Self-Regulated Learning and the Use of Information and Communications Technology in Norwegian Teacher Education: The Project ICT as a Factor of Change in Teacher Education

Ivar Bråten,
Helge I. Strømsø
and Bodil S. Olaussen

Høgskolen i Østfold
Rapport 2003:4

Online-versjon (pdf)

Utgivelsessted: Halden

Høgskolen i Østfold har en godkjenningsordning for publikasjoner som skal gis ut i Høgskolens Rapport- og Arbeidsrapportserier.

Ivar Bråten
Institute for Educational Research, University of Oslo
Faculty of Education, Østfold University College

Helge I. Strømsø
Institute for Educational Research, University of Oslo

Bodil S. Olaussen
Institute for Educational Research, University of Oslo

Contents

1. Introduction

Teacher education is an issue of great public concern. While the education of nurses, economists, or lawyers, for example, may certainly be a subject of controversy, the question of how we best qualify the educators of our sons and daughters seems to stand in a class by itself in many societies. This is no matter for surprise, however. The qualifications of teachers closely concern the well-being and the development of children as humans and learners, and based on the vivid school experiences of both children and parents, those qualifications are discussed, and often criticized, in almost every home. In addition, the issue of teacher education holds a prominent place on the political agenda because investments and improvements in teacher education are believed not only to make schools better places to live and learn, but also to promote the development of human, economic, and technological resources that can improve the ability to compete with other countries.

In this report, our purpose is to open a window on Norwegian teacher education with a special focus on attempts to develop ICT-based learning environments. The remainder of the report is divided into two main parts. In the first part, we discuss Norwegian teacher education broadly, with an emphasis on the general teacher education which qualifies for teaching all subjects in all classes in the compulsory primary and lower secondary schools. In the second part, we focus on an innovative teacher education program where the use of information and communications technology (ICT), as well as student responsibility for knowledge construction, was intended to pervade all parts of the program. In addition to describing this program, we report some data from evaluations carried out during the first year of the study. We conclude with some comments on the current debate on teacher education in Norway and the educational reforms that may possibly result from this debate.

2. General Teacher Education in Norway

Because Norwegian teacher education must be seen in the context of the larger educational system, a brief introduction to the Norwegian school system at primary and lower secondary levels seems necessary. Next, we outline the system for general teacher education, highlighting the conceptions of learning and teaching that are expressed in the national curriculum for teacher education. We also discuss the strong emphasis that is given to promoting competence in using information and communications technology (ICT) within Norwegian teacher education, and show how this emphasis joins up with a strong emphasis on developing self-regulated learners. This part concludes with a brief review of research indicating that Norwegian teacher education may still be rather traditional in regard to its culture of learning.

The Educational System

General teacher education primarily qualifies for teaching at the levels of compulsory education. In Norway, compulsory education spans 10 years of children's lives. At the age of 6, all children start in primary school (6-13 years), and at the age of 16, they leave the lower secondary school (13-16 years). During the 1990s, interdisciplinary studies and the use of innovative teaching methods like project- and problem-based learning gained a foothold in the compulsory school. The students are expected to take more responsibility for their own learning and problem solving, and the use of information and communications technology (ICT) is seen as an important tool in this respect. Hence, the use of ICT is to be involved in the learning of all school subjects.

During the primary school years, children usually have the same class teacher, and each class (not exceeding 28 students) is kept as a unit. Cooperation between the schools, children's homes, and the community is seen as important,

and the primary and lower secondary schools take considerable responsibility for the general welfare and upbringing of children. For example, in accordance with the needs and wishes of each student and his or her parents, schools have to arrange for some supervision for children from 6 to 9 years before and after ordinary school hours.

The egalitarian ideology emphasized by Norwegian social democratic governments in the second half of the twentieth century has made the Norwegian educational system renown for its egalitarian practice (e.g., Undheim & Nordvik, 1992; Undheim, Nordvik, Gustafsson, & Undheim, 1995). The curricula of primary and lower secondary schools seem to stress the importance of developing social responsibility, cooperative attitude, and tolerance much more than competitive spirit and drive for excellence. Adapting the classroom instruction to the individual needs and characteristics of students is of essence to the Norwegian educational system, and students are not receiving grades before they enter lower secondary school at the age of 13.

In addition to the de-emphasizing of ability differences and competitive grading in the compulsory school, the ideology and practice of special education may also be seen as part of the egalitarianism of the Norwegian educational system (Flem, 1998). There is a great emphasis in Norway on a common school for all that includes students with special educational needs. Thus, children in need for special education have equal opportunities with other students to receive adapted education in local schools, and most of them are taught in regular primary and lower secondary schools. Only 0.7 % of the children are not educated in regular schools (Flem, 1998).

Of course, the fact that the educational system includes a large diversity of students and has to differentiate instruction to this diversity, represents a formidable challenge to schools and teachers. In a recent study of inclusive education in Norway, Flem and Keller (2000) concluded that educators at different levels of the educational system were positive toward the ideology of inclusion,

but that characteristics of teachers, classroom environment, school climate, cooperation, support from people with competence, attitudes, and resources were factors that affected the implementation of this ideology.

3. The National Curriculum for General Teacher Education

There are 16 state colleges offering general teacher education in Norway. There are no school fees at any of these colleges, and all of them follow the national curriculum for general teacher education, laid down by the Ministry of Education, Research, and Church Affairs (1999). The 4-year general teacher education programs that are offered qualify for a position as class teacher at all levels of primary and lower secondary schools.

Admittance to general teacher education programs only requires that students have completed upper secondary school (16-19 years), regardless of what subjects and branches they have chosen at the upper secondary level. This implies that there is great variation in students' prior knowledge regarding the subjects taught in teacher education programs, with some students having very little background in particular subjects (e.g., mathematics or natural science). Lately, there has not been much competition for entrance to teacher education programs, and most of the students who have applied for entrance have been admitted.

The general teacher education programs include one compulsory part consisting of educational theory (e.g., adapting teaching to individual students' needs, sociocultural perspectives on children's learning, the school as an organization), supervised practice in schools (18 weeks during the first three years of study and 2-4 weeks in the fourth year), and a study of the main school subjects (e.g., mathematics, Norwegian, religion and ethics, art and crafts). The study of each school subject is combined with a study of teaching methods in that subject. In the fourth year of general teacher education programs, students choose to specialize in certain subjects. These subjects may be the same as those studied in the compulsory part of the program or they may be new subjects specified in the national curriculum (e.g., English). Students may also choose to specialize in

teaching at a certain level of education (e.g., the first four years of primary school) during their fourth year of teacher training.

In each of the first three years, a theme is studied that cuts across the different subjects. The teachers of the different subjects as well as the supervised practice are thus expected to focus on one common theme each year, and the students work on at least one interdisciplinary project related to each year's theme. The theme of the first year is called "Student, teacher, learning environment", and it focuses on the interaction between student and teacher, the active student, learning in school, at home, and in the leisure time, the role of the teacher, and the purpose and teaching plans of the school. The theme of the second year is called "Student, class, school", concerning the school as a place for learning and growing up, communication, esthetics, professional ethics, and a sense of community in a local, individual, and cultural sense. During the third year of study, the common theme is "Student, school, society", focusing on the interaction between schools, homes, and the local community, the school as an organization, the function of education in society, and local, national, and international perspectives on education.

Taken together, the courses in educational theory do not represent more than half a year of full-time study in the general teacher education programs. It is emphasized in the general plan for this subject that the study of educational theory introduces four perspectives which are important to the work as a teacher: (1) A value-oriented perspective which focuses on ethical and value-oriented issues relevant for educational work; (2) a differentiating perspective which focuses on inclusive education and individually adapted teaching; (3) a sociocultural perspective which focuses on cultural background differences and adapting teaching to such differences; and (4) a vocational perspective which focuses on the teacher's application of educational theory in particular contexts.

Graded examinations are few and far between in general teacher education programs. Thus, only final examinations in the different subjects are graded, not

students' day-to-day work during the semester, their preparation for lessons, their classwork, or their work on assignments. The final examinations may include written, oral, or practical tests, and other work produced in the course of the program (e.g., project work) may be evaluated as part of the final examinations. Individually performed tests must constitute at least half of the examination material which is evaluated. In addition to final examinations, the students must complete individual and group assignments in the different subjects in the course of the program. This work is not graded, but it is evaluated by the college teachers and has to be approved by them before the students are allowed to take their final examinations in the subjects. Throughout the program, students will be supervised in order to help them develop the professional and personal skills needed by a teacher, and to learn how to supervise and evaluate their own work. If students do not seem to be able to handle the tasks of a teacher, the college board may decide that they have to terminate their teacher education. Such decisions are based on a broad assessment of academic, pedagogical, and personal skills.

The demand for teachers is high in Norway, and the chances of getting a job after finishing general teacher education are very good no matter what grades students have received in the program. Moreover, all teachers who have graduated from a general teacher education program receive the same salary independent of their graded academic performance. Teachers' salary is generally regarded as relatively low.

While general teacher education in Norway is certainly centralized in the sense of being regulated by the national curriculum, every college offering general teacher education also has a unique profile and offers a unique study program. Within the framework of the national curriculum, each college of education provides a more detailed description of program contents, organization, teaching methods, and evaluation. All teacher education programs are thus regulated by a local curriculum that specifies both the program as a whole and the individual subjects, in addition to being regulated by the national curriculum. For example,

each college must specify the general examination requirements by giving details about examination forms and procedures. In educational theory, the final examination consists of two parts: One individually administered written test that counts at least 50 %, and one test that is decided by each college. The latter test must have a different form than the individual written test.

Aims

The main purpose of teacher education is to develop competence in planning, conducting, and evaluating teaching, learning, and upbringing, taking each child's characteristics and abilities as the starting point. Furthermore, teacher education aims at promoting student teachers' personal development and professional ethical attitude, developing their ability for reflection, awakening their interest in academic and pedagogical development work, and providing them with an understanding of the relationship between professional teaching and the function of the educational system in society.

In addition to this general purpose of teacher education, set forth in the Universities and Colleges Act, it is specified that teacher education aims at promoting skills in five areas in the course of the study. First, student teachers are expected to acquire expertise in the school subjects they are going to teach, so that they are able to create good learning environments and supervise their future students' work. Student teachers are also expected to gain an understanding of the differences and similarities between the subject from a student's point of view and the subject from a teacher's point of view, and how all the subjects can be integrated in interdisciplinary and theme-oriented studies. Second, student teachers are expected to acquire teaching skills, both in general and in relation to specific subjects. It is emphasized that students must learn to base their teaching on the principles of learning and developmental psychology, and that they must learn how to adapt their teaching so that all students, regardless of background and

abilities, can take equal part in the social, academic, and cultural environment of their school. For this purpose, student teachers should try out many different teaching methods and materials, including the use of ICT. Third, teacher education aims at promoting social skills that enable future teachers to interact, communicate, and cooperate with parents, fellow-teachers, and students with different abilities, experiences, and social and cultural backgrounds. Fourth, student teachers should acquire professional ethical skills, qualifying them for making choices based on the fundamental values underlying the educational system, and for explaining and justifying those choices to students, parents, and colleagues. Fifth, teacher education should prepare students to take part in developmental and innovative work by promoting both skills and willingness to meet and initiate necessary change and innovations in schools. In particular, it is emphasized that all teachers should be updated on ICT and able to utilize new technological innovations for educational purposes.

Conception of Learning

The national curriculum for general teacher education emphasizes that all education should be part of a life-long learning process, implying that all types of education should encourage continued learning and personal development. The conception of learning underlying all teacher education programs assumes that children are curious and enterprising and wish to learn and try new things. Thus, schools should support children's natural motivation for learning and encourage their attempts to master new challenges.

As children grow older, it is seen as important that they are given more responsibility for their own learning process, as learning is essentially an accomplishment of each individual child. Children must learn how to set goals for themselves and evaluate their own efforts and achievements. They should also take part in the evaluation of the learning environment in their school. Learning

by experience in work and play, and by searching for insights, should be based on children's own initiative, activity, creativity, and feelings of joy. Accordingly, teacher education students should be given independent responsibility for their own learning, even in the subjects where they have limited background knowledge. At the same time, however, it is emphasized that learning is not only a matter of independence, but also a matter of team work and a sense of community, stressing the importance of learning in interaction with others.

