compared to the whole city of Espoo. However, there are some rental apartments of the city of Espoo located nearby the Aurora school and it is possible that some families living in these apartments are below average in their financial resources.

Aurora school has 332 students; 149 (45%) of them are girls and 183 (55%) are boys. There is one immigrant-student in the school. Most of the students come from the official district of the school, and 29% of the students come from other school districts. There is a special preparatory class for those students who have problems to begin the school at the age of seven. At the moment there are 6 students in this class.

There are altogether 19 teachers in Aurora school, 5 of which are men. Most of the teachers are class-teachers but foreign languages and textile handicrafts are mainly taught by two subject teachers. Other staff includes school secretary who works part-time; one teacher for special education, 2 school assistants, one caretaker, a psychologist (one day a week), a nurse (two days a week) and kitchen and cleaning personnel. These all are paid by Espoo School Administration, except the nurse, whose salary is paid by Social and Healthcare System.

The turnover of the teachers has been very low in Aurora school. According to the principal it has been approximately 3 teachers in 4 years. The number of teaching hours per week per teacher is about 25. At the moment (2000-2001) there are 14 classes in the school (and the small preparatory class). The average class size is 23,5 students/class. In the largest class there are 30 and in the smallest class 20 students. The daily timetable of Aurora school is divided into the 'morning' (8-11 a.m.) and the 'afternoon' (12.15-14.30/15.15 p.m.). In the middle, there is a

75-minute break (11-12.15) during which students have their free lunch, participate in different clubs or play and relax with their friends. Usually the teachers also have some kind of meeting during this break where they discuss urgent issues and news.

The 'main building' of Aurora school was built in 1957. Due to lack of space, some temporary rooms were constructed in the 1980s. However, these temporary buildings are still in use and the school is waiting for its renovation.. Lack of space is one of the current problems of Aurora and it has also restricted the decisions concerning the placement of computers in the school. According to the teacher and parent interviews as well as additional written material of the school, the characteristics and aims of Aurora school are:

- be considered as a safe and an active 'school of the village'
- support the personality of the child; both diversity and equality are respected
- pay special attention to children with socioemotional or academic problems
- be a school with modern and advanced curriculum
- be considered as a school which use drama, theatre, visual arts, and ICT in teaching

The use of ICT in Aurora school will be described in detail in the following sections starting from the past events and projects. Although it is obvious that in Aurora school there has been problems with both the technical equipment and funding the ICT projects, also some evident advantages have been achieved:

- active use of ICT has been established as one of the characteristics of Aurora school
- is considered and accepted as one of the means to develop the school pedagogically
- is a culture for using the ICT in the communication between the school and home
- teachers have become familiar with ICT although some still use it more actively than others
- teachers and students have positive attitudes towards ICT although ICT- skills vary

## 2 Overview of the past: A history of the reforms

In Aurora school the use of ICT as a tool for learning begun as early as in the late 1980's. At that time, the use of computers was still quite haphazard or rare in most primary schools in Finland. However, in Aurora the ICT was from the very beginning used actively in rather ambitious projects, considering the technical resources available. In short, the history of ICT utilization in Aurora school consists of several small-scale and a few larger-scale projects, which have been considered as an important part of the pedagogical development of the school.

It must be noted that especially in the beginning, ICT was actively used only by a few

enthusiastic teachers skillful in the use of ICT (including the principal), although also other teachers were interested in increasing their ICT skills and to use it in ordinary school tasks (e.g. in writing). This can be considered as a common trend in most schools in Finland. In order to facilitate the introduction of ICT to Aurora, the class teacher who was responsible for the ICT had made a suggestion that the school should invest in Macintosh computers, which were easier to handle than the PCs at that time.

The introduction of ICT at the school level was carried out with moderate changes, one example being the decision to locate a computer in every classroom with the help of class committees' money. The aim was to avoid the piling up of the ICT-lab and to ease the everyday-use of computers in each class level. In the beginning of 1990s, there were only 3 computers (MacPlus) in the ICT-lab, one of which had a modem connection. Later on, the school decided to carry on as a 'Mac-school', although the city of Espoo had made a decision to invest in IBM PC compatibles. Aurora school was well satisfied with the Macs, but some maintenance and funding problems occurred due to the preference of PCs at the Espoo school administration.

Consequently, the early use of ICT at the school level can be described as emphasizing ICT as a tool for the normal learning practices but also as a source of information and a tool for communication via Internet and e-mail. In 1988 an ICT-club was founded that was open to all students interested in the subject. In classrooms the computers were mainly used in word processing and to draw pictures with drawing applications. However, during the 1990's some classes and a couple of teachers attended several ICT-projects, which varied in scope and in content. In many projects Internet-connections (via modem) were used to communicate with other students in homeland and abroad. Communication involved for example the writing of serial stories, 'Teleolympics' and exchanging of information and experience with other students in different environments. Some students of Aurora school also participated in the publication of an 'electronical journal' that could be read through e-mail. This journal was done in cooperation with other schools, students and parents around Finland in 1991. Before the WWW was in use, other networks (e.g. TeleSampo, Infotel) were utilized. In 1997 Aurora was connected to the local area network and the number of computers was increased with 3 PCs.

