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OECD / CERI ICT PROGRAMME

**A Case Study of ICT and School Improvement
at
Länsimäki Lower Secondary School, Finland**

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1. Overview

Länsimäki School is a lower secondary school located in Länsimäki, an eastern suburb of the city of Vantaa. The socio-economic status in Länsimäki is somewhat lower than elsewhere in Vantaa and e.g. the percentage of immigrants is 9.0 compared with the mean, 3.9 %.

Länsimäki School has 381 students; 209 (54,9 %) of them are girls, 172 (45,1 %) are boys. Compared with many Finnish schools and Vantaa lower secondary schools, Länsimäki School has more immigrant students, 46 (12,1 %)(1.5.2000). Länsimäki School is a typical suburban school since the students come mainly from the two closest elementary schools and many of the students continue to a local higher secondary school.

The staff consists of about 50 teachers or other employees working in education. 34 of them hold a full-time job as a teacher, 8 have a part-time job as a teacher, 5 are school assistants (i.e.

help the teacher in the classroom, e.g. with a disabled student), one is a social welfare officer, one a caretaker, one a school secretary and one a nurse (working at Länsimäki School three days a week). The school also has kitchen and cleaning staff. These all are paid by Vantaa's school administration.

The rotation of the teachers is about 4-5 every year; the main reasons for leaving the school are maternity leave or for a permanent post in some other school for teachers with annual contracts. The mean number of teaching hours per week per teacher is about 22. The principal has for some years emphasised ICT skills and willingness to participate in development processes when choosing new teachers.

The size of classes is rather small, about 20 students / class. The school building is 10 years old and in good condition. The rooms are fully booked, but there's not really a lack of space.

Characteristics of the school

Parents, teachers and students all described Länsimäki School in a surprisingly similar way. The characteristic features were:

- Emphasis on students' complete social welfare, not only academic performance. The school tries to take care of students with special needs, immigrant students and students with learning difficulties. This care is carried out, for example, through close collaboration with other public services, parents and different organisations. Teachers in Vantaa have estimated the need of special education in their own schools, and in Länsimäki the percentage was 25, which was medium sized when compared with other schools.
- Emphasis on school as an entity: there is a conscious aim to develop a common feeling of "our school" and a good social atmosphere. This is built, for example, by extended cultural activities, like musicals. Parents are also involved, although this doesn't reach all parents. Länsimäki School is a local school and most likely it is an important element of helping people in Länsimäki to regard the suburb as their place of domicile. Even adults have contact with the suburb through contact with the school. Länsimäki School has an important role in the suburb; it is somehow a centre or "identity-maker" in a manner similar to schools in rural areas. This is possibly not so typical for other suburban schools.
- Emphasis on school development and being up-to date. This is especially seen in the use of ICT. It is regarded as an essential and necessary element of the school. The reasons for using ICT are varied. To the majority of the teachers the main reasons were both pedagogical (= motivates, develops learning methods) and based on the value of knowing ICT (= important skills for the future). Parents emphasised the latter. The use of ICT is also a question of image. Länsimäki School is appreciated in Vantaa for its

application of ICT in particular. All students will learn to use ICT and it is largely integrated into learning. Two local elementary schools, Länsimäki School and one local upper secondary school have already co-operated for several years to make it easier for a student to change from one level to another. One example of this co-operation is a common ICT curriculum in which the schools have defined what kind of ICT skills a student will learn at each level.

It is worth noticing that academic performance was not mentioned in the interviews, even by any of the teachers. The school takes responsibility for the students' complete welfare by building a well functioning school community and only then is academic performance possible.

2. The past

The history of the reforms

The school reform started properly in 1994 with the Laptop project. The school was only four years old at that time, the staff was young and there were eager teachers who wanted to develop the pedagogical use of ICT. In fact, staff members of the ICT Learning Centre (a unit of the University of Helsinki located in Vantaa) and two teachers of Länsimäki School created the idea and the structure of the project. The project was organised collaboratively by the school, the university department, and the Vantaa's school administration.

In this project, the students of a 7th grade class got Laptops for their personal use throughout the three years of lower secondary school. The aim was to see what kind of teaching and learning practices would evolve in such a technology intensive environment. Participation was voluntary for both students and teachers. The participating teachers were provided with both technical and pedagogical training and consultation. The consultation was organised both for groups and individuals. The project's teacher-group formed, during the three years, a reflective and creative community with good pedagogical results. The project was a success: all participating organisations were satisfied, as were the teachers, students and parents. Länsimäki School got a lot of publicity and the project was well publicised.

In the beginning of the Laptop project there was resistance to the project and the use of computers, sometimes even strong resistance, even though teachers participated voluntarily in the project. Part of the resistance was silent: some teachers just ignored ICT.