Individual differences are also viewed as important in the conception of learning that is expressed in the national curriculum for general teacher education. The learning environment should thus be adapted to each child's cultural background and gender, interests, and capacities for comprehension, mastery, and participation. This emphasis on individualized or adapted learning experiences is grounded on the assumption that equality between students can only be achieved by taking individual differences into consideration and providing a diversity of school tasks reflecting those differences. It is a fundamental view that also children who strive more than others, both academically and socially, should be given opportunities to use their abilities, attain a positive view of themselves, and experience continued learning and personal development.

Conception of Teaching

In accordance with a view of learning that stresses the importance of students' own responsibility for their learning, teaching is primarily understood as a process of mediating, guiding, and supervising students' work. As part of this process, teachers should encourage children's initiatives and give them freedom to make their own choices. Because all children must be given opportunities to play, experiment, and learn, good teaching also involves the provision of varied yet challenging tasks that they are able to perform.

The social aspect of teaching concerns organizing the learning environment in ways that promote interaction and friendship. Social interaction between teachers and students, as well as between students, are thus seen as an essential element in good teaching. Indeed, students are regarded as co-workers in the teaching process, and teachers have to work together with their own students also in the evaluation of the students' learning environment. All teacher education students must participate and be supervised in doing interdisciplinary projects and learn to organize different types of project work. In addition, the teaching process involves cooperation between teachers, especially between teachers sharing responsibility for the same group or class of children. Cooperation between teachers and parents, based on mutual respect and focusing on what is in the best interest of the child, is also a crucial part of the teaching process.

Finally, teaching should be adapted to the abilities and progress of each individual child, giving each child assistance and support on an as-needed basis. A teacher must communicate faith in the potential of every child and see to it that he or she is given the necessary support and challenge, an opportunity for positive self-expression, and a sense of belonging in the class. In short, good teaching must be based on the realization that all children are different and should be treated differently.

4. ICT in Norwegian Teacher Education

A number of national initiatives have recently advocated increased use of ICT in higher education. For example, a much debated White Paper from the Ministry of Education, Research, and Church Affairs (2001a), initiating extensive qualitative reforms within higher education, emphasized that new teaching methods involving the use of ICT must be an important part of those reforms. Among other things, ICT is seen as an important tool for promoting a high level of student activity, with students planning and monitoring their own study progression in a self-regulated way.

The Ministry of Education, Research, and Church Affairs (2000) has also given special emphasis to increased use of ICT in teacher education. This is based on recent surveys indicating that Norwegian teachers' skills in using ICT are quite limited. For example, Statistics Norway (1997) documented that although the majority of teachers had some skills in using word-processors, less than half of them were able to use ICT as a pedagogical tool. Moreover, it was found that ICT was used little in general teacher education. The Second Information Technology in Education Study confirmed these findings, showing that primary and secondary school teachers generally felt that they were insufficiently trained in using ICT for educational purposes (Quale 2000). In launching their action plan for increasing teacher competence in the pedagogical use of ICT, the Ministry of Education, Research, and Church Affairs (2000) maintained that ICT is not only an important pedagogical tool, but also a potential catalyst for the development of new roles for teachers and students. The Ministry sees ICT in education as no less than one of the most important elements in the Government's educational policy in the new century.

It is specified in the Ministry's action plan for ICT in Norwegian education that all student teachers must learn to develop and use ICT in teaching and learning. Because increased teacher competence is seen as essential for

implementing ICT-based learning environments, student teachers must develop skills in the basic use of ICT, the use of ICT as a pedagogical tool, and the use of ICT integrated into the teaching and learning of the subjects. In addition to this focus on teacher education, the Ministry wishes to concentrate on Internet-based continued education and training courses for teachers.

The Ministry's action plan has resulted in 29 projects at different colleges of education, aimed at promoting increased ICT competence among student teachers and teachers. Evaluation of these projects after one year indicates that the action plan has led to important revisions of local curriculums for teacher education, concerning both their structure and their content (Ministry of Education, Research, and Church Affairs, 2001b). Specifically, revised curriculums have emphasized more student-centered teaching and learning, for example, in the form of more problem-based learning and interdisciplinary projects. As the use of e-mail and Web-sites for the purpose of communication and information seems to be well-established in the institutions in question, there seems to be less emphasis on basic ICT competence and more focus on ICT as a pedagogical tool in these projects. Because the ICT innovation projects are still in an initial phase, several of the institutions taking part have concentrated on evaluating different net-based tools by piloting them on small groups of students. Another priority has been to increase the college teachers' competence in pedagogical use of different kinds of groupware.

One major project growing out of the Ministry's action plan for ICT in education is a four-year project directed at primary and secondary schools that involves 135 schools in nine different counties. When Erstad and Frolich (2002) recently surveyed the participating teachers' use of and attitudes towards ICT, they found that in the initial phase of the project, the teachers seemed to use ICT mainly for three different purposes: a) word processing, b) Web-based information search, and c) e-mail communication. In their work as teachers, they used ICT most frequently to plan their teaching and to search the Web for subject-related

information. The teachers felt that there was not enough time to plan the integration of ICT into their actual teaching and therefore used it less as a part of the lessons. At the same time, the teachers who participated in this project believed that the use of ICT can influence students' work positively, with the majority of the teachers expressing that ICT mediates more flexible and differentiated forms of teaching and learning. In fact, about 80 % of the teachers doubted that it was possible to realize the intentions of the national curriculum without integrating ICT into teaching and learning processes.

The teachers in this project also believed that the use of ICT might promote student skills in self-directed learning, for example, in regard to searching and judging different information sources. Moreover, nearly all the teachers believed that the use of ICT could contribute to more student collaboration and project-based learning. However, even though they maintained that the use of ICT had led to a greater variation in teaching methods, these teachers did not really think that it had resulted in major changes in the organization of their daily teaching. This seems to be consistent with the idea that the pedagogical use of ICT should be given an even greater emphasis in teacher education programs.

Can ICT Deliver the Goods?

In the national curriculum for general teacher education, the point is being repeatedly made that student teachers must learn to use ICT for educational purposes, both in their own studies and as a preparation for their future teaching in compulsory schools. At the same time, it is emphasized that student teachers must acquire skills enabling them to plan, implement, and evaluate learning processes and teaching, and to work deliberately towards a goal, with these latter skills playing a prominent role in current models of self-regulated learning (e.g., Zimmerman, 1998, 2000).

The integration of ICT into educational practice has often been backed by arguments that ICT-based learning environments can promote students' knowledge construction and their development of higher-order thinking skills. For example, Web activities like the use of on-line databases and participation in on-line project-work have been referred to as forms of ICT that can foster higher-order thinking skills (Owston, 1997; van den Bosch & Bolluyt, 2001; Windschitl, 1998). However, other researchers have expressed doubt that the use of ICT by itself can foster higher-order thinking skills such as problem solving and critical thinking (e.g., Roschelle & Pea, 1999). In fact, Hartley and Bendixen (2001) recently argued that rather than <u>fostering</u> higher-order thinking skills, some uses of ICT for learning seem to <u>require</u> such skills. Noting that the skills necessary for effective ICT-based learning can be described as self-regulatory skills, these authors assumed that "learners' repertoire of strategies, like monitoring for understanding, and their willingness to invoke such strategies will dramatically affect their ability to manage the wealth of information found on the Internet" (p. 24). The idea is that because self-regulatory skills mediate effective learning in traditional environments (Boekaerts, Pintrich, & Zeidner, 2000), the advantage of good self-regulators will be exacerbated in demanding ICT-based environments involving a bombardment of images, sounds, texts, and links to related materials and concepts that are often used at the students' own discretion. Hartley and Bendixen (2001) cited some studies confirming that individual characteristics of students can impact their ability to succeed in ICT-based learning environments (Jonassen & Wang, 1993; Land & Greene, 2000; Lee & Lehman, 1993; Repman, Willer, & Lan, 1993; Shute, 1993). At the same time, they argued that much more research is needed before we know what it takes in terms of self-regulatory skills to utilize new technological tools effectively.

The somewhat heretical thought that the ability to benefit from ICT-based learning environments assumes good self-regulatory skills may certainly dampen some of the enthusiasm about what ICT can do for learners. However, it may also

be seen as a challenge to those who design ICT-based learning environments to provide students with the necessary support to succeed in those environments (e.g., see Winn, 1998).

Recently, much research on ICT in education has focused on social interaction between students and between students and teachers, and some researchers have come to regard the social interaction taking place in ICT environments as more important than the interaction taking place between the individual and the technology (Koschmann, 1996). It has been argued that ICT-based environments are especially suited for promoting students' collaborative learning activities (e.g., Jarvela & Hakkinen, 2002; van den Bosch & Bolluyt, 2001). Thus, technology for "computer-mediated communication" (Garrison, Anderson, & Archer, 2000) or "computer-supported collaborative learning" (Dillenbourg, 1999; Koschmann, 1996; Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999) is designed to increase students' active participation in authentic learning and co-construction of knowledge, for example, by engaging them in e-mail exchanges, on-line discussions, news groups, or electronic conferences. However, several evaluations of attempts to promote collaborative learning through the use of ICT have indicated that this is not always met with success (e.g., Feilberg, 2001; Guzdial, 1997; Mason & Bacsich, 1998). For example, Jarvela and Hakkinen (2002) recently found that only a small fraction of the discussions of student teachers during computer conferencing could be described as higher-level discussions. In this study, higher-level discussions were defined as theory-based discussions with mutual negotiations, also involving mutual or reciprocal perspective taking. In addition, the activity level of students seems to vary a lot, the teacher is often the most active participant, and discussions between students tend to die out rather quickly (cf., Strømsø, 2002). According to Carl Bereiter and Marlene Scardamalia (2000), this is the "dirty little secret" of many ICT-based learning environments. Indeed, this is not a trivial objection given the findings that effective collaborative learning depends on active

participation by students, and the generation of multiple (often conflicting) interpretations and explanatory activities during problem solving (e.g., Dillenbourg, 1999; Wathen & Resnick, 1997; Weinberger, Fischer, & Mandl, 2001).

Also in regard to social interaction, some of the problems with ICT-based learning environments may be related to the fact that such environments require certain skills by the students at least as much as they foster them. Students must often learn how to become more effective collaborators and contributors in communities of learners (Brown, 1997; Meichenbaum & Biemiller, 1998), and ICT-based learning environments are probably no exception to this rule. It may therefore be essential that ICT-based environments are designed to support students' development of skills in social interaction, communication, and collaboration quite explicitly rather than expect that such skills will develop more or less automatically through the use of ICT (cf., Jarvala & Hakkinen, 2002; Winn, 1998). In line with this, some researchers have given much emphasis to organizing and structuring group discussions in ICT-based environments. For example, research by Soller (2001) and by Weinberger et al. (2001) indicates that strong support for effective social interaction during electronic conferences leads to improved learning compared to conferences where the participants are left alone to organize their discussions. In Soller's (2001) work, the support for social interaction involves the construction of a sentence opener-based interface, requiring that the students begin each contribution with pre-specified phrases like "I think ..." or "I disagree because ...". Weinberger et al. (2001) refer to this kind of supported social interaction as "cued interaction", showing that the use of a "cued cooperation script" can influence individual knowledge transfer in a positive manner.

To the extent that effective cooperation and meaningful discussions can be supported in ICT-based environments, written discourse may well have some advantages over oral discourse. For example, Bereiter and Scardamalia (1996)

emphasized that students have more time for reflection, and that writing increases students' need to elaborate on their arguments. Besides, written discourse allows for the construction of a community database that makes the cumulative knowledge-building discourse available for the participants themselves as well as for other interested persons. In this way, the problem-solving processes of one single group may become part of the learning processes of broader knowledge-building communities (Bereiter & Scardamalia, 1996).

The point that we want to make here is that the use of ICT in higher education in general, or in teacher education in particular, does not in itself foster self-regulated learning or effective collaborative learning. If ICT-based environments are not carefully designed to support the development of self-regulatory and collaborative skills, we may risk that only students already possessing such skills may reap the potential benefits of the new technology, and that the good intentions of policymakers about improved learning for all students may suffer the inevitable disappointment that befalls most wishful thinking.

5. Is General Teacher Education Still a Matter of Teacher-Regulated Knowledge Transmission?

It is certainly possible that the directives and guidelines expressed in the national curriculum for teacher education, as well as in other political and administrative documents dealing with general teacher education, have only limited effect on local teacher education cultures, that is, on the everyday practices embedded in norms, values, and conceptions of reality based on tradition and history (Kvalbein, 2001). While political and administrative resolutions stress the importance of student teachers taking greater responsibility for their own learning and developing self-regulatory skills (e.g., through the use of ICT), this does not necessarily prevent that traditional instructional practices are retained in local cultures.

