OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement at

Ringstabekk Lower lover Secondary School, Bærum

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1.   Overview

The introduction of ICT is sometimes a story of regressing to old pedagogic methods where indirect motivation and assimilative learning is said to be predominant. Presently, the needs for new innovative and progressive pedagogical methods are recognised by many institutions. In the case of Ringstabekk Lower Secondary School, pedagogic methods focusing on problem-oriented problem oriented, project-oriented project organised and participant-managed participant managed sessions have been are practised for almost 10 years. The research team expected that decisions related to organizational changes were already in place. So what differences will the introduction of ICT make in such a case?

Fig. The open school and an open architectures   Fig. The computer lab

The ICT -project at this school started during the fall of 1998 when and Ringstabekk became omes a partner in the European School Network (ENIS). The overall goal of ENIS is to create a network of innovative schools which can be utilised for full demonstration of pilot projects. The complete network consists of approximately . 500 schools with broad European representation, and will constitute a common integrated framework in terms of a connectivity and technical infrastructure. The network comprises schools with proper ICT-equipment and experience of using it.

The perspective of learning that knowledge is constructed in a context has given birth to many problem and project-based project based learning approaches. The seeds of the present reforms were already in placein place when the school opened for the use of ICT.

However, the The role ICT plays in supporting this approach has still some barriers to overcome. This is due to the low student computer ratio and a modern, yet but for some purposes inflexible, computer lab. The project-based learning approach

requires a flexible ICT infrastructure and a robust operation platform.

In the case of Ringstabekk, the focus in this report is on the integration of online resources in the work with problem-based problem based learning, project-based project based learning and distributed project-based project based learning approach.

2.   The past

Ringstabekk Lower Secondary School was officially opened in 1972, presenting a school building typical of that time's architecthure. The inaugural address emphasized the following: skole ble åpnet i 1972 og representert arkitektonisk trekke som var spesiell i norsk sammenheng på denne tiden.. I åpningstalen ble dette poengtert:

In this country, and to a certain extent also in other places of the world, the approach to an open education has yet to find its definite form. This learning approach is constantly developed and shaped. All in all, it can be claimed that the pedagogical situation is highly unstable. There is, however, reason to believe that the system of an open school and an open education will remain. Few things indicate a return to the closed class or "cell" system. Den åpne undervisning og den åpne pedagogikk her til lands - og forsåvidt også ellers rundt om i verden - har nok ennå ikke funnet sin endelige form. Den er stadig under utvikling og utforming. Den pedagogiske situasjon må i det hele sies å være svært labil. lmidlertid er det grunn til å slå fast at åpen skole og åpen undervisning i en eller annen form er kommet for å bli. Det er lite som tyder på at man noen gang helt og holdent vil vende tilbake til det lukkede klasse- eller "cellesystem".

Ringstabekk is a lLower sSecondary sSchool (grade 8-10). The pupils are organised in double-sized classes of 50-60 pupils in each class, two classes in each level. For every class there is a team of teachers consisting of 5-7 teachers who are responsible for most of the teaching in the class. The pedagogical development in the school takes place as a process between the pedagogical board (the management and the leaders of the different teams), the teams themselves and all the colleagues in common meetings.

Fig. Team teaching started as early as 1984. Poster at Ringstabekk.

All the employees at the school are working on developing and improving their own practice. In this respect, connection with that they are now in the middle of developing a new pedagogical platform.

When looking at the different work plans from the 1990s, it becomes clear that a challenge for the school is to improve the didactic work. The development plan for the school year of 1999/2000 is quoted below, and serves as an example of this. It is also evident that issues related to ICT are gradually are included in the plan. Here, it is more a question of an evolutionary development than revolutionary changes from one year to the next: I de ulike arbeidsplanen på nittitalle ser en at skolen har et kontinuerlig arbeide med å forbedre det didaktiske arbeidsfeltet. Utviklingsplanen for skole året 1999/00 gjengitt nedenfor er et eksempel på dette. En ser også at ICT spørsmål gradvis legges inn i planen. Det er mer sakk om en evolusjonære utvikling enn revolusjonær omveltinger fra det ene året til det andre:

SubgoalDELMÅL:
The school is to develop various methods for the work form that focuses on subjects and projects, and relate the work to the national curruculum. The goal is to achieve a higher degree of professionalism of our methods. Skolen skal videreutvikle ulike metoder innen tema- og prosjektarbeidsformen og relatere arbeidet til L97. Stadig større profesjonalisering av våre metoder er målet.

MeasureTILTAK:

Active use of the pedagogical platformPedagogisk plattform – aktiv bruk av den:
The platform constitutes a common background for the work. Sharing of experiences is to be related to the jointly adopted plan for students and teachers, which is part of the pedagogical platform.Plattformen er en felles bakgrunn for arbeidet. Erfaringsdeling skal relateres til det felles vedtatte elev- og læringssyn som ligger nedfelt i den pedagogiske plattformen.

Development of the storyline-methodUtvikling av storylinemetoden:
The human resource seminar of 1999 will be focusing on training in the storyline-method, with Steve Bell as lecturer, and will take place in Edinburgh, Scotland, in September/October 1999. The parents will assist as teachers for one day, giving the seminar one extra day. Personalseminaret 1999 vil konsentrere seg om opplæring i storylinemetoden med Steve Bell som foreleser, og vil finne sted i Edinburgh, Skottland, september/oktober 99. Foreldrene vil overta skolen en dag slik at seminaret kan bli forlenget.