The pioneer teachers said that it was initially difficult to motivate teachers towards the project and there were opinions that the funding could be used for other, more important purposes. (At the same time a deep economical regression radically diminished public funding for schools.)

The resistance diminished with time for several reasons: The school got a very good reputation and the Laptop project had succeeded well. The school got good and extraordinary publicity

that was not possible to achieve in traditional ways. Active and motivated teachers in the Laptop project also diminished resistance by demonstrating good pedagogical practices to other teachers. The participating teachers themselves learnt through action and reflecting together, and became inspired about their own results and experiences.

The pedagogical and the technical development were in quite a good balance, and from the very beginning the pedagogically meaningful use of ICT was emphasised. For this reason there was no pedagogically argued resistance, as a matter of fact, the teachers participating in the Laptop project were surprised that the project was so pedagogically directed. Initially they expected mainly technical development project..

Since the Laptop project, Länsimäki School has developed possibilities for the pedagogical use of ICT with some practical reforms:

- The library has been renovated into an info centre with books, CD-ROMs, 10 computers with Internet access and a printer. There are tables and room for group and independent learning. The aim is that there will be an adult supervision helping students during breaks and after school, but this has not yet been realised in practise. The utilisation rate of the info centre during school hours is 80 %.
- All 7th grade students have some obligatory ICT-training which is integrated into other subjects, such as learning to use word processors. These courses have been carried out with the ICT teacher and the content teachers.

- Intranet is being taken into more effective use and new services are continuously developed.-

In the winter of 1999, the school joined in a European Union funded CL-Net-project, a computer-supported collaborative learning research project. In the project innovative new learning environments were investigated in collaboration with universities and schools. This project started a new pedagogical development phase in Länsimäki School, first with 3-4 teachers, and during the next year, 5 teachers started to use a web-based collaborative learning environment, WorkMates.

In all these phases of the process there are several elements that have been considered, although differently emphasised depending on the on-going reform:

- Teacher training, both pedagogical and technical
- Developing the teacher community
- Supporting the activities in classrooms
- Developing technical resources, equipment, help and support

Länsimäki School has, from the beginning, been co-operating with the University of Helsinki's ICT Learning Centre, which is a teacher training and development unit of the Vantaa Institute for Continuing Education. This co-operation has included for example:

- 1) Consulting and research in the Laptop project and in the computer-supported collaborative learning project.
- 2) Teacher training

The Educational Technology Unit of the University of Turku has been another source of support, especially during the computer-supported collaborative learning project.

3. The present

The technical resources

Länsimäki School has two classrooms with Pentiums or computers with a 486-processor (10 + 9) for student use. The library / info centre has 10 computers for students (Pentiums and 486's). There is also one classroom with 16 old 286's for learning technical writing and this classroom is not used for anything else. About 20 computers are located elsewhere in the school, mainly in classrooms. All computers have Internet access through the local network. A few computers (5 - 7) are exclusively for teacher use.

In all, the school has on average about 7,8 students per Pentium or 486, and this amount is about the same as that the National Board of Education is aiming for in lower secondary schools (8). The school also has one digital camera and "enough" printers and scanners. All students get a username for the school network, so all use can be identified afterwards. Misuse of computers results in students losing the right to use school computers for a certain period. This happens a few times every year.

Although resources are satisfactory, the use of ICT is so wide that there is a need for more computers.

Teachers' ICT skills and the use of ICT

Teachers in Länsimäki School are quite familiar with computers and the majority of teachers used computers as a tool for planning and preparing lessons and also as a learning tool with students. In their own work teachers know how to use a computer in writing and they know the basic functions of email and the Internet. Teachers also use administrative programs. The skills are, indeed, heterogeneous: some 5 teachers know only the basics and about 5 could be regarded as experts with various applications and technical equipment. The rest of the teachers are somewhere in between.

Only one teacher out of 15 who answered the survey, never uses computer in the classroom. Teachers have acquired the skills over time and combined the learning with practice; many of them learnt the basic ICT skills during the Laptop project. Several teachers have bought a home computer because they wanted to learn more.

There are differences between teachers both in skills and in use of ICT. The differences depend mainly on how easily ICT can be adopted into the subject they are teaching. There exists no explicit resistance to using ICT as a tool, either in administrative and planning activities or in

the classroom teaching.

In the teacher survey, 10 out of 15 evaluated their own ICT skills only as fair. The estimation appears somewhat too low and it might depend on the quite high level of ICT use in school: teachers know of plenty of opportunities, they already have a large understanding and knowledge of examples and they compare their own knowledge and skills to these models. In the circumstances, they know as much as could possibly be expected.