Inger Anne Kvalbein (1998) recently studied the culture of teaching and learning at a large Norwegian college offering general teacher education. Using a qualitative approach, involving both interviews and fieldwork, she demonstrated that general teacher education to a large extent reproduced traditional forms of teaching and learning that the student teachers had previously encountered in primary and secondary school. For example, Kvalbein (1998) found that the lecturers felt responsible for students' acquisition of what the lecturers themselves defined as essential parts of the subjects. Not only did the lecturers seem to control students' acquisition of knowledge through their selection and structuring of subject matter during primarily monologic presentations. In addition, the lecturers took the responsibility for students' further study of the presented material, by giving them teacher-made assignments to work on, by organizing study groups, and by setting aside time for students to work in those groups during the day. Kvalbein (1998) pointed out that when the lecturers take major responsibility for students' knowledge acquisition, students are left with little responsibility for their own learning during everyday studying. Usually, it suffices

for students to appear for the lessons and participate in the activities that are decided on by the instructors.

In regard to attitudes and behaviors of student teachers, Kvalbein (1998) found that they conceived of their instructors as organizers and authoritative sources of knowledge, with the students' task being that of meeting the demands made on them by the instructors with as little effort as possible. The student teachers seemed to expect and accept that the instructors to a large extent controlled and regulated the study activities, and they regarded this as the natural form of instruction. In fact, they viewed the knowledge in the study not only as fixed and given, but as given by the instructor. Accordingly, they were concerned with acquiring the knowledge presented by the instructor during lectures, often writing down his or her notes on the blackboard or transparencies verbatim and uncritically. Kvalbein (1998) noted that students' trust in their instructor as an authority responsible for their learning actually seemed to increase in the course of their teacher education.

Thus, the culture of teacher education may still involve the conception that learning is something generated by the instructor, with the job of the students boiling down to passively memorizing and reproducing the subject matter as presented to them by the instructor. An instructor who teaches in traditional ways, essentially trying to transmit ready-processed knowledge to his or her audience, may therefore be seen as a greater authority on his or her subject than an instructor who tries to cede control to the students and promote student activity. According to Kvalbein (1998), instructors who try to break away from the accustomed lecturing may get low status among the students, and they may even switch back to traditional one-way lecturing because the students express that they learn more and feel more secure when the instructors organize the instruction and transmit in clear what is expected of them. The result is that the instructor takes major responsibility for giving the necessary knowledge to the students, which seems to foster the epistemological beliefs among students that knowledge is something

26

fixed, objective, and handed down by authority (cf., Schommer, 1990). In contrast to the intentions expressed in political and administrative documents, then, everyday practice in teacher education may work against student development of responsibility for their own learning and self-regulatory skills. According to Zimmerman (1994), contexts that permit little amount of student choice in participation, in learning methods, and in which tasks to perform, as well as little amount of student control over their learning environment, limit the opportunity for the development of self-regulatory learning skills.

In Kvalbein's (1998) study, student teachers expressed that their study of theory at the college and their practice in schools were two different spheres with few points of contact between them. However, when Sundli (2001) recently studied the supervised practice which is a compulsory part of general teacher education, she found that instructor control and induction into a traditional teacher role were important elements of the supervision process as well. This is certainly in contrast to current plans for supervised practice in general teacher education, where the development of critical self-reflection and reasoned teaching practice based on independent judgment are emphasized. Sundli (2001) used a qualitative approach combining the data technologies of field notes, document analysis, and interviews. Data from longitudinal case studies indicated that students became more self-reflective in the course of their study. The general impression is, however, that the supervised practice she observed was an extension of students' experiences in the theoretical part of their education, reinforcing conceptions of the instructor as omniscient, the students as recipients, and the knowledge as given.

Recently, the Ministry of Education, Research, and Church Affairs asked the Network Norway Council to conduct an evaluation of teacher education in Norway, including the four-year programs in general teacher education. The resulting report (Network Norway Council, 2001) indicated that most of the colleges wished to employ more student-activating instructional strategies in their general teacher education programs, for example, by increasing the amount of

problem based learning and portfolio assessment. According to the Network Norway Council, turning instruction into ways of promoting active student learning and, thus, putting the student in the center of the stage and making him or her more responsible for the learning process, is among the greatest future challenges for general teacher education programs. At the same time, the program evaluation conducted by the Network Norway Council showed that the national curriculum for general teacher education was seen as a main *obstacle* to quality improvement. In particular, the national curriculum was seen as imposing too many detailed regulations that made it difficult for the institutions to create programs with individual profiles in order to provide good learning environments for their students.

While the informants actually considered themselves constrained by a detailed and ambitious national curriculum that all programs must adhere to, the Network Norway Council (2001) pointed out that the national curriculum may provide opportunities for change that are not utilized at the institutional level. In other words, the national curriculum for general teacher education may be interpreted too rigidly by teacher educators, who tend to impose unnecessary restrictions on themselves. Especially, it may seem that the national curriculum for general teacher education leaves room for the development of self-regulated learning that is not utilized in many local teacher education cultures.

In what follows, we will describe a specific teacher education program attempting to take advantage of the opportunity to concentrate on developing self-regulated learning and competence in using ICT within the framework of the national curriculum. Some evaluation data regarding this innovative effort will also be reported.

6. ICT as a Factor of Change in Teacher Education

The Program

The general teacher education program described in this section was initiated as the result of a national competition between institutions for public funds to be used in changing and modernizing teacher education, specifically, in the direction of using ICT more actively in the study and providing a better integration between the theoretical and practical elements of teacher education. As one of the winners of this competition, the Department of Teacher Education at Østfold College started a project called "ICT as a factor of change in teacher education" in the autumn of 2000, including 120 first-year general teacher education students in the project. The main aims of the project were to concentrate on more student-activating learning methods, integrate ICT into the daily study work, and develop a better practice training model for general teacher education.

The students in this program are organized into so-called "basis groups", with four to six students participating in each group. The students are supposed to do most of their study work as active and responsible participants in these groups, working collaboratively on problems related to teaching practice within the framework of interdisciplinary projects. The problem-based approach to learning involves working through different stages ranging from clarification and problem identification to obtaining new information and applying that information to the problem at hand (Lycke, 1995). Problem-based learning has been especially popular in medical education (e.g., Lycke, Strømsø, & Grøttum, 2002), and several studies have indicated that this approach may promote student motivation, interest, knowledge transfer, and self-regulation (e.g., Norman & Schmidt, 1992; Schmidt & Moust, 2000). The students are responsible for planning and managing their own learning time in the basis groups.

While the core activities in the study are supposed to take place in the basis groups, the students are also organized into larger "seminar groups", with about 30 students participating in each seminar. In these seminars, the students are supposed to present and discuss the results of their problem-based work in the basis groups with other students and the instructor.

In addition, there are large lectures for all the 120 students. These lectures are also intended to contain elements of student activity and dialogue, and they are legitimized by their relevance for the problem-based learning in the smaller groups. In this way, the lectures are meant to support and supplement the students' active construction of knowledge and their sharing and discussion of their knowledge with others. At the same time, the lectures are meant to be a source of inspiration and a help in structuring information that the students need in their problem-based and interdisciplinary project work.

Finally, all the students and all the instructors are supposed to participate in a weekly collective meeting, which is a forum for the exchange of information and the discussion of problems of mutual interest.

The interdisciplinary organization of the program involves that the individual subject is considered subsidiary to themes cutting across several different subjects. This organization is reflected in the organization of the staff into interdisciplinary teacher teams. Rather that being organized into sections according to subject, a team of about a dozen teachers from different fields is responsible for the organization of teaching and the following up of students' work each study year. For example, during the first semester of the program, this team consisted of teachers from the field of education, mathematics, Norwegian, drama, music, and art and crafts. Within the framework of the national curriculum for general teacher education, the teacher team is free to plan the study in cooperation with the student teachers. Each of the teachers in this team is responsible for guiding the work of two basis groups.

The evaluation practice is attempted to be adapted to the rest of the program. The work in the basis groups is supposed to be evaluated in weekly meetings between each basis group and its adviser. The basis for this evaluation is student log-books from the group work, and the focus of the evaluation is said to be student collaboration and responsibility for their own learning. In addition, the students' presentation and discussion of their problem-based work in the seminars are to be evaluated by both students and teachers. The larger projects that the students work on are the main basis for evaluation, and written feedback is always provided on this kind of work. As regards formal examinations, individual student works are stored digitally and evaluated by en external examiner as part of portfolio assessment. In addition, final examinations in the different subjects consist of individual and group tasks in the form of presented cases, with the use of ICT supposed to be involved in the students' work on these tasks.

In this program, ICT is seen as an important tool in students' problem-based learning and interdisciplinary project work. Indeed, a full-scale integration of ICT is seen as a precondition for changing the learning and teaching methods of the study and for organizing it in new ways. Every student in the program has his or her own laptop and is given unlimited GSM-access to the Internet for high-speed transmission of data and speech. In addition, all the students are connected to a wireless local area network establishing a digital learning center for presentations, discussions, commentaries, guidance, and information. The students are thus given flexible opportunities, in terms of both time and place, to actively search for information and participate in communication about subject matter globally as well as locally. In their daily work, the students are supposed to use ICT when they work together on a project in their basis group, when they communicate with other students or the instructor, and when they work individually at home. The idea is that this establishment of a digital learning environment can support an increase in student activity and knowledge construction, as well as changes in the

teaching process in the direction of more student guidance and student--teacher dialogues.

Finally, ICT is also intended to play an essential role in the development of a new practice training model. This model is part of an effort to bring together the theoretical and practical elements of teacher education, and it involves that the student teachers stay in close contact with so-called practice schools during the entire study year. This continual contact with practice schools is meant to let the student teachers experience everyday aspects of the teaching profession, and to connect their problem based learning and interdisciplinary project work at the college to real life teaching problems. The practice schools are invited to take part in the development of the new practice model and given the opportunity to profit from the development of an ICT-based learning environment. Each basis group is attached to one class at one practice school through the entire study year, and the students' work at the college is supposed to be closely linked to the everyday life in this class. The student teachers shall take part in the planning, implementation, and evaluation of project work in the class, and they shall teach the students in the class how to utilize ICT in their work on projects. Thus, the students in the school class can learn how to use laptops, search for information, and communicate about subject matter during project work and other study activities. In addition to this direct, face-to-face contact with the students in "their" class, the student teachers are supposed to be in frequent contact with the class via the Internet (e.g., video conferences), providing guidance to the students in the class regarding both their learning at school and their homework. Not only the students in the class, but also the class teacher, is thus given the opportunity to increase his or her competence in using ICT through cooperation with the college students. At the same time, the student teachers get hands-on experience of project work in a school class and of pedagogical use of ICT. They can also relate their own problem-based learning and project work at the college to real life problems that they experience in the class. In fact, the planning, description, and evaluation of their contact with the

practice schools is in itself a major project for the student teachers during the first year of their study.

In addition to this group-based cooperation with the practice school, the participants in the basis group are individually supervised by the class teacher. This means that the class teacher is engaged as a teaching supervisor who sees to it that each individual student in the basis group gets the amount of supervised practice specified by the national curriculum for general teacher education. As mentioned earlier, each college instructor is responsible for guiding the work of two basis groups. This also involves following up the contact between the basis groups and their practice schools.

In summary, the general teacher education program described above represents an innovative effort to move teacher education from teacher-regulated knowledge transmission toward self-regulated knowledge construction based on real teaching problems. As an important tool purportedly mediating students' self-regulated knowledge construction and their collaborative work on real life problems, ICT is integrated into both students' daily work at the college and their contact with the outside world of schooling. The described program seems to be based on a model bearing strong resemblance to the "e-ducation" framework proposed by Nulden (2001), in which the use of ICT is integrated into an educational approach emphasizing active construction of knowledge, problem- and practice-based learning, collaborative learning, and formative assessment. In the next section, we present some available evaluation data from the first year of the project and discuss how well the program seems to have succeeded in its ambitious attempt to forge a new teacher education.

