Learning and Artefacts

On the Use of Information Technology in Educational Settings

JONAS ALMQVIST
Dissertation presented at Uppsala University to be publicly examined in Sal 101, Odensgatan 8, Uppsala, Friday, May 13, 2005 at 13:15 for the degree of Doctor of Philosophy. The examination will be conducted in Swedish.

Abstract

The aim of this thesis is to develop and apply an empirical approach that can be used in studies of the relationship between different expectations of, and actual use of, information technology in educational settings. The studies focus on meanings of artefacts shaped in people’s talk about and/or use of technology.

The aim is based on the twofold ambition to (1) develop an approach that opens the way for empirical investigations on the usage of technology and (2) to make a contribution to research about computers in education. I show how an approach based on a sociocultural perspective on learning, specified by inspiration from a sociotechnical perspective on artefacts, generates new questions about the usage of technology and its influence on learning and socialisation. Furthermore, I show how discourse analyses, inspired by the writings of Ludwig Wittgenstein, can be used in studies of educational processes.

The thesis consists of five case studies. In the first study I examine the rhetoric on information technology during the years 1994-1998 (Paper I). In the three following cases I analyse video-recorded conversation between children using computers in science education (Papers II-IV). In the light of the results from the first four studies I return in the fifth to the rhetoric on technology. In that paper different expectations on the usage of technology in education and on the technology users, expressed in the curricula for the Swedish compulsory school during the years 1962-1998, are clarified and discussed (Paper V).

The results of the thesis show that expectations are central parts of human action and that different expectations may result in different kinds of practices. The historical studies show that it is in no way obvious for what purposes artefacts are to be used in educational settings, or who is to decide on this issue.

Keywords: information technology, computer, education, learning, discourse analysis, socialisation

Jonas Almqvist, Department of Education, Box 2109, Uppsala University, SE-75002 Uppsala, Sweden

© Jonas Almqvist 2005

ISBN 91-554-6228-6
urn:nbn:se:uu:diva-5758 (http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-5758)
To Annika, Sofia and Christoffer
List of papers

I  Almqvist, Jonas (1998). Vi och våra goda kunskaper – om (natur)vetenskaplig rationalitet och talet om IT i undervisningen [We and our good knowledge – on scientific rationality and the talk about IT in education]. *Utbildning och demokrati*, 7(3), 61-76.


IV  Almqvist, Jonas & Östman, Leif (In progress). To doubt or not to doubt. On the use of information technology in science education.

V  Almqvist, Jonas (Submitted). Teknikretorik i utbildningspolitik – en historisk fallstudie [Rhetoric of technology in educational politics – a historical case study].
Contents

Acknowledgments........................................................................................................... 9
Introduction.................................................................................................................. 11
  Aim.......................................................................................................................... 12
  The organisation of the text .................................................................................. 13
  The meaning of artefacts ....................................................................................... 14
  Previous research ................................................................................................. 15
Technology in action..................................................................................................... 19
  A sociocultural perspective on learning ............................................................... 19
  A sociotechnical perspective on artefacts ............................................................. 22
  Implications for the empirical studies .................................................................. 24
Methodology.................................................................................................................. 24
  Rules in action ........................................................................................................ 26
  Habits, customs and intentions ............................................................................. 27
Situations and texts...................................................................................................... 30
  Situations ................................................................................................................ 31
  Texts ......................................................................................................................... 32
Summary ...................................................................................................................... 33
Results and discussion ............................................................................................... 34
  We and our good knowledge (Paper I) ................................................................ 34
  Technology and education .................................................................................... 34
  Expected use of technology .................................................................................. 36
  Conclusions from Paper I ..................................................................................... 36
  New questions ........................................................................................................ 37
Three cases of information technology usage in educational settings
(Papers II-IV) ................................................................................................................. 38
  Introduction .............................................................................................................. 38
  Images of the Internet (Paper II) ........................................................................... 38
  Education and/or entertainment (Paper III) ........................................................... 41
  To doubt or not to doubt (Paper IV) ..................................................................... 46
  Conclusions from the three classroom studies and new questions ..................... 49
Rhetoric of technology in educational politics – a historical case study
(Paper V) ...................................................................................................................... 49
  Introduction .............................................................................................................. 49
Findings .................................................................50
Conclusions and discussion of the historical case study ..........53
General discussion and future perspectives ..........................55
Using artefacts ...........................................................55
Habits, customs and intentions ...........................................56
On the question of implementation .....................................58
Learning and socialisation ...............................................58
On the confusion .........................................................60
Methodological considerations .........................................61
Future perspectives ......................................................62
References ........................................................................63
Acknowledgments

Many people have inspired me in my work with this thesis. Some of them are mentioned in the list of references. Others, however, have meant much more than is visible in the text. In the following I would like to express my sincere gratitude for their interest and support:

First of all I want to thank my supervisor Leif Östman. We have worked together rather closely for the last years and I want to thank you for your support and confidence in me, for letting me go my own ways and for encouraging me to keep on working when some of those ways appeared to be detours. Ulla Riis, my co-supervisor, I am grateful for your support and for your contribution with knowledge in the intersection of educational research and sociotechnical perspectives. Thanks are also due to Tomas Englund, my first supervisor, who gave me the best start on postgraduate studies one can ever wish for.

I have written my thesis within the Lärnot-project and I would like to recognise the contributions made by my colleagues Malena Lidar and Eva Lundqvist. We have spent a lot of time together during the last six years recording, discussing, writing, traveling and drinking coffee. Thank you both for making the Lärnot-project a good place to work in. I would also like to express my sincere gratitude to all the teachers and pupils who have let us record their educational settings. The project, and hence my thesis, has been financed by The Björn Svedberg Foundation for Science and Technology. Thank you!

Anders Wello Westlin, my friend and colleague, thank you for your support and interest in my work. I have very much appreciated the discussions we have had and to write together with you.

During my time as a PhD student I have been fortunate to get opportunities to take part in various research groups and networks. In those I have met persons who have commented on early drafts on my texts and who have learned me very much. First, I want to thank the research group SMED (Studies of Meaning-making in Educational Discourses): Thank you Karin Andersson, David Kronlid, Mikael Quennerstede, Karin Rudsberg, Margareta Svennbeck, Marie Ohman, and Johan Ohman, you have all meant much to me during the last couple of years. Second, I want to thank all the members in Enheten för didaktik, and especially mention Karin Hjälmeskog, Niclas Månsson, Carl-Anders Säfström and Ulrika Tomberg. Third, I would
like to express my sincere gratitude to all the members in NSKS, (National Network for Sociocultural Studies) and in SOC-INN. Thank you all!

I am also sincerely grateful for comments made by Fritjof Sahlström, Jörgen Nissen and Lars Ingelstam on earlier drafts of this thesis. Furthermore, I would like to thank Ulf P. Lundgren for valuable questions and encouragement in the final stage of my writing process.

Special thanks goes to friends and colleagues at the department of teacher education. I would like to thank you all for comments and discussions and for contributing with interest and support, for your friendly smiles and our good times together. Åke Persson, I am grateful for technical support on computers and video-recording equipment.

I also want to thank teachers and colleagues at the department of education. I have very much appreciated to be one of the PhD-students at the department, and to take part in various courses and seminars. Ingegerd Öfverstedt, I am grateful for your help with all the formal PhD-student matters.

My mother Barbro Norbelie and her husband Bertil have given me valuable assistance, support, critique and encouragement. Your generous contributions to this thesis have made it better than it would have been otherwise. Thank you!

Barbara Rosborg, thank you for expert help with the English texts.

Catarina Svennilson and Josefin Lundstedt, my dear sisters, thank you for good old times and for days to come. My mother in law Christina Höddelius, thank you for your love, support and assistance. Kristina and my sisters Johanna and Caroline Almqvist, thank you for support and for lending us your summer cottage, where parts of this text have been created.

And to all my dear friends, I am grateful for our valuable breaks from work.

My deepest gratitude, however, goes to my family: My wife Annika, this thesis would not have existed without your love, patience, humor and encouragement. Our children, Sofia and Christoffer, I want to thank you both for your curiosity, love and expectations on me as a family member. You have given me rich and valuable opportunities to participate in completely different kinds of actions than writing a thesis.
Introduction

In educational settings, teachers and pupils use artefacts on a daily basis, many of which form their actions in the classroom. In the course of history some of these technologies, like blackboards, desks and chalks, have remained the same, while others have now been discarded. New artefacts in educational settings have emerged and are still being developed. In the Swedish educational system of today for instance great investments are being made to implement and develop the use of information technology in education.

The nature of the relationship between artefacts and human action, however, is rather confusing. On the one hand, it is possible to emphasise that technology determines action, underlining that many ways of acting would be entirely impossible without the use of artefacts. On the other hand, it is possible to emphasise the notion that different agents and social groups, including users, have different expectations of, and intentions for, the use of technology, thereby shaping its meaning through their attitude and actions.

This confusion grows even greater when the relationship between technology and human beings is discussed in terms of values and norms. People often make normative statements about the need to do one thing or another with the help of technology. Technology is expected, on the one hand, to change the educational system by adapting it to technological development. Opponents to this argue, on the other hand, that technology is simply a “natural tool” being used in education in the same way as other natural tools before it. A third group expresses warnings against the influences of technology on people’s lives. This thesis relates to this issue. The overall objective is to discuss the relationship between the use of technology in classrooms and different expectations on the effect it can have on action and learning.

To be able to find a way of avoiding this confusion I will develop and illustrate a methodological approach that can be used in studies on the relationship between what is expected of technology and the actual use of it. My approach is based on a sociocultural perspective, influenced by a sociotechnical perspective on artefacts and inspired specifically by the writings of Ludwig Wittgenstein.
Aim

The specific aim of this thesis is to develop and apply an empirical approach that can be used in studies of the relationship between different expectations of, and the actual use of, information technology in educational settings.

The aim is based on a twofold ambition: first, to develop an approach that opens the way for empirical investigations on the issue of technology usage in actual settings and its role in learning processes, and second to make a contribution to research about information technology in education. This is done in five case studies: three case studies of the usage of information technology in educational settings (Papers II, III and IV), and two case studies of different expectations as expressed in the governmental rhetoric on the issue of technology in educational settings (Papers I and V). A guiding theme for all of these studies has been the attempt to develop an approach that can be applied in empirical studies of the relationship between expectations and actual usage, without assuming beforehand that technology “itself” – or any other factor – determines the use of the artefact. Hence, the focus in this thesis is on technology in use in specific practices.

All of the case studies are presented in the form of stories about the usage of technology in educational settings. Each of them can be read separately. However, there is a relationship among the cases. Although the empirical examples are close studies of action they all handle the relationship between expectations and actual use.

Paper I examines the rhetoric of information technology during the years 1994-1998. It is shown that this rhetoric was based mainly on assumptions of instrumental rationality, technological optimism and determinism and a constructivist view on learning. The paper’s main role in the thesis is to give an introductory picture of the rhetoric of information technology and to pose new questions on how to understand the meaning of technology in use and its relationship to learning and socialisation.

Since people have different expectations on the use of technology, the question of the meaning of technology is a central part of human action. Actions performed in actual use are not pre-determined by the use of the artefact in an uncomplicated way. This is obvious in the conversations of pupils using information technology as shown in Papers II, III and IV. The meaning of technology was different from that which was expected. In Paper II the aim was to develop and illustrate an approach that would make it possible to understand how the pupils constitute images of the Internet while using it in an educational setting. The results are discussed in relation to education and democracy. The aim of the study presented in Paper III was to analyse how meanings of information technology are constituted in a teaching aid and its application. The results are discussed in relation to questions about learning and socialisation. In the last of the classroom
studies, which is presented in Paper IV, we show how Wittgenstein’s method can be used to analyse privileging processes in situ.

In Paper V different expectations on the usage of technology in education and on the technology users, expressed in the curricula for the Swedish compulsory school during the years 1962-1998, are clarified and discussed.

The organisation of the text

The research problem, aim and some of the most central concepts used in the thesis are introduced in the first sections of the Introduction. In the section “Previous research”, I will begin my argument for the need to develop an empirical approach that can be used in studies of the relationship between the expected and the actual use in order to understand the use of information technology and its importance for action and learning.