EvaluationVurdering:
The school will work to achieve an overall competence through interdisciplinary thinking related to L97. Evaluation criteria are used and developed parallel to professional thinking. Skolen vil arbeide for å innfri helhetlig kompetanse gjennom tverrfaglig tenking relatert til L97. Vurderingskriterier brukes og utvikles parallelt med faglig tenking

Record-keepingLoggbok – work planarbeidsplan:
The work groups keep a record of all projects. The students are trained in individual learning by planning the projects in order to make the group work develop social competence. A work plan is developed in the theme classes.Prosjektene sikres gjennom bruk av loggbok i arbeidsgruppene. Elevene øves opp i selvstendig læring gjennom å lære å planlegge prosjektene slik at gruppearbeidet utvikler den sosiale kompetansen. Arbeidsplan sikres i tematimene.

Entrepreneurship. The Nordic Council of MinistersEntreprenørskap. Nordisk Ministerråds prosjekt:
The school continues to follow up on the idea of entrepreneurship through an increased use of partnership companies, as well as a focus on ICT by having close contact with other schools in the Nordic countries over the Internet.Skolen fortsetter entreprenørskapstenkingen gjennom økt bevisst bruk av partnerskapsbedriftene og IKT-satsing gjennom internettkontakt med skolene i Norden.

3.   The present

The head teacher thecher and the staff at Ringstabekk Ssecondary Sschool work hard to create an attractive, educationally stimulating environment that has high expectations. The head teacher comments that the school aims to continue to be "at the forefront of developments.

The principal at Ringstabekk bases her leadership on what is called "the school's own platform", which again is based upon the ideas of the national "Reform 97". All employees have to accept and commit themselves to teach and organise in accordance with the platform.   ThisIt is, in fact, a condition for being employed. Stronger and more direct management is an escalating tendency across the country.   A general impression of the requirements to school leaders in Norway, is the expectations that they shall fill a comprehensive role. With an increased delegation out to the schools concerning organisation, economy, use of resources and issues relating to human resource, the principals' role appears to be defined as more as a defined managers now than it was 10-15 years ago.Et generelt inntrykk av kravene til skoleledere i Norge, er at man forventer at skoleledere skal fylle en allsidig rolle. Med økt delegering ut til skolene vedrørende organisering, økonomi, ressursbruk og personalspørsmål fremstår rektorene som klarer arbeidsgivere nå en for ca 10-15 år siden.

The teachers are encouraged to challenge traditional methods through an experimental approach to teaching. The tolerance of making mistakes and creating contemporary chaos is high and gives the teachers confidence enough to try to test ideas in practice. The school is in constant change and development, and bases its pedagogical philosophy onin a framework which we jointly can labels as a project-based projectbased education.

In order to ensure that a constant creationg and diffusion of innovations is taking place, the organisation consists of creative cells – staff teams. Arenas for exchanging ideas have been secured through a network structure and different formal forums.
   All teachers have to be a part of a team, at least formally. There are two teams for each level, and each of them is in charge of about 60 students. Within the teams the autonomy is extensive to stimulate the creativity needed to bring Ringstabekk one step ahead and secure the difference from form other schools, something which in itself seemed to be an important goal in itself.

This organisation of staff is a part of "the platform", which also gives imperatives and guidelines as far as theories of learning/teaching theories are concerned. The idea of performing and learning in relation and interaction with others is put into practice in the are taken down to the classrooms. All students are organised in groups put together by the teachers. The groups are kept together in most situations for periods of six weeks, and this consequent policy is, as far as we see it, the most significant value in Ringstabekk's ideological basis. A significant amount of Much effort is spent trying to make the students learn and adapt a systematic approach to the faces and the process of projects, and to be able to cope with the extended freedom implied. Students are in periods less monitored and their personal responsibility is consequently put to a test. In periods, The students' abilities to organise and to present their products are, according to teachers, quite advanced. The school year is divided into six periods of six weeks, each period focusing on a special theme, which is dealt with through different ways of working.   .

The staff at Ringstabekk is addressing many challenges and educational problems and are engaged in different educational activities. As and example is the The Scottish storyline methods, which is an innovative approach to curriculum integration, serves as an example of this. Storyline is based on the theory that all learning is guided by a person'sone`s prior knowledge and experience and that learners constructe their own meaning through action and experience.

Furthermore, to be able to "challenge the future", the school has continued to addressed the problem that a major part most of the teaching is out of context. To phrase one team leader in 9th. grade:

Many students experience have problems when it comes to to can learning information given out of context because they have no prior learning or experience to "anchor" it to. As such,, it becomesis fairly meaningless and while it can be used to pass an examination or test, it is not suitable for use used in day to day problem- solving (Team leader).

We assume that this is one of the reasons why Ringstabekk makes efforts to involve the community with local trade and business in the learning arena for the students. Students point out the frequent excursions to companies and organisations as one of the factors that make the learning interesting. After an excursion to a court trial, one student claimed that he had set his heart on becoming a lawyer.One of them claim that he almost decided to become a lawyer after an excursion to a court trial.

In addition, there has been established a student business firm enterprise has been established at school, which is to be run by the students as professionalyly as possible. The students are employed for periods of six weeks, and positions jobs in the "company" are applied for like normal jobs. The firm enterprise is supposed to offer different services to the school community, e.g. like for example catering and issuing a school paper.