The best known and most widely used applications

Word processing is a familiar application to all teachers. It is the main application used in the classroom with students, and 6 teachers use it weekly. Some teachers might have minor difficulties with some special features, but no large problems exist. According to the technology specialist, some teachers still need support with word processing.

WWW browsers are the next most popular application with students in the classroom, one third (5) of the teachers use them weekly, and 9 at least once a month. The use is mainly information gathering but also other activities, like on-line discussions or collaboration via the net. 8 teachers feel that it is easy to seek information from www, for 7 it is somewhat difficult.

E-mail is a well-known application and only 2 teachers out of 15 have difficulties in using it. The majority of teachers use e-mail, but not very much. Only one teacher sends or gets 6 - 11 messages per day.. 6 teachers don't use e-mail at all. Teachers use e-mail with students only seldom, but some teachers said that they get e-mails from parents.

Instructional programs have a stable user group: language teachers (and occasionally teachers of math, physics and chemistry). Three teachers use instructional programs at least weekly, 9 teachers use them at least once a month, and 3 teachers never use them. (It might be that CD-ROMs are included in this group even though they are mainly information resources.)

In addition, the interviewed students, and the 9th grade students who answered the survey, said that the mostly widely used applications were word processors; educational software (drill and practice -programs) and information seeking in the Internet are the other popular applications. These applications can be regarded as regular "learning tools" but these are used less than weekly.

Special applications, not largely known and used

One third of the teachers (5 out of 15) have made some technical changes: installed or updated an application program or made some changes to a computer's memory chips, hard disc or processor. These require some technical skills, which the majority of teachers do not have or need. The ICT teacher as a technology administrator is responsible for all of the more difficult technical activities.

A few teachers know how to draw with a computer and create a database, and 4 teachers have used a digital camera. Graphics programs are also only seldom used with students (7 teachers have used them in their teaching).

A spreadsheet is seldom used with students. 3 teachers have used some special tools like a personal digital assistant in their classes but only monthly.

WWW and its possibilities

WWW is used for seeking information and for e-mail. Other www-applications are less well known and used. Whilst the school has its own homepages, not many teachers do. Several students have homepages, but the city of Vantaa hasn't allocate server space for students' homepages, so these are located in commercial servers.

The wider pedagogical use of www seems to be the next step in teaching and learning. Seven teachers have participated in computer supported collaborative learning projects, and these teachers are probably also the ones who have participated in on-line discussion forums and participated in other virtual courses through Internet. Six teachers participate in on-line forums, chat rooms and MUDs at least once a month.

Creating a www-homepage and HTML programming are known by one-third (5) of those teachers who answered the survey. Students create web pages only during the ICT classes since only two teachers use this application with students.

Three teachers have prepared material for virtual courses, which are also open to other schools. One set of materials is for learning ethics and different religions and the second for learning electricity.

Students' ICT skills

The level of students' ICT skills is heterogeneous. The interviewed teachers regarded the level as quite high. Those teachers, whose own skills are limited, tended to overestimate students' ICT skills in particular, and the technology specialist had a less optimistic opinion.

A survey of students' use of and skills in ICT was carried out in one 9th grade class and it revealed substantial differences between boys and girls. According to self evaluation, boys estimated that they know well or really well both technical use of ICT (like file management or implementing accessories) and the use of many software applications: word processors, painting/drawing and the Internet. Girls estimated that they know only the Internet well. All students reported that they didn't know desktop publishing, programming and www-publishing. These results show that the students all have some ICT skills, but many girls still lack a deeper understanding about the possibilities of ICT.

Länsimäki School has developed, together with two local elementary schools and an upper secondary school, a system of teaching ICT skills. The two elementary schools are responsible

for basic skills. In Länsimäki school all students in the 7th grade have an compulsory ICT course to fill possible gaps. Students learn to use different applications in some curriculum context (like word processing in writing stories and counting elements of receipts with spreadsheet applications). This course is carried out both with the ICT teacher and the subject teachers. The idea is to diminish the differences between student sub groups, (boys vs. girls and Finnish vs. immigrant students.) The compulsory course started 1999. Both teachers and the principal mentioned this system and that they expected that it would diminish the differences between students.

ICT at home

It is difficult to estimate how many students of Länsimäki School have a computer at home. The social background of the students is rather low and households with less educated parents and low income have fewer computers. Teachers estimated that 50 - 70 % of the students have a computer at home. All the interviewed students had a computer at home and the survey of one 9th grade class showed that only one student out of 17 didn't have a computer at home. It is possible that about 80 % of the students have a computer at home. An Internet connection is less common; e.g. the survey of the 9th grade class showed that 7 students out of 16 who had a computer at home didn't have an Internet connection.