It is also noticeable, that in Aurora school there was a project for instructing parents to use e-mail as early as in 1994. The goal was to experiment the use of e-mail in the communication between teachers and parents. Internet was also used in another way for this purpose: the school started to publish it's own electronic notice board in 1991. There was a possibility for anyone to participate in the discussion concerning school-life in general and the neighborhood of the Aurora school in particular. According to Aurora school's staff, there were lively discussions in which also 'outsiders' - e.g. employees of some local firms - took part. However, this electronic notice board is no longer in active use because of the problems in Internet connections.

With these projects carried out, Aurora school became known of its versatile and active use of ICT. In 1994 Aurora school was involved in a project of Espoo City School administration where the more advanced schools guided and instructed the other local schools in ICT use. At the same time, the development of these advanced schools was further supported by the city of

Espoo. Related to this event, the school started to create its own Web pages.

During the years 1996-1999 Aurora school participated in two larger-scale ICT- projects, which were also paid attention to in the media. In 1996 the principal attended a developing project of a nationwide Virtual School, a distance learning environment in the Finnish Freenet. The principal of Aurora school acted also as the principal of the Virtual School. In Virtual School students could perform courses independently and at their own pace regardless of their actual location. This kind of distance learning possibility was seen to be useful for example for the gifted and chronically ill students or for those living abroad. The older students in Aurora School could attend an extra course organized via Virtual School. The Virtual School -project was suppressed few years later because of insufficient funding resources and problems in the technical infrastructure.

Another larger-scale project initiated in 1996 was the so-called Comenius-project: "history through the eyes of children". In this project ICT was used as a communication tool between schools in different countries. The main pedagogical focus was in the historical phenomena investigated by students themselves and the different perspectives on these phenomena in different cultures. However, in this project communication via Internet did not work as it was intended to because of inadequate technical equipment and Internet access in some of the partner-schools.

Since 1998 Aurora school has also participated in Matilda-project, a telematic book club for primary school children. In this project a selected group of students study literature in virtual study groups. Students are required to read two books a month and engage in conversation by using Matilda web-site and discussion tool in the web. Every school, which takes part in Matilda-project, has a teacher who works as a tutor. Teachers tutor their own home group with about 8 students from 3-4 different schools. The program started in Espoo in 1997-1998. In Aurora school the participation has been voluntary for the teachers. To date, two teachers interested in literature have acted as tutors and some 5-8 students (per semester) have participated in the project. The first teacher who participated in Matilda considered the project as very meaningful and interesting one both for the teacher and for the students. However, she also commented that the time, benefit and effort were not in balance and there were also many technical problems during the two years that she attended the project.

## **3 The Present**

### **The use of technology in Aurora School**

## Technology Infrastructure

Aurora school has a small and close computer lab equipped with 8 Apple PowerPC Macs, which have Internet access through the local network. However, at the time of the research, 3 of them were out of use. In the library there are two small rooms with 6 computers, which have Internet access. The school has mainly invested in Macs, but due to the maintenance and compatibility problems the personnel have made a decision to gradually switch over to PCs. In the library one of the computers is a new iMac with video-editing possibility. Four of the library's computers are Pentiums, which were admitted by the city of Espoo for a special ICT-project. In almost every classroom there is one older Mac to be used in word processing and drawing. At the time of the research, the school had on average about 20 students per computer, which is below the recommendation that the National Board of Education has set for the primary schools in Finland (10). However, according to national surveys, the ratio usually tends to be about 1 computer per 10-13 students.

The students can have access to the computer lab during the daily break, when it is reserved for the ICT club. However, students must make a reservation for a computer beforehand (there is a list outside the lab). During the daily break the ICT use is not very intensively watched over and some misuse has occurred. During the research there was lively discussion about the problem and the access to the lab was - at least temporarily- restricted so that only students of the same class level could use it at the same time. Students do not have or need usernames to establish Internet connection, so the misuse is difficult to identify afterwards. In the library the computers are used mainly for study-purposes and students must have a teacher's permission to enter. Students are not allowed to play computer games with the PCs, but in the computer lab during the daily break it is permitted.

The school has 9 printers, 6 for teachers and 3 in students' use. There is also one videocamera, 2 cameras and 2 scanners available. The teachers have 4 computers with Internet access in their use. Two of the teachers have also laptops with Internet connections in their use because they are involved in a training program related to the Espoo-city ICT-reform (see below).