However, "Anchored instruction" in this case is not a technology-based learning approach similar to the well- known approach that has been developed by the *Cognition & Technology Group at Vanderbilt[1]*. Neither the storyline- method nor the business firm enterprise at Ringstabekk is heavily supported by ICT. This is one of the major topics addressed in the plan for 2001.

Integrating Problem- Based Learning and ICT Resources (PBL)

The teachers submit themselves to conduct a problem and project- based teaching on in a large scale.

The work is organised in cross-curricular topics throughout all of Lower Secondary School. The pupils solve their problems through extensive co-operation with other pupils. The teacher's role is that of a coach. Working on a project is a process. First, the pupils must find the good questions, (defining the problem), then they have to collect information; and finally they must process that information to finally being able to produce a product/presentation. Co-operation is the ultimate and committing element in the school's philosophy, and must be developed and learned by all groups participating in the project work. The cross-curricular topics are created by looking at the cCurriculum in new ways, in order for by putting subjects to be put together in new constructions to find answers to the problems/questions put forward by the pupils' have.

Fig. The PBL posters put up at the main entrance in Ringstabekk in 1996.

The distinction between problem-based learning and other forms of cooperative or active learning are often are blurred

because they share certain common features and hybrid approaches abound as instructors adapt methods for particular situations. For the last two years, the staff has addressed these topics in In a research and development program at Ringstabekk for the last two years the staff addressed this topics. The official descriptions generally explain describe it as "an instructional strategy in which students confront contextualized, ill-structured problems and strive to find meaningful solutions". Many cross-curricular topics in the past at Ringstabekk can be labelleds as "co-operative learning," "collaborative learning," and "active learning." The essential component of problem-based learning was clearly articulated by the team leaders to be that content which is introduced in the context of complex real-world problems. In other words, the problem comes first.

Stages in Problem- Based Learning at Ringstabekk

In the process of observing the students' work, it was possible to identify at least five phases in the problem-based work.: Whether ggathering information through a variety of sources on the Internet, through printed sources, or or by speaking with experts, analysis of es the different kinds of information and presenting the informationed by web pages or printed materials. Tthese stages explicated below are characteristic of problem-based work at Ringstabekk, and are explicated below:

Stage 1: Defining the Problem

At this point, a very highly focused pProblem sStatement was posed to the student.

In the steering group where the students are represented, it is chosen to emphasise 7 different problem areas, which together can be assigned a greater subject area. I styringsgruppen hvor elevene er representer er det valgt å legge opp 7 uilke problemområder som til sammen kan tilordnes et større emneområdet.

The problem stated by one selected group is as follows.: Is the concept 'healthy youth' nothing but a myth? Is there a tendency among young people to contract certain illnessesdiseases, which may be related to our life style? Does our life style force any consequences? Er begrepet sunn ungdom en myte?. Er det spesielle sykdommer som ungdom rammes av og som kan være knyttet til livsstil. Får vår levemåte noen konsekvenser?

The group asked itself the following question: Gruppa stilte seg følgende spørsmål:

What do I know already know about this problem or question?

What do I need to know to effectively address this problem or question?

Stage 2: Collecting information
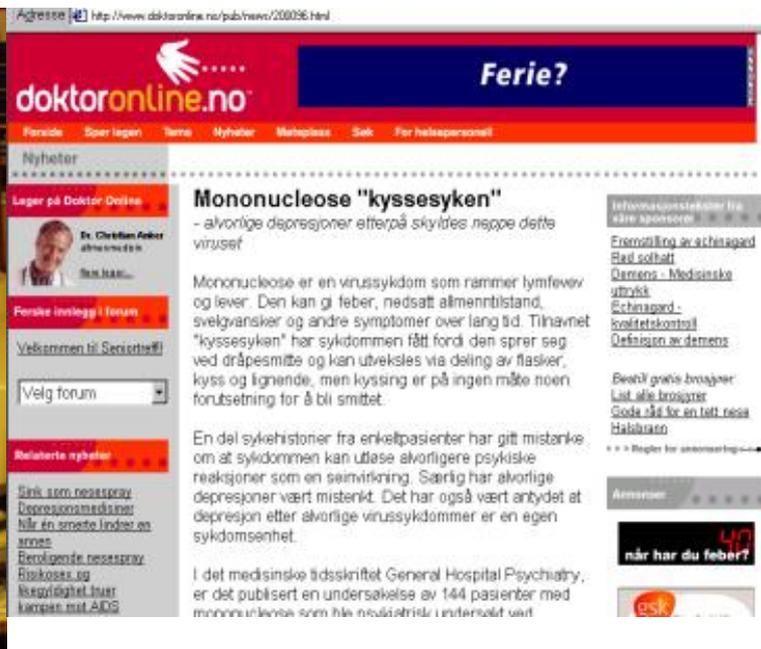
Once they have clearly defined the problem, student's access printed, human, or electronic information resources. Our selected group get most of the information by intentionally/systematically searching the web. Before beginning, students make a plan for the search. A search strategy for to search the WWW proved difficult to find. was not easy to solve. They need to know the steps and functions of the search engines. Having completed an initial draft of their plan, students meet with their teacher for feedback.

Are there any ideas at the site that can be used in their reports to answer the question we haves stated?

The theacher stated that the girls are more determined in their search for information, i.e. they are more focused more on a problem-solving approach, while the boys search more freely.

