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## Summary

### ICT has contributed to

- better student performance
- greater motivation and responsibility for students' own learning
- more professional teacher role
- more effective school administration
- more individualized teaching

### Success in ICT-based developments in schools depends on

- goals and processes that are supported by school leadership and teachers
- reorganization of practice and learning methods as a whole



# PILOT: ICT and School Development

NETWORK FOR IT-RESEARCH  
AND COMPETENCE  
IN EDUCATION

**PILOT is an acronym for Project Innovation in Learning, Organization, and Technology. PILOT is Norway's largest and most comprehensive initiative supporting the educational use of ICT in schools.**

During the course of four years, 120 schools have been involved in the PILOT project. The ultimate aim of the project was to motivate participating schools to develop the educational and organizational potential of learning with ICT. PILOT was initiated by the Ministry of Education and Research in 1999 and was completed in 2003. ITU had administrative responsibility for the research work and communities involved in PILOT. The final reports on PILOT was submitted in October 2004.

## School Example

### Computers and Language Skills

**At Årås elementary school in Austrheim, computers were used in combination with other methods for reading and writing lessons in the first grade.**

The students began by pretending that they were writing on the keyboard, in what they called their own secret language. This play stirred an interest in letters and numbers, and when the students became familiar with the location of letters on the keyboard, they became excited about writing text that was more meaningful.

The teachers stated that the students learned to spell words earlier than the norm. Students were also able to 'crack the reading code' and to begin reading by the end of the first school year.

In other words, experience from this study shows that both reading and writing levels were higher than what was typical for students who did not write using computers. Students did not need to use energy and time forming letters, and were instead able to concentrate on the content to be written. Using computers made it easier for many children to discover the relationship between spoken and written words.



## About the Research

Research in PILOT has primarily been based on qualitative studies of learning activities, which have been supplemented by several quantitative surveys. In the qualitative analyses, researchers have observed classes at a number of schools over a four-year period. In the quantitative research projects, students, teachers and leaders at PILOT schools and a number of control schools have responded to questionnaires before and after the PILOT project period. Five university colleges and the University of Tromsø have been involved in the research effort, which has been led by ITU.

# Findings



**PILOT represents a national initiative to advance the educational use of ICT in Norwegian schools by focusing on organizational and pedagogical conditions and activities. The main conclusion is that schools working systematically with organizational frameworks, flexible methods and a focus on learning are most successful with the educational use of technology.**

### What changes do *students* ascribe ICT in schools?

- 52% of students believe ICT has increased their performance in school subjects.
- 83% of teachers agree that student performance has increased.
- Students use ICT more frequently and in a more advanced manner, away from entertainment sites and toward scholarly resources.
- More than half of teachers believe that ICT has reinforced students' critical thinking skills.
- 50% of students believe computers offer assignments better suited for their individual needs.
- Students believe that ICT makes it easier to organize their own learning through the use of, for example, digital portfolios.
- 65% of students believe that ICT has at least partly contributed to a greater sense of responsibility for their own learning.
- Students experience greater influence on their own learning due to less traditional teaching methods and a move away from teacher lectures at front of classroom.
- ICT plays a part in developing and challenging the uniqueness of a subject domain.
- Mathematics is challenged as a subject through greater emphasis on geometric understanding and less on arithmetic. In biology, students are able to follow research developments related to new diseases, while new design developments are the focus in art subjects.
- Learning management systems (LMS) and programs that support learning in specific subject domains are being used to a larger extent. This has led to greater variation in pedagogical approaches and more individualized learning.

- Differences in computer time between boys and girls have lessened, as girls are encouraged to explore their interests in technology. Girls and boys nonetheless use ICT differently, and girls are not a homogenous user group.

### What changes do *teachers* ascribe ICT in schools?

- 63% believe that ICT has been a valuable support in solving pedagogical problems.
- New ways of working have led students to assume greater responsibility and to work more independently, allowing teachers more time to follow up individual students.
- Teachers have moved from being knowledge mediators to assuming more of an advisor role, as a critical dialogue partner and a leader with responsibility for specific subject domains.
- Attitudes toward the use of technology have become more positive.
- Teachers have become more positive to developing and reorganizing their own schools.
- 65 % believe that ICT has been a valuable support in solving organizational problems.

### What changes do *school leaders* ascribe ICT in schools?

- Schools with technology integrated in pedagogical practice require administrative leaders that can also function as educational leaders.
- Innovative approaches have given school leadership new ideas about how to better integrate computers to strengthen subjects.
- Networking opportunities promote collaboration and the exchange of experiences across schools.
- E-mail and learning management systems have increased the efficiency of school administration.