Students used various ICT applications to a great extent during their leisure time, boys more so than girls. The interviewed students used e-mail and word processors and boys played games. The survey showed that 8 students out of 17 used ICT daily. All students used it at least sometimes. Those students that used it less than once a month were three girls, two of whom were immigrants. The time spent in ICT was mainly less than one hour per day. The interviewed parents confirmed that girls use ICT less than boys. It is remarkable that students in Länsimäki School used ICT for homework seldom, although some teachers assumed so.

Different student groups as users of ICT

In Finland, common public opinion is that all students should have similar opportunities for learning. In practice, students in schools are ranked according to high or low ability, but this ranking is unofficial. This is also the situation in Länsimäki School. The question of low / high ability students as users of ICT is difficult to answer because there is no formal ability group based tracking in Finnish schools. In Länsimäki School one teacher mentioned a quite common opinion by saying that all students gain, the use of ICT in learning benefits everyone somehow.

Teachers believed that the use of ICT is more equal than other activities in school, but students with social or learning problems are not always active ICT users. Generally speaking students profit of the use of ICT; but it might be that academically less skilled students remain beyond the scope of some pedagogical reforms because they still have some weaknesses in their basic skills like fluent reading and writing.

Active students with better academic skills always learn, regardless of the methods they are taught, as some of the interviewed teachers mentioned. The two teachers interviewed after the

computer supported collaborative learning project discovered that inquiry-based learning places demands on students, and during the project one less motivated pair of students didn't succeed. This pair of students were absent from the classes so much that they never really grasped the task.

On the other hand, some teachers believe that low-achieving students gain much when using ICT: their products looked fine and "professional", they learn more and better writing skills because word processing helps them and the use of ICT motivates boys. ICT helps boys in particular to become interested in learning. For example, due to the use of ICT boys know English much better and their vocabulary is larger.

All students have equal opportunities and demands in using technology since tasks and activities are always for the entire class. ICT skills are taken for granted. Länsimäki School has a conscious goal to give all students ICT skills because these skills are regarded as essential in students' further life. The school also emphasise the importance to offer ICT skills for students with special needs (for example students attending a special class because of their behaviour problems). One important group of students to whom ICT skills were regarded as essential are the immigrant students, especially girls. Without necessary ICT skills they would be in danger of becoming dropouts.

Many teachers avoided learning tasks that could be completed with a computer at home in order to diminish social inequality.

Some girls prefer working traditionally and this has made differences in ICT skills. Several teachers and even parents mentioned the difference of motivation between boys and girls in using ICT in learning. To guarantee ICT skills for all girls, the school has reorganised the curriculum during the school year 1999 - 2000 so that all students use ICT in certain activities.

ICT in teaching practices

Teachers estimated that 70 - 80 % of teachers use ICT in teaching, to a greater or lesser extent. There are several ways in which ICT is used:

1. ICT is mainly used as a tool for writing, information search, and calculating. Because several teachers use project learning, students are used to writing different reports and articles and also combine them with pictures. Teachers of Finnish language (mother tongue) use computers for word processing. Word processing is also used by foreign language teachers but not so frequently. Information searching is used for project learning and is widely applied e.g. by the teachers of history, biology and religion.
2. Traditional computer assisted instruction (CAI) is mainly used in foreign language learning where books, workbooks, teacher books and computer programs form an integrated learning material package. CAI programs are also sometimes used in specific science education topics.
3. ICT for collaboration and publishing is quite new and not in regular use yet. One third of the teachers have used such applications. Teachers have used on-line forums, chat rooms and computer-supported collaborative learning via www. Because the city of Vantaa has made it impossible for students' to have their own www-pages on school computers, www-publishing

cannot be more widely developed.

4. ICT as a learning content. All 7th grade students get some basic training in ICT skills and this training is integrated into other learning contents. In the 8th and 9th grade ICT is an optional subject with is taught 2 hours / week. Usually there are enough students for 3-4 groups of voluntary ICT-learning and its popularity is on a par with other subjects. (Earlier, when the 7th grade students didn't have obligatory training, practically all students chose optional ICT courses and it was the most popular choice.)

Nowadays ICT is mainly regarded as a tool, not a separate subject. However in 7th grade curriculum there is a obligatory ICT course. In the curriculum of 8th and 9th grade the students can choose volunteer ICT courses. As a whole, ICT is well integrated into learning processes.