Alexander Graham Bell's patents from 1874 is sometimes the most efficient way to get information. The interface and usability of this ICT equipment is excellent.

girsl er mer målrettet når de søker etter informasjon. D.v.s. de er mer problemløsnings fokusert, mens gutten søker mer fritt.

Stage 3: Analysing

As the students visit the web sites that have been identified, they started on the process of evaluatinge whether the information that they have found concerns this the question was raised. The critical thinking skill engaged by intentional searching seems to be assessing information, determininge criteria, prioritising, recognising fallacies and verifying.

The search that the students completed in the previous step would identify numerous web sites. The problem is to verify the content's quality - that that anyone can put anything on the Internet server.

Only by using the Norwegian word language "KYSSESYKE" to search for information about for this specific illness disease, the students have to browse 13 web sites. The Latin expression "MONONUCLEOSE" gives 194 hits.

How can the student validate the information provided? Is someone trying to sell a product or a point of view? Who provided this information? Why? Does the information represent theory or evidence, fact or fiction? How does the student distinguish between these?

Coaching students in these processes to seem to be very important. The staff's ICT competence had been built through some basic courses, although but mainly through personal initiative and training – on the job and on the demand. Some of the teachers were was in the position to guide the students on how to do intentional searching on the web.

Stage 4: Presenting

In this stage, students create a multi-media production focused on around an essential question.

The process of coaching the student was not by not using directions, but by asking some questions:

· How are you going to organise your presentation?

· Which are the most important themes in describing your content?

· How are you going to decide on what to include and what to leave out?

Fig. The presentation within an ICT environment.

Fig. The presentation with ICT equipment.

Sharing what they learn with the public is part of each student project. No projects are completed without the presentation of a product in some form. The presentations validate the work that the students are doing and bring parents and the community into the educational process

Stage 5: Consolidation

The students seems to continuously review the information they have found, as well as any progress towards fulfilling their goals. When After the project is was completed, the students reflects on the work done project by asking themselves what they have we learn learnt about the content that they we collected.

In this phase, the whole project work is summed up. Important milestones, barriers and solutions are outlined.Under denne fasen ble hele prosjektarbeidet oppsummert. Viktige milepæler hindringer og løsninger trukket opp. In this respect, the distinction between reflection in action (phase 1-4) and reflection on action (phase 5) can be a valid descriptions. (Schøn. D. 1983)[2]

After having observed In the observation of the intentional searching, it is likely to assume that the students engage in critical, creative, and complex thinking skills. However, it is difficult to predict precisely which skills are needed based on this observation. The primary skills needed seem to beby critical skills, especially those focusinged on evaluating information. There are also Ccreative thinking is also involved in organizing and designing the presentation. Learners must determine the purpose of the presentation and evaluate different approaches to organizing it.

Distributed problem- based learning (DPBL)

The next step in the project work at Ringstabekk, was to Tosupport problem-based learning as a distant or distributed learning method by using ICT, was the next step in the work at Ringstabekk. Ringstabekk has applied for membership in The European Network of Innovative Schools, which consists of 500 schools from around Europe, and. The the application was accepted in 1999.

The school search for partners in the problem- based learning approach:

We are particularly interested in co-operation with European schools that are basically project-based, as well as schools that use the Internet and e-mail actively in their teaching. It would have been very interesting if pupils from different countries could solve a problem-based project with the help of ICT. (The application p. 4).

The attempt to work with distributed problem- based learning is currently at an early stage.just in the very beginning. Recently an A pilot study was recentlyjust finished at the school. This project has been named "The Leap", and is more a project-based learning approach than a problem- based one.
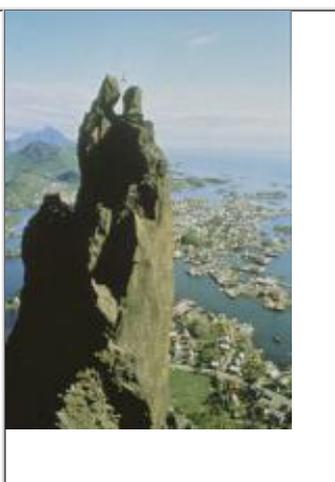
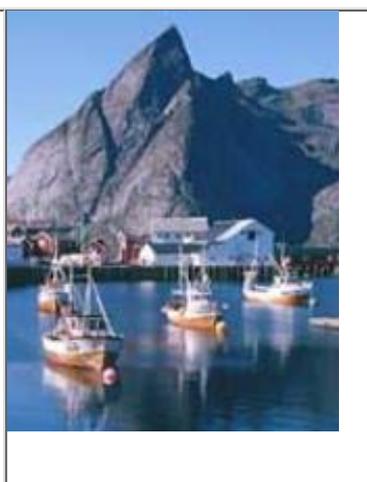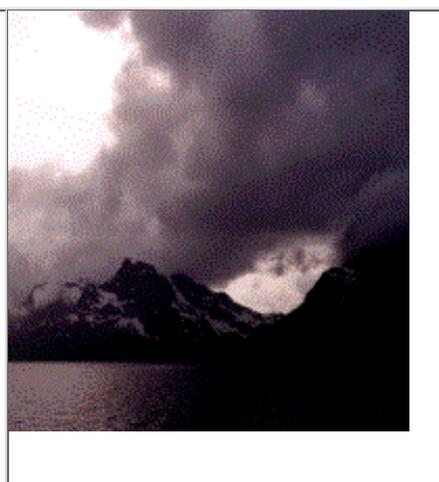However, project-based learning and problem-based learning seem to share several characteristics. Both are instructional strategies that are intended to engage students in authentic, "real world" tasks to enhance learning. The students arewas given open-ended projects or problems with more than one approach or answer, intended to simulate professional situations. The team leader for this project makes this statement:

From my understanding, problem-based learning Problem based Learning can be more focused on helping students learn problem solving skills through the use of real problems. Project- based learning develops learning through the use of a meaningful project. Students learn while doing the project. They doIt is not necessarily solve a problem that students solve. It might be that they fulfilcould also be a need that they have.