Program Evaluation

Data Collected by the College

Near the end of the first semester, a questionnaire was administered to the 120 students who started on the new general teacher education program at Østfold College in August 2000. The students ranged in age from 19 to 46 years ($\underline{M}$ = 24.8 years, $\underline{SD}$ = 6.4 years). There were 68.5 % female and 31.5 % male students in the program. The questionnaire was part of the college's own evaluation of the program, and it was completed and returned by 64 % of the students. When asked about their new study context and the instruction, most of the students seemed to be relatively satisfied with the cooperation in the basis groups. However, the students seemed to be less enthusiastic about the guidance and instruction offered, and they reported that the instruction was nearly as much characterized by lecturing and knowledge transmission as by student activity and problem-based learning. In regard to the new practice training model, most of the students seemed to favor a combination of the new flexible model and the old model with predetermined, continuous practice periods.

When asked about their use of ICT in the study, the most frequent use of the computer seemed to be related to students' work on assignments and the writing of reports, search for information on the Internet, and communication with other students via e-mail. In addition, more than half of the students reportedly used ICT for communication with other students on the local network (Webboard), and for communication with instructors and practice teachers. However, less than 25 % reported to have used ICT for communication with students in their practice class. While most students seemed to use the Webboard for accessing information about specific projects and the study in general, as well as for reading the contributions and messages of others, relatively few seemed to use it interactively, that is, by themselves contributing to ongoing discussions. In regard to student competence in using ICT, most of the students reportedly mastered search for

information on the Internet and use of the Webboard. However, the students especially expressed the need to increase their competence in constructing Web-sites (homepages) and in using presentation programs. The students seemed to be relatively satisfied with the ICT user support they could get at the college for those purposes.

Finally, the students were asked to evaluate the innovation teacher education program they participated in as a whole. Eighty-eight per cent were either satisfied or very satisfied with the program. The relatively low return of the questionnaire (64 %) was probably due to the students being in the middle of an intensive period of work at the time in question.

Near the end of the first semester, the college also administered a questionnaire to the 26 practice teachers participating in the project, with a return of 22 (77 %) questionnaires. Quite a few of the practice teachers found both the general information about the project and the specific information about their tasks as practice teachers that they had received from the college less than satisfactory. However, the practice teachers were generally satisfied with the students' preparedness for the teaching practice, even though they thought there were large individual differences among the student teachers with regard to this. In addition, the practice teachers were generally satisfied with the cooperation between themselves and the student teachers in the planning of the teaching practice, and most of them thought that ICT had been integrated into the students' teaching practice to a relatively large extent (e.g., during project work and through the use of pedagogical software in the class). Even though few of the practice teachers regarded themselves as novices in the use of ICT, they especially expressed the need to increase their competence concerning the pedagogical use of ICT, and they also wanted to learn more about the use of ICT in relation to different school subjects and about different kinds of software. Finally, from the perspective of the practice teachers, there seemed to be plenty of room for improvement in the

communication and cooperation between the practice teachers and the advisers of the basis groups.

After the first semester, the head of the project pointed out in an evaluation report that there was still a need for real change in teaching methods towards more problem- and practice- based work. In addition, he stated that more systematic methods for developing ICT competence among students and teachers were needed, especially, regarding ICT as an integrated part of working with different subjects and with projects. Finally, the head of the project asked for even closer contact between the students' theoretical studies at the college and their teaching practice, emphasizing the responsibility of the advisers of the basis groups with respect to this. Taken together, these challenges seem to accord well with important points made by the student teachers and the practice teachers in their questionnaire responses.

In an evaluation report written by the head of the project after the second semester, it appeared that real changes in the direction of more problem- and practice-based work, increased competence in using ICT among students and teachers, and more integration between college studying and practical teaching experiences, were still among the most important challenges for this new teacher education program. The new teaching practice model obviously represented a great challenge for the college teachers to organize instruction in other ways than giving lectures to the students, as well as for the student teachers to learn in other ways than attending such lectures. It is a premise for this model that traditional, teacher-regulated instruction is replaced, or at least supplemented, by Web-based information exchanges and the creation of an interactive digital learning environment, with this demanding increased ICT competence among both college teachers and students. During the second semester of the project, the effort to increase students' ICT competence focused on producing Web-sites to be used in presentations of interdisciplinary project work. According to the head of the project, there seemed to exist a division of work within basis groups working on

projects, with those group members mastering ICT taking responsibility for ICT-related tasks, and the other group members doing other things.

After the first year, 21 of the students who started on the program had quit or obtained leave from the study, most of them for personal reasons, while three students had been transferred to this program from other colleges. The number of students who had chosen to quit their teacher education after one year of study was much lower than what had been usual at this college.

When the Network Norway Council (2001) externally evaluated the general teacher education program at Østfold College, they also found the new practice teaching model to be promising, and recommended that the college took the necessary measures to develop this model further in the direction of an even more school-oriented teacher education. In general, the Network Norway Council felt that the described innovation project had taken important steps away from the traditional form of general teacher education, yet keeping within the framework of the national curriculum.

SRLTC Program Evaluation

As part of a larger project, Self-regulated Learning and Text Comprehension (SRLTC), our research group at the Institute for Educational Research at the University of Oslo collected several sets of evaluation data from the general teacher education students during their first year of study. Thus, during the first semester, we surveyed the student teachers' academic motivational beliefs as well as their cognitive and metacognitive strategy use. During the second semester, we conducted a group interview with the students in one of the basis groups, and also observed these students as they worked on a project. In addition, we observed lectures in Norwegian and seminars in mathematics and interviewed the head of the project during the second semester. We present the results of our evaluation efforts below.

Survey data. To assess positive academic motivational beliefs among the student teachers, we used measures of perceived self-efficacy, mastery goal orientation, and study interest. Self-efficacy focuses on students' judgements about their capability to accomplish study tasks as well as on their confidence in their skills to perform those tasks. Mastery goal orientation focuses on the development of competence through learning, self-improvement, and the mastery of challenging tasks, and study interest concerns students' enjoyment and valuing of study activities and subjects for their own sake. Both mastery goal orientation and study interest are conceptually related to intrinsic motivation. The measure of self-efficacy was adapted from Pintrich, Smith, Garcia, and McKeachie (1991), the measure of goal orientation from Midgley, Kaplan, Middleton, Maehr, Urdan, Anderman, Anderman, and Roeser (1998), and the measure of study interest from Schiefele, Krapp, Wild, and Winteler (1993). When we compared the performance of the student teachers on the motivational measures with the performance of two other groups of students participating in the SRLTC project, student nurses and business administration students, one-way analysis of variance indicated significant differences in both mastery goal orientation ($F(2, 408)=21.8$, $p<.001$) and study interest ($F(2, 407)=25.5$, $p<.001$). Results from post hoc analyses with Tukey Honestly Significant Difference (HSD) test revealed that the student teachers scored significantly higher on both mastery goal orientation ($p<.001$) and study interest ($p=.001$) than the business administration students. Both mastery goal orientation and study interest seemed to be related to gender (mastery goal: $r=.25$, $p<.01$, interest: $r=.36$, $p<.01$) and age (mastery goal: $r=.33$, $p<.01$, interest: $r=.35$, $p<.01$) among the student teachers, with female students obtaining higher scores than males, and with older students obtaining higher scores than younger students (Bråten, 2001).

To assess students' strategy use, we adapted a measure of reading comprehension strategies from the Learning and Study Strategies Inventory

(LASSI) (Weinstein, Palmer, & Schulte, 1987). This measure was used to assess to what extent students approached their reading tasks in an active, strategic way. There were no differences between the student teachers and the student nurses or the business administration students on this measure. In addition, the performance of the student teachers was comparable to that of other Norwegian student teachers previously administered the LASSI (e.g., Bråten & Olaussen, 1998, 1999). Also, when we constructed a measure to assess to what extent the students strategically used the Internet to search and locate relevant information and to communicate about what they were studying, we found no differences between the student teachers and the two comparison groups. However, when the items focusing specifically on using the Internet for communication about subject matter were separated out through factor analysis, significant differences between the three groups were found (F(2, 403)=26.5, p<.001). Post hoc analysis (Tukey HSD) indicated that the student teachers outperformed (p<.001) the two other groups on this measure. Interestingly, there were no relationships between any of the strategy measures and gender or age among the student teachers. There were, however, significant relationships between the use of reading comprehension strategies and three of the motivational measures, self-efficacy (r=.34, p<.01), mastery goal orientation (r=.60, p<.01) and study interest (r=.38, p<.01). Strategic use of the Internet was also related (r=.27, p<.01) to the students' reported amount of study interest (Bråten, 2001).

Finally, we assessed students' use of metacognitive, self-regulatory strategies with a measure adapted from Pintrich et al. (1991). This measure addresses to what extent students use self-regulatory activities to plan, monitor, and regulate their cognition and learning. Our finding indicated that the student teachers reportedly used self-regulatory strategies more than business administration students. Moreover, for both the student teachers and the business administration students, self-regulatory strategies were uniquely predicted by

mastery goal orientation but not by perceived self-efficacy (Bråten, Samuelstuen, & Strømsø, in press).

In summary, there seemed to be few consistent differences in favor of the students participating in the innovative teacher education program resulting from of our preliminary comparison between these students and other student groups. However, an important exception to this was related to students' strategic use of the Internet for communication, cooperation, and discussion about subject matter. As pointed out earlier, this was indeed an essential part of the ICT learning environment that the innovation project aimed to create. It should be noted that this survey was conducted during the first semester of the study. As the SRLTC is a longitudinal project, later comparisons between the student teachers and other student groups participating in the SRLTC project may shed further light on potential benefits of the described teacher education program.

Basis group interview. In the middle of the second semester, a one-hour group interview was conducted with one of the basis groups, consisting of one male and five female students. In this interview, the students were asked to describe how they conceived of the instruction at the college in general terms, and also how they conceived of the different forms of instruction they participated in (i.e., large lectures, seminars, and basis groups). In relation to each of the different forms of instruction, the students were asked to describe the tasks and the responsibility of the college instructors, for example, to what extent the instructors emphasized knowledge transmission, guidance, and student independence, respectively, both regarding subject matter and learning-to-learn skills. In addition, they were asked to describe the role played by ICT in relation to each of the different forms of instruction as well as in the study in general.

In the group interview, the students expressed that they preferred instruction in smaller groups to that of large lectures, even though they conceived of all instruction where there was a college teacher present as largely teacher directed.

They also mentioned that each basis group could become somewhat "encapsulated" in itself during other forms of instruction, which meant that the strong emphasis on the basis groups could actually hinder the development of appropriate group processes at other levels of instruction.

When the students described the large lectures in particular, they described the instructor's role as imparting and explaining subject matter and the students' role as listening to his or her presentation, with at least 90 % of the time being devoted to this kind of one-way communication. Even though the instructors permitted discussions to take place during lectures, the circumstances (e.g., large lecture room, 120 students present) mostly prevented the students from engaging in discussions with each other or with the teacher. Moreover, the students did not feel that the lectures had been used for recommendations, guidance, or discussions about learning and study strategies. This meant that instruction in learning-to-learn skills were not seen as being integrated into the instructors' presentation of subject-related knowledge. However, in connection with specific projects, the instructors had informed the students somewhat about the method of problem-based learning and how to organize the project. When asked about the role played by ICT in relation to the lectures, the students expressed that they were sometimes informed via the Webboard about the topic of upcoming lectures, and that the instructors sometimes presented materials from their lectures on the Webboard afterwards. It also occurred that students commented on that material or asked questions to the instructors on the Webboard after the lectures. The students emphasized, however, that it was not a standard arrangement that the instructors presented material on the Webboard after the lectures, but something that seemed to be left to the individual instructor's own discretion.

When focusing on the instruction in seminars, consisting of groups of about 30 students, the students expressed that this was very much like a traditional class in secondary school, where the teacher was still responsible for transmitting knowledge to the students, but where there was more contact and discussion

between the teacher and the students than in the large lectures. They also thought that the teacher felt more confident in this instructional context, receiving more feedback from the students, for example, in the form of questions about subject-related problems that they did not quite understand. In addition, the students emphasized that there was better contact between the students in seminars. Sometimes the students in the seminars worked individually on assignments while in class, but usually they would break up the seminar to work in the basis groups for a period of time (e.g., for two hours), and then return to the seminar to go through their work with the teacher. The students expressed that study strategies or learning-to-learn skills had never been discussed in the seminars in which they had participated, except from the very general suggestion that they should work on assignments. The students also agreed that ICT was used much less in connection with the seminars than in connection with the lectures, and that the traditional class instruction taking place in the seminars was rather unaffected by the ICT focus of the teacher education program. This meant that material concerning the seminars was neither presented digitally before the lesson nor after the lesson for the students to comment on, and that the students seldom used their laptops during the lessons. When the Webboard was sometimes used to discuss subject-related problems, as in mathematics, this was apparently occurring independent of what was going on in the math seminar.