### Recommendations for Further Research

- There is a need for further research in the actual use of ICT by students and teachers.
- changes in the teacher's role due to ICT.
- relationship between learning activities with ICT and forms of evaluation.
- changes in perspectives on knowledge and specific subjects.
- students' influence on their own learning.
- quality of digital educational resources.

## Discussion of Central Findings



**While PILOT has not primarily focused on the effect of ICT on student performance and grades, questions of evaluative measurements and quality improvement are nonetheless legitimate.**

- **Both students and teachers believe that student performance has increased as a result of the educational use of ICT.**

Moreover, ICT has contributed to community building between schools, students, and teachers, thus influencing the quality of learning. Technology in this study has served both as a platform and as a focus in itself. Networks have been important for participants in the sense of encouraging reflection and contributing to developmental change.

Another direct influence of ICT has been seen in a more flexible and better organized teaching milieu, which again influences the quality of learning.

Research shows both students and teachers believe that ICT has influenced student learning. 8 of 10 teachers believe that performance in specific subjects is better when ICT is used in teaching. The students believe that they learn more using ICT, working in a more concentrated and focused manner on specific subjects that utilize more student-friendly teaching approaches. The qualitative analysis also shows that texts production has increased, leading to increased competence in writing, argumentation, and reflection skills. In other words, findings from the PILOT project suggest that pedagogical use of ICT has a positive effect on student learning.

- **ICT in schools offers new and better opportunities for differentiated learning.**

However, the function that ICT has in learning situations is the decisive factor rather than the technology itself. Schools report that students assume greater personal responsibility for their own learning when they use ICT, working more independently and effectively. Teachers have more free time to assist individual students according to need.

The computer functions as notepad, textbook, study tool, and forum for discussions between students and teachers. In writing classes, ICT enables personalized instruction regarding a student's text, and e-mail often increases communication

between students and teachers. Students receive more individualized tasks and greater insight into teachers' aims, and are able to work at their own tempo with tasks appropriate for their level of study.

Differentiation of tasks implies access to and the use of different learning arenas: classrooms, libraries, group rooms, workshops, auditoriums, business locales, and nature. This means that methods other than teaching at the blackboard are needed. Diverse learning situations equip students with a range of work and study techniques that increase their chances for success. The results from PILOT show that students who work in varied learning environments experience that the use of computers leads to better performance in their subjects. The educational use of ICT thus seems to function best in differentiated learning situations.

- **The teacher role has shifted from primarily being a knowledge mediator to that of advisor, critical dialogue partner, and leader with responsibility for specific subjects.**

Traditionally, teachers have primarily been knowledge mediators. As technology has become more accessible, learning approaches have become more differentiated and students work more independently. Teachers now assume roles that are more complex.

Changes in work methods demand a restructuring of the teacher role, one that positions the teacher more clearly as a versatile leader. In addition to the traditional knowledge mediator role, she must advise, challenge, and be a critical dialogue partner for students, stimulating collaboration and motivation. Teachers must provide perspective and direct students to focus on specific content when working with ICT. This is also the kind of leader role that students want and expect.

## Research Says



ITU's series Research Shows presents a summary of comprehensive research results in an accessible format. Research Shows aims to highlight ITU research, with an emphasis on national and international relationships within the field ICT and education. The series is especially intended for teachers, school administrators, and school policy makers within public and private sectors.

## About ITU

The Network for IT-Research and Competence in Education (ITU) is a national Ministry of Education and Research initiative within the field ICT and education. ITU actively works as a program initiator and dialogue partner for Norwegian and international educational institutions concerned with ICT in schools. In its present four-year funding period, ITU is focused on building national awareness and knowledge about digital competence in schools.

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### Important Questions for Schools

- Are students being well equipped to participate in a knowledge society?
- To what extent is ICT integrated in the overall plan for your school?
- Does your school have a clear pedagogical vision of ICT use?
- Is the leadership at your school educationally inspiring?
- Does your school devote enough time and economic resources to increase the level of competency and collaboration among its teachers?

## In Order to Succeed...



- restructuring must be anchored at all levels: leaders, teachers, parents, and students.
- implementation strategies must be systematically developed.
- teachers must have good access to their own computers and other digital equipment.
- schools and school owners must insure sufficient funding for continual maintenance and a professional operational level.
- schools must bolster pedagogical and technical competence among teachers in order to utilize ICT in an innovative manner in class.
- flexible teaching methods and plans must be developed, adapted and retained.
- pedagogical practice must be oriented toward and adapted for differentiated student learning.
- schools must adapt and update organizational structures by using ICT for administrative functions.

## Literature List

### Reports published in connection with PILOT:

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