In the second part of the thesis, Technology in action, the theoretical framework for the studies is presented. In the section “Methodology” I will further develop the approach, with inspiration from Wittgenstein. In the section “Situations and texts” I will describe and discuss my selection of the empirical material used in the studies. It is important to note that the approach is a result of the empirical studies and not a ready-made framework applied to the empirical material. Hence, the content of the introductory part of the thesis can be seen as a summary and discussion of the introductory parts of the five papers.

In the third part, Results and discussion, I will summarise and discuss the empirical results in the five papers. This part is divided into four sections. The first section consists of a summary of Paper I. In the second one, called “New questions”, the implications of the results of the first paper for the understanding of technology in action are discussed. The third consists of summaries of the three classroom studies and ends with conclusions and implications. In the fourth I discuss Paper V.

The fourth part of the thesis, General discussion and future perspectives, consists of a general discussion of my results and some ideas for further research. The main point that is made in this section is that expectations of the use of artefacts are central parts of human action, but that they in no simple way determine how the artefacts are actually used. This, however, is not to be confused with the fact that some ways of using technology can be taken for granted, they are used as may be expected, and seem to be totally obvious. Furthermore, I will outline some implications for further research on the use of artefacts and their role in human action and learning, and also discuss implications for the issue of developing and designing tools for educational purposes.
The meaning of artefacts

In this thesis I will discuss the issue of meanings of artefacts in educational settings. Before going into the descriptions and analyses of my studies, I will try to explain what I mean by the expression “meanings of artefact”.

Think of a table. Most people will probably think of a board on four legs. Think of a coffee table, a dinner table or a meeting table and you can probably picture a special kind of board on four legs. The differences among them are not only the design. There are also differences in how they are expected to be used. Around the dinner table people gather to eat, while the meeting table is used for discussions, negotiations and decisions.

The differences between expectations of – and the actual use of – artefacts are central to my argument in this thesis. When we sit down at the dinner table, we do not expect it to fall apart, we use it as we are used to, even though our expectations on the construction of the table will probably not be articulated, at least not explicitly. When we use an artefact in everyday practice, in most cases we do not doubt that it will work as we expect it to. We have, through earlier experiences, formed a habit of using it in a special way. This use constitutes the meaning of the artefact in the specific situation. However, the way of acting with technology is not obvious or given beforehand by technology itself or any other determinant. It is something we have learned to do.

The notion that the meaning of the artefact is constituted in action does not imply that it is possible to do whatever we want to do with it, though. Dancing on a dinner table is physically possible, but in most situations it would seem like a strange thing to do. And so would activities like sleeping and playing football on the table do too. Hence, how the artefact is expected to be used is socially constituted. If I started dancing on the table during an important meeting, the other participants would probably think that I was stupid, ignorant or uneducated. Consequently, certain customs of use are more legitimate than others.

Turning the coffee table upside down may turn it into a spaceship, a boat, a stable or a car in children’s games. In one sense it would still be a physical object called a coffee table. For example, parents could say, “don’t play with the coffee table”. But in another sense it would not be a coffee table. From another perspective it would certainly be a spaceship, a boat, a stable or a car. In fact, this is a central notion about artefacts: that they can be used for different purposes in different situations. If we intend to use the coffee table in a certain way, as a spaceship for example, the meaning of the coffee table will also be changed. A slightly less dramatic example: we can use the meeting table for dining purposes (and vice versa). In a sense it would still

1 An artefact is a human-made object. I will also use the terms tool and technology to signify the same thing.
be a meeting table, but in using it to put food and drinks on, it gets a different meaning than if it were used in a meeting.

Hence, the use of an artefact in a specific way, in a specific situation, constitutes its meaning for the participants. In the perspective developed and used here, this is true for the use of tables, but it is also true for other kinds of artefacts – for example, information technology. The meaning of an artefact is, in this perspective, not always simply an instrumental tool with a predetermined use. It is a much more complex issue of possible meanings constituted by the users’ habits and intentions and the customary use in specific situations.

Previous research

The issue of the usage of information technology in educational settings has increasingly attracted attention in current research and debate during the last few decades. However, the problem dealt with in this thesis has, to my knowledge, not yet been dealt with in educational research. In this section I will give a brief outline of the research done in the field.

There are several studies about the expectations of information technology. Some of those stress that the development of information technology changes society into an information society or a network society (Castells, 1996:41; Echeverria Ezponda, 1998). Others focus on the new opportunities for communication, social life and identity formation made possible by the new technology (Søby, 1998). Some claim that educational practices must be changed now that we have access to a new society and a new technology (Russell, 2000; Dede, 2000).

A basic assumption in all these studies is that technology determines action and that it thereby forces individual, sociocultural and educational development in certain directions. Papert (1994:27), one of the most distinguished researchers in the field, stresses that the development of the new computer technologies requires us to rethink what sorts of knowledge and ways of learning the school system should offer its pupils.

Others warn of the negative consequences that are built into the computer (Bromley & Apple, 1998; Moore, 1996). Bromley (1998:13), for instance,
points out that certain people with specific interests design the technology, and that this makes some groups benefit from using computers more than others. Most often researchers in this line of work emphasise the possibilities for teachers and other users to resist the expected use and to find alternative ways of using them. They emphasise the potential to shape context in such a way that the negative side of computers and IT, and its influence on action and learning, can be avoided (e.g. Bromley, 1998; Apple & Jungck, 1998; Kahn & Friedman, 1998; Nissenbaum & Walker, 1998).

Consequently, users can resist using technology in the way it was expected to be used. Technologies can be used in other ways. An extreme version of this, of course, is to not use it at all. And this is also often the case. In spite of the investments that have been made in implementing information technology in education it has not yet been used as was expected. Thus, there is often a split between how the technology was designed to be used and how it is actually being used in the context of education (Cuban, 1986; Jedeskog, 2000). Furthermore, technology can mean different things for different individuals and groups (Bryson & Castell, 1998; Huber & Schofield, 1998; Johnson, 1991; Light et al. 2000; Underwood, Underwood & Wood, 2000) and at different times of history (Ilshammar, 1998; Johansson, 1997).

With the notion of various views on information technology in education as a point of departure, Dev & Walker (1999) involved teachers, the potential users, in the design of a digital educational resource. Initially, they wanted to develop a digital resource for biology education by creating a virtual frog that students could dissect on the computer. In the end, after taking the users’ opinions into account, the game was entirely different. It consisted of a virtual world, “Frog Island”, where the user could learn about the lives of frogs in various settings. From my point of view this is an interesting approach since it shows how different agents – including the users – can get involved in designing resources for educational purposes.

Once information technology has been installed in the classroom new issues arise. The actual use of information technology in educational settings, with the purpose of both developing and evaluating new educational methods, is one such issue that has been dealt with by scholars (Roth, 1996; 1997; Stigmar, 2002; Kelly & Crawford, 1996), as well as that of describing the use from an ethnomethodological approach (Schofield, 1995; Enochsson, 2001). In a study on the interaction of children who try to solve problems in front of the computer, Fitzpatrick & Hardman (2000) show that the interaction is shaped by whom they work with. Children were divided into

---

3 See also van Lieshout et al. (2001). Riis et al. (1997); Riis (2000) and Nissen (2002) stress the importance of a top-down and a bottom-up perspective simultaneously when implementing new technology in schools.

4 See also Littleton & Light, (1999); Resnick, Pontecorvo & Säljö (1997); Bliss, Säljö & Light (1999) and Säljö & Linderoth (2002).
three different groups: boys working with boys, girls with girls and mixed
gender pairs. In most cases they did not find any significant differences
among the groups. However, when interaction breaks down, boys in mixed
gender pairs tend to take control of the use of the computer. This means,
among other things, that technology in itself does not in a simple way
determine action. When we try to understand the use of artefacts, it is
important to consider other factors such as who works with whom. Ljung-
Djärf, (2004) shows how the different expectations of and visions about
information technology differ in essential ways from how it is actually used
in pre-school education. She stresses that the culture of pre-school, and the
different rationalities it is based on, shape the use of computers. In other
words, everyday practice shapes the use of information technology.

Very few studies, however, highlight the fact that different people with
different expectations may influence the use of information technology.
Expectations and actual use are often separated. In a study of the
development of word processing and its importance for human action,
Grossen & Pochon (1997) relate to theories from the psychology of
cognitive development and ethnotechnology. They stress that the design of
word processors is a result of the interaction as well as competition between
different designers and the intentions and expectations of the users. The
result emanates from a complex relationship between competing groups of
people, which leads to great implications for the use of the programmes.
Grossen & Pochon stress that the interaction between human and machine is
characterised by an indirect dialogue between users and designers in an
interactional space:

Thus, when someone uses a computer, he or she is confronted not just with a
piece of technology but also with the assumptions of other individuals
(Grossen & Pochon, 1997:272).

According to the authors, users of word processors enter this interactional
space that is shaped by a dialogue between the user and the people who have
developed this tool. This interaction shares many characteristics with
ordinary dialogue – ambiguity, conflict, negotiation and so on – that has
great implications for the understanding of information technology’s
importance as an educational resource. In their study, Grossen & Pochon
outlined a theoretical framework for studies of learning in relation to issues
of interaction between man and machine, and have been an important source of inspiration for my work.\footnote{Grossen & Pochon build their argument on a social constructivist view on learning, referring both to Piaget and to Vygotsky. This is, however, a line that I have chosen not to follow. In the section Methodology below, I will show how Wittgenstein’s work can be used for understanding learning in practice. In so doing I follow the notion of Wickman & Östman (2002a, 2002b) that the writings of Wittgenstein can be used to study meaning-making \emph{in action} without losing sight of individual continuity.}

Most of the studies referred to in this thesis do not explicitly deal with the issue of the relationship between what is expected of information technology and its actual use. They either focus on the expectations on the use without considering the actual use of technology, or they focus on the actual use without considering the question of different expectations. If they do focus on the relationship, it is to emphasise that there is no relationship at all. In other words, the confusion remains. This does not, of course, mean that the researchers referred to here are confused, or that their contributions do not give answers to essential questions. My point is that the matter of technology and human action as such is confusing. Inspired by the approach developed by Grossen & Pochon (1997), I will show how a sociocultural perspective on learning, combined with and specified by a sociotechnical perspective on artefacts and the work of Ludwig Wittgenstein, can be used to study this relationship. It is not my intention to make any synthesis or to launch a new theory out of the combination of the different research traditions. I want to combine them, with the purpose of being able to pose new empirical questions and thereby contribute to the understanding of technology usage in educational settings.
A sociocultural perspective on learning

The concept of artefact is central within the sociocultural perspective on learning. The use of tools is an important part of human learning since participation in most practices involves using technology in certain ways. Furthermore, the artefacts used in educational settings are developed by others, often for purposes other than learning, and contribute to the shaping of the sociocultural context of education.

The usage of tools allows us to do things that would not be possible to do otherwise (Wertsch, 1991, 1998; Säljö, 1996, 1999; Ivarsson 2004). Think of information technology, for example. With access to a computer connected to the Internet you are, if you have learned to use it, able to create, store, manipulate and communicate large amounts of information. Over the course of history various artefacts have been used for those purposes. The computer is, in a sense, only the latest in a long line of technologies, including paper and pencils, telephones and so on, used for information and communication (Säljö, 1999).

However, even though the artefacts are often stressed to be social constructions made by different people in different times of history, approaches within the sociocultural perspective on learning sometimes tend to emphasise that the use of artefacts shapes action. It would also be possible to emphasise the opposite position, namely that human interactions shape the use of artefacts. To avoid falling into one or the other of those opposite positions, I want to make the question of what determines what into an empirical one. In this section I will start with a brief outline of different assumptions about the relationship between the individual, the sociocultural and technology.

In a sociocultural perspective on learning the focus is on the study of the relationship between thinking and speech and between individual learning and sociocultural context. Learning, it is argued, can be defined as the

---

8 It is more appropriate to talk about sociocultural perspectives (in plural), since different sociocultural approaches to learning are based on different theoretical traditions. Most of them, however, relate to the writings of Vygotsky (1934/86, 1978) and/or American
process in which human beings appropriate ways of acting that enable them to participate in different verbal (and other) practices (Chaiklin & Lave, 1996). Even though the questions on the relationship between the sociocultural and the individual are answered somewhat differently in different theoretical traditions within this perspective, they all share some assumptions about the study of human development. The most obvious one is the assumption of the social nature of thinking and learning. What we think is not constructed in our brain alone, but has its origin in our communication with others: “Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level” (Vygotsky, 1978:57). Learning, in this perspective, always stems from social interaction.