The maintenance of the ICT equipment in the school is taken care of by both the city of Espoo and Aurora school itself. In primary schools it is usual that one class teacher takes the responsibility of the ICT equipment and the 'acute' technical problems teachers or students face in the school. This teacher gets compensation of one hour per week, which is insufficient with regard to the workload. Besides this, there is a possibility to call in an ICT specialist of the city of Espoo who will handle all the larger technical repairs or adjustments. According to the teachers of Aurora school, this support is not sufficient and it may take too long to get the help needed. In principle, if a computer breaks down, the city of Espoo will cover the costs. However, this applies mainly to the PCs, and because Aurora school has a lot of Macs in use, the school has to pay the repairing of this equipment itself.

Part of the ICT support system is related to the ongoing ICT-reform of Espoo school administration, which goal is to develop especially the pedagogical use of ICT in schools.

Therefore, in every school there are one or two voluntary teachers who are being trained to act as 'pedagogical ICT guides' for other teachers. It must be noted that this is a special arrangement, and concerns only the schools in the Espoo City area. In Aurora school there are two such teachers, the other is the former ICT-responsible teacher who held this status for 20 years, and the other is an ICT skilled class teacher interested in the subject. These teachers get compensation of 6 hours per week for the extra work. In Aurora, these two teachers have trained the other teachers in ICT skills and they support them in everyday ICT use. Some teachers think still, that they would need more concrete, regular and intensive guidance to use ICT more effectively in teaching. As far as the teachers are concerned, they claim that it is not the pedagogical but the technical skills they are lacking.

## **ICT in teachers' work**

ICT is a common tool in many daily activities for teachers. Most of them need word processing in their work (tests, notices, messages etc.), use e-mail in communication and Internet to search for information. Approximately half of the teachers consider their ICT skills as moderate, but it is evident that the competencies are varying. Five teachers estimated their skills as rather poor and one or two hardly ever use ICT in their work. The most skilled and active users of ICT are all men (including the ICT responsible teachers and the principal) who are - among other things - used to take responsibility for the basic ICT equipment maintenance in the school.

Related to the Espoo School Administration's ICT-reform, in each school there has been formed an ICT-group, which is responsible for elaborating and creating an ICT-strategy for the school. Based on the quality of the school's ICT strategy, the city of Espoo admits resources for the ICT equipment and projects in different schools. In Aurora school this group consists of 4 class teachers who are familiar with or interested in the development of school with ICT. Three of the teachers are men and one is a woman (the former and present ICT responsible teachers, one ICT skilled male teacher, and one female teacher interested in the pedagogical use of ICT). This group has had training how to create the ICT-strategy for the school and it also acts as a mediator between the City School Administration and the school itself. In Auora school the group actively negotiates how to proceed in the strategy planning and it also informs the other teachers of the progress and city policies.

## **ICT in education**

Almost all teachers have had some informal or formal training in ICT skills. Still, the usage of ICT in the classroom varies depending on the teacher but also on the class level and age of the students. It can be estimated, that in grades 3-6, the students get to use ICT about 1 to 2 hours per week. However, depending on the teacher, the amount varies from very occasional to quite regular usage. Teachers agree that it is essential to guarantee the basic ICT skills for all students but there is a tendency to rely on some teachers activity in more demanding ICT use, and to think that it is more suited for the students in the higher grades (i.e., fifth and sixth graders).

Most often ICT is (in teaching) used in teachers' own projects as a tool for process writing and information searching. Some teachers have also taught students to use drawing applications to illustrate their own stories. In the interviews teachers commented that during the present year the use of Internet has decreased compared to previous years because of problems and breakdowns in the network connections. Teachers and also students are frustrated with these problems and some have even decided not to use the Internet until the connections become more stable and reliable. In teacher interviews one common comment was that when using ICT in teaching, it often happens that the 'advantage is not worth the effort'.

In teachers' interviews there was also concern about the pedagogical value of the Internet use for primary school children. The teachers admit that often the information searching may in fact be mechanical information copying from different and sometimes even unreliable sources. There has not been any formal training for children to use the Internet meaningfully, but it depends on the teacher's own perspective and Internet skills how the students are guided in this area. It also appears that the Internet is mainly used to search information for some specific and fragmented questions that may not require the student to process the information in any way. However, there have been some projects in Aurora, where Internet has been a resource for more deep going inquire-based study projects.. According to the principal and teachers involved in these projects, the ideal would be to get the students to create their own research questions, instead of mere copying of information. These kinds of research type projects have, however, been rare and the usual Internet usage is focused on the more superficial information searching and processing.

Another problem related to Internet use is the risk of inappropriate material and Web pages that the students may encounter when surfing in the net. At the time of the research, this was a current problem in Aurora, which the principal and the ICT-group were trying to solve. It was seen important that the school should be able to provide a safe environment for learning also with regard to the ICT use. The ICT-group started to draw up a list of the rules for the computer use in general and for the use of Internet in particular. Also the control for the Internet use was tightened. The common opinion seemed to be that the censorship should rather be built in the school's culture than rely on technical solutions.