In this case, pProject-based learning both begins in this case with and ends with having a product or "artifact" in mind, the production of which requires specific content knowledge or skills and typically raises one or more problems that students must solve. In this case, the artifact is a short film kortfilm. The project was interdisciplinary, with main aspects from Norwegian, social studies, nature and environment study, as well as art and craft.Prosjektet var tverrfaglig med hovedmomenter fra norsk, samfunnsfag, natur- og miljøfag og kunst og håndverk.

Here, tThe project-based learning approach her used a production model: First, students define the purpose for creating the end product and identify their audience. They research their topic, design their product, and create a plan for project management. Students then begin the project, resolve problems and issues that arise in production, and finish their product. The work can be summarised in the following steps:

·   An authentic, ill-structured problem was presented to the students in a way that supports an inquiry where students acquire only the information they request about the problem as they request it.

·   We want to make a film about Svolvær which shows the special characterictics of this place. The question is: Can we, if we together with students from this area 1500 km away from us, can use ICT facilities when discussing a film script that is to be produced when we go to visit thise place for a week?

Ringstabekk and Svolvær Lower secondary schools in DPBL sessions.	It these a good places to start shooting the first scene?

will lage en film om Svolvær som viser de særdrag dette stedet har. Spørsmålet er om en i felleskap med elever fra dette området 1500 km fra oss kan bruke ICT hjelpemidler til å diskuter oss fram til filmanus som vi kan produsere når vi besøker stedet i en uke?

·   Students arewas able to communicate synchronously with guidance by a tutor during their discussions about the problem as it is presented and analysed.

Students in the chat mode	The ICT tutor at Ringstabekk withfor teacher and fellow student !	Peer tutor at the site of Svolvær Llower Ssecondary Sschool.

·   A whiteboard iswas visible at all times, where the students' ideas, problem information gained through inquiry, and learning issues can be recorded as they develop, as well as and can be edited as their discussions proceedcontinue.

·   In September, grade 10a went to Lofoten for a week to make the short film together with the students from Svolvær. The students acted in the film themselves, which was recorded with video cameras.Klasse 10a reiste i september en uke til Lofoten for å lage kortfilmene sammen med elevene fra Svolvær. Elevene spilte selv i kortfilmen, og filmene ble gjort med videokameraer. In this activity, students began the production phase of their projects by using the video equipment to film scenes for their projects. During the week, the classes had a short film festival, a film premiéere and a film award calledI løpet av uken hadde klassene kortfilmfestival, filmpremiere og prisutdeling som ble kalt "The Golden Goat".

"The Golden Goat festival"	And the winner is ….

In many projects, ICT will be one of many facilities. It is difficult to separate the effect of ICT from the rest of the process. It will be more natural trying to determine the role of ICT as compared to creating a product. Obviously, the students' experiences with having meetings in chat rooms as opposed to the physical room, cannot be compared. These students' memories, experience and learning were probably not closely related to ICT. However, it must be exciting to meet up with the person with whom you have been chatting and sent email to. Whether or not the ICT communication that preceded the project really contributes to the development of good film scripts, is difficult to say.

Defining	Collecting	Production	Presenting	Consolidation

	ICT			ICT	ICT					

Fig. ICT support in the DPBL-study at Ringstabekk

But many of the students stated that they had learned many ICT skills.I mange prosjekter vil ICT være et av mange andre hjelpemidler. Hva slags effekt ICT har er vanskelig å separere fra den øvrige prosessen. Det er mer naturlig å spørre om rollen ICT hadde i forhold til å skape et produkt. Det er helt klar at elevenes opplevelser av å møtene i chatrom i motsetning til det fysiske rom er totalt usammenliknbare størrelser. De minnene, opplevelsen og læringen disse studentene hadde dreier seg sannsynlig lite om ICT. Spennende må det allikevel vær eå møte de personen en har chattet og sendt e-post til. Om den ICT - kommunikasjonen i forkant av prosjektet bidrar til utviklinger av gode filmanus, er det vanskelig å svare på. Det vi vet at noen prosjektgrupper la tilside sine skisser når det første møte med et storslått landskap som det er vanskelig å oppleve å få inntrykk av i virtuelle rom. This makes us realize the need for a discussion that lies beyond the scope of this report, about the type of problem areas where ICT would play a role.Dette gir oss anledning til å reise endiskusjon som det ikke er rom for i denne sammenhangen om de typer problemområder hvor ICT vil ha en rolle.