In order to analyse individual learning from a sociocultural perspective, one needs to go beyond the distinction often made in psychological studies between the individual and society (Vygotsky 1934/86). Wertsch (1998) uses the concept “mediated action” to do so. He argues that the use of artefacts, intellectual or physical, shapes human actions in essential ways, and that these artefacts, shaped in social processes, also bring cultural aspects into the situations in which they are being used. The relationship between action and socioculturally shaped artefacts lies at the heart of the sociocultural perspective:

The task of a sociocultural approach is to explicate the relationships between human action, on the one hand, and the cultural, institutional, and historical contexts in which this action occurs, on the other (Wertsch, 1998:24, emphasis in original).

The term artefact, in this respect, can be applied to a number of phenomena, from written language (Luria, 1976) to algorithms and pole vaulting (Wertsch, 1998). Let me give an example of how artefacts can influence human action in this perspective. Schoultz, Säljö & Wyndham (2001) show that children’s understanding of the form of the earth and of gravity depends on whether or not they have access to a globe. If they had access to a globe, the phenomenon of people living on the other side of the world, “down
under”, was not especially problematic for the children. Without the globe, however, it was much more difficult to talk about the shape of the earth. Here, according to the authors, the globe functions as an aid for children’s thoughts about the earth, gravity and so on.

However, we can turn this the other way and emphasise the notion that action shapes the meaning of artefacts. Different actions shape artefacts differently depending on the different goals for the action. There are possibilities of using the same artefact for various reasons (Wertsch, 1998, chapter 2). For example, we can imagine a situation where the globe was used as a football that the children and researchers used in a football game on the table. It would also have been possible for the children to question the shape of the globe in the first place. This means that human action is not always determined by access to artefacts.

Consequently, my confusion remains. From a sociocultural perspective one can emphasise that artefacts shape action in essential ways. Conversely, we can stress that action and peoples’ intentions shape the use of artefacts.12 A third possibility, however, is to emphasise the process of meaning-making and learning in specific practices. From this point of departure, the possible influence of artefacts, and the possible influence of human action, are seen as two aspects of the same practice. In this perspective the question of whether or not technology determines action becomes an empirical question. Wertsch et al. formulates this position like this:

/…/ mediation is best thought of as a process involving the potential of cultural tools to shape action, on the one hand, and the unique use of these tools, on the other (Wertsch et al. 1995:22, emphasis in original).

I will focus on this process when further developing my approach. The use of artefacts is an important part of human action and learning. In educational settings the users of technology use tools shaped by others in other settings and often for completely different purposes. Hence, the users are relevant actors in the process of shaping the meaning of artefacts.

Since artefacts will be used in certain ways and not in others, the focus on the mediation process raises additional questions on who is to decide how artefacts will be used and by whom. To handle such questions I turn in the next section to a sociotechnical perspective on artefacts. My purpose with this is to specify the concept artefact and to relate it to questions about learning and socialisation.

---

12 On the issue of using language as a mediational tool, Wertsch (1998:56) says that “On the one hand, then, agents must appropriate the words of others whenever they wish to speak /…/ On the other hand, agents have in their power a range of possibilities for how these words will be appropriated, a range extending from actively embracing to strongly resisting them”.

21
A sociotechnical perspective on artefacts

Sociotechnical perspectives on artefacts emphasise the social nature of technology. From a sociotechnical perspective, the development of technology is shaped in a struggle between different social groups with different intentions.\textsuperscript{13} I will follow this line of approaches. In so doing I relate to research in the field often called STS (Science, Technology and Society), which is a comprehensive term for a whole range of different theoretical traditions studying technology within various scientific disciplines.

The relationship between technology, society and the individual has increasingly attracted attention over the last few decades in disciplines like history and sociology.\textsuperscript{14} A range of theoretical traditions has emerged. Here I will follow one of these traditions, namely the \textit{social construction of technology} (Bijker, 1995; Kline & Pinch, 1999). This line of approach opens the way for studies focusing on the differences between social groups and parallel meanings of technology (Feenberg, 1999; Summerton, 1998). Since my focus in this thesis is on identifying and discussing different expectations on, and ways of, using technology, this tradition is the most appropriate one to follow. Technology does not, in this perspective, get its final shape until the struggle between the different social forces is decided, a condition called technological \textit{closure}.\textsuperscript{15} This means that there is no such thing as “technology as it is”:

The idea of a “pure” technology is nonsense. Technologies always embody compromise. /…/ And, it also follows, they might have been otherwise (Bijker & Law, 1994, s. 3).

The notion of technology as social constructed leaves space for the possibility of examining the human relationship to technological changes without predefined and general laws for change (Summerton, 1998). I will stress that this focus on different meanings of technology, and divergent opinions about them makes it possible to scrutinise technology in action. To

\textsuperscript{13} Bijker uses the concept of the interpretative flexibility of technology to emphasise the notion that technology can mean different things for different social groups and in different times in history (Bijker, 1995:73-77). Winner (1980) emphasises that certain groups will dominate the shaping of technology and that the design of artefacts, thereby, is a political question.

\textsuperscript{14} For an introduction to the field, see Bijker, Hughes & Pinch (1987); Bijker & Law (1994) and MacKenzie & Wajcman (1999). For a short, but informative, introduction in Swedish, see Summerton (1998). The relationship between technology and society is, however, not a new question. Marx, Mumford and Heidegger, for example, have discussed it. For an extended discussion, see Feenberg (1991, 1995, 1999) and Dobres (2000).

\textsuperscript{15} “Closure, in the analysis of technology, means that the interpretative flexibility of an artifact diminishes. Consensus among the different relevant social groups about the dominant meaning of an artifact emerges and the ‘pluralism of artifacts’ decreases” (Bijker, 1995:86).
be able to study technology in action, however, two limits in this perspective must be overcome. First, although the research has its focus on interpretive flexibility, and thereby different social groups’ views on technology, the products of the research exclude the possibility of different and parallel meanings: the notion of closure often tends to be too rigid (Kline & Pinch, 1999:114). Second, and of great importance here, there is a limit that can be seen as a special case of the first, namely the exclusion of the users: there are very few studies on how meanings are being constituted in actual use. This is especially the case when it comes to the use of technology in educational settings.\textsuperscript{16} While studying technology with a focus on the question of large systems or issues concerning innovation, diffusion and final closure of technological design and use, one might miss how artefacts are actually being used in practice (cf. Latour, 1994).

The concept of closure is, thus, rather problematic from my point of view, since it points to a final meaning of technology. It leads to an emphasis on certain meanings of technology, while others will be excluded. My point, however, is that to be able to understand the use of technology in action it is necessary to open the black box of technology again and again and to make its meaning into an empirical question.

When children have learned certain ways of acting, like sitting by and not dancing on a table, we may say that they have been socialised to act in a certain manner (cf. Bloor, 1997:47). The use of technology in a certain practise may, however, differ in essential ways from the customary use and give it entirely new meaning. Thus, the questioning of the concept of closure has great implications for understanding the issue of socialisation: the users’ habits of using technology and their intentions with their practices may differ from what they are expected to do, and it may differ from the use for which technology was designed.

This leads to questions about the users’ possibilities to contribute to the shaping of technology. On the one hand they may be expected to use technology in a certain predefined way. On the other hand, they may be expected to take part in decisions about how and if technology should be used. Assumptions about technology coming in from outside determining action or, conversely, that human action determines the meaning of artefacts are both rather naïve. The use of technology is a much more central and complex part of everyday life (Feenberg, 1999). A focus on the process of using artefacts in educational settings opens the way for studies of the usage of technology beyond assumptions about determinism and essentialism.

\textsuperscript{16} See, however, the section \textit{Previous research} above.
Implications for the empirical studies

Meanings of artefacts are, from a sociotechnical perspective, not something given beforehand but shaped in a struggle among different groups (including the users) involved in shaping it. A sociotechnical perspective on artefacts enables us to identify different meanings of technology and to reveal the struggle between them. Furthermore, it makes it possible to discuss questions about who is expected to decide whether or not and for what purposes artefacts ought to be used in educational settings in the first place.

In a sociocultural perspective on learning, artefacts shape human action in essential ways. Access to different technological items, for example, makes it possible for humans to do things they would not have been able to do without them. Hence, learning to use technology in certain ways is a central part of education. The meanings of technology in educational settings are, however, in the sociotechnical perspective developed and used here, not necessarily given beforehand, but constituted in actual use.

My problem, thus, can be formulated like this: we have no possibilities to tell in advance whether or not technology determines action. Likewise, we do not have the possibilities to tell if people can decide entirely by themselves. Therefore, in an empirical study of technology in action it is necessary to focus on the processes where technology is being used. This can be done if we emphasise the notion of the multiple meanings of artefacts and of multiple expectations on the use of technology in practice.

I will concentrate my study on these processes. This means that the relationship between action and technology will not be treated as a relationship between two separate entities influencing each other, but as a whole constituted in actual situations. Hence, it would be more accurate to talk about individuals-acting-with-artefacts-in-educational-settings, but for practical reasons I will write “use of artefacts” and similar formulations in this text. To be able to study this problem empirically I turn to discourse analytic approaches, especially to those inspired by the writings of Wittgenstein.

Methodology

My central source of inspiration is Ludwig Wittgenstein (1953/2001, 1958, 1969). In my reading of his work I tried to follow his recommendation to avoid constructing general theoretical views on human action, and instead to develop methods that can be used to solve problems about language, practice, the individual, the social and so on (cf. Pleasants, 1999). Furthermore, I will develop an approach that can be used for understanding the use of information technology beyond assumptions of essentialism and
determinism. This means, for example, that I treat the relationship between expected and actual use as an empirical question.

A preliminary definition of the concept discourse, proposed by Marianne Jørgensen and Louise Phillips, is “a particular way of talking about and understanding the world (or an aspect of the world)” (Jørgensen & Phillips 2002:2, emphasis in original). When a person learns to talk about and to use technology in a specific way he or she is socialised into a certain discourse. However, since this definition does not say anything about how, where or by whom discourses are constituted it must be further specified. I chose to do so with inspiration from Wittgenstein.

The meaning of a word, according to Wittgenstein, is constituted in its use within a certain practice, a language game. Different practices, thereby, shape different meanings of the same word (Wittgenstein, 1969, §65). Meaning is constituted in action. Wittgenstein (1953/2001, §108) makes an analogy between a word and a chess piece. The rules for using words or chess pieces are constituted in the practice and not in an absolute and general way. Using the chess piece, the king for example, in a game other than chess would give it another meaning. It could be used in a game where it would be allowed to go more than one step in a move and where the game would not end if another piece were placed on the same spot as the king. In a sense it would still be a chess piece. One of the players could, for example, ask, “Why did you move your king?” In another sense, however, it would not be a chess piece at all, since its function would be completely different in this game than in the game of chess.

One of Wittgenstein’s main points is that the meaning of a word does not come into practice from outside, but is shaped by the participants’ use of it. This notion has, as I will show, major implications for the understanding of institutionalised language (Bloor, 1997). For a competent participant there are always things within a language game that are not worth doubting, it stands fast for him or her (Wittgenstein, 1969, §144, §152). Furthermore,

---

17 I am, of course, not the only one who has been inspired by Wittgenstein when developing and specifying this concept. Much of what is done within Discursive psychology has Wittgenstein as its main point of departure (cf. Edwards 1997; Edwards & Potter, 1992; Harré & Gillett, 1994; Jørgensen & Phillips, 2002, chapter 4). Bellack et al. (1966) were among the first to use Wittgenstein’s writings on language use in studies of educational practices even though they did not use the concept discourse. It would, of course, be possible to base the discourse analysis on other writers, for example Foucault, but since I am interested in studying meaning-making in action I turn to Wittgenstein. For a short discussion on this issue, see Almqvist (2003), and for a more extended discussion, see Jørgensen & Phillips (2002).


19 Wittgenstein’s writings have inspired many researchers in the social sciences (c.f. Winch, 1958; Bloor, 1997; Lynch, 1993). For critical analyses of these and other approaches, see Pleasants (1999).
this means that individual continuity must be understood as a question of learning. A person has learned to act like this or that in similar situations.20

Rules in action

Wittgenstein’s writings have been criticised on various points. For my argument the most central critique is that of his “conservatism”. In his book *Philosophical investigations* he stresses that philosophy does not and cannot change anything in the world. He says that philosophy leaves everything as it is and can only result in descriptions of how people use language. It cannot produce prescriptions or explanations about anything (Wittgenstein, 1953/2001, §109).