Word processing is also actively used in remedial teaching, especially in spelling rehearsals. Teachers think that it is an effective way to learn to pay conscious attention to one's writing and it also motivates the student. Also the use of instructional programs and CD-ROMs (e.g., math and language games) is more common in remedial teaching than in normal classroom situations. It must, however, be taken into account that the size of the computer lab restricts heavily the use of computers in teaching. With the whole class, the students must be divided in different locations (e.g., the ICT-lab and the library are far away from each other) and even then there are always two students per computer. It is difficult for the teacher to try to control and guide all the students at the same time and often it is the case that the students have to wait for the teacher a while if they have problems starting a program etc. Because of the differences in type and quality of the computers available, the programs (e.g., word processing) also vary and this is why the students should each time try to use exactly the same computer when they continue with their tasks.

Extra resources for the ICT use are the so-called resource-hours, during which the former ICT responsible teacher can take a few students to the ICT-lab and teach them individually. He often utilizes different computer programs in these situations or guides the students in the Internet searches. During the current year (2001) there were 2 hours per week reserved for this kind of teaching in the school's budget.

## Different student groups as users of ICT

In Aurora school the students in the higher grades (4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup>-graders) use ICT more often than the younger students. Although it is obvious that the age of the students pose some limits to the way ICT is used, it is also common to think that ICT is not yet very important or useful tool in the lower grades. Still, there is variation among teachers. Some ICT skilled or enthusiastic teachers use computers regardless of the students' age. The older students (mostly boys) also use computers more often during the daily break (ICT-club) to play computer games or to surf in the Internet. In the student interviews the younger students commented that they have other and more interesting things to do during the break (e.g., to play outside with friends) than to play with the computers. It can be said that the students' ICT skills become more even in the higher grades because then all students also get to use ICT in school. Till then, it seems partly to depend on the teacher, students' own interest, or their homebackground how actively the students use ICT and how familiar tool it is for them.

Some of the teachers commented that although there aren't very large differences in the amount of ICT use between the boys and girls (in the higher grades), it might be that they use ICT in different ways. The girls seem to use ICT (e.g., during the daily break) for communication more often than the boys (e-mail, chatting) whereas the boys play and visit different web sites more often than girls. The language teacher also noted that in Aurora school the boys are better in English and that this might be partly due to the computer games, where boys have an opportunity to enlarge their vocabulary. While the male teachers did not consider the gender to be an important factor in the students' ICT skills, some female teachers had a concern about the girls and thought that the 'world of ICT is still the world of men'. However, all the interviewed teachers agreed that it might be more dependent on the students' motivation and interest and the subject than their gender how students use the ICT in school. The interviewed male teachers noted that if the students get proper guidance in the ICT use, usually they all are very motivated to use it as a tool for learning. Also all the interviewed students themselves commented that they like to use ICT in teaching and that they would be willing to use it even more than they usually do (still, they acknowledged that the size of the ICT-lab and number of computers limit the use to some extent).

It seems that quite a large number of Aurora school's students has a computer at home in their use. So, the computer access is not directly related to the students' socioeconomical background. However, some of the interviewed teachers noted that the education of the parents may affect the way students' are guided in the computer use at home, although the students also seem to learn a lot from their older siblings and friends. All the interviewed parents had a higher education degree and it was obvious that they both guided and controlled the use of ICT

in their homes. In the higher grades the teachers mentioned that sometimes they might give homework or projects that can be completed with a computer, but the use of computer is never compulsory in these situations.

According to the teachers, all students may benefit from the pedagogical use of ICT, but they also thought that the benefit might be different for students with different academic skills. As it was mentioned earlier, teachers use ICT rather often in the remedial teaching where the students with different academic problems (spelling, math etc.) can use, for example, computer games and programs to rehearse the certain subject individually or in small groups. The ICT is also seen to be motivating for the students with socioemotional or concentration problems. The teachers think that some students who have problems in adapting to ordinary school tasks may find new competence-areas in the ICT-use and even perform better than the other students and act in a tutor's role for the others. However, teachers also acknowledge, that there are students who are not motivated to use ICT and who lack even the basic ICT skills and are, thus, in a danger to lag behind in the subjects or projects where ICT is actively used. On the other hand, the differences between the students are not yet very drastic in the primary school level, and the teachers are aware of the school's duty to try to even out these differences.

## The primary reforms

The reform is in the case of Aurora school defined as the process of developing the school and learning by using ICT. There is not any single ICT project in process that could be identified as 'the' reform, but the purpose of ICT use is based on the general aims of the school (see page 4), and the goal is to try to utilize ICT when developing the school as a whole. It can be said that this has been the case from the beginning, although there has been variation in the broadness of the ICT projects as well as in the extent that the teachers are involved in the ICT use. Right now the school is in a 'transitional stage' as regards the use of ICT. The school gets a fast network connection and the Macs are gradually replaced by PCs. Still, there are certain trends in the ICT use that can be seen to support the aims of the Aurora school.