Problem/Project- Based Learning and ICT

A ratio of one computer to 18 students means a drawback when it comes to integrating ICT in the problem-based learning at Ringstabekk. The ICT equipment is mainly located in a computer room to which access had to be booked by the teacher. No student use of the computers was allowed unless there was a teacher present in the room. According to both students and teachers, this is a way of organising the ICT equipment that makes the best of the situation as it provides all the students an equal just minimum of access. There could be a long time waiting, but that made it even more necessary to use the time as efficiently as possible. The open structure of Ringstabekk Secondary School, both when it comes to construction and organisational flexibility, probably creates a need for a more rigid plan for carrying out an ICT-supported project. In this respect, we are of the opinion that the different project phases have to be carried out more strictly than what has been necessary.I forhold til den åpne strukturen Ringstabekk skole har bade når det hjelder bygnings og organisasjonsmessige fleksibilitet, skaper dette trolig behov for mer rigid planlegging for å gjennomføring av et ICT suported prosjekt. Vi mener i denne sammenheng at de forskjellige prosjektfasen må gjennomføres etter en strammere linje enn det som har vært nødvendig.

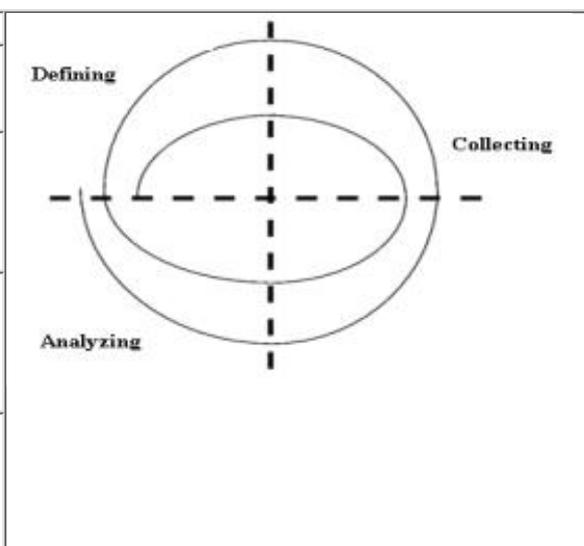| Problem:	Defining	Collecting	Analysing	Presenting	Consolidation
1.week					
2.week		ICT SUPPORT			
3.week			I C T		
4.week				I C T	

Fig. The Waterfall Model

Fig. The Spiral Analogy

The figure to the left above, portraying fixed milestones and transitions between each phase, resembles a "waterfall-model" or a procedural descriptions of PBL. This might be useful in providing an orientation to newcomers. In many areas, it has appeared to have major weak points because problems are discovered during the process which forces one to return to the starting point, make new experiments and, in many cases, redefine the problem.Figuren ovenfor to the left minner mest om det vi kaller Waterfall- modellen i industriell prosjektsammenheng Med faste milepeler og overganger mellom hver fase. Den har på mange områder har vist seg å ha stor svakheter fordi en oppdager problemer underveis som tvinger en til å gå tilbake til utgangspunktet, gjøre nye undersøkelser og i mange tilfeller omdefinere problemet.

The evolution of the overall problem-based plan can be illustrated through the spiral analogy in the right part of the figure above, which shows the iterative nature of work. The major steps of planning, action, observation and reflection do follow a straightforward line. This model can emphasizes constant evolution and redefinition of the original goal through a series of reconnaissances recurring in every cycle. The computer lab does not support the need for flexibel organisation.

The organization of the computer lab can also make it more difficult to make the use of ICT in daily work. Ringstabekk has been running training sessions for the teachers that they should to enhance the use of computers in the cross-curricular work, and problem- based learning. The following statementA comment from one of the teachers captures the situated actions and the significance of embedded learning in the following statement:

In my experience - The most important thing that helps me to use ICT in my teaching is the informal support I receive in collaboration with my colleagues, i.e. someone who I can ask to help me with the ICT. Sometimes I also find training sessions on new ICT applications helpful, but this only the case if I have to use it directly in the classroom or in my daily professional practice - and again, with the informal support network around me. Do you think this is similar to or different from to other peoples' experiences? (Teacher at Ringstabekk)

4.   Main Hypotheses

Conclusions related to hypothesis and conjectures of the study

4.1   Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology served only as an additional resource and not as a catalyst, i.e. that the forces that drove the reform also drove the application of technology to specific educational problems.

Evidence supporting the hypothesis:

·   Within few subjects areas ICT- based projects have been performed that would not have been possible without the support of ICT. In such cases, the ICT tools are a major part of the motivation for running the projects.

Evidence supporting the rival hypothesis:

·   ICT is primarily used as a tool. Mainly, it is used to collect information, especially the kind of information which is not expected to be found in books. The ICT also assists the pupils in the presentation of different products, like written material and pictures.

·   None of the teachers regarded themselves as dependant upon ICT in their teaching, and all of them could easily have managed teachingdone without it. There would of course have been a lot of practical problems, and the idea of ICT- free teaching was unthinkable.

·   Most of the themes that are focused, are not chosen with any regard to ICT.

4.2   Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovations, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that therefore different diffusion patterns therefore occur.

General remarks:

At Ringstabekk Ssecondary Sschool, the reform work could not be characterised as an ICT- dependant reform. This makes it hard to draw conclusions on these issues.

Evidence supporting the hypothesis:

·   Teachers showing a personal interest and having high ICT competence, seemed to be those who were most involved in the ICT- based projects at school, while those in the other end of the scale showed the opposite tendency. Some people of the latterof the last category got however, involved, however, through their commitment to the teams. The teams, as mentioned earlier, decide on projects and methods of teaching and it i's likely to believe that this may have an initiating effect on ICT involvement.