ICT is mainly used collaboratively: two or three students using one computer together. The activities students are required to complete have to be suitable for a small group. The solution to use computers in pairs is based both on pedagogical reasons and on the lack of computers since it is not possible to find free computers for the entire class simultaneously. This causes sometimes problems: some interviewed students and parents complain that one student dominating the pair doesn't allow the other use computer. Sometimes the less capable in ICT skills voluntarily gives control of the computer to the more skilful student. (This was also noticed in classroom observations and in discussion with the students.) The pedagogically well argued way to use computes collaboratively sometimes also causes less desirable consequences. It is possible the teachers haven't noticed this since none of them mentioned this.

Students, both those interviewed and those who answered in the survey, estimated that the use of ICT in the curriculum was not very high. From the students' point of view, the use was maybe not as frequent as they would like. Because the school has a periodic timetable, the use of ICT varies from one period to another, and it was not possible to say the exact amount of hours per week.

Students said that ICT is used mostly in science (biology, chemistry), languages, and the humanities (history, religion) and least in learning Finnish, practical subjects, and art (music, visual art).

A new and innovative method of using www was computer supported collaborative learning. Some teachers had such experience during the Laptop project, but a more developed Internet access made it possible to carry out new kinds of learning projects. Two groups of teachers exist who have used the collaborative application. Science teachers have already had three projects that were based on enquiry learning and students worked in groups of 2-3. History teachers have used the collaborative application twice, though more traditionally: it was a publishing and commenting forum for individual products.

The science teachers said that positive outcomes were:

- students learned to set good questions for their own study
- they thought for themselves and could find answers to their own questions
- they learned to evaluate their own learning

Students' opinions about one of the collaborative projects were positive. They all liked the project, the majority thought that they had learned more than if the lessons had been taught traditionally, although 4 out of 18 students liked traditional learning more.

Students' self-evaluation forms after the project showed that they could evaluate well the working process and that they had realistic opinions about their work. When evaluating the learning outcomes, students emphasised first the content, and second learning skills like collaborative learning with other students and information seeking. Only a few mentioned technology skills.

Support for teachers to use ICT

The common opinion both among interviewed teachers and parents about Länsimäki School is that it supports development work and even presumes it. The interviewed teachers were satisfied with the opportunities for staff development.

All interviewed teachers understood staff development mainly as an opportunity for continuing education. The school has actively supported the teachers' participation in different professional courses, and the limits for training have been mainly practical: it has been difficult to be off from classes very much. The training has consisted of both technical and pedagogical content. The continuing education is organised by a university unit, the ICT Learning Centre, since the city of Vantaa has had permanent collaboration with the unit. The city of Vantaa pays a certain amount for services, like courses for using ICT. The school itself has also funded participation in training; and some of the training has been organised in the school, too.

The other, less frequently mentioned support for development, according to the teacher interviews, were 1) Informal two-hour meetings about different pedagogical issues, 2) collaborative projects with other teachers, 3) networks with other teachers, 4) a university researcher's consultation (this was mentioned by the active teachers).

Technical support in using ICT was not organised well enough and several teachers, especially those with less ICT skills, would have liked to have had more help.

Accomplished in the reforms

Länsimäki School has accomplished in its reforms the following^[1]:

1) Teachers form a pedagogically directed teacher community. The has a well prepared strategy on how to continue the reform which is a good basis and vision for future.

The pedagogical reforms based on the use of ICT seemed to be both known and accepted among teachers and parents. The acceptance does not mean, however, that the current strategy is accepted in every detail and there might still be some silent resistance against the strong emphasis of ICT in particular.

2) There is large interest in the use of ICT in a meaningful way and there are several ICT-supported pedagogical innovations widely in use. Such innovations are ,for example, a student-centred approach, process and project working, authenticity in learning activities and tasks, support for individual metacognitive awareness and skills.

The majority of teachers use ICT-supported activities at least in some part, and the activities seemed to be appreciated amongst fellow teachers. Majority of the interviewed teachers thought that the use of ICT has diversified the methods, changed radically the concepts of learning and teaching and motivated the teacher. (One interviewed teacher didn't see any affects of the use of ICT.)

The interviewed parents were able to identify some examples of these pedagogical innovations, but they didn't have a clear picture of the day-to-day work in classrooms. The interviewed students especially liked the student-centred approach and independent work, and they even argued for these activities by using well elaborated pedagogical arguments. The same acceptance could be seen in some self-evaluation forms that students had completed.

Länsimäki School has a good reputation as an up-to-date school in ICT.

The teacher community didn't seem to have very much common discussion about pedagogical innovations and it might be difficult to share the experience in an effective way. Teachers are at different stages of applying new pedagogical innovations; the most advanced teachers work collaboratively with educational research and take advanced challenges to improve their teaching practices.