### *Aurora as a safe and an active 'school of the village': ICT in communication*

From the very beginning, in Aurora school the ICT has been recognized as a useful means to support the communication between the school and home and also to spread knowledge of the school through the Internet. Almost all teachers have e-mail address to change information with the parents and some parents also use this possibility quite actively. All the interviewed parents commented that the use of e-mail is a convenient way to communicate with the principal and with other teachers. Also the www-pages of Aurora school can be considered as one way to 'open the school' to the community. In the www-pages there is a description of the history of the school and also of the ICT use in Aurora. The Curriculum of the school is also to be seen and commented on in the www-pages. Aurora school is also interested in developing the use of Internet and www-pages as a communication tool if new possibilities emerge.

Another example of the co-operation between the school and home is the ongoing 'Net workshop', which is a possibility for the parents to use the school's computers and Internet

connections in the evenings. Students and their parents have a free access to the library, where other ICT skilled parents guide them in the computer and Internet use. This project was arranged together with the teachers and parents and it has been experienced positively by the participants..

*Supporting the personality of the child; diversity and equality in ICT use*

ICT is in Aurora school used as a one way to differentiate the teaching. It is recognized that students may benefit from different kind of tasks, which support their individual ways of learning or their special competencies. One example is the utilization of the 'resource-hours', when small group work with computers may be used in parallel with the whole class teaching. Also there are different clubs where ICT is used as a tool for creative work and self-expression. These include animation making, video editing and producing music with computers. At the same time, however, there is a general opinion that school must provide all students equal opportunities to ICT access and basic ICT skills. One current aim of the school is to develop common goals for the ICT use in each grade level in order to unify the ICT practices at the school level. Attention has also been paid to the differences between the genders in ICT use. Few years ago there was an experiment to give the girls their own ICT-club session during the daily break. Also the ongoing telematic literature club Matilda was initially seen as a way to encourage the girls to become more familiar with the computers and the Internet. The Matilda project is not, however, exclusively meant for the girls, but to all students interested in reading and analyzing books.

*Paying special attention to children with socioemotional or academic problems with the help of ICT*

ICT is considered as a useful tool in special education and remedial teaching, for example in writing or in math, where it is important to pay conscious attention to the types of errors that one is doing. Teachers believed that it is helpful if these mistakes can be seen on the computer screen (e.g., in writing).

One of the current projects of Aurora school, called 'The Stop', is also one example how to use ICT to support other pedagogical practices. 'The Stop' is a rather new innovation and it was developed in order to improve the work and emotional climate of the classrooms. The project involves small group work (4-8 students) in the library during the normal lessons. The group is formed together with the class teacher (one class participates at a time) and it is meant for the students who have concentration or socioemotional problems in the whole class situations. Each group participates in the group work for two weeks time, 15 hours per week. After these two weeks the ICT responsible teacher, who is the 'leader' of this group, starts to form a new group with another class teacher. Teachers also give feedback to the group's teacher and the students may participate in the 'Stop' groupwork again later on, if it is considered necessary.

In the library, where the group works, there are 6 computers with Internet access. These computers are used in the groups' own projects (usually the teacher starts some project with each group) for information searches and word processing. Also the new iMac with video editing possibilities has been used in the group work. A group of boys made their own music video with this computer and also a short presentation video of the idea of the 'Stop'-project itself. These kinds of practices are considered for students as possibilities to try out their skills

in different domains and to increase their self-esteem in areas other than traditional schoolwork. However, the students also work with their normal tasks and school subjects, but in a small group they are able to get more support from the group leader and to concentrate better than in the whole class situations.

#### Aurora as a school with modern and advanced curriculum

ICT is also seen as a part of the curriculum of the Aurora school. To date, it has mainly been integrated in the different school subjects or presented in connection with the special ICT-projects. However, there has been discussion about ICT's role in the curriculum and the current opinion is in favor of enlargement of the ICT use in general and better definition of the ICT related goals on different grade levels. This is seen necessary in order to guarantee the basic ICT skills for all students, starting from the lowest grades. Also the teachers have expressed concerns about the lack of knowledge of convenient ways to use ICT in different grades (especially in the lower grades) and the goals they are supposed to achieve. Besides this, the purpose is to maintain the role of ICT as integrated in the normal school subjects and in the other pedagogical practices of the school. Consequently, Aurora is in process of starting a new project ('Futures'), which all classes take part in and where ICT is used on each grade level. ICT skills are seen to be essential for all students in order to succeed in their future studies and in the 'knowledge society' in general.