·   To a certainsome degree, the administration has engaged itself in involving ICT in teaching. ICT was put on the agenda for the annual personal conference this year, and at least one project is expected to be ICT- related in this school year.

Evidence supporting the rival hypothesis:

·   ICT has changed the relationship between the teachers and the students as the students now at least tend to be on an equal level as far as technical ICT competence is concerned. Teachers sometimes used student assistance to succeed in different projects. In this sense, one could claim that technology- based reforms are slightly different and may have an alternative diffusion pattern, at least on the practical level in the classrooms.

4.3   Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence.

Evidence supporting the hypothesis:

·   Teachers and students agreed that Ringstabekk's computer ratio was insufficient to integrate ICT in instruction to a satisfactory degree. Some teachers also claimed that a scattered structure with PCs in the different classrooms would make integration easier.

Evidence supporting the rival hypothesis:

·   The fact that the most competent teachers used ICT most frequently indicates that teacher competence is necessary to decide whether ICT is relevant or not in teaching. Even active teachers seemed to have a down to earth attitude to ICT integration, and students with high competence expressed the same view. ICT and PCs are no longer a novelty in the area where Ringstabekk is situated.

4.4   Hypothesis 4

Where all students have equal access to ICT, gGaps in performance between high and low poverty students will be enlarged rather than diminished. where all students have equal access to ICTThe rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students.

General remarks:

It was regarded as a fact that no student was prevented fromform ICT access due toout of economic reasons. If there were no computers at home, the teachers assumed it to be a cultural choice rather than an economic one. Due to this, there has been no evidence found to support either of the hypotheseis's. In fact, almost all the students have access to a computer at home.

4.5   Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students

spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

Evidence supporting the hypothesis:

· Ringstabekk Ssecondary Sschool directed most of itstheir pedagogical work towards themes and projects. Setting academic goals and expectations is a central element in these methods. ICT work was meaningful as long as it contributed to filling these expectations. AlthoughEven if the equipment and the ICT material proved not to bewas not outstanding, they wereit wa used efficiently related to academic goals. Due to this reason,Therefore most teachers found ICT beneficial related to academic standards

Evidence supporting the rival hypothesis:

· Even if students and teachers wanted to obtain more ICT access, they could see the risk of ICT becoming a waste of time. Too much time using low quality programmes and web content was believed to have a lowering effect on academic standard, especially when alternative activities were considered.

5. Projection to the Future

The principal, the team -leader, and the staff's commitment to and vision of project and problem- based learning approaches, ensure that it will be sustained. Furthermore, the sustainability of project-based learning is tied to a mixture of funding mechanism that supports its implementation.

The transferability can best be analyzed into an action research model. Action research has been described as an informal, qualitative, formative, subjective, interpretive, reflective and experiential model of inquiry in which all individuals involved in the study are informed and contributing participants. If we can say that action research is based on the close interaction between practice, reflection and change, many of the initiatives at Ringstabekk fit into this model. The goals of action research in this respect are to understand one's own practice and the institutions in which one operates.

The protocol is iterative or cyclical in nature and is intended to foster a deeper understanding of a given situation, starting with conceptualization and particularization of the problem and moving through several interventions and evaluations. The participants negotiate meaning in the analysis of the data and contribute to the selection of interventionist strategies.

Transferability between organizations
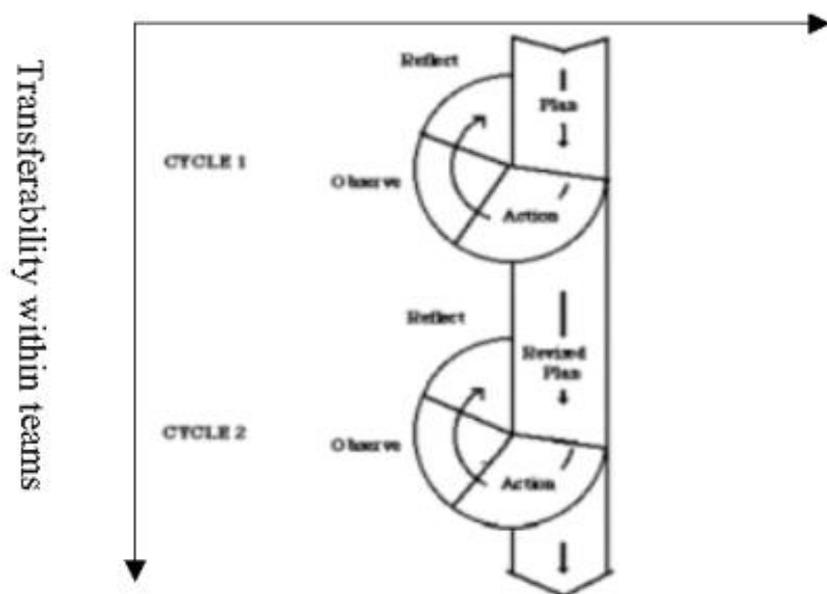
According to the figure above, transferability can be viewed from two different perspectives. A relevant question is whether one through evaluation of own practice is capable of reflecting and adapting this in new actions or if the research "dies" after the attention is gone. Several of Ringstabekk's year plans are characterised by a research-based development model which carries on established methods, e.g. storyline. In the same way, the ICT-based experiences create a rudiment or prototypes which can be analysed and revised. This is especially true for ICT-supported PBL and DPBL.