3) Teachers and students have good ICT skills and the school have plans how to take case that all students will learn essential ICT skills. One example is the course for all 7th graders in which students systematically learn ICT skills by using different applications integrated with different subjects of the curriculum. An example of the conscious plans for securing ICT skills in all students is the co-operation with two local elementary schools and a higher secondary school. Schools have a common curriculum for taking care of the systematic long term development of ICT skills. Teachers have very good opportunities to learn ICT if they are motivated.

This achievement might be unnoticed in school and amongst parents because they have fewer possibilities for comparison. When compared with other Finnish schools the teachers of Länsimäki seem to have better than average ICT skills, though many still feel uncomfortable and believe that they don't know enough.

The similarity between the staff, students and parents in their opinions about the school was surprising. The opinion about the achievements among the majority of all groups was positive. Even those who expressed critical comments accepted the main lines of the school's ICT

strategy. One parent wondered if the emphasis on ICT detracted resources from teaching other subjects.

4. Key hypotheses: Conclusions about each

1. Is technology a strong catalyst for educational innovation or does it serve only as an additional resource for improvement?

In the beginning of the reform, technology (= the Laptop computers) was a strong catalyst for educational reform in Länsimäki School. (The educational reform had begun before Internet access was a reality for the school.) Technology was the main catalyst for forming the content of the reform in the first phase. In any event, the reform was deeply dependent on the kind of pedagogical support that helped to turn the emphasis from technology to pedagogy.

In Länsimäki School the pedagogical consequences of the Laptop project were:

- Technology as a meaningful tool instead of a learning content or simple "training tool".
- Authenticity became an important method for learning content and skills. Authentic activities were usually constructed by using problem-based or inquiry learning methods.
- Metacognitive awareness arose: several teachers used questionnaires for self-evaluation or portfolios.
- Teachers became conscious of the importance of pedagogical collaboration.

The reform has led to more student-centred learning, so that the students are active in collecting, processing and constructing information. They have process- and project-oriented activities that direct the students' activities to questions and problems that interest them. The students are also responsible for their own learning process and this improves their metacognitive consciousness.

It is difficult to say how conscious the educational reform is in the teachers' minds. The teacher community is not a homogeneous entity and it is very likely that ideas of the pedagogical opportunities and development are diverse. Some teachers have participated in an intensive pedagogical development process for several years. They are familiar with new ideas of research on learning and instruction. To others, new pedagogical activities are more intuitively accepted and used. It must be kept in mind that initially most of the new pedagogical ideas didn't come from teachers, but from researchers (e.g. inquiry or problem based collaborative learning).

During the years of reforms, teachers have become more aware about technological possibilities and they demand better, quicker, easier, technically more stable applications and solutions.

As a result, Länsimäki case doesn't support either hypothesis since both elements were needed from the very beginning.

2. Did the diffusion of use of ICT in teaching follow the traditional diffusion pattern for reforms and innovations or did, different diffusion patterns occur?

In Länsimäki School the innovations followed mainly the traditional diffusion pattern. The innovations have spread from two energetic and inspired teachers to about 5-7 early adopters and then slowly to the majority of the teachers. (There still exist some teachers who don't use ICT with students.) The process has taken about 6 years.

It is important that the ICT teacher has been active to promote the pedagogical use of ICT from the very beginning. The teacher's technical understanding was needed in the early stages to form realistic goals, and later to build a technically working environment. As the first reform began to expand amongst the teachers, the ICT teacher's skills were needed to make the technical learning environment easier and more suitable to less skilled teachers.

The principal has been equally important during the reform process. The principal has not taken a leading role in the reform, rather primarily an administrative and organisational. The principal has mentally supported the development and has in such a way made the atmosphere possible for changes.

The innovators and the early adopters had quite intensive support from the university department and this maybe made the process rather effective. They also combined the development project with daily activities, which made it easily adaptive. Other teachers have had less support from outside but have (possible) had support from some fellow teachers at the school. The early adopters have, with time, developed practices that help all teachers in using ICT. One important factor has been the ICT-positive atmosphere. After all, it has always been every teacher's own decision to use or not to use ICT in education but active resistance would perhaps be rather difficult.

3. Has the successful implementation of ICT depended mostly on staff competence in the integration of ICT into instruction and learning or has the school's technological infrastructure and student ICT competence determined outcomes?.

Both hypotheses are true - depending on the phase of the reform. In the beginning of the Länsimäki case, the technological infrastructure benefited the successful introduction, both in the Laptop project and the computer-supported collaborative learning project. It was very important that the technological infrastructure was reliable and user-friendly since problems cause stress and lack of motivation.