Philosophy may in no way interfere with the actual use of language; it can in the end only describe it. For it cannot give it any foundation either. It leaves everything as it is (Wittgenstein, 1953/2001, §124).

However, in order to understand this position it is important to note two aspects of his writing. First, Wittgenstein’s work is done within the practice of analytic philosophy.21 This means that when he says that philosophy leaves everything as it is, he speaks from his position as philosopher and not, as has often been stressed, as a philosopher with theories about society. Second, that, and as a result from the first, it does not mean that it should be left as it is. It only means that philosophy in the Wittgensteinian way ends up in descriptions (Pleasants, 1999:182; Stenlund, 1999:42). The notion that there are no absolute rules behind the use of language leads to an emphasis on descriptions of practices, and in my case to descriptions of actions in educational settings.

Wittgenstein makes an important distinction between “following a rule” and “acting according to a rule” (Wittgenstein, 1958:13, see also Pleasants, 1999:66 and Edwards, 1997:4-8). When people follow a rule, they do so explicitly, but when they are acting according to a rule, they act as they are used to, in accordance with their habits.22

20 For further discussion, see Wickman & Östman (2002a, 2002b).
21 For an introduction to Wittgenstein’s life and work, see Fann (1969/93), or even better Monk (1992).
22 An alternative and much more common and widespread interpretation of the writings of Wittgenstein on this issue is the one that David Bloor (1997) among others makes. He stresses that Wittgenstein makes a distinction between following a rule and conforming to it (Bloor 1997, chapter 4). Furthermore, Bloor claims that it is impossible for people to follow a rule if they do not do so consciously: “A rule is followed if, and only if, the actors bring about the conformity of their behaviour with the rule by intending to follow it” (Bloor 1997:44). Conforming to a rule is, on the other side, when an action “/…/ happens, by coincidence, to fit the specifications” of a rule (Ibid, p. 43). Winch (1958) who, according to Pleasants, makes a similar interpretation of this issue, has influenced many writers including Giddens, Habermas
His recommendation to avoid the formulation of general theories about different phenomena in the world (including the rules for action), but rather to describe how people act, leads us to the notion that the relationship between the individual and the sociocultural must be seen as an empirical question. Consequently, the meaning of an artefact, like other meanings, is constituted in action. Hence, there is no general answer to the question of how and why people use artefacts in specific kinds of practices. We have to give up the hope of being able to formulate general and absolute rules for actions. There are no general rules for acting with technology. In this perspective, the answer must be sought in action.

Habits, customs and intentions

One way to describe human action is to use the concepts of habits, customs and intentions. In the earlier example with the table I already described the use of the artefact in terms of these concepts. In this section I will develop the argument somewhat further.

In everyday practice we do a number of things without doubting that they could or should be done. We act in accordance with our habits. In the terminology introduced by Ludwig Wittgenstein (1969) a number of things stand fast in practice. In most cases it would seem odd to tell other people about the things standing fast for us. To tell someone that you know something, that we do not need to doubt it, is in some situations a strange thing to do:

It is queer: if I say, without any special occasion, "I know" -- for example, "I know that I am now sitting in a chair", this statement seems to me unjustified and presumptuous. But if I make the same statement where there is some need for it, then, although I am not a jot more certain of its truth, it seems to me to be perfectly justified and everyday.

In its language-game it is not presumptuous. There, it has no higher position than, simply, the human language game. For there it has its restricted application.

But as soon as I say this sentence outside its context, it appears in a false light. For then it is as if I wanted to insist that there are things that I know. God himself can’t say anything to me about them. (Wittgenstein, 1969, §553-554, emphasis in original).

In a language game, in a certain practice, there are always things taken for granted, things not worth doubting. In fact, how could we act if this was not the case? What would happen if we had to doubt every step on the way? In a

and Bhaskar. For further discussion, see Pleasants (1999, chapter 3 and 4) and Lähteenmäki (2003).
certain practice it is very easy to see the things standing fast for the participants.

Why do I not satisfy myself that I have two feet when I want to get up from a chair? There is no why. I simply don’t. This is how I act (Wittgenstein, 1969, §148).

The notion of habits is intimately connected to the concept of “experience”.23 Taking part in and experiencing different kinds of actions shapes habits. This does not mean that we cannot doubt anything, but that it is not always reasonable to doubt. To doubt that we have two feet when we get up from a chair in a certain situation may be more or less reasonable. It is rather a question of what would be reasonable to doubt in that specific situation. It would seem completely rational if a seriously injured person doubted if he or she had any feet left at all and checked the lower end of his or her legs. But when getting up from chairs in other situations this would probably seem like a strange thing to do.

The issue of certainty is intimately connected to the question of how a mistake would look. If a person, acting within a specific language game, can be expected to act in a certain way, to act in accordance with the rules of that practice, it would seem like a mistake if he or she did not. If we want to understand what people in a certain situation take for granted, what stands fast for them, we can think about how a mistake would look.

Many people share certain habits over a long time. We can call these habits customs. We may act according to our habits in all kinds of situations, but in some of them we might risk breaking the customary rules for action.

It is not possible that there should have been only one occasion on which only one person obeyed a rule. It is not possible that there should have been only one occasion on which a report was made, an order given or understood; and so on. – To obey a rule, to make a report, to give an order, to play a game of chess, are customs (uses, institutions) (Wittgenstein, 1953/2001, §199, emphasis in original).

Consequently, customs can be defined as the habits of a particular group of people. If someone were to express a custom verbally, it would have the form of “here we follow this and that rule and we expect you to act in accordance with that.” This also means that learning certainty is the same

---

23 In this thesis I use the concepts of experience and habit, Wittgenstein does not. However, his concept “stand fast” is very similar to William James’ (1890/1983) and John Dewey’s (1916/66) concept of habits. Using a concept from American pragmatism in combination with the writings of Wittgenstein may seem eclectic and strange, but there are important connections between them. One of Wittgenstein’s most important sources of inspiration was the writings of Willam James (Fann, 1969/93; Monk, 1992).
thing as learning what is worth doubting and what is not (Wittgenstein, 1969, §144, §449).

If someone has the habit of breaking the custom, dancing on the dinner table, or destroying the school’s computers, it means that she or he cannot or does not want to follow the rules. Therefore it follows that we may intend to follow a rule or to break it. Intentions to act in a certain way are thereby possible only in relation to specific social actions.

An intention is embedded in its situation, in human customs and institutions. If the technique of the game of chess did not exist, I could not intend to play a game of chess. In so far as I do intend the construction of a sentence in advance, that is made possible by the fact that I can speak the language in question (Wittgenstein, 1953/2001, §337).

In this thesis I will highlight the notion that there can be multiple customary rules for using technology, and hence multiple intentions. In my empirical analyses, described and discussed below, I used the concepts of experiences, habits, customs and intentions to describe action.

The rules for the use of technology, and hence the meaning of information technology, are constituted in situations where the technology is being used or discussed. The meanings, from this point of view, are shaped by the participants’ habits, the institutional customs and the problems they intend to solve. The rules for meaning-making do not come into a situation from above, behind or below, but in the actual use in a specific practice.

A discourse analysis inspired by Ludwig Wittgenstein focuses on how meanings about different phenomena, like information technology, are constituted in action. The main point is that we need to try to avoid basing our empirical studies on assumptions about the essence of the world. Based on this, and the framework presented above, I formulated my main empirical question: How is it reasonable for people to act with, and to talk about, technology in the way they do?

To answer this question it is necessary to clarify and discuss the meanings of the use of technology. Let us return to the example with the table once more. Think of the following situation: John, a five-year-old boy, has developed a habit of sitting on the dinner table playing with his toys. His father, who very much dislikes this, comes into the room, yells at the child and lifts him down to the floor. This is repeated day after day. The boy succeeds in his intention to break the family custom and to get attention and the father succeeds in telling the child about the customary rules. How this pattern of action ends we can only guess, but the point is that the boy and his father have different intentions, and different habits, in relation to the customary use of the table, hence the conflict.

Learning and individual development, in this perspective, are learning specific practices, a socialisation to take part in certain customary ways of
acting. The concepts of habits, customs and intentions, hence can be used for understanding people’s actions and learning in certain situations and under specific circumstances.

The distinction between following and acting in accordance with a rule has another very important implication for empirical studies of human action. When a person acts according to a rule in a situation it means that he or she does not, of course, explicitly formulate the rule. In other situations, however, following rules explicitly can be a part of the language game. A typical example of the latter is when a teacher tries to teach the students something specific, for example to use computers in certain ways. When studying action, as a researcher (from a third person perspective, Stenlund, 1999:11), trying to understand the rules for a language game, it is important to note that these rules are not necessarily obvious to the participants as rules. This means that the results of this research ends up in descriptions “from outside”, even though we can try to create descriptions as recognisable as possible. My ambition, therefore, is to tell stories about how people act in educational settings and to try to understand, in terms of habits, customs and intentions, how it can be reasonable for them to act in this or that way.

It is possible to use descriptions of human practices in critical discussion. Pleasants (1999) stresses the potential of using descriptions of action in order to reflect on the way we act in specific situations. I analysed my empirical material in two steps with a similar ambition. First, I described what the participants do with, and what the texts say about, technology use in practice. In this step I tried to understand how it can be reasonable for the participants to do what they do in the particular situations. In the second step, descriptions from the empirical material are compared with other feasible descriptions to critically discuss the way technology is expected to be used in practice (cf. Culler, 1992; Säfström, 1999).

Situations and texts

The material that has been used in this thesis consists of texts and video-recorded situations from classroom use of information technology. In this part of the thesis I will briefly present and discuss my choice of texts and recordings. Aspects of relevance for the selection of material, strategies for and ethical considerations for video-recorded classroom activities will be described. Specific choices of texts and situations, and the methods used to analyse them, are described and discussed in the articles and in the result part of this thesis, but some general lines will be presented here.

Since the summer of 1999 four Swedish schools have participated in the research and development project called Learning in Science and Technology (Lärande i naturvetenskap och teknik, Lärnot). The main
purpose of this project has been to study and develop science and technology education in such a way that as many of the pupils as possible will become more interested in those subjects. The project has been divided into two different parts. In the first one research on learning in educational settings was conducted (Östman, 2003). In the second part of the project, researchers and teachers in the department of teacher education, in co-operation with teachers in schools, worked with the development of educational practices.

In my work with the empirical material, both with the recordings and with the texts, I performed the analyses in two steps. First, I read and re-read (and listened and re-listened) with the purpose of trying to understand what they do and say and how it can be reasonable for them to do so. Second, I used differences in the material to make comparisons between different expectations of, and actual ways of using, technology in educational practices.

Situation

In the research part of the project, within which my thesis is written, we conducted video-recordings in two different schools during the years 1999-2005. The main focus for these recordings was to catch everyday practices in educational settings, which means that we tried to interfere with teachers and pupils as little as possible. During the last three years of the project, however, we were involved in the formulation of tasks given to the children. We did so because there was a need to study specific questions of importance to our research. In the material for my Paper IV the children were working with one of these tasks.

From this material I selected recorded situations where information technology was used. This selection consists of five situations, of which I chose three on which to focus. Nevertheless, the two lessons that I decided not to analyse further, due to the bad quality of the recording, influenced the case study presented in Paper IV to a certain extent. What the two excluded recordings showed is the need to analyse a situation where pupils select information from the Internet.

Dealing with video-recorded material raises questions of an ethical kind, especially when the material is so extensive and reaches over such a long time period as our material does. Therefore we asked the children’s parents for permission to record the pupil’s actions, we keep the material in a safe place and do not use it for purposes other than research related to the main purpose of the project, and we have changed all the children’s names when

---

24 Each of these steps has been divided further in the studies. Slightly different divisions were made in the different studies (e.g. Paper IV).
25 The recorded material consists of approximately two hundred recorded hours. Recordings used as empirical material for this thesis, however, cover just a small part of them. In sum, it consists of approximately seven hours of recordings.
writing about them. For further discussions on these issues, see Almqvist, Lidegran & Lundqvist (2003).

In a way this thesis can be seen as a contribution to the wider issue of science education. In the Lärnot project we tried to understand parts of the educational practices in the science and technology classrooms of a few Swedish compulsory schools (cf. Östman 2003; Lidar et al. submitted).