When the students were asked to describe their work in the basis group, they agreed that they cooperated quite well in regard to both project work and work on other assignments. When starting on a project, they used much time for joint discussions, but after this somewhat slow start they felt that they worked effectively in distributing tasks among the members of the group (e.g., looking up literature, searching for information on the Internet, writing drafts) as well as in sewing the parts together into a presentable report. All the students in the basis group did not necessarily take part in the final writing up of the project report; sometimes two or three students would do this job with the rest of the students

more or less passively watching them. However, all the students in the group tried to read through the whole report and comment on it. The students also expressed that they had made some progress in working on projects in the basis group over time. Thus, in their first project, each student had just handed over his or her contribution to the one responsible for formatting the manuscript, with this resulting in a rather fragmentary piece of work. In their latest project, however, they felt that they had succeeded more in distributing the work and had found a better solution to the formulated problem. Sometimes the students in this basis group would divide into two smaller groups located in different places when working on a project, keeping in touch with each other through the use of their computers. The students admitted that they could easily loose focus and become inefficient in the periods when they left the seminars to work independently on assignments in the basis group, before they returned to discuss their work with the instructor and the other participants in the seminar. The students also informed us that there were great variation between the basis groups in the program, with many groups experiencing conflicts, for example, because some students did not do their share of the work or even did not appear at the appointed time and place.

In discussing the tasks and the role of the adviser to the basis group, the students expressed that they had actually used their adviser very little, but that they felt they could contact him if they needed any special assistance. Even though they had not experienced a great need to use their adviser, the students informed us that they had consulted him about the formulation of problems during project work, and also asked him to read through drafts to be included in the project report. However, they generally felt that they had worked so intensively on projects that there had been little time left for "troubling others", that is, the group had been self-sufficient and absorbed in their project work. On the basis of this, the students agreed that their work in the basis group to a large extent was student directed. They also agreed that their work in the basis group contrasted most sharply with the large lectures in regard to this, with the seminars falling

somewhere in between, being predominantly teacher directed but also giving opportunities for considerable discussion and dialogue between teachers and students. The students emphasized that some of the other groups had used their advisers much more, both in relation to supervising their academic work and in relation to solving social problems within the groups. They expressed that if cooperation did not go smoothly in a group, that group would need more help from the adviser than other groups. Somewhat surprisingly, the students had not discussed study strategies or learning-to-learn skills with their adviser. Thus, in connection with their project work, the contribution of the adviser had only been directed towards academic problems, not towards <u>how</u> the students could work strategically with the study materials.

When asked about the role played by ICT in relation to studying in the basis group, the students reported that when trying to find information that was relevant for a project, they used as much time to search for information on the Internet as they used to search for relevant literature in the college library. They usually divided this part of the project work between them, with some of the students searching the Internet and others searching the library. They did not find it harder to assess the quality of information that was found on the Internet than information located in the library, with this somewhat dependent on the familiarity of the material. They also reported that they had received some information from the head of the project about where to find reliable information on the Internet. While working on a project, the students communicated digitally to a large extent, for example, by e-mailing what they had written to another student for comments and further cooperation about the text. They also used e-mail to keep in touch more generally, to inform each other about appointments, send messages about where they were at the moment, etc. So far, the students had been allowed to choose whether they would present the result of project work digitally on the Webboard or on paper, and this basis group had chosen to use paper, even though they, of course, had used text processing software in writing their reports. In the project

starting shortly after the interview, however, they were for the first time required to present the work in the form of Web-pages. The students agreed that ICT was best integrated into their work in the basis group, that it was also used to some extent in connection with the lectures, but very seldom used in connection with the seminars.

Finally, the students were asked how they perceived the connection between the different forms of instruction. Their answers indicated that this connection was somewhat obscure. Indeed, the basis group, the lectures, and the seminars appeared to be somewhat dissociated in these students' minds. For example, even though they had worked on assignments related to the lectures in the basis group, their work in the basis group was sometimes focused on content quite different from what was dealt with in the lectures.

Basis group observation. A few days after the group interview, the same basis group was observed for two hours while working on a new project related to learning difficulties in mathematics. The basis group was expected to work on the project for one week. At the end of the week, five to seven basis groups would be asked to present their work while other groups would be asked to make comments. The project work was intended to be a study of relevant source material located on the Internet, in books in the library, or somewhere else, and the final product should be available as Web-pages discussing a specific problem formulated by each group. All the groups were requested to contact their adviser after they had formulated a problem that could guide their further work on the project. General information about the project was also presented to the students in the form of project Web-pages, also specifying how they should design their own Web-pages constituting their final project report (e.g., in the form of net-based hypertexts). The project Web pages also called attention to some relevant references (books and articles) and provided links to some Web-sites where the students could search for information.

We observed the basis group in the middle of the project. Their work was both audio- and video-taped during the observation periods. When we analyzed our observations, we first focused on whether all the group members participated in the project work and, moreover, whether they participated in equitable ways. According to Duek (2000), positive interdependence will not occur if not all group members are constructively participating in the learning process. Besides, groups need to function in equitable ways, emphasizing the relevance of equality of discourse (i.e., in length, type, and frequency) among the group members (ibid.). During the observation periods, the students sat at a long rectangular table, three students at each side of the table, each student with her own laptop in front of her. Even though all the students seemed to participate in the work, it was striking that there was very little collaboration across the table. However, at each side of the table, the subgroups of three students seemed to be involved in considerable peer collaboration. Within these subgroups, the three students seemed to contribute equally to the work, even though most of the collaboration periodically involved only two of the students with the third student working alone on her laptop. (Which student worked alone varied over time.) Generally, the students seemed to encourage each other and to be involved in the project work in the two subgroups.

When we next looked at the content of the collaboration within the two subgroups, we observed that one of the subgroups focused entirely on technological tools for solving the problem while the other group focused on conceptual tools. In the group focusing on technological tools, the content of the collaboration concerned the design of the required Web-pages, with all the participants actively involved in loud discussion about how to publish the final project report (a challenge they described as "a nightmare"). In this subgroup, all three students were involved in the discussion at the same time more often than in the other subgroup, working on the same laptop and focusing on the same monitor. In the group focusing on conceptual tools, the content of the collaboration concerned searching for and introducing conceptual and textual resources to

46

promote problem solving. In this subgroup, the three students were involved in reading books, producing text on their computers, and discussing subject matter. Part of the time, the reading and writing activities in this subgroup seemed to be performed individually, without much discussion with the other students. However, there was also considerable dialogue in pairs of student in this subgroup, especially, with one of the students commenting on and evaluating the text being produced by the two others. In general, the discussion in this subgroup was low-voiced. As mentioned earlier, there seemed to be little collaboration between the two subgroups. When the "technology group" ran into an insoluble problem, they contacted a "nerd" outside the basis group instead of addressing members of the other subgroup. Only once a student moved over to the technology team (to comment on a saving procedure), and only once a member of the technology team moved over to the other side (to assist in the reformulation of a sentence). The other "crosstalk" that occurred simply involved that the members of the technology group asked for materials to be included in the final report, urging the students producing content to send over finished text via e-mail.

Finally, we focused on the extent to which the students reflected on and regulated group processes during the observation periods. Hmelo and Lin (2000) recently pointed out that reflective self-assessment is an important tool that scaffolds students' inquiry during problem-based learning. As students reflect on the usefulness of the group processes they are involved in, such process-oriented reflection may engage students in metacognitive monitoring and regulation of their own learning (ibid.). However, few indications of reflection on group processes could be observed in this basis group. When one of the students asked for assistance in reformulating a part of her text, she was asked why she could not do this herself, answering that it was impossible to concentrate on the task in such a noisy environment. This comment was not followed up by any of the other group members, however, even though it pinpointed a central problem. The loud discussion continually taking place in the technology group apparently made it

very difficult for the students in the other subgroup to reflect on and produce texts. In addition, the project work had obviously been planned to some extent before our observation started, but there was virtually not any discussion of the planned division of work during the observation periods. Near the end of the observation periods, however, a number of comments on time management were being made. These involved students discussing the time schedule for the project, checking the progress of the group members, and evaluating whether that progress was satisfactory.

In summary, our observation of the basis group gave us the impression of a strict division of work that did not seem to serve the purpose of problem-based learning well. Indeed, involving the whole group in problem solving processes concerning the major issues would have been more in line with the idea of problem based learning. In that way, all the group members would have been given opportunities to make contributions and to learn from the different aspects of the project work. Even though there had probably been some collaboration involving the whole group in an earlier phase of the project, collaborative problem solving seemed to take place only at the level of subgroups during the observation periods. Thus, one might certainly ask if the two subgroups had not fared better if located in separate rooms. It should be noted that what we observed in this basis group confirmed the general concern of the head of the project when he stated that the division of work within basis groups working on projects seemed to involve that the students who mastered ICT took responsibility for ICT-related tasks while the other group members worked on other aspects of the project. Probably, the work in this basis group would also have profited if the group members had prepared themselves better individually before meeting to discuss the project. For example, after having initially planned their work together, individual group members could have spent time studying relevant source materials and producing drafts outside the basis group. Then, the time in the basis group could have been used for a collective discussion about important points in the source materials and

the drafts dealing with them, as well as for an exchange of ideas concerning technical problems related to publishing their work engaging all the students. After that, the students could, if necessary, have withdrawn to revise their drafts before returning to the basis group. In accordance with this, van den Bosch and Bolluyt (2001) described four working processes that are essential in ICT-based collaborative writing of papers and reports: exploring the subject, exchanging information, arguing and discussion, and editing.

Lecture and seminar observation. Near the end of the second semester, we also audio- and video-taped two lectures in Norwegian and two seminars in mathematics. Our observation of the lectures confirmed the impression given to us in the group interview, that lectures could be characterized as one-way knowledge transmission from the instructor to the students. In brief, there was very little dialogue between the students and the instructor and no dialogue between students during the lectures. Only three students used their laptops in the observation periods. To the extent that the other students were taking any notes, they used paper and pencil. As one student significantly remarked after the lectures: "There is often much talk about ICT and things like that, but after all it sort of mostly becomes the blackboard, the overhead, and good-bye".

Our observation of the seminars also confirmed the impression given to us in the group interview. The seminars were thus characterized by quite traditional class instruction, with he instructor very much in charge but with considerable dialogue and discussion taking place. In the first seminar, the students worked independently and in pairs on assignments given by the instructor, with considerable low-voiced discussion about the assignments going on between the students, and with several students raising their hands and receiving assistance and explanation from the instructor. In the second seminar, the instructor went through and explained in front of the whole class the assignments that the students had worked on, using the blackboard and answering questions from several students

while doing this. At the end of the second seminar, the students started to work on a new assignment given by the instructor, which he would later go through and explain on the blackboard. During the two seminars that we observed, no student used a laptop; everyone used paper, pencil, and calculator.

Interview with the head of the project. Finally, we also conducted a one-hour interview with the head of the project near the end of the second semester, using the same interview schedule that we had used in interviewing the basis group. The head of the project first expressed that he thought there had been a positive development in the use of interdisciplinary projects over the study year. He acknowledged, however, that the instructors had generally been too passive in the planning and the implementation of project work, resulting in the students complaining that they had problems getting the guidance they needed. In later projects, this had improved because of greater clarity about the obligations of both students and instructors during project work.

In regard to the lectures in particular, the head of the project agreed that they mainly involved teacher-regulated knowledge transmission, yet with some elements of dialogue. His impression was that both the students and the teachers adhered to this form of instruction because some of the final examinations were still quite traditional, but also due to tradition and lack of knowledge about other ways of teaching (e.g., about problem-based learning). The head of the project did not know whether the instructors introduced appropriate study strategies or discussed ways to approach study materials with the students during the lectures, but he did not really think that this was integrated into the lectures. When asked how ICT was used in connection with the lectures, he mentioned that some instructors had used the Web actively along with their lecturing, for example, to help students keep up in a subject during periods of practice in schools. According to the head of the project, instructors presented materials related to their lectures digitally both before and after the lectures (e.g., materials supplementing the

lectures or assignments), but he felt that the students seldom commented on this material, asked questions about it, or became involved in Web-based discussions. In regard to the connection between the lectures and other forms of instruction, he maintained that the instructors often gave the students assignments during the lectures that the students then worked on in the basis groups and reviewed in later lectures. He admitted that this deviated from problem based learning, with its emphasis on student responsibility for formulating problems and constructing knowledge, instead involving much practice in working on teacher-specified tasks and receiving feedback on the work. The problem was, however, that the students were often not able to complete such assignments in the basis groups.