Another relevant issue is whether transferability in relation to experiences done by the teams are spread internally within own institution and are applicable to in other organisations. Concerning the ICT-supported measures observed at Ringstabekk, tThis issue remains unclear subsequent tofollowing the survey at the school. We do not have evidence that the ICT experiences are explicitly expressed to all members in the organization. As means to transferability between the teams at Ringstabekk, this report may serve as a small contribution. when it comes to the IC-supported measures observed at Ringstabekk

Appendix A

The Norwegian research team:

Assistent Professor Lars Vavik

Senior Research Johannes Johannessen

Senior Research Marianne R. Notland

This team visited three schools in different areas in Norway. The time spent at Ringstabekk school was two days for the research + one meeting in front of the visit to organise the research.

At all three schools we used the Workbook Appendix C-H for the different interviews.

Most of the interviews took place within 50-70 minutes.

At Ringstabekk school we interviewed these number of participants:

Teacher: 8

Student: 9

Parent: 4

Tech.int: 2

Adm.int: 1

Knowledgeable people outside school: 1

For observations inside and outside classroom we used Appendix J and K . In addition to these instruments we translated the appendix I in order to avoid resistance and misunderstanding.

We also produced a final form to collect all data from the Prac. Survey (Appendix I) and from this final form we have some graphs in the report. The average lengths(in Time) of the different interviews are:

Teacher: 50-60 minutes

Student: 40-50 minutes

Parent: 40-50 minutes

Tech.int: 60 minutes

Adm.int: 60-70 minutes

Knowledgeable people outside school: 50 minutes

Other supporting evidence collected at Ringstabekk School (Appendix C):

Examples of student, teachers and admin. work

The homepage address is: WWW.baerum.kommune.no/ringstabekkskole/

In order to use a search function we wrote all the information in Word and gave each part of the interviews a code. Thereby we got the opportunity to compare the different aspects more easily when we worked with the five hypotheses.

Appendix I

OECD/CERI ICT PROGRAMME

ICT Practices Survey for Teachers

I. How comfortable are you with using a computer to do each of the following?

	very comfortable	comfortable	somewhat comfortable	not at all comfortable
1.Write a paper	16	0	0	0
2.Search for info on (WWW).	6	10	0	0
3.Create and maintain web pages	0	4	4	8
4.Use a database.	0	12	4	0
5.Develop a database.	0	0	6	10
6.Send and receive e-mail.	16	0	0	0
7.Write a program	2	0	6	6
8.Draw picture or program.	6	6	2	2
9.Present information (ex. PowerPoint)	4	4	8	0

II. How important is each of the following computer-related skills for your teaching?

	very important	important	so-so	not important
10. Write a paper with word processor	12	2	2	0
11. Search for info on (WWW)	12	4	0	0
12. Create web pages	0	4	6	6
13. Use a data base	0	6	4	4
14. Develop a data base.	0	0	2	12
15. Send and receive e-mail..	6	6	4	0
16. Write a program	0	0	6	8
17. Draw picture or program.	4	8	2	2
18. Present information (eks. PowerPoint).	4	6	4	2

III. During past school year, how often did your students on average do the following for the work you assigned?

	Several times each week	Several times each month	A few times	Never
19. Search for info on (WWW)	8	8	0	0
20. Create web pages	0	2	8	6
21. Send and resive e-mail	0	10	6	0
22. Write a paper with word processor	4	10	2	0
23.Use a computer to play games.	0	0	10	6
24. Use a spreadsheet.	2	0	12	4
25. Use a graphics program.	2	0	6	8
26. Join in chat-room	0	0	8	8
27. Use a presentation program	2	0	12	2
28. Use an instructional program	0	0	4	12

29.Other computer uses:. Special chatroom., Musicator, Pedagogical programmes...

30.How would you rate your ability to use a computer: Good: 8, Fear: 8, Poor: 0

IV. Answer nr.31-38 based on experiences from the last school year.

31. Was student computer used ever evaluated for grading? (yes/no):yes: 10, no:6

32. If you assigned WWW searching, how much freedom did you allow students in locating sites to visit?   No restrictions: 2, some restrictions: 14, designed sites only: 0

33. Did you modify a Web site with any of your classes that you taught? (Yes/No): Yes:6, No:10

34. What portion of the computer use in your classes was directly related to the course content?

all: 4   most: 10, some: 2 very little: 0

35. What portion of the computer use that you assigned was done by students individually?

all: 0   most: 4   some: 10 very little:2

36. How often did you use a computer at home for preparing teaching?

(several times a week: 12

several times a month: 2

a few times: 2

never: 0

no computer: 0

37. Did you participate as a student or instructor in a virtual course through the Internet/WWW?

Yes: 16, No: 0

38. Did you involve your students in collaborative learning over the Internet/WWW?

Yes: 8, No:8

39. Are you currently using technology to collaborate with other teachers (chat-room, or the like)

 Yes: 10, No:6

40.How many e-mail messages do you send each week on average?

more than 12:	6
6-11:	6
1-5 :	4
none :	0

V. How many of the following have you ever done!

	often	sometimes	never
41. Made changes to a computer hardware	6	4	6
42. Updated an application program(Word processor, graphics)	4	4	8
43. Recovered a damaged file	2	8	6
44.Created a web site.	2	4	10
45. Developed a data base.	0	4	12

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[1] http://www-hcs.derby.ac.uk/tip/anchor.html

[2] Schön, D. A. (1983). The Reflective Practitioner: How Professionals Think in Action. London: Mauric Temple Smith.