**Texts**

There are a large number of texts dealing with educational issues. In the historical studies (presented in Papers I and V) I analyse expectations on the usage of technology in education as expressed by agents in a completely different arena than that of the classroom. The material here consists of texts written by policy makers and politicians. I based my selection on the following four criteria:

First, the texts must handle issues related to the goals, content and organisation of the work in Swedish compulsory school. Second, the texts have to be produced for political purposes and express politically legitimate expectations on the shaping of education. Third, the texts shall be directed towards the potential users of technology in schools. This criterion is more central and obvious in Paper V since it focuses on expectations on the users. Fourth, I chose texts that, in one way or another, deal with the question of the usage of technology in educational settings.

The selected texts cover the years of 1962–1998. This period reaches from the time of the introduction of a nine-year compulsory school for all pupils in Sweden, to the time of the introduction of the Internet in Swedish schools.

During these decades a large number of texts about the usage of technology in educational settings were produced. Since the texts chosen must express politically legitimate expectations on education I chose to use three kinds of texts. First, I used the curricula for the Swedish compulsory school. Second, I chose a selection of texts in the series of Official Reports of the Swedish Government (Statens offentliga utredningar, SOU), and third, I chose texts among the Government Communications:

The series of Official Reports of the Swedish Government are a central part of the political system (Johansson, 1992). Government bills are often based on suggestions from these reports. However, since they are not primarily written for the potential users in schools, other texts had to be selected as well. In Paper I this was not a problem since the focus in this study is on current rhetoric of information technology on a governmental level. In paper V, however, a different kind of selection must be made.

The focus of the study presented in Paper V is different from the one used in Paper I. In Paper V the aim was to identify expectations on the usage of technology in education and on the technology users as expressed in the
curricula for the Swedish compulsory school. This means, among other things, that it is important to select texts that in one way or another are directed towards the potential users of technology in educational settings. Therefore the curricula were chosen. The curricula of 1962, 1969 and 1980 express instructions about educational goals, content and organisation. The latest curricula (Lpo 94a and Lpo 94b), however, do not give any instructions on how the work in educational settings shall be organised or in what ways teachers and pupils are expected to work. Therefore, it must be complemented in order to fulfil my first criterion for selection. For this reason the material has been complemented with a Government Communication (Regeringens skrivelse 1997/98:176). In this text the Swedish government gives instructions on the large effort to implement and develop the use of information technology in educational settings called ITiS (Information Technology in School). It has also been published and distributed to the Swedish schools thereby fulfilling all the selection criteria.

Summary

The aim of this thesis is to develop and apply an empirical approach that can be used in studies of the relationship between different expectations of, and the actual use of, information technology in educational settings. An empirical approach was developed based on a sociocultural perspective on learning. The main empirical question is: how can it be reasonable for the participants to do what they do with technology.

The importance of the usage of artefacts is a central question within a sociocultural perspective on learning. People use artefacts to be able do things they would not be able to do otherwise. Learning, in this respect, is a matter of appropriating ways of acting with artefacts. However, the nature of the relationship between artefacts and human action is, from a sociotechnical view, rather confusing. On the one hand we can emphasise the influence of artefacts on action. On the other hand we can emphasise that the meaning of artefacts is constituted in action. A third possibility, that is a base for my empirical work, is to emphasise the process in which individuals act with technology.

Inspired by Wittgenstein I will focus on what the users, as well as those who expect things of the users, take for granted on the issue of the usage of technology in specific educational settings. I will use the concepts of habits, intentions and customs in the studies. As a researcher I will, from a third person perspective, clarify the rules governing the action, and compare and discuss meanings of technology in relation to questions on learning and socialisation.
Results and discussion

We and our good knowledge (Paper I)

The great investments that have been made in implementing and developing the use of information technology in the Swedish educational system are surrounded by different kinds of rhetoric. This is, however, not the first time in history that great investments have been made in a specific area related to education. For example, efforts have been made to reform science education since the end of the 1950s, efforts that were also accompanied by a strong rhetoric. These efforts can, as is shown in this study, be compared to the investments in information technology. The study is designed as a comparison between the current rhetoric on information technology and earlier rhetoric on science education. It shows that the same kinds of arguments and goals that motivated parts of the efforts in reforming science education are also to be found in the rhetoric on information technology. The concept of rationality is being used to compare the two areas of rhetoric.

Technology and education

The relationship between technology, individual and society regarding issues on education are analysed in texts on information technology in education produced on a governmental level from 1994 to 1998. The study examines, in terms of rationality, how the relationship between technology and society and between technology and the individual are conceived in the texts.

26 The rhetoric on reforming science education goes back to at least the 1950s and can, according to Östman (1995), be divided into three different generations, with roots in three different times in history, but also in three different ways to perceive science education. These differences can be understood as related to different kinds of rationality. The term rationality is used here to describe the relationship between the ends and means of an activity and can be divided into two major categories – instrumental and value-oriented rationality respectively. Furthermore, the latter of these rationalities can be divided into subcategories depending on how one treats the issue of values. Before going into a description of these rationalities it is important to note that the different generations have arisen in different times of history, but it is not obvious that the old ones disappeared when the new ones appeared. They have existed more or less parallel with each other.

A basic assumption in the rhetoric on information technology in education is that it determines the development of society. It is stressed that information technology takes society into a new phase, the so-called information society, a new form of society leaving the industrial society behind. This new society is characterised by a new type of labour market (e.g. SOU 1998:65, p. 1). In some texts it is even stressed that Sweden has no other choice than to invest in information technology as a means of increasing the quality of life (SOU 1994:118, p. 5 and SOU 1997:185, p. 21). The goals of investing in information technology are to follow the development of society towards an information society. These goals are not questioned or discussed at all in the texts. The meaning of the relationship between information technology and society is based on instrumental rationality in combination with a deterministic view on technology. Characteristic for instrumental rationality is that it leads to a total focus on the means, and that there is no explicit discussion of the ends of an activity. Value-oriented rationalities, on the other hand, include the goals for the activity.

One important exception in the texts is a short passage in a government communication (Regeringens skrivelse 1997/98:176, p. 14-15). Here we find another view on information technology. First, it is stressed that “we” have chosen this new society. Second, it is stated that information technology shapes new conditions for political debate. With the help of information technology, people can meet and debate various questions, and thereby deepen democracy. Logically, this must also mean that “we” can discuss the goals of and means for the use of information technology, its design and use, and consequently be able to discuss questions on information technology in education.

In the history of the Swedish curriculum three different kinds of value-oriented rationalities can be found. In the first one, value rationality, the goals for an activity are related to God and the nation in one way or another. This rationality was central within the curriculum in the first decades of the 20th century (Englund, 1986). The second one, the scientific-value rationality, is a central part of the scientific rational discourse, which stresses that science can solve all kinds of problems, including the ones obviously dealing with different kinds of values and judgements (Östman, 1995). The third one, the communicative rationality, is the basis for the democratic discourse (Englund, 1995, 1998). Here the goals of and means for an activity must be the result of a democratic discussion to count as rational. Consequently, different views on the relationship between the ends and means for an activity implicate different rationalities.

---

28 Instrumental rationality is, according to von Wright (1986), a central aspect of traditions built on science and technology in the name of enlightenment and modernity.
Expected use of technology

The second part of Paper I deals with how information technology, according to the texts, is to be used. The texts analysed here are the same as above.

The study shows that the arguments in the texts are grounded in a relativistic view on knowledge and a constructivistic view on learning. However, at the same time they emphasise the need for all children to learn basic (or good) knowledge. This implies that the children are supposed to construct their own knowledge as well as to appropriate knowledge given beforehand. This is a paradox built on a combination of two different educational philosophies, a combination Östman (1995) calls progressentialism. In this view the focus is on the creation of educational methods and activities to achieve the goal, which is to gain basic knowledge.

One of the major problems of stressing a relativistic view of knowledge is that someone has to decide what is to be regarded as true. This truth is called “good knowledge”, and here we get back to the question of “we”. “We” could, based on a scientific rationality, be the experts on technology or economy. But on the basis of a communicative rationality “we” could be as many citizens as possible. “Good knowledge” differs if the education aims at educating experts or citizens.

There is an opening for the latter conception of education in one of the analysed texts. In a passage in the government communication of 1997/98 (Regeringens skrivelse 1997/98:176, p. 10-11) a different view on knowledge is formulated. Here it is being stressed that within the humanities it is common that different views on a phenomenon may exist parallel with each other and that if the education can take up these views for discussion it will lead to a deeper understanding. Here knowledge is related to the democratic values in society. This opens the door for a discussion on issues related to who “we” that shape the future society are and what “good knowledge” we need to do this.

Conclusions from Paper I

There are great similarities in the rhetoric on science education and on information technology. The same kinds of arguments and goals exist in both: it is necessary to educate all pupils in science and information technology respectively, to make them prepared to join the society of the

29 The view on knowledge can be divided into three major categories, each containing different traditions that have essential assumptions in common. The difference among the three views, here called objectivism, relativism and pragmatism is, briefly, that objectivism and relativism claim that knowledge is always grounded in something; nature, religion, culture or the like, while pragmatism relates knowledge to questions on social practices, values and judgements, questions related to democratic action. See Bernstein (1987) and Rorty (1979, 1985).
future. The rhetoric on information technology can be described as a combination of a constructivist view on learning, relativism, technological determinism and instrumental rationality. It has the major consequence that “we”, who have chosen this society, tend to be either technology itself or the ones who have the power to decide how to design and use it. The “good knowledge” to be learned in school becomes a scientific rational one.

However, these arguments and goals are not the only possible ones. And what is of great interest here is that they are not even the only feasible ones in the analysed texts. There are parallel views on the role of technology and education, where other assumptions are made, where “we” can be as many citizens as possible with “good knowledge” to participate in democratic discussions. Starting in a different kind of rationality, here called the communicative one, it is therefore essential to clarify different perspectives on various issues and to discuss them within and in relation to education.

New questions

The results from Paper I have several implications for the aim of this thesis. First, it gives an introduction to contemporary expectations on the use of technology in education, further analysed and discussed in the fifth article. Second, it shows the possibility of, and from a democratic point of view the importance of, clarifying different discursive meanings of information technology in education and to discuss them in terms of learning and socialisation. And third, it shows how the relationship between different agents and technology in no way is obvious or given beforehand. It shows that the issue of deciding if and how information technology should be used in practice is a political question. It does not, however, say anything about how to understand the use of technology in educational settings. Consequently, the approach must be further specified.

The relationship between politically privileged views on different phenomena and classroom action and learning, is one of the important issues for further research emphasised in the evaluation of Swedish educational research (Rosengren & Öhngren, 1997:113, 184, 188). One of the main purposes in the Lärnot project is to handle questions related to this issue, to find ways to deal with learning and socialisation simultaneously (Östman, 2003).

The following studies relate to the implications of the first study. In order to analyse the relationship between the expected and the actual use of technology, a somewhat different approach has to be developed. Taking the first study as a point of departure, an approach has therefore been developed that makes it possible to study the meanings of information technology constituted in practice and to understand how it can be reasonable for pupils to use technology the way they do.
Paper I deals with questions about the implementation of information technology in schools and the efforts agents on different levels in the educational system are expected to make. However, in the approach I developed since then, other questions about the usage of information technology have risen. In focus for the studies presented in Paper II-IV is the question of how meanings of technology are constituted in different settings (cf. Almqvist & Persson, 2002). The last study (presented in paper V) returns to the issue of rhetoric on a governmental level, but it does so in light of the classroom studies.

To make comparisons between the meanings of information technology as expressed in use and in texts, I developed the approach presented and discussed above. The most central feature of this approach is the goal of avoiding assumptions of technological essentialism and determinism (cf., Almqvist, 2003; Almqvist & Westlin, 2003). If those assumptions are not avoided it will not be possible to handle the relationship between different expectations on, and actual use of, technology as an open empirical question.

Three cases of information technology usage in educational settings (Papers II-IV)

Introduction

In the following I will present and discuss the results of the classroom studies (Paper II, III and IV). The main empirical issue of all these cases has been an ambition to try to understand how it can be reasonable to act with technology in the way the users do. I will also compare and discuss the meanings of information technology constituted in the classrooms with other feasibilities.

Images of the Internet (Paper II)

In current discussions of information technology, the Internet stands at the centre of interest, even though the technology can be used in many other ways. Depending on how we talk about and use information technology, different discursive meanings, different images of the Internet will be constituted (cf. Johansson, 1997).