When focusing on the instruction in seminars, the head of the project had the impression that there was generally more student activity and less knowledge transmission in the seminars than in the lectures. In his opinion, students worked better on the assignments given in the seminars when they stayed in the seminar groups with the instructor present than when they broke up the seminars to work on the assignments in the basis groups. In regard to instructor recommendation or support for learning and study strategies, the head of the project could not tell whether that took place in the seminars or not. His impression was, however, that the instruction in the seminars varied with the instructor, that is, with some instructors using student activating approaches more than others. He also informed us that the students were expected to use their laptops somewhat in the seminars, for example in mathematics, where they should learn how to use different kinds of relevant software. In addition, he confirmed that teachers presented assignments on the Webboard stemming from their instruction in the seminars, and that both students and teachers participated in online discussions about these assignments. He admitted, however, that not many (about 25) students contributed actively to discussions on the Webboard, and that the contributions of the teachers often involved that they just presented the assignments and then, after a while, provided the correct answers. According to the head of the project, it was

a challenge to increase teacher competence in moving the instruction from the classroom to the Web, for example, in facilitating Web-based discussions. The interview confirmed our impression that the connection between what was going on in the seminars and the Web-based activity was rather loose, with the main emphasis given to the instruction taking place in the seminars.

The head of the project informed us that there had been problems with cooperation in quite a few basis groups during the first year of the study. These conflicts were related to study work at the college, not to practice in schools, and they concerned, for example, disagreements about how seriously one should take the study, when to appear, the distribution of tasks, the planning of work, and the alternation between individual work and group work. In some cases involving large conflicts, after much effort from both the head of the project and the group advisers, the groups had even decided to split up. The head of the project emphasized that conflicts within groups were seen as an important topic of discussion in the study, because the students must learn how to cooperate with different kinds of people as a preparation for their work as a teacher. When asked about the tasks and the role of the adviser, he expressed that there was a need to systematize the contact between the advisers and the basis groups more, for example, by giving more emphasis to the making of firm appointments. Even though he acknowledged that there had been great variation between groups in regard to this, he considered it a problem that some advisers were contacted by the basis groups on an as-needed-basis only. It was his impression that the advisers mostly guided the basis groups in their work on interdisciplinary projects, both during the planning process and during the formulation of a problem, as well as in the course of their further work on the project. He perceived the task of the adviser to be more like general study guidance than assistance with specific academic problems. This meant that the assistance of the adviser should be directed toward the dynamics of the groups, for example, toward helping them get started and supporting their cooperation, and that the students had to contact other

instructors to receive assistance regarding specific academic issues. The head of the project believed that the advisers of the basis groups also gave the students some tips about learning-to-learn skills, again admitting the problem that this was not organized in any systematic way. When we asked about the use of ICT in the basis groups, he expressed that the basis groups to a large extent communicated via e-mail when they did not work together in real life. Besides, he confirmed that they used the Internet a lot to search for information during project work, even though he contended that some students had problems locating information on the Internet. He agreed that the use of ICT was better integrated into the work in the basis groups than into the other forms of instruction, and especially pointed out that the students in the basis groups taught each other important ICT-related skills. However, he expressed that there might be a problem that students who were highly competent in ICT were used very much by other students who wanted their assistance. Especially, some students seemed to repeatedly ask them for help without showing much willingness to increase their own competence in using ICT. According to the head of the project, some students did not really try to come to grips with the ICT part of the program, with these students also experiencing the greatest problems in their study. He also expressed that the basis groups seemed to work better in relation to projects than in relation to other assignments given in the lectures or seminars.

Finally, we asked the head of the project about the weekly collective meetings, which he himself most often directed. Sometimes these meetings only involved giving information to the students, at other times they involved discussion, for example, about the practice training model and the composition of the basis groups. Especially, he mentioned that there had been much discussion about the evaluation practice, in particular, concerning whether the students could use their laptops when sitting for the final examination. Even though the students did not create the agenda of the collective meetings, they could use the Webboard for commenting on the items of the agenda afterwards and, thus, engage the head

of the project or other instructors in a discussion about those items. In this web based discussion, students who did not rise to speak in the collective meetings also participated by commenting on or expressing themselves about issues raised in those meetings.

7. Discussion

According to the Network Norway Council (2001), "ICT as a factor of change in teacher education" is the most extensive ICT project within general teacher education in Norway. The project gives much emphasis to promoting a high level of student activity and responsibility for the learning process, with problem-based learning and practice-related work supposedly permeating all parts of the study. Moreover, a full scale integration of ICT into the different forms of instruction is seen as an essential tool for effecting such changes in the learning and teaching process.

No doubt, the college has seriously attempted to fulfill the ambitious aims described above. However, much remains to be done. In this section, based on our program evaluation, we briefly discuss some of the most important challenges facing the students, the teachers, and the head of this program.

First, there seemed to be little or no support for students' development of self-regulatory learning skills in the program. For example, the teaching or discussion of learning and study strategies was not systematically integrated into any of the different forms of instruction. Indeed, this is notable given the fact that very much was demanded of the student teachers with respect to this, with the core activity in the program supposed to be student-regulated work in the basis groups, and with elements of student knowledge construction and problem-based learning also supposed to be part of the other forms of instruction. Our survey indicated that the students had not developed sophisticated self-regulatory learning skills on their own. Also, students' development of collaborative learning skills was not systematically supported in the program. For example, this aspect of studying should probably have been targeted more extensively and systematically to ensure that differences between the technological "haves" and "have-nots" did not increase through inappropriate division of work within the basis groups. Likewise, better support for student collaboration might have contributed to more group

55

reflection on and regulation of social interactional processes during project work. Again, this omission is particularly noteworthy in the context of the great demands made on the students in regard to collaborative learning activities in this program. As mentioned earlier, there is no reason to believe that the introduction of an ICT-based learning environment automatically promote students' self-regulatory and collaborative learning skills. To the contrary, those skills probably need to be directly supported for many students if they are to succeed in such an environment. In trying to do this, drawing on the experiences and judgments of program participants seems more profitable than adhering to rigid, prescribed forms of strategy instruction (cf., Duffy, 2002).

Second, our program evaluation indicated that the integration of ICT into the different forms of instruction was not satisfactory. While the students seemed to use ICT as an integral part of their studying in the basis groups, the organization of the lectures and the seminars did not accord well with a full scale implementation of an ICT-based learning environment. For example, not many students seemed to be engaged in Web-based discussion and collaboration about issues raised in the lectures and the seminars, and the instructors apparently did not have enough competence in initiating and facilitating such discussion and collaboration. An additional challenge would thus be the creation of an ICT-based learning environment encompassing all forms of instruction, also implying increased competence among students and instructors in using that environment actively for constructive and collaborative learning.

Third, much of the instruction in the program could still be characterized as teacher-regulated knowledge transmission. Thus, student responsibility for knowledge construction consistent with the concept of problem-based learning was mainly restricted to the basis groups, while more traditional instruction under the indisputable leadership of the college teachers was still very much alive in the lectures and the seminars. The focus on traditional teacher-regulated lecturing and class instruction is part of a long-standing teacher education culture in Norway. In

addition, this form of instruction may be seen by the participants as a kind of guarantee for passing the final examinations in the subjects. However, real changes in the direction of more student-regulated learning require not only attitudinal changes and, possibly, new evaluation practices. Increased competence in using teaching methods that cede control over the learning process from the instructors to the learners themselves is highly needed. No doubt, the aim to integrate student-regulated learning into all forms of instruction still represents a great challenge in this program.

Finally, the different forms of instruction seemed to be too loosely interconnected in this program. This problem is obviously related to the second and the third issue raised above. Thus, the different forms of instruction seemed to be located quite differently on a teacher-regulated--student-regulated continuum, as well as on a continuum representing the extent to which ICT was integrated into the instruction. Moreover, students' problem-based learning and project-oriented work in the basis groups, in a large degree involving the use of ICT, were often weakly related to what was going on in the largely teacher-regulated and ICT-free zones of lectures and seminars.

Of course, one limitation of our program evaluation is that it only covered the first year of the innovation project. Still, it suggests that the program had taken important steps away from the traditional teacher education culture described by Kvalbein (1998). In particular, this was related to the fact that the lion's share of studying was now taking place in the basis groups in the form of problem-based learning and project-related work involving the use of ICT. At the same time, however, this represented a great challenge in terms of providing better support for students' development of self-regulatory and collaborative learning skills. In addition, the activity in the basis groups seemed to represent a life of its own in relation to the rest of the study. It would certainly be in the innovative spirit of this program to involve both students and instructors in constructive collaboration to

try to meet such challenges, not least because this can be seen as an important and authentic part of preparing students for their future work as teachers.

8. Conclusion

At the time we write this report, Norwegian teacher education is once more the subject of heated debate in our society. Norwegian teacher education programs can be characterized by centralization and strong external regulation through the national curriculum. The national curriculum has been seen as an important tool for achieving a common standard for teachers, ensuring that all Norwegian teachers are highly qualified and making certification or licensing of teachers quite easy. However, the institutions offering teacher education have repeatedly claimed that the national curriculum unduly restricts their academic freedom and their opportunities for specialization and development of their own academic profiles. In a recent White Paper, the Ministry of Education and Research Affairs (2002) has therefore recommended that a less comprehensive and detailed national curriculum is developed, giving the individual institutions more flexibility and room for constructing their own programs. At the same time, less central and external regulation of teacher education will increase the opportunities for individual students to shape their own education. Thus, the Ministry of Education and Research Affairs (2002) recommends that the student teachers are given more freedom to choose subjects according to interest and to study subjects in depth rather than in breadth.

Specifically, the most recent plan for reforming the general teacher education in Norway recommends that the compulsory part of the programs is reduced from three to two years. Students will thus be free to choose the content of their study during the third and fourth year, with their choices specializing them for teaching in either primary or lower secondary school. While education, mathematics, Norwegian, and religion and ethics are retained as compulsory subjects in this proposal, the Ministry of Education and Research Affairs (2002) recommends that knowledge about the teaching profession and the teaching of basic reading, writing, and mathematics form new compulsory parts of general

teacher education. Students have to choose subjects taught in school in at least one of the two years. Students who choose to study relatively few subjects in depth primarily qualifies for teaching in lower secondary school, while students who choose to study more subjects in breadth primarily qualifies for teaching in primary school. Moreover, the Ministry presupposes that the pedagogical use of ICT will be integrated into all subjects and requires that increased use of interdisciplinary project work will be part of the new general teacher education.

In summary, then, the very strong external regulation of Norwegian teacher education is probably about to fall during the next several years, leaving more room for individual institutions to develop their own programs and specializing in different subject areas, as well as giving individual students more freedom and responsibility for creating their own teacher education according to interest, motivation, and ability.

Another issue that is currently much discussed in relation to Norwegian teacher education is how to create stronger connections between theoretical study and practical teaching. Teacher education programs are often criticized for not preparing students for the reality they will face in schools after their education, with better preparedness purportedly needed to avoid the so-called "practice-shock" that many young teachers seem to experience. One way to gear teacher education more to the professional needs of the teacher is to improve the cooperation between programs and schools. In particular, the Ministry of Education and Research Affairs (2002) recommends that teacher education institutions make agreements with cooperating practice schools rather than individual teachers. In addition, project work that integrates theoretical studies with student teaching experiences may create closer contact between programs and schools, without limiting this contact to the traditional, compulsory practice periods of students. According to the Ministry, all college teachers in teacher education programs should have responsibility for following up student teachers during practicum. However, the connection between formal study and teaching

practice is not only a matter of quantity. As the American researcher Mary Kennedy has pointed out, most research on student teaching practice has, in fact, noted that the influence of this portion of teacher education may be negative, with this negative influence attributable to the conceptions and practices of cooperating teachers (Kennedy, 1997). It is therefore essential that student teachers are allowed to cooperate with teachers in practice schools where high-quality, conceptual teaching is commonplace (ibid.). Given that teaching practice experiences with ICT are important for the future use of ICT by newly qualified teachers, it is also essential that student teachers are given opportunities to participate and be supported in meaningful integration of ICT in the classroom. However, this is no matter of course, which may be due to the lack of both technological and human resources (cf., Galanouli & McNair, 2001).