The rival hypothesis got also support, once the reforms were under way. In Länsimäki, the pedagogically advanced teachers had the greatest success and they developed the reform in their personal use although "less advanced teachers" participated in the reform, too.

4. Will the gap in academic performance between high and low economic status students increase rather than diminish when all students have equal access to ICT.

At Länsimäki School the conscious decisions and solutions have possibly helped to diminish

the gap between different groups of students as *users* of ICT.

The gap in *academic* performance is more difficult to avoid or diminish. There exists differences in academic performance, in school motivation, etc. and these differences are partly dependent on socio-economic background and the parents' own education and profession. At Länsimäki School the solution was to prevent social problems and thus integrate all students in normal school work

The use of ICT has motivated some students, especially boys, and this has helped these students perform well at least in some activities which subsequently might have supported their school performance as a whole.

Different kinds of process work methods, which are largely in use, support a student's independent and responsible learning. These motivate the majority of learners, and such methods also support metacognition and intrinsic motivation. Students work for themselves, not (only) for the teacher. On the other hand, students were also taught in a way that might expand the gap in academic performance. The use of Internet as an information resource doesn't always support higher order learning students with low metacognitive skills. Similarly the "project work" which were sometimes mere collections of "copy and paste" activities than processed knowledge may lead to superficial learning processes among low achieving students. A third example of activities that is used to a great extent that might expand the gap is working in pairs. Typically the more skilled student of the pair takes the responsibility whereas the other takes to role of passive follower without own meaningful activity.

The conclusion is that there was evidence that supported both the first hypothesis and the rival one. The contradictory results are based on teachers' different ways of using ICT and, perhaps, on their different pedagogical concepts. The more conscious and pedagogically advanced the teacher, the better she/he can adopt ICT to promote learning of all students.

5. Projecting the future: will the accomplishments remain?

The main possible reason not to continue the present development is that the key persons (the principal and the ICT teacher) would leave the school at the same time and their successors wouldn't support the development. In this case teachers who already use ICT would surely continue to do so, but new innovations might be in danger. In any event, such a course of events is not likely to happen in the foreseeable future.

It is likely that developing the school and learning by using ICT will continue in Länsimäki School and the present practices will remain and even expand amongst the teacher community.

The arguments for the continuing development process are as follows:

1) Länsimäki School is consciously aiming towards continuous pedagogical reform and the

development work is a daily part of the school community.

The school has pedagogical plans and these form the basis for ICT development as well. The school puts emphasis on teachers' continuing education, development of pedagogical and technical support for teachers, extending the technological infrastructure, development of students' ICT skills, and supporting the use of ICT among all students (especially the less-skilled students or students in a disadvantage, eg. emigrants)

The school is also active in seeking out resources to carry out the plans: it sends applications to administration for financial support, participates in national conferences with presentations, sends teachers to international conferences and meetings, etc.

2) Länsimäki school has two important key personnel, the principal and the ICT teacher, whose work and support are known and appreciated by teachers and parents. They have visions for the future, understanding about the present situation and skills to carry out the visions and share them with other teachers.

3) Although teachers in Länsimäki school have variations in pedagogical thoughts, there exists a pedagogical community: all (interviewed) teachers accept the main development processes and are aware of them. There are open discussions about the direction, division of resources etc. Rival groups or aggressive resistance do not exist. The teachers seemed to form a positive team, with characteristics of a learning organisation.

4) The reform is not based on a few teachers but on several. In fact, one of the first innovators left the school three years ago and the reforms continued. The leader of the computer-supported collaborative learning -project leaves the school this summer, but the project will continue with another teacher leading it.

7) Teachers are aware of the history of the reform and they know what has already been accomplished. The reform is not just series of pedagogical tricks, but a deeper development process.

Some remarks about problematic practices:

- The main reform would need a dedicated team with division of labour, strategies to carry on the activities, etc.

- The ICT teacher is overworked. Possible solutions are also dependent on the city of Vantaa, but it may be that the ICT teacher's tasks and responsibilities could be divided amongst the other teachers.

- existing practices are ineffective for learning and may even increase the learning differences between students (information searches from the web for the "open project" don't promote learning if the student doesn't fully know what to search, students working in pairs without controlled division of labour sometimes leads to domination of the "stronger" student).

Extension to other schools

The reform is dependent on school culture and teachers' pedagogical motivation. If other schools are motivated and their teacher community is a functioning pedagogical community, innovations would succeed. It would (perhaps) need some technological resources, teacher training and consultation, and pedagogical support, but all the ideas of the reform are possible to extend. As a matter of fact, there is nothing especially different or brand new in the Länsimäki School reform. It is more a result of several years' conscious development work, which has been extended in realistic steps.