In this study, the focus is on the constitution of different discursive meanings of the Internet. The history of the Internet goes back to the creation of the Arpanet, designed in the 1960s for military purposes. Since then new ways of using the Internet have arisen. It can be seen as an arena for democratic discussion, a supermarket (Ilshammar, 1998), or a place to live a part of your life (Turkle, 1995; Søby, 1998).
In the study presented in Paper II, the Internet could be used in at least two different ways. It can be used both as a source of information and as an arena for discussion. These two images of the Internet, both expressed in the governmental communication (Regeringens skrivelse 1997/98:176), differ in their view of the relationship between facts and values. An educational setting based on one of these two views of the Internet will result in different practices, thereby, in line with the framework presented above, having different consequences for learning and socialisation.

In this study I develop and illustrate an approach that makes it possible to understand how pupils constitute images of the Internet while using it in an educational setting. The results are discussed in relation to education and democracy.

The use of Internet in school
An analysis of the conversation of six groups of children who are using the Internet shows how they constitute meanings of information technology. They were videotaped in their classroom in the autumn of 2000. The children, 13 to 14 years old, worked in groups of two or three at a computer. They worked with two tasks, related to bridges:

- What kinds of bridge-constructions exist and why are they constructed that way?
- Consider arguments for and against bridges.

Here these two tasks will represent the two images of information technology found in the governmental communication referred to above: one where the Internet is seen as a source of information and one where it is seen as an arena for discussion.

All groups worked for 25-35 minutes at the computer. Similarities and differences among the conversations of the groups were identified, with special focus on what stands fast for the children and what is problematic in their work.

One of the main results is that the conversations among the participants in the situation constitute the Internet as a source of information. The pupils in all the groups used words like bridges to search the web for information on different kinds of bridge-constructions. They went back and forth between different pages, often without finding anything of interest and sometimes with the only result that the page they were looking for could not be found on the net. One of the groups compared the Internet with a book, and came to the conclusion that they preferred searching for information in books instead of the Internet. They said it is easier and quicker to work with books.

---

30 Videotape number 23, 24 and 25 in the material recorded in the Lärnot project. For detailed references to the tapes, see the original article (Paper II).
The study, thus, shows that the meaning of the web constituted in conversations of the groups is a slow and not always effective source of information.

The next question is whether or not the pupils also used the Internet to solve their task to consider arguments for and against bridges, that is what kind of information they seek and what goals they have for their search. The following transcription illustrates a central finding in the study. It is transcribed from the conversation of three girls forming one of the groups:

66 Helena We are supposed to find arguments for and against using bridges
67 Maria Yeah, but we already know that
68 Viktoria Yeah
69 Helena Yeah
70 Helena And then, what else? Yes, what they are like, how different bridge constructions are made
71 Viktoria Right
72 Helena And why they don’t break and everything
73 Viktoria Mm
74 Helena Why you build a bridge instead of a boat and so
75 Viktoria Yeah... yes, but this I know, because boats...
76 Maria Are much more expensive
77 Viktoria Yes, but they pour oil and stuff into the water
78 Helena It is easier to go by bridge
79 Viktoria And gasoline
80 Helena Instead of waiting for the ferry
81 Viktoria And gasoline
82 Viktoria Yes, but cars are quite bad too
83 Maria Yeah, right
84 Viktoria Bridges, I mean
85 Maria Okay
86 Viktoria Yes!
87 Maria Fine
88 Viktoria Well, it’s true. Cause there’s a lot of exhaust fumes in the traffic
89 Maria Mm... No, but who cares?
90 Viktoria Okay... Let’s go further down

This group is dealing with the second of the two tasks, but without using the Internet. On the question of arguments for and against bridges, Maria says Yeah, but we already know that (67) and the others agree (68 and 69). After a short discussion on the second task in terms of time and pollution (74 to 88), the children go back to the first of the two tasks when Maria says but who cares? (89), and Viktoria agrees: Okay... Let’s go further down (90).
Conclusion

The analysis of the conversation of six groups working with computers shows how the meaning of the Internet is constituted in their conversation. Internet is used as a source of information. None of the groups use it for anything else. This result has two major implications related to the themes of this thesis:

First, it shows that the discursive meaning of the Internet is a result of the children’s earlier experiences and the tasks they are supposed to solve. Using sources of information this way in education can be described as a habit, it stands fast for the children. So, the tasks, together with earlier experiences, shape the meaning of the Internet.

Second, the study shows that in this situation, the meaning of the Internet is constituted in a certain way, but also that it is not sure that this is the way the children always use it. A person can always participate in various kinds of discourses (Harré & Gillett, 1994). The image constituted in a certain situation is a result of what seems to be a relevant way of using it: “/…/ what counts as a relevant solution of a problem varies, because the problem is seen and understood in different ways in different human practices” (Säljö, 2000:126, translated from Swedish). Hence another meaning would have been possible if the focus of the tasks, and the habits of using information technology in education, had been different than they were in the situation examined here. This indicates that in another situation, with other tasks, the meaning of the Internet, for example, could have been constituted as an arena for discussion.

Education and/or entertainment (Paper III)

In the second case study the conversation of a group of pupils working with an edutainment disc called Draken Gilbert och den kemytiska ön (1998) is examined. The term “edutainment” is a combination of the words education and entertainment and the disc is designed for teaching chemistry.

The aim of the study is to analyse how meanings of information technology are constituted in a teaching aid and in the application of it. The meanings constituted are discussed in relation to questions about learning and socialisation.

The material analysed in this study consists of both a video-recorded situation where two children work with the edutainment disc, but also of the disc itself. The situation was video-recorded in a Swedish classroom in the autumn of 2000. The two children (11 years old) worked for a whole lesson with the disc, while their classmates did some laboratory work in chemistry. Using the edutainment disc was part of an educational theme and the two children recorded had previously worked with chemistry.
The game

Gilbert, a dragon, comes flying from outer space inside an egg landing on Chemistry Island. On arrival the egg breaks and its parts are spread over the island. Here Gilbert’s search for the parts of the shell on the island begins. In his search he must solve a number of problems in different environments on the island. The problems are related to different chemical phenomena and result in the end in a solution to the bad weather-conditions on the island. These weather conditions are caused by a battle between the hot Lava-man and the cold Ice-queen.

The game, made for nine to twelve year-old children, is divided into two parts. The first part, called the Writing book, consists of a number of clues to the solution of the problems Gilbert encounters on his expedition, a collection of chemistry experiments and “Gilbert’s friends” where the creatures Gilbert meets on his way tell him about different phenomena in chemistry. The second part consists of the adventure itself.

The content and design of the game is based on the assumption that chemistry is an always present and ongoing process in peoples’ lives and not, as is usually conceived, something just for scientists and industry. Chemistry, it is stressed, is a natural and an exciting phenomenon (Draken Gilbert och den kemytiska ön, 1998, p. 3). The aim of the game is to stimulate pupils’ inner urge to explore and challenge their surroundings, to place chemistry in a wider historical context and to show the children their importance in developing society with the help of knowledge in chemistry (p. 5). In short, the purpose of the game is to stimulate children’s curiosity and understanding of basic knowledge in chemistry and relate it to their everyday lives and society.

The designers of the game want to combine an exciting adventure with children’s learning about the world of chemistry (p. 3). As a complement to the actual adventure, the designers recommend teachers let their pupils do the experiments described in the writing book and to use the web page related to the game.31 In the adventure part the player moves Gilbert among different environments: a beach, a wood, a desert, a glacier, a mine and a laboratory, where he meets different creatures and collects different items for later use.

The meaning of information technology in design and content is complex and contains a major paradox. On the one hand, the aim of the game is to combine education and entertainment, to stimulate curiosity and the urge to learn and to develop a deeper understanding of basic knowledge in chemistry as related to history, society and everyday life. On the other hand, the adventure consists of a number of problems, such as making colour and paper, making foil out of aluminium cans and soil out of grass. These problems relate to children’s everyday life, however often artificially, but the

relationship to the history of chemistry and society is totally absent in the game.

**The situation**

In the following, the meaning of information technology constituted in the conversation of children is analysed on the basis of questions on what stands fast for the children in relation to information technology, what gaps appear and what the children do to bridge these gaps.

In this summary I chose to present one part of the transcription from the children’s conversation, but before the children get to this place, they have explored some of the problems and environments on the island. They have been at the beach receiving sunglasses, getting foil out of a can made of aluminium, received a toothpaste tube and a comb. At the mine they have been assigned the task of mending a broken satellite dish and opening a locked door, and in the laboratory they have received a thermometer among other things.

For these two children the toothpaste found at the beach becomes a central item in the game. It leads them to a search for a camel that one of the children knows exists in the game, a camel to which the children shall give the toothpaste. It stands fast for them that a central task in the game is to find the camel. The only way to understand this is that one of them has an earlier experience with the game. Finally, they find the place where the camel stands in the shadow of a tree in the desert:

62 Lina and Maja
There!

63 Lina Yeah, watch now.
Gilbert says he can’t go near the camel because of its bad breath.

64 Lina There’s a tube of toothpaste (…) there!
65 Maja And then, that comb?
66 Lina Yeah, and then those (…) glasses?
67 Maja Strange [inaudible]
68 Lina There, what’s…
69 Maja He is doing something, he is pulling something
70 Lina But what is he pulling? One never gets to know (…) [inaudible]
71 Maja But if you take Gilbert in that direction…
72 Lina It won’t work [inaudible]
73 Maja He did something
74 Lina Where shall we go now then?
75 Maja Maybe we can do something with the crying child.
There, Lina and Maja say when they finally find the camel (62). When they “click” on it (63), Gilbert says he cannot go near it because of its bad breath. Giving the toothpaste to the camel solves this problem (64). One thing not shown in the transcription above, but obvious when the game is played, is that when the camel gets the toothpaste it says that it won’t walk out of the shadow. Giving it a pair of sunglasses solves this problem. The pupils skip this “click”, showing once more that they have an earlier experience of playing this particular game (66).

When the camel has received the toothpaste and the sunglasses it starts walking, pulling a log around. This results in a new problem for the pupils, namely to understand what he is doing when he is pulling the log, a problem that is not solved in this situation (70). They try to move Gilbert to see what has happened, but this is not allowed by the game (71-72). Instead they go on to solve another problem (73-75).

The meaning of information technology, as it is constituted in the children’s conversation, is a result of the fact that one of them has played the game before. Her earlier experience contributes to the constitution of meaning. Also, while trying to solve other problems they encounter they try to bridge other gaps, and use their earlier experiences. Thus the children’s earlier experiences play a central role in the constitution of meaning of using the information technology. However, they use a special type of experience in trying to solve the problems. These are experiences from their everyday life and not from chemistry. At first glance the children’s strategies to bridge the gaps seem like wild guesses. However, upon a closer look, the strategies are both reasonable and rational. When they come across the problem of opening a locked door, the children guess that they need to find a key, they guess that they need a screwdriver to mend the satellite disc and that the thermometer will be used later in the game to help someone who is ill.

The solution that takes you further into the adventure is, however, of a completely different kind. The door opens when you let Gilbert throw a car battery at it and the acid inside the battery destroys the door and he can enter the mine. He is also supposed to make a new satellite disc out of a wok pan and aluminium foil. The Lava man needs the thermometer for his ovens. Solving problems like this demands a very specific kind of discourse belonging to the world of chemistry. Thus the meaning of information technology in this situation is not a combination of chemistry education and entertainment as the designers hope. It is a meaning shaped by the children’s earlier experiences from everyday life in combination with the problems they are supposed to solve, a meaning of entertainment but not of chemistry education.

Conclusion
This study shows how the meaning of an edutainment disc is constituted in a situation by the users’ experiences and the problems they are expected to
solve. This has at least three major implications for the understanding of the use of information technology in educational settings.

First, it shows that the meaning of information technology is constituted by what is evident for the users, both regarding the design and content of the game and in its actual use. In design and content, the meaning of the disc is a combination of chemistry education and entertainment. When the game, which is aimed to stimulate the children’s curiosity, learning and understanding of chemical phenomena, is being used in the classroom it gets another meaning. The chemistry discourse never becomes relevant for the children because the problems they are to solve are formulated in such a way that they can refer to everyday life and not a specific chemistry discourse. Doors are normally unlocked with a key, screwdrivers are often used to mend things and thermometers are used when people are ill. The children’s experiences together with the tasks they get shape the situation and hence the meaning of information technology.