To make general teacher education more directed toward schools and professional teaching, the Ministry of Education and Research Affairs (2002) also recommends that knowledge about the teaching profession becomes a compulsory part of all programs. The Ministry explicitly mentions the role of the teacher, management, professional ethics, cooperation between the school and the home, the role of the school in society, and multicultural learning environment as possible themes to include in such a study unit. Whereas the National Union of Teachers has welcomed this proposal about a new compulsory part of general teacher education, it was not approved in a recent parliamentary discussion about reforming Norwegian teacher education.

Finally, the challenge for teacher education that fast technological changes represent is much discussed in Norway. The development of competence in using ICT is generally seen as an essential part of reforming teacher education. On the one hand, ICT in teacher education is seen as an important tool in improving student teachers' learning by contributing to more student-regulated and cooperative approaches to studying. On the other hand, ICT in teacher education should prepare students for the pedagogical use of ICT in schools, for example, by

including opportunities for students to experience net-based teaching and the use of digital educational material. At the same time, the Ministry of Education and Research Affairs (2002) emphasizes that it is important to develop a reflective and critical attitude toward the new technology. To the extent that the Internet is used during instruction, such an attitude becomes especially important because quality control of easily accessible, huge amounts of information is ceded to the students themselves.

There is also an increased emphasis on strengthening teacher competence in using ICT through further education. In a nationwide program starting in 2002, teachers are invited to participate in Internet-based further education concerning the pedagogical use of ICT. This program is planned to be closely related to teaching practice and can be taken in cooperation with other teachers at the workplace. It is also supposed that an increased emphasis on ICT in teacher education programs will make it easier for new teachers to participate in net-based further education during their professional career (Ministry of Education and Research Affairs, 2002).

In conclusion, it should be noted that many of the new directions discussed as part of reforming Norwegian teacher education (e.g., more emphasis on student choice and regulation, increased use of interdisciplinary project work, better integration of ICT into teacher education, and stronger connection between theory and practice), were essential in the innovative teacher education program described in this report. However, our evaluation of that program indicated that such reforms are not easily implemented. While political and administrative efforts to change teacher education may certainly lead to changes on structural and organizational levels, more far-reaching changes in teacher education practice probably require changes in the historically and culturally embedded conceptions of both student teachers and teacher educators. According to Kennedy (1997), those conceptions concern what good learning and teaching are all about, and they are often formed early in life. While there is no reason to believe that such prior

conceptions are easily malleable, it should be a central task for teacher education to bring them more into agreement with current directions in research on learning and teaching.

References

Bereiter, C. & Scardamalia, M. (1996) Rethinking learning. In Olson, D.R. & Torrance, N. (Eds.), Handbook of education and human development: New models of learning, teaching, and schooling (pp. 485-513). Oxford: Blackwell.

Bereiter, C. & Scardamalia, M. (2000) Commentary on part 1: Process and product in problem-based learning (PBL) research. In Evensen, D.H. & Hmelo, C.E. (Eds.), Problem-based learning: A research perspective on learning interactions (pp. 185-195). Mahwah, NJ: Erlbaum.

Boekaerts, M., Pintrich, P.R., & Zeidner, M. (Eds.) (2000) Handbook of self-regulation. San Diego: Academic Press.

Brown, A.L. (1997) Transforming schools into communities of thinking and learning about serious matters. American Psychologist, 52, 399-413.

Bråten, I. (2001) Some preliminary results from the project Self-Regulated Learning and Text Comprehension (SRLTC). Institute for Educational Research, University of Oslo, Norway.

Bråten, I. & Olaussen, B.S. (1998) The learning and study strategies of Norwegian first-year college students. Learning and Individual Differences, 10, 309-327.

Bråten, I. & Olaussen, B.S. (1999) Strategisk læring: Teori og pedagogisk anvendelse [Strategic learning: Theory and educational application]. Oslo: Cappelen Akademisk Forlag.

Bråten, I., Samuelstuen, M.S., & Strømsø, H.I. (in press) Do students' self-efficacy beliefs moderate the effects of performance goals on self-regulatory strategy use? Educational Psychology : An International Journal of Experimental Educational Psychology.

Dillenbourg, P. (1999) What do you mean by "collaborative learning"? In Dillenbourg, P. (Ed.), Collaborative learning: Cognitive and computational approaches (pp. 1-19). Amsterdam: Pergamon.

Duek, J.L.E. (2000) Whose group is it anyway? Equity of student discourse in problem-based learning (PBL). In Evensen, D.H. & Hmelo, C.E. (Eds.), Problem-based learning: A research perspective on learning interactions (pp. 75-108). Mahwah: NJ: Erlbaum.

Duffy, G.G. (2002) The case for direct explanation of strategies. In Block, C.C. & Pressley, M. (Eds.), Comprehension instruction: Research-based best practices (pp. 28-41). New York: The Guilford Press.

Erstad, O. & Frolich, T.H. (2002) Omstillingens utgangspunkt [The starting point for change]. Oslo: ITU, University of Oslo, Norway.

Feilberg, J. (2001) Samarbeid i virtuelle rom [Virtual collaboration]. In Jopp, C. (Ed.), IKT og læring i et humanistisk perspektiv [ICT and learning in a humanistic perspective] (pp. 50-69). Oslo: Cappelen Akademisk Forlag.

Flem, A. (1998, April) Special education in Norway. Paper presented at the Council for Exceptional Children, Minneapolis, MN.

Flem, A. & Keller, C. (2000) Inclusion in Norway: A study of ideology in practice. European Journal of Special Needs Education, 15, 188-205.

Galanouli, D. & McNair, V. (2001) Students' perceptions of ICT-related support in teaching placements. Journal of Computer Assisted Learning, 17, 396-408.

Garrison, D.R., Anderson, T., & Archer, W. (2000) Critical inquiry in a text-based environment: Computer conferencing in higher education. The Internet and Higher Education, 2, 87-105.

Guzdial, M. (1997) Information ecology of collaborations in educational settings: Influence of tool. In Hall, R., Miyake, N., & Enyedy, N. (Eds.), Computer support for collaborative learning (pp. 83-91). Toronto: University of Toronto.

Hartley, K. & Bendixen, L.D. (2001) Educational research in the Internet age: Examining the role of individual characteristics. Educational Researcher, 30 (9), 22-26.

Hmelo, C.E. & Lin, X. (2000) Becoming self-directed learners: Strategy development in problem-based learning. In Evensen, D.H. & Hmelo, C.E. (Eds.), Problem-based learning: A research perspective on learning interactions. Mahwah, NJ: Erlbaum.

Jarvela, S. & Hakkinen, P. (2002) Web-based cases in teaching and learning: The quality of discussions and a stage of perspective taking in asynchronous communication. Interactive Learning Environments, 10, 1-22.

Jonassen, D. & Wang, S. (1993) Acquiring structural knowledge from semantically structured hypertext. Journal of Computer Based Instruction, 20, 1-8.

Kennedy, M.M. (1997, April) Defining an ideal teacher education program. Paper prepared for the National Council for Accreditation of Teacher Education. Available: http://www.msu.edu/~mkennedy/

Koschmmann, T. (1996) Paradigm shifts and instructional technology: An introduction. In Koschmann, T. (Ed.), CSCL: Theory and practice of an emerging paradigm (pp. 1-23). Mahwah, NJ: Erlbaum.

Kvalbein, I.A. (1998) Lærerutdanningskultur og kunnskapsutvikling [The culture of teacher education and the development of knowledge]. Doctoral dissertation, University of Oslo, Norway.

Kvalbein, I.A. (2001) Hvilke muligheter finnes for endringer i lærerutdanning ut fra lærerutdanningens kultur? [What possibilities are there for changing teacher education within the framework of its own culture?] Nordisk Pedagogik, 21, 292-301.

Land, S.M. & Greene, B.A. (2000) Project-based learning with the World Wide Web: A qualitative study of resource integration. Educational Technology Research & Development, 48 (1), 45-68.

Lee, Y. & Lehman, J. (1993) Instructional cueing in hypermedia: A study with active and passive learners. Journal of Educational Multimedia and Hypermedia, 2, 25-37.

Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (1999) Computer supported collaborative learning: A review of research and development. J.H.G.I. Giebers Reports on Education (No 10). Department of Educational Science, University of Nijmegen, The Netherlands.

Lycke, K.H. (1995) Problembasert læring: Dokumenterte effekter og teoretisk forankring [Problem-based learning: Documented effects and theoretical foundation]. Tidsskrift for Den Norske Lægeforening, 115, 718-720.

Lycke, K.H., Strømsø, H.I., & Grøttum, P. (2002) PBL goes ICT: Problem-based learning in face-to-face and distributed groups in medical education at the University of Oslo. Oslo: Institute for Educational Research, University of Oslo, Norway.

Mason, R. & Bacsich, P. (1998) Embedding computer conferencing into university teaching. Computers & Education, 30, 249-258.

Meichenbaum, D. & Biemiller, A. (1998) Nurturing independent learners: Helping students take charge of their learning. Cambridge, MA: Brookline Books.

Midgley, C., Kaplan, A., Middleton, M., Maehr, M.L., Urdan, T., Anderman, L.H., Anderman, E., & Roeser, R. (1998) The development and validation of scales assessing students' achievement goal orientations. Contemporary Educational Psychology, 23, 113-131.

Ministry for Education and Research Affairs (2002) Kvalitetsreformen: Om ny lærerutdanning [The quality reform: About new teacher education]. Oslo: Statens forvaltningstjeneste.

Ministry for Education, Research, and Church Affairs (1999) Rammeplan og forskrift for 4-årig allmennlærerutdanning [National curriculum and regulations for 4-year general teacher education]. Oslo: Norway Network Council.

Ministry of Education, Research, and Church Affairs (2000) IKT i norsk utdanning: Plan for 2000-2003 [ICT in Norwegian education: Plan for 2000-2003]. Oslo: Ministry of Education, Research, and Church Affairs.

Ministry of Education, Research, and Church Affairs (2001a) Gjør din plikt - krev din rett: Kvalitetsreform av høyere utdanning [Do your duty--demand your right: Quality reform of higher education]. Oslo: Statens forvaltningstjeneste.

Ministry of Education, Research, and Church Affairs (2001b) Rapport fra første prosjektår om institusjonenes IKT-satsing i lærerutdanningen [Report from the first project year about the ICT-development of the teacher education institutions]. Oslo: Ministry of Education, Research, and Church Affairs.

Network Norway Council (2001) Evaluering av allmennlærerutdanningen ved fem norske institusjoner [Evaluation of the general teacher education at five Norwegian institutions]. Oslo: Reports from the Network Norway Council.

Norman, G.R. & Schmidt, H.G. (1992) The psychological basis of problem-based learning: A review of the evidence. Academic Medicine, 67, 557-565.

Nulden, U. (2001) e-ducation: Research and practice. Journal of Computer Assisted Learning, 17, 363-375.

Owston, R.D. (1997) The World Wide Web: A technology to enhance teaching and learning? Educational Researcher, 26 (2), 27-33.

Pintrich, P.R., Smith, D.A.F., Garcia, T., & McKeachie, W.J. (1991) A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ). The University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning.

Quale, A. (2000) Second International Technology in Education Study (SITES): Module 1 national report for Norway. Department of Teacher Education and School Development, University of Oslo, Norway.

Repman, J., Willer, H., & Lan, W. (1993) The impact of social context on learning in hypermedia-based instruction. Journal of Educational Multimedia and Hypermedia, 2, 283-298.

Rochelle, J. & Pea, R. (1999) Trajectories from today's WWW to a powerful educational infrastructure. Educational Researcher, 28 (5), 22-25.

Schiefele, U., Krapp, A., Wild, K.P., & Winteler, A. (1993) Der Frageboden zum Studieninteresse [The Inventory of Study Interest]. Diagnostica, 39, 335-351.

Schmidt, H.G. & Moust, J.H.C. (2000) Factors affecting small-group tutorial learning: A review of research. In Evensen, D.H. & Hmelo, C.E. (Eds.), Problem-based learning: A research perspective on learning interactions (pp. 19-52). Mahwah, NJ: Erlbaum.