To summarize, in Aurora the use of ICT has been integrated in the general policy and in the normal pedagogical practices of the school. The introduction of ICT has not happened in a moment, but rather through gradual process and development work that are still in progress.

## 4 Main hypotheses

1. *the technology a strong catalyst for educational innovation and improvement or does it serve only as an additional resource for improvement*

As the principal of the Aurora school stated, the development of the school has not been based on the ICT and, hence, the development has not been technology-driven. According to the teacher and parent interviews and additional material, the emphasis of the school's 'ethos' is on the pedagogical development of the school as a whole and ICT can be considered as only one possible sector or means that should serve this purpose. However, it can be said that the use of ICT has also enabled such pedagogical practices that would have been difficult to actualize without the help of technology (e.g., virtual communication). The more ambitious ICT- projects of Aurora school have clearly been seen as useful for the whole school, but still they have not been fully realized in the whole school. From the beginning, the ICT projects and innovations have been on the responsibility of a small group of teachers while the other teachers have used ICT occasionally as a tool for ordinary school tasks. It can also be said that the development of the school with the ICT has not been very systematic, but been driven by a general desire to try out new and interesting tools and means to improve learning. In Aurora school, there is a trend

to be seen that the school is now moving to a more systematic and unified planning in the use of ICT and also the ICT use is becoming to be considered as everyone's responsibility. However, ICT is still regarded as a possible tool for developing the school, not as a 'promoter' in itself.

1. *the diffusion of use of ICT follow the traditional diffusion patterns or did different diffusion patterns occur?*

In Aurora school the use of ICT in teaching has gradually, during the years, become familiar to almost all teachers. The diffusion can be considered as having followed the 'traditional pattern', since there are certain teacher groups that can be identified as early and late adopters, although there has not been direct resistance with regard to ICT use. As the history of ICT in Aurora school shows, in the beginning, the dissemination of the ICT use was mainly the task of one enthusiastic teacher and the principal, who initiated several projects quite on their own. Later on, more teachers have become interested in the possibilities to use ICT more actively in their own projects and as the skills have developed, the use of ICT has increased. For some teachers the initiation of ICT use has also emerged from the desire to develop professionally and has been regarded as one challenge in their own career (quite independently from the school's policy).

In Aurora school, there is a common 'deal' that the teachers are not forced to participate in different projects, but everyone is free to choose what projects they attend to. Because of this, there has not been resistance towards special ICT-projects, for the participation has always been voluntary. Also, the teachers have quite long been free to decide the extent they want to use ICT in their work. While all teachers have acknowledged the importance of teaching the basic ICT skills to the students, some have left the responsibility to the teachers of the higher grades or to the teacher responsible of ICT in Aurora school. ICT as a tool for learning and development of the school is respected, but some teachers still don't see it as their 'area of practice'. In the teacher interviews, the female teachers spoke of the ICT projects and use as the "male's territory" and referred to "their plans and strategies" (meaning the ICT-strategy of the school). It can be said, that the ICT matters are not always considered as 'common' issues, but something that concerns only some teachers.

1. *the successful ICT implementation depended mostly on staff competence in integrating ICT into instruction and learning or have the school's technological infrastructure and students' ICT competence determined outcomes more than staff competence*

In Aurora, all the elements mentioned in the hypothesis have somehow affected the way ICT has been implemented and used in the school. In the beginning, when there were only couple of computers available, especially the technological resources limited the wider use of ICT in teaching. Even now when the amount of computers in Aurora school has increased, technical problems, the lack of proper space and the location of the computers limit heavily both teachers' and students' willingness and possibilities to use them. Some teachers also mentioned their insufficient ICT skills as the reason why they do not use ICT more often or why they feel uncertain to try out new ways of using ICT. When the teachers feel they lack the skills needed

it also seems to require too much effort when compared to the benefit they are expecting to have. Some female teachers also commented that they would need more on-line support with the ICT in order to successfully carry out the tasks that they would like to perform with the students.

Students' ICT skills are, in primary school, related to the age of the students. In Aurora, the age of the students may sometimes be mentioned as an excuse not to use ICT in the lower grades. Evidently, there are some restrictions that the age of the students pose, but it might also be possible to try to find ways to use the ICT that were suitable for the younger students too. This might even out the differences between the students' skills that otherwise may not be recognized until the higher grades. Those teachers who use ICT actively do not consider the differences in students' skills as a major problem, although they admit that the differences exist. Maybe it is easier for them to differentiate and plan the instruction according to students' skills, for they can use ICT flexibly and guide students in different skill levels. Hence, it can be concluded that the technical infrastructure, students' and teachers' ICT skills are interrelated issues that are all part of the culture of using ICT in Aurora school.