In this way, and this is the second major conclusion of the study, the meaning constituted in a particular situation, can also explain what is not said and done, what is included and excluded in discourse. It is shown that at least two different meanings of the game are feasible, but that in the actual use the children’s actions constitute the meaning of the technology. Consequently, the technology does not shape human action in an easily explained way, and the issue of the relationship between humans and technology is far more complex than it is often assumed to be.

Finally, the study implies, for further research, that the saying and not saying, the inclusion and exclusion in a situation, the use of different discourses, may have different consequences for further action. One way to understand this is to see the design and content of the game in a wider context, to see it as historically situated. As previously discussed, Östman (1995) shows that two major discourses have been feasible in science education during the last few decades. These two are grounded in different kinds of rationality, the scientific rationality and the communicative rationality related to social goals. According to Östman (1995) these two discourses may have consequences for the pupils’ socialisation to become active citizens in a democratic society. However, in the situation analysed here neither of these discourses was actualised. The goal of the children was to find the camel, the key, the screwdriver and a person feeling ill. They were doing this based on a rationality, situated in their actions, which constituted the meaning of information technology as a tool for entertainment.
To doubt or not to doubt (Paper IV)

The overall objective of this paper is to develop a method of approach that can be used in addressing the issue of the use of information technology and its importance in human meaning-making.

The activity in focus in this paper was shaped by our aim to study a situation where children were expected to value and judge information on the Internet. The conversations of six groups of children were video-recorded and analysed. The issue discussed in the groups was the greenhouse effect, an issue of great political significance. The task given to the children is motivated by an interest in studying if and how they handle value issues in science education (Östman, 1998).

Our method of approach consists of three stages of analysis. First, the focus is on the process that Wertsch (1991:124ff) calls “privileging”, a term he introduced to draw attention to the fact that participants in the meaning-making process value and judge certain artefacts, meetings, questions, etc., as reasonable and fruitful, while others, though fully conceivable, are ignored or disregarded. This “privileging” that takes place during meaning-making, directs learning in a certain direction and towards a certain content. We will show how Wittgenstein’s (1953/2001, 1969) method can be used to analyse privileging processes in situ. This will be done based on a reading of Wittgenstein’s later works, in particular his recommendation not to establish all-embracing theories but to study what happens with people’s actions in concrete, everyday situations (cf. Pleasants, 1999). In our privileging analysis, we studied the interaction between the pupils and the Internet to try to discover their search strategies, whether or not valuations and judgements played a role, and, if so, in what way.

The second and third stages constitute an analysis of the circumstances by which meaning-making takes place. The circumstances we focus on in the second stage are meaning patterns that the pupils encounter on web pages; in the third stage, the circumstances surrounding the pupils’ intentions are in focus. To understand people’s actions and the meanings created by them, we should look at the prevailing circumstances during those actions (Wittgenstein, 1953/2001). The first circumstance analysis is motivated by the fact that it is in meetings with the surrounding world that children learn the language game and that whether you learn to doubt depends on whether you are given the opportunity to experience situations in which doubt is expressed. The second part of the circumstance analysis involves pupils’ intentions in their interaction with the Internet. This is motivated by the fact that the direction of the participants’ action depends on whether or not they intended to value or judge the information they encountered on the Internet in the first place.

To illustrate our method, we chose to study a situation in which six groups of pupils (fourteen pupils in total) were given an assignment whose
main purpose was to let them valuate and judge information on the Internet. More specifically, the assignment was to use the Swedish Schoolnet to help them write three sentences about what they felt was the most important aspect of the greenhouse effect. The pupils’ conversations were taped and used as the basis for the analysis. The videotape was made in the spring of 2003 and pupils aged thirteen to fourteen worked with the assignment during one lesson. Their conversations were then transcribed for further analysis.

The assignment was designed to fulfil the following two conditions: (1) it could be dealt with in many different ways, which would encourage the pupils to choose relevant information, and (2) it would give them the chance to apply their earlier experiences from their science classes. The exact wording of the assignment was:

Search the Link Library for information about the greenhouse effect. The address is: http://lankskafferiet.skolverket.se/. Then write three sentences about what you think is most important to know about the greenhouse effect.

The Link Library is part of the material that makes up the Swedish Schoolnet, which the Swedish National Agency for Education since 1994 – and as of March, 2003, the Swedish National Agency for School Improvement – has been in charge of. The Link Library is a compilation of links deemed appropriate for children from ten to fifteen years of age. The links have been chosen for their quality and function: “they must be relevant to schools and be directly applicable in an educational setting” (Skolverket, 2001, p. 2). Searching for the term “greenhouse effect”, pupils came up with twelve hits.

The empirical material consisted of the taped sessions and the website used by all the groups to collect their information. This particular website belongs to the Swedish Society for Nature Conservation (SSNC).

All six groups we taped worked with an assignment that required selecting and discarding information. Our findings show that the pupils merely copied the information they found. In addition, the findings show that while the mode of reinforcement of the texts used by the pupils may have provided little opportunity for doubt or learning how to doubt, the pupils’ intentions with their work determined the result of the interaction: copying. If they had intended to search for other explanations of the greenhouse effect in order to choose the most important aspects, our findings would probably have been entirely different. Under the prevailing circumstances, based on the website they used and the way their habits had them solve this kind of

---


assignment, it was perfectly reasonable that they did what they did. Information technology thus came to be used as a source of information that could be copied in order for them to finish the assignment quickly.

Some of the Swedish rhetoric about the introduction of information technology in schools has stressed the democratic potential of the technology. By giving pupils access to a large number of voices surrounding various phenomena in society through information technology, the conditions would be conducive to critical thinking. In this paper, we show that things are not so simple: access to a particular technology does not automatically result in a particular behavioural pattern. In an attempt to understand why pupils did not make a valuation of the information they encountered on the websites they visited, we chose to study, inspired by Wittgenstein, the circumstances that prevailed during the pupils’ meaning-making. What we found was that the institutional circumstances in terms of habits made the pupils’ lack of valuations understandable. In all groups, there was an expression of the habit of “doing the assignment because it has been assigned.”

However, it is always possible to break and change your habits in encounters with the world around you. In the texts the pupils found on the web pages it was clear that the applied mode of reinforcement was declarative and convincing. Such a mode of reinforcement precludes critical reflection or reasoning; rather, it presents a logic that connects valuated statements and factual information in the light of conviction. If the pupils had encountered a text where the focus was on presenting different voices and critically examining them or if they had been given a slightly different task, perhaps the pupils’ habits would have been broken. This is merely speculation, but well worth looking into.

Based on this study, we have an indication that the means by which the introduction of a particular technology influences pupils’ meaning-making is in no way uncomplicated in terms of an artefact determining human action. Nor is it so simple that this influence is entirely contingent. Rather, based on the findings of this study, we could say that institutionalised habits play a significant role in how a certain technology affects the making of meaning. If these findings were shown to have empirical bearing in future studies, it would mean a challenge to many ingrained ideas about the role of technology in people’s meaning-making. In the first place, it would mean that identified patterns regarding human meaning-making in the encounter with an artefact could be given a different interpretation than the determining one. For how can we know in advance if it is the technology that influences or a habit in which the technology is used?

Even if the results of our study emphasise that habits play an important role in how people use technology and thereby influence the role technology plays in people’s meaning-making, it is in no way our intention to argue that technology does not influence meaning-making. The role of the computer
might have been completely different if the website had used a different mode of reinforcement. In other words, the role of the computer in the pupils’ meaning-making might also depend on the discourse practices the pupils have access to via the computer.

Conclusions from the three classroom studies and new questions

In all the situations analysed here pupils are using information technology. They do so, however, not in the ways they were expected to. As shown in the classroom studies the meaning of information technology as constituted in action can be understood as the result of the children’s experiences, habits and intentions. This is not to say that technology or the customary use of it does not influence actions. It would not have been possible for them to act in the way they did without access to information technology.

The studies also show that it was fully reasonable to act in the way the children did. Based on their earlier experiences and their habits of searching the Internet for information to copy, and to play games on the computer, they shaped the use of the artefact in the educational settings. Another way of expressing this point is that they acted in the way they expected themselves to act. Expectation is a central part of human action.

In the final study (presented in Paper V) I take the issue of different expectations a step further. One can ask how it would be reasonable to act with artefacts in education if acting as expected by the curriculum.

Rhetoric of technology in educational politics
– a historical case study (Paper V)

Introduction

Different agents within the educational system – pupils, teachers, school leaders, debaters, public authorities, politicians and so on – may have different expectations on the use of technology. This means that the implementation and development of the usage of technology for educational purposes is a political issue, as some ways of using artefacts in educational practices will be included while others will be excluded. Certain agents will be involved in the design of the usage of technology, whereas others will not take part. Paper V connects to this problem.

The aim of the study is to identify expectations on the usage of technology in education and on the technology users as expressed in the curricula for the Swedish compulsory school during the years 1962-1998.
In addition to the curricula for the Swedish compulsory school the empirical material for the study consists of the Government Communication entitled *Lärandets verktyg* (Regeringens skrivelse 1997/98:176).

The following research questions were posed to the texts:
- For what purposes is technology expected to be used in educational settings?
- What experiences are the pupils expected to get when they use technology at school?
- Who is expected to decide why and for what purposes educational technologies are to be used?

**Findings**

Following are the results from the study. They are divided into three historical periods – the 1960s, 1980s and 1990s – each characterised by a special theme; individualisation, politics and information society respectively.

**The 1960s: Technology for individualisation**

When the Swedish compulsory school in the 1960s replaced the parallel school system and all children were to attend the same school system, a very specific pedagogical problem arose: education had to be individualised to serve children from different backgrounds and with different interests. Much of what is said about educational technology in the first two curricula, Lgr 62 and Lgr 69, are attempts to solve this problem.

Discussions regarding the compulsory school in the 1960s were very much characterised by an optimistic view on science and technology and strove for modernisation (Westlin, 2000:139ff). The goals for education were mainly to give all children opportunities to learn for their future contribution to a complex society with its rapid development in science and technology.

The question of individualisation, however, was shaped by different expectations of the educational system. Children were supposed to be given basic knowledge and be able to pose new questions and find the answers for themselves (Lgr 62:15-17, Lgr 69:12-15). This twofold ambition resulted in a central tension in the texts. On the one hand, technology was expected to be used for learning with the help of ready-made material. Pupils were supposed to work on their own, fulfilling educational tasks with the help of different artefacts like books, pictures, mechanical devices and so on (Lgr 62:98, Lgr 69:63, 82).

Conversely, technology was expected to be used only as a complement to children’s observations of the world around them (Lgr 62:20, Lgr 69:16). According to the first of these expectations pupils could use technology to
test the level of their knowledge, to work on this level by themselves and to be tested again. Since the idea was that they could work by themselves with technology as the only resource, it differs essentially from activities where technology is used as a complement.

In comparison with Lgr 62, Lgr 69 further developed the issue of individualisation, but it also discussed the issue of who is to decide about the use of artefacts. There is a shift between the two curricula towards greater opportunities for the pupils to take part in the process of deciding how the educational practice is to be shaped (Lgr 62:19, Lgr 69:16). This is developed even further in the next curriculum.

**The 1980s: Technology and politics**

In the early 1980s a new curriculum, Lgr 80, was implemented in the Swedish compulsory school. It has many similarities, but also central differences, in comparison with the earlier curricula. In the 1970s the political debate in Sweden was characterised by a critique of the modern view on the relationship among society, science and technology (Englund, 1986; Westlin, 2000). This critique had important consequences for how technology was expected to be used as a resource in educational settings.

The main difference between Lgr 80 and its predecessors is that the shift away from a situation where the teachers alone decide the issue of whether and how technology is to be used became more obvious. Lgr 80 clearly expresses the view that teachers and pupils are expected to shape the educational settings – and hence also the use of technology – together (Lgr 80:13, 29-31).

The focus on participation, to give the pupils opportunities to make decisions, was a central part of a goal to socialise the children into active citizens (Lgr 80, 13, 16). This, in turn, has consequences for the understanding of the concept of individualisation. In Lgr 80 the child working by herself/himself with pre-made material is totally absent. Instead there is a focus on teachers and pupils working together (Lgr 80:48-50). The meaning of the concept of individualisation is constituted by the focus on each individual’s ability to contribute to the common activities in educational settings (Lgr 80:50).

The main difference between Lgr 80 and the earlier curricula is its focus on common activities in classroom practices, and not on the individual. This means that the issue of the usage of technology is blurred since it does not express any obvious expectations on how it shall be used. Conversely, it becomes more obvious, not in the curriculum text, but potentially in practice, since it becomes a question for the pupils and teachers to discuss (Lgr 80:46).