Länsimäki School can't extend the experience to other schools alone: this is the task of the school administration of Vantaa, which is mainly responsible for extending the results of the reform to other local schools. For some reason this hasn't happened; the local administration is not very active in using Länsimäki as a good example. The school administration has co-operated with Länsimäki School by giving some extra financial support during the Laptop project, and the school was among the first where local network and better internet-connections were built. Länsimäki School, as other schools in Vantaa, has also had some funding for teacher training. Apart from this, Länsimäki School has carried out the reform quite independently but with permanent co-operation with the University of Helsinki.

One way in which Länsimäki School can, and has, made an impact is the co-operation between the two local elementary schools and the higher secondary school.

Resources required for maintenance

Länsimäki School is quite capable to take care of the pedagogical and technological development by itself - as long as the key personnel, the principal, the ICT teacher and several active teachers - stay at the school.

First and foremost amongst support for the reform is the principal's attitude: she is strongly devoted to the development work and organises resources for it. Teachers and the interviewed parents appreciate this. Secondly, there is the flexible and devoted ICT teacher who supports other teachers' pedagogical use of ICT. Teachers in particular regard the ICT teacher as an important person for ICT development. One threat for the maintenance of technical infrastructure at school is the work overload of the ICT teacher.

Because of Finnish administrative decisions, the ICT teacher has also a own teaching load, and the ICT related activities are diminishing this load very little.. The teacher gets compensation of one hour per week, which is not enough to cover the work done. Länsimäki. The city of Vantaa has organised technical support personnel for schools, but their time is divided between several schools and they aren't able to help enough. The lack of ICT support is a complicated problem, which cannot be solved purely at school level.

The school has had consultative support from the university throughout pedagogical reforms, and this is both appreciated and needed.

What support is in place to keep it working?

Technical support: Because ICT is so widely used in school, a lack of computers exists and the present capacity is in full time use. The school needs more computers if the plans are to be carried out. More technical support is needed for maintaining the technical infrastructure and to help the work of the ICT teacher. The support should be regular and available also during school hours.

Pedagogical support: In-service training, courses etc are needed all the time. It would be good to connect these activities to daily practices and common projects so that the training would also include pedagogical reflection of ongoing teaching-learning practices. From the point of view of developing innovations, it would be good to have some outside influences, support and consultation.

Appendix: Methodology

The collected data

Material from three different phases has been used for this evaluation:

1) The data collected for OECD evaluation

During the spring of 2000 data was collected by means of

- Interviews: 8 teachers were interviewed (30mins - 1 hour each), 4 students (about 30 - 45mins), 3 parents (45mins - 1,15 hrs), the principal, the technology specialist, and 3 additional staff.
- Informal discussions with 3 other teachers and they brought some material, like students' portfolios and examples of students' writings.
- ICT practices survey (n=15)
- Classroom observations (8 classes, 45mins / class).
- Additional data, like curriculum plans, project plans, material produced by the students, material given to students during classes etc.
- WWW-pages of the school and some students and www-learning material produced by three teachers.

2) The data collected for the project of computer-supported collaborative learning using

www-based learning environment

The data consists of three different study projects during school years 1998 - 1999 and 1999 - 2000.

- Questionnaire to 7 teachers participating in the project in autumn 1999
- A questionnaire about the use and skills of ICT, 17 students in one 9th grade class, December 1999.
- Interviews of two participating teachers before and after a project and an additional evaluation interview with the students, winter 1999-2000
- Students' and teachers' log files for the projects, 1999 - 2000
- A conference presentation of one teacher, spring 2000
- Notes from the meetings with teachers, 1998 - 2000

3) The Laptop project

The researcher's articles and presentations, 1996 - 1999.

The use of the data and the analysis

The material was organised and analysed mainly by the researcher, sometimes with the help of one research assistant. The description and conclusions are based on several interviews or different kinds of data, not just single opinions. One pioneer teacher read the evaluation paper and made some remarks.

The OECD-material:

The interviews were analysed by classifying the content of the remarks.

The questionnaires were analysed by using the SPSS-statistical analysis program.

The additional material and the notes from class observation were used to formulate a view of the pedagogical use of ICT.

The plans and similar material were analysed by classifying remarks based on their pedagogical content.

The computer-supported collaborative learning -project material:

The teacher interviews were classified and analysed by the researcher, some of were classified in a more precise way by the item-based Atlasti-program.

The contents of the projects were used to formulate a view of student activities and results.

The self-evaluation forms of the students were used to form a view about the project and its results. §

The material of the Laptop project:

The articles and similar material was used to form a view about the development process at the school.

[\[1\]](#) These accomplishments are such that they are essentially more developed achievements compared with a traditional Finnish lower secondary school.