1. *the gaps in academic performance between high and low poverty (more advantaged and disadvantaged) students increase or not when all students have equal access to ICT*

In Finland, the labeling of students according to their socioeconomic background is not considered proper and it is not a usual policy in schools to try to find out the economical status of the students' family. It is also very difficult to estimate the effects of the ICT use on students' performance - especially in the primary school level where the use of ICT is only one part of the academic program of the school and students' everyday school life. However, in Aurora school it has been recognized that the school must pay attention to the possibilities that students have to use the ICT in school, also because of students' different possibilities to use computers at home. Thus, students' equality in access to ICT is taken into account in Aurora school. This is illustrated for example in the project of 'Net workshop', where the school allows students and their parents to use school's computers outside the regular school hours. Also the ICT-club and concern for equality in ICT use between the genders show that actual decisions have been made to reach this goal.

In teachers' opinion, all students benefit from the ICT-use if it is used meaningfully. ICT is seen as a very motivating tool that the students' are usually eager and willing to utilize. However, the teachers also recognized that different students may benefit from the ICT in different ways, although they found it hard to specify what they meant with this argument. Some teachers also expressed critical evaluations (also those who have used ICT actively) about the effects of ICT in learning. They saw that very often ICT is only used in an entertaining way that has nothing to do with real learning outcomes. If ICT is used in this way and without conscious connection to the learning goals, it is not surprising - in their opinion - that it does not affect learning either.

All teachers considered the ICT skills as basic competencies that all students should have in order to succeed in future studies and working life. Some also recognized that working with

ICT may teach students to regulate and evaluate their own learning when students own responsibility increases. However, this was considered to be realized only when the 'working method' and nature of learning tasks supports such a learning process, not with the use of ICT itself.

1. *successful implementation of ICT lead to the same or higher academic standards in spite of the low quality of many ICT materials or does ICT use lead to a lowering academic standards as students spend more time on marginally beneficial ICT materials*

The main advantages of the ICT use mentioned by the teachers were experiences of co-operative work, connections to other students and experts via the Internet, and the motivating effect of computers. No one could say whether the use ICT effects on the quality of students' learning, except through the extra motivation to work with computers. Common opinion was that students' products (when done with a computer) may look more 'professional', but this does not necessarily mean that the content would be any better than before. However, ICT is in Aurora also sometimes utilized as a tool for students' self-expression and creative work (music, drawing, animations etc.) and these experiences are considered to be very valuable to the students' self-esteem and well-being in general.

The ICT material is not considered to be the major factor when evaluating the effects of the ICT on students' academic performance. More, it is the nature and purpose of the learning tasks that is seen as essential and that guides the way students are required to process the information. In Aurora school, most teachers don't use any ready-made digital material when they use ICT in teaching.

## **5 Projection to the future: will the reforms remain?**

The basis for using ICT in Aurora has been formed gradually and it has reached a stable position as one sector in developing the school and also as a characteristic of Aurora. It is likely that this situation will remain the same as the daily use of ICT continues to diffuse in the school and the technical infrastructure improves. The arguments for the continuing development work are as follows:

1. In Aurora school there are active teachers and a group of promoters who keep the present practices going on and bring out new ideas to develop it further. The essential individuals in this respect are the former ICT responsible teacher, the members of the ICT-group and the principal. The former ICT responsible class teacher initiated the use of ICT in Aurora and made the groundwork for its wider use in teaching. At the present, he still is the person who other teachers most often turn to in various ICT matters and technical problems. Alongside the principal he has also been the one to participate in the more demanding ICT projects and to

encourage other teachers to do so too.

2. The formation of the ICT-group in Aurora school can be considered as supporting the use of ICT also in the future. In the group, the responsibility is divided among several people and it is easier to develop new ideas in joint discussions. This way the perspectives of different kinds of teachers will be taken into account in ICT decisions and the information will be easier to distribute. There is one female class teacher in the ICT-group. It is possible that she also gets other female teachers more interested in the ICT and acts as an example in this respect.

3. The current policy of the Espoo City School Administration is favorable with regard to maintaining and improving schools' ICT use and technological infrastructure. Rather large amount of money will be invested in improving the network connections of all schools in the City of Espoo and at the same time, new computers will be provided. Also the pedagogical use of ICT in schools is supported with the training of the 'pedagogical guides' (see page 9), who are able to use some time each week concentrating solely on the pedagogical issues related to ICT.

4. Aurora school has developed good relations to students' homes, and from the beginning, also the parents have acted in a supporting role in ICT projects and investments. All the interviewed parents saw Aurora school as a rather advanced school in the ICT use, although they were not quite aware how ICT is used in everyday teaching. As the parents and teachers share a common conception of the importance of ICT use in school, it is likely that also this is a cause to try to maintain the status of ICT in Aurora as it is, and even develop it further.