Schommer, M. (1990) Effects of beliefs about the nature of knowledge on comprehension. Journal of Educational Psychology, 82, 498-504.

Shute, V. (1993) A comparison of learning environments: All that glitters. In Lajoie, S. & Derry, S. (Eds.), Computers as cognitive tools (pp. 47-73). Hillsdale, NJ: Erlbaum.

Soller, A.L. (2001) Supporting social interaction in an intelligent collaborative learning system. Journal of Artificial Intelligence in Education, 12, 40-62.

Statistics Norway (1997) IT in schools 1997. Available: http://odin.dep.no/odinarkiv/

Sundli, L. (2001) Veiledning i lærerutdanningens praksis: Mellom refleksjon og kontroll [Supervision in teacher education practice: Between reflection and control]. Doctoral dissertation, National University of Education, Denmark.

Strømsø, H.I. (2002) IKT-støttet samarbeidslæring i høyere utdanning [ICT-supported collaborative learning in higher education]. UNIPED, No 1, 41-51.

Undheim, J.O. & Nordvik, H. (1992) Socio-economic factors and sex differences in an egalitarian educational system: Academic achievement in 16-year-old Norwegian students. Scandinavian Journal of Educational Research, 36, 87-98.

Undheim, J.O., Nordvik, H., Gustafsson, K., & Undheim, A.M. (1995) Academic achievements of high-ability students in egalitarian education: A study of able 16-year-old students in Norway. Scandinavian Journal of Educational Research, 39, 157-167.

van den Bosch & Bolluyt, J. (2002) The role of hypertext in the writing of group papers. Journal of Computer Assisted Learning, 17, 355-362.

Wathen, S.H. & Resnick, L.B. (1997, March) Collaborative versus individual learning and the role of explanations. Paper presented at the annual meeting of the American Educational Research Association, Chicago.

Weinberger, A., Fischer, F., & Mandl, H. (2001, August) Scripts an scaffolds in problem-based CSCL environments: Fostering participation and transfer. Paper presented at the biennial meeting of the European Association for Research on Learning and Instruction, Fribourg, Switzerland.

Weinstein, C.E., Palmer, D.R., & Schulte, A.C. (1987) LASSI: Learning and Study Strategies Inventory. Clearwater, FL: H & H Publishing.

Windschitl, M. (1998) The WWW and classroom research: What path should we take? Educational Researcher, 27 (1), 28-33.   Winn, W. (1998) Learning in Hyperspace. Human Interface Technology Laboratory, University of Washington, WA.

Zimmerman, B.J. (1994) Dimensions of academic self-regulation: A conceptual framework for education. In Schunk, D.H. & Zimmerman, B.J. (Eds.), Self-regulation of learning and performance: Issues and educational applications (pp. 3-21). Hillsdale, NJ: Erlbaum.

Zimmerman, B.J. (1998) Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In Schunk, D.H. & Zimmerman, B.J. (Eds.), Self-regulated learning: From teaching to self-reflective practice (pp. 1-19). New York: The Guilford Press.

Zimmerman, B.J. (2000) Attaining self-regulation: A social cognitive perspective. In Boekaerts, M., Pintrich, P.R., & Zeidner, M. (Eds.), Handbook of self-regulation (pp. 13-39). San Diego: Academic Press.
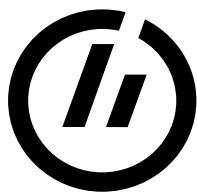
Høgskolen i Østfold

1995:1   Salthe, Gunnar:
Hensikter og prinsipper i omsorgen for mennesker med psykisk utviklingshemming.
ISBN 82-7825-000-6

1995:2   Haaland, Frode H.:
Lederutvikling - læring uten handling. Evaluering av "Program for lederutvikling" i Østfold Fylkeskommune.
ISBN 82-7825-001-4

1995:3   Dybvik, Kjell-Arne:
Psykisk utviklingshemmedes muligheter og begrensninger for sosial integrasjon i nærmiljøet sett på bakgrunn av ansvars-reformens intensjoner.
ISBN 82-7825-004-9

1995:4   Bakke, Nils Arne:
Reconciling Conflicting Principles of Production Planning & Control within Make to Order Companies.
ISBN 82-7825-005-7

1995:5   Bakke, Nils Arne:
Principles of Cost Accounting and the Analysis of Set-up Cost.
ISBN 82-7825-006-5

1995:6   Haaland, Frode H.:
Sakskunnskap, forståelse eller problematisert forståelse? Veiledning som del av et lederutviklingsprogram.
ISBN 82-7825-007-3

1996:1   Billeau, Jacky:
Typologie comparée des migrations de fonction. Regards sur culture d'accueil. Enquête auprès des personnels d'entreprises français en Norvège et norvégiens en France.
ISBN 82-7825-019-7

1996:2   Jacobsen, Karsten:
Competitive Advantage through College-Industry Cooperation in Østfold.
ISBN 82-7825-022-7

1996:3 Ramsdal, Helge:
Kan psykiatrien reformeres innenfra? Evaluering av "Prosjekt psykiatri".
ISBN 82-7825-023-5

1996:4 Lie, Alfred:
Aldersblanding i skolen. Evaluering av aldersblanding som organiseringsmåte ved Kambo skole i Moss.
Av Alfred Lie og Kjell Arne Solli.
ISBN 82-7825-025-1

1996:5 Flaata, Stig:
Humorstrategi og pedagogisk handling.
ISBN 82-7825-029-4

1997:1 Lie, Alfred:
Aldersblanding ved Steinberg skole. Evaluering av et skoleutviklingsprosjekt.
Av Alfred Lie og Kjell Arne Solli.
ISBN 82-7825-031-6

1997:2 Fjellvang, Tormod:
Klasser, lagdeling, konsekvenser.
ISBN 82-7825-032-4

1997:3 Stene, Fridtjov:
Interesse for idrett. Tanker og opplevelser blant skoleungdom.
ISBN 82-7825-033-2

1997:4 Nilsson, Thorbjørn:
Søkelys på lokaldemokratiet. Noen organisasjonsformer i skandinaviske kommuner.
Av Thorbjørn Nilsson, Geir Conrad Tufte og Lars Zanderin.
ISBN 82-7825-034-0

1997:5/Part1 Fryberger, David:
A model for ball lightning.
Part 1 of the proceedings from the "First international workshop on the unidentified atmospheric light phenomena in Hessdalen"
ISBN 82-7825-035-9

1998:1 Lyngmo, Thor Vidar:
Ledelse av sykepleietjenesten i sykehus. En undersøkelse av et utvalg avdelingssykepleieres utøvelse av ledelsesfunksjonen i noen norske sykehus. ISBN 82-7825-042-1

1998:2 Billeau, Jacky:
La France et l'Europe: Choix et nécessité 1945-1957.
ISBN 82-7825-044-8

1998:3   Kristoffersen, Nina Jahren:
Motivasjon og kompetanse – viktigere enn tid og penger for sykepleiere som er veiledere? Et utviklingsarbeid rettet mot kvalitetsutvikling i praksisstudiene i sykepleierutdanningen.
ISBN 82-7825-045-6

1998:4   Rosenberg, Arnljot:
Den nye kommunale særomsorgen for mennesker med psykiske utviklingshemminger. Særomsorgens framvekst og konsekvenser.
ISBN 82-7825-046-4

1998:5   Strand, Erling:
Experimental Methods for studying the Hessdalen-Phenomenon in tlightof the Proposed Theories: a Comparative Overview.
ISBN 82-7825-047-2

1998:6   Dybvik, Kjell-Arne:
Livskvalitet for mennesker med psykisk utviklingshemming.
En sammenligning mellom fire kommuner i forhold til brukernes sosiale relasjoner, bosituasjon og fritidsaktiviteter.
ISBN 82-7825-049-9

1999:1   Sandell, Ove:
Veiledet praktisk læring. En vernepleiefaglig forskningsrapport.
ISBN 82-7825-056-1

1999:2   Fritz, Axel:
Faust - ein deutscher Mythos und ein Stück europäischer Kulturgeschichte. Mit einem Kommentar zu Goethes *Faust I.*
ISBN 82-7825-058-8

1999:3   Solli, Kjell-Arne:
Lederopplæringsbehov. En undersøkelse blant ledere i grunn- og videregående skole i Østfold.
Av Kjell-Arne Solli, Kjeld Qvortrup og Alfred Lie.
ISBN 82-7825-061-8

1999:4   Fritz, Axel:
Zusammenhänge. Politik, Gesellschaft und Kultur in den deutschsprachigen Staaten nach 1945 Mit einer historischen Einführung.
ISBN 82-7825-063-4

2000:1   Avias, André:
Organisation séquentielle du discours économique.
ISBN 82-7825-071-5

2000:2   Solerød, Erling, Tor Hammervold og Steinar Wennevold:
                Studiemiljø og læring.
                ISBN 82-7825-076-6

2000:3   Sandvik, Ninni:
                Når munterhet rommer livets alvor. Fenomenet munterhet blant 1-3-åringer i
                en barnehage.
                ISBN 82-7825-078-2

2000:4   Tufte, Geir:
                Hvordan kommunal eldreomsorg organiseres - spiller det noen rolle?
                ISBN 82-7825-082-0

2000:5   Kolle, Tonje:
                Ordene som ble borte. Et historisk og feministisk perspektiv på Åse Gruda
                Skards bøker om barneoppdragelse.
                ISBN 82-7825-078-9

2000:6   Björk, Eva Lambertsson og Vestli, Elin Nesje (Utg./Hrsg.):
                Stationen - Stationer
                Festschrift für Axel Fritz – Festskrift till Axel Fritz.
                ISBN 82-7825-084-7

2001:1   Fritz, Axel:
                Von Goethe zu Grass.
                ISBN 82-7825-086-3

2001:2   Sandell, Ove:
                Helse og sosialfaglig veiledning: Nye perspektiv på den varme kunnskapen.
                ISBN 82-7825-090-1

2001:3   Eschenbach, Jutta og Schewe, Theo (Hrsg./Eds.)**:**
                Über Grenzen gehen – Kommunikation zwischen Kulturen und Unternehmen
                (Crossing Borders - Communication between Cultures and Companies).
                Festschrift für Ingrid Neumann.
                ISBN 82-7825-092-8

2001:4   Bostrøm, Edgar:
                Informasjonsteknologi i videregående skole – en faglig og didaktisk analyse av
                lærerplanene i faget etter Reform 94.
                ISBN 82-7825-094-4

2002:1   Nilsen, Sigurd Roger og Hansen, Gunnar Vold:
                Økte personalressurser – bedret tjenestetilbud?
                ISBN 82-7825-096-0

2002:2   Christiansen, Kari og Moser, Thomas:
                Sammenhengen mellom motorisk og språklig-kognitivt funksjonsnivå hos 11/12
                åringer.
                ISBN 82-7825-097-9

2002:3 Skærbæk, Eva:
Who cares – Ethical Interaction and Sexual Difference.
ISBN 82-7825-099-5

2003:1 Winther, Rune og Dahll, Gustav
Utvikling og bruk av kritiske programmerbare systemer : en kartlegging av kompetanse og behov i norsk industri.
ISBN 82-7825-111-8

2003:2 Akerjord, Mari-Ann og Rusås, Per-Olav
Mappeevaluering og veiledningsbasert undervisning – hvem tjener og hvem taper? : erfaringer fra dataingeniørstudiet ved Høgskolen i Østfold.
ISBN 82-7825-106-1

2003:3 Ulseth, Brit (coordinator) et al.
From Language Teacher to Teacher of Languages
ISBN 82-7825-109-6

2003:4 Bråten, Ivar, Strømsø, Helge I. and Olaussen, Bodil S.
Self-Regulated learning and the use of Information and communications technology in Norwegian Teacher education : the project ICT as a factor of change in teacher education
ISBN 82-7852-113-4

2003:5 Skærbæk, Eva
Anerkendelse, frihed og faglighed : en forskningsrapport
ISBN 82-7852-121-5

2004:1 Danielsen, Ruth
Reformasjonen i bilder : reformasjonsmaleren Lucas Cranach som didaktiker
ISBN 82-7825-137-1

2004:2 Sandell, Ove
Om faglig veiledning, om ulike perspektiver på læring, om kunnskap
ISBN 82-7825-135-5