What is currently considered as the major obstacle in everyday ICT use in Aurora, are the inappropriate ICT-lab and still unstable Internet connections. However, it is likely that some of these problems will be solved gradually, as the ICT reform of Espoo City proceeds and schools are provided with better ICT equipment and resources. The size and location of the ICT-lab will not be so easily solved, but the teachers are trying to find out alternative solutions with regard to the placement of the new computers. Also some teachers still wish for more training in technical issues as well as guidance in the way that ICT could be integrated in the ordinary schoolwork.

Further, it can be stated that although both teachers and students hold positive attitudes towards ICT, it is not yet used school wide and equally in all classes or grade levels. The next challenges for the Aurora school might be to improve especially the pedagogically meaningful and systematic use of ICT in teaching in all grade levels. Also, it could be possible for the teachers to use the Internet as a tool for creating networks with other colleagues in different schools and grade levels.

# Extensions to other schools

In Aurora school there has been a tradition to inform other schools of their ongoing projects and innovations and try to share both the positive and negative experiences. According to the teachers, it usually is the principal who is actively in connection to other schools and colleagues. The teachers of the school also write actively in professional (teacher-) magazines of the pedagogical practices of Aurora. However, in teacher interviews a common opinion was that currently the neighbor schools are not actively seeking innovations or new ideas from each other, but that the interest often comes from further away. Some ICT projects of Aurora have also been part of international research programs and, thus, they have been reported in different research articles and reports.

It could be stated that the practices of using ICT in Aurora is not easily transferred to other schools, as it has been a result of gradual development and because it is closely related to the culture of Aurora in general. However, some individual ideas and practices are certain to be of use in other schools too, if only the school personnel is interested in the development work. Enthusiasm was the thing that the teachers of Aurora emphasized as a necessity of different projects. Also Aurora school is open to the suggestions and ideas that come from other schools, and for example the Matilda-project was started as a result of recommendations from one neighbor school.

# Appendixes

## Appendix A: Methodology

The data collection was carried out with the means of:

- with the key personnel:
  - classteachers (2 men, 3 woman), the principal and the secretary of the school,
  - parents and 8 students of different grade levels
  
- of classroom and outside of classroom:
  - where ICT is used as well as a couple of lessons without ICT use
  - during the 'daily break' (Matilda, ICT-club, band rehearsals)
  - teachers' meetings & meetings of the ICT-group
  
- of school documents
  - and history of Aurora school, Aurora News (the monthly newsletter of the school)
  - of the school, different publications of the school practices (project reports)

- practices survey

The first visit to Aurora School was made in January 2000, when the study and its contents were discussed with the principal. The teachers were informed more closely about the study in their first meeting in the beginning of the semester. The actual data collection took place between January and February 2001. The total amount of visits in the school was 10 and they were carried out by one researcher. In order to increase the reliability of the interpretations made on the basis of the data collected, the study and the conclusions were discussed with other Finnish OECD case study researchers.

## Appendix B: Teachers' responses to the ICT survey (frequencies)

**Table 1:** The teachers' self-reports regarding different ICT practices (N=15).

How comfortable are you with using a computer to do each of the following?	Very comfortable	Comfortable	Somewhat comfortable	Not at all comfortable
write a paper	12	1	1	1
search for information on the WWW	7	5	1	2
create and maintain web pages	3	2	1	9
use a data base	1	4	3	6
develop a data base	-	1	6	7
send and receive e-mail	10	4	1	-
write a program	-	1	1	13
draw a picture or diagram	6	2	3	4
present information (e.g., use PowerPoint or equivalent)	1	4	2	8

**Table 2:** The teachers' self-reports regarding different computer-related skills in their

teaching (N=15).

<b>How important is each of the following computer-related skills for your teaching?</b>	<b>Very important</b>	<b>Important</b>	<b>So-so</b>	<b>Not important at all</b>
write a paper with a word processor	11	2	1	1
search for information on the WWW	3	7	4	1
create web pages	1	-	5	9
use a data base	-	2	9	3
develop a data base	-	1	4	9
send and receive e-mail	8	3	2	1
write a program	-	-	1	14
draw a picture or diagram with a graphing / drawing application	2	3	8	2
present information (e.g., use PowerPoint or equivalent)	1	-	8	6

**Table 3:** The teachers' self-reports of the ICT activities in education (N=15).

<b>On average, how often do your students do the following for the work you assign?</b>	<b>Several times a week</b>	<b>Several times each month</b>	<b>A few times in a year</b>	<b>Never</b>
use the World Wide Web	2	5	7	1
create web pages	-	-	1	14
send or receive e-mail	5	4	1	4
use a word processing program	3	6	5	1
use a computer to play games	4	7	2	2
use a spreadsheet	-	-	1	14
use a graphics program	1	1	8	5
join in an on-line forum or chat room	-	2	5	8

use a presentation program (e.g., PowerPoint)	-	-	-	15
use an instructional program (including simulations)	2	1	3	9
other computer uses	2	3	1	7

## **Appendix C**

WWW-site of Aurora school <http://www.aurorankoulu.net>