In an educational system based on Lgr 80 the users are expected to contribute to the shaping of educational practices and to the usage of technology in the classroom. The point is that this curriculum leaves room
for a discussion on issues concerning content and ways of working in the classroom. Both teachers and pupils are regarded as important agents in the shaping of educational settings.

The 1990s: Information society and learning

In 1994 two important texts were published that are central to this thesis. The first one is a new curriculum, Lpo 94. In Lgr 62, 69 and 80 goals and means for educational practices are formulated, which means that they also handle questions about the use of artefacts in education. Lpo 94 only gives instructions about the educational goals, and thereby leaves the decision on how to shape classroom activities to teachers and pupils. Since it does not handle the question about educational means, I complemented my empirical material with another text.

The second text, published in 1994, was written by the government’s IT-commission. It was the starting point for a discussion on the governmental level that resulted in a decision to invest in the implementation and development of information technology in education.34 The results of this decision were described, and instructions to the schools were given, in a Government Communication in 1998 (Regeringens skrivelse 1997/98:176).

The discourse on modernisation that characterised the debate about the compulsory school in the 1960s now returns in a revised version (Westlin, 2004). According to the rhetoric, the development of information technology has brought society from an industrial to an information society.

The Government Communication has many similarities with the curricula for the compulsory school. It stresses that the educational system is to provide opportunities for all children to gain a common basic knowledge and to learn to formulate and solve problems in order to be prepared for life in society (Regeringens skrivelse 1997/98:176, p. 6-7). However, there are also important differences.

First, it stresses the need for the school to adjust to the development of information technology and an information society. This means that all children must learn to search for and select information from various sources, but it also stresses that new ways of working are needed in the classroom (p. 12). Parallel to this, the text also expresses expectations on the information technology to be used in a completely different manner, namely as an arena for discussions with other people on various subjects (p. 16).

Second, the expected demands from technological development to change education is similar to the ambitions formulated in the curricula of the 1960s. The great difference, however, is that in the 1960s, the school system was expected to be a central and positive force in shaping society (Lgr 62:14), while in the 1990s it had to follow the technological and societal change:

---

34 This work is described and discussed in the summary of Paper I above.

There is also a focus on critical thinking in the governmental communication. Children are expected to learn how to select and judge information from various sources (p. 12). However, this is not the case when it comes to the question of choosing educational methods and hence not the use of technology in education. If one is to follow the instructions in the Government Communication it is impossible not to use information technology in educational settings.

Conclusions and discussion of the historical case study

There is a close connection between the view on the purposes of education and the pedagogical problems that the use of technology is expected to solve. During the 1960s the optimistic view on technology and science, in combination with the ambition to give all pupils a basic education, influenced the expectations on the use of technology in education. The central question in the 1960s was the one of individualisation. All pupils, regardless of background, were to attend the same school in order to gain opportunities to contribute to the modernisation of society. However, there are no absolute directives about how technology is supposed to be used.

Optimism regarding technology, and the view on technology as a determinant on the educational system, returns in the texts from the 1990s, but in a slightly different manner. The problems that technology was expected to solve are about technology itself. All pupils are expected to get the possibility to appropriate knowledge about the use of information technology as a tool in education for learning and for preparing them for life in the information society. In the 1960s the school was expected to be a positive force for social change, while in the 1990s it was expected to follow technological developments.

Lgr 80 differs in central parts from the earlier and later texts. The critique of the view on technology and science as positively shaping the future resulted in a shift in the curriculum: the problems that technology was expected to solve were not as obvious as they had been. The absence of the expectation of technology to be used for individualisation by children working by themselves, with material for learning or searching for information, leaves open the question of how technology is expected to be used. At the same time the problems that technology was expected to solve became more obvious, not in the curriculum text, but potentially in educational practice. In Lgr 80 the use of technology is not taken for granted. It is a subject for discussion among teachers and pupils on how technology can be used and what problems it can solve.

When it comes to the question of who is expected to decide why and for what technology is to be used, there is a tension between two positions in the
texts. The first one emphasises the role of technology itself. Most obvious is the text from the 1990s where technology demands new ways of working in educational settings. The second one argues that technology is dependent on the decisions people make. It is, however, possible to distinguish between two different positions in this latter view. On the one hand it is the experts, in this case the teachers, who are expected to decide about technology usage. This view is expressed mainly in Lgr 62. On the other hand, it is the users, that is teachers and pupils, who are expected to decide. This is expressed in Lgr 69 and, above all, in Lgr 80.
General discussion and future perspectives

The aim of this thesis is to develop and apply an empirical approach that can be used in studies of the relationship between different expectations of, and the actual use of, information technology. In focus are different educational processes where people use artefacts and where expectations on their use are expressed.

The aim is based on the twofold ambition to (1) develop an approach that opens the door for empirical investigations on the usage of technology and (2) to contribute to the research field about information technology in educational settings. I have shown how an approach based on a sociocultural perspective on learning, specified by inspiration from a sociotechnical perspective on artefacts, generates new questions about the usage of technology and its influence on learning. Furthermore, I have shown how the writings of Ludwig Wittgenstein can be used in studies of educational processes. In the following, I will connect and discuss the empirical results of the five case studies to the relationship between different expectations of, and the use of, information technology and its influence on learning in educational settings.

Using artefacts

In a sociocultural perspective on learning the use of artefacts is a central dimension of human action and learning. In the course of history people have developed and used different kinds of tools that have made it possible to do a number of things not otherwise possible. It is not, however, the case that the way technology will be used is obvious or given beforehand. We may expect a tool to function in a specific manner, but in actual use we will not be able to use it in that way. It might even be that we do not expect anything at all from a tool since we have not yet learned what to expect of it. Furthermore, in interaction with other people we can meet expectations different from our own. In all of these cases technology can be an issue for discussion and negotiation. Most of the time, however, we use artefacts without reflecting on their meaning; we take their use for granted.
Habits, customs and intentions

Think of information technology. Most people today will probably think of a computer connected to the Internet. Think of a computer used by children searching the Internet for information, maybe about bridges or the greenhouse effect (cf. Paper II and IV). Think of a computer used for playing games (Paper III). In a sense the children in all these cases used the same kind of technology. They all used an artefact called a computer connected to other computers on the Internet. On the other hand they did not use the same kind of technology at all. In the cases of information search, the technology was used in one way and in the case of playing a game it was used in another. In the latter case the children did not even have to connect to the Internet at all. In this way different meanings of information technology are constituted in action.

Some ways of using technology are included in educational practices while others are not. From the results of the study presented in Paper II we know that the meaning constituted in a certain situation is only one of at least two possible meanings of the Internet in the situation analysed (cf. Papers I and V). The children were given two different tasks. In the first task they were expected to find information about different kinds of bridge-constructions and why the bridges are constructed that way. In the second task the children were expected to consider arguments for and against bridges. From the results of the study we know that the pupils only worked with one of these tasks, namely the first one. The meaning of information technology was constituted as a source of information (cf. Paper IV). This kind of use seemed to be obvious for the children; they took for granted that the artefact was to be used this way. From a sociotechnical perspective on artefacts this is an important result, since it points at the fact that the construction of technology repeats itself over and over again, but in different ways in different situations. There was no struggle about the meaning of information technology among the pupils in any of the recorded situations. Still, their use of the artefact differed from what was expected.

Using information technology the way people do sometimes may seem strange since they were expected to act otherwise. The most obvious examples of this are the results of the second classroom study (Paper III). In this situation the children were expected to work with chemical problems with the help of an edutainment-disc. The design and content of the disc was to give children an opportunity to learn chemistry while experiencing an adventure in the game. What they did, however, was to try to solve the tasks in a completely different way than expected. Instead of, for example, throwing a car battery at the door to the mine as was expected, they went out in the woods looking for a key. My conclusion from this case is that the ways that the two girls tried to solve the problems is completely reasonable. They used their earlier experiences from other situations – where doors are
opened with keys – and acted in accordance with their habit of playing games on the computer. Throwing a battery at a door and letting the acid destroy it would seem like a strange thing to do in most everyday situations.

Similarly, it may seem strange that the children in Paper IV copied information from the net without doubting its relevance at all. However, this was also a completely reasonable way of acting under the circumstances. First, the mode of reinforcement in the text they met on the Internet was declarative and convincing. No room was left for doubt or discussion. Second, the study shows that the children intended to “do the assignment because it has been assigned”. We can imagine that the practice would have been shaped differently if the text had been based on another mode of reinforcement, or if the children had a different intention with their work. This is, however, a task for further research to investigate.

Using artefacts in education in the way the curricula from the 1960s (e.g. Lgr 69) instructs may seem just as strange. It would mean that children would be expected to use ready-made software for learning and not, as is said in the rhetoric on information technology of the 1990s, to formulate their own questions and search for answers in different information sources (Paper V). However, it might also seem strange to use information technology in the way the Government Communications from 1998 suggests. Consequently, technology can be used in many different ways, but in specific situations, based on specific customs, it will be more reasonable and relevant to use it in certain ways than in others. Certain meanings about the use of technology will be, in other words, more appropriate than others.

When people use artefacts they often take their use for granted. They act in accordance with their habits of using the artefacts in a certain way. A central part of this practice is their intentions and expectations of what the technology can be used for. Some ways of using artefacts may be excluded since they would break the expected and customary use of the artefacts. However, it is important to note that it is possible to break a custom by intention.

We can now draw a first conclusion about how to understand the relationship between different expectations of, and actual use of, artefacts as an empirical question: expectations are central parts of human action and different expectations may result in different types of practices.

The notion about many possible meanings of artefacts is important for understanding the influence of artefacts in use. It is, however, also a relevant notion when trying to understand the efforts made on other levels of the educational system and the great expectations about technology that have surrounded the rhetoric of the information society during the last decade (Paper I and V). Furthermore, connected to this issue is the question about who will decide the direction of the efforts made in school. This is a question about whose expectations are to be regarded as legitimate. Let us now turn to these question.
On the question of implementation

Think of information technology again. Some people will probably think of the relationship among technology, society and individuals. The development of new technologies is often stressed to demand societal (and educational) changes (Paper I and V). However, there is an obvious risk of being blinded by these changes and drawing conclusions on how educational practices will, or should, be shaped. This is also the case in the rhetoric on information technology in the 1990s, where the different possible ways of using IT are compared to a normative stance about the “good way” of using it. How the usage of technology in educational settings should be shaped is, however, as the results of Paper V show, in no way obvious or given beforehand. In light of this study, the rhetoric on the use of a multi-faceted tool like information technology seems to be reduced to a question of using it in certain ways, and with no possibility of not using it at all.

The implementation of information technology in the Swedish compulsory school can be assumed to be shaped by a struggle between different views of information technology, for example as is shown in Paper I, between information technology as a source of information or as an arena for discussion. In the course of history many attempts have been made to find technological solutions to pedagogical problems; many different kinds of expectations on the usage of artefacts have been expressed on different levels in the educational system. In a sociotechnical perspective it is not possible to tell in advance what kinds of changes to the educational system (if any) may appear when new technologies are implemented. The users and the classroom culture will influence the use of artefacts.

This can launch studies of, and discussions about, who is expected to decide whether or not technology shall be used in a certain way in education, and leads to a second conclusion on the question of expectations and actual use: in the efforts of implementing and developing the usage of technology in education different agents express different expectations. So, who is to decide how to use artefacts: the technological development experts or as many involved people (including the users) as possible?

Consequently, actions performed in actual use are not determined by the use of the artefact in any uncomplicated ways. There are always potential opportunities for using technology in multiple ways. However, some will be included and some will be excluded. This in turn has consequences for the understanding of issues on learning and socialisation.

Learning and socialisation

If there can be multiple and parallel meanings of an artefact, and if meanings are constituted in action, we can ask ourselves which of all possible
meanings should be included in practice. Before going any further into this issue, I just want to say that I will not give an answer to this question. Rather, I want to contribute to the discussion about the use of technology in relation to the issue of learning and socialisation. This theme runs through all the papers, but with a focus on slightly different aspects. A commonality of all the articles is an ambition to open the discussion on the voices of the users related to the possibilities of participating in discussions about the use of information technology.

We can make a distinction between two aspects of the relationship among learning, socialisation and information technology. First, it is possible to use the computer for learning in different ways and with different kinds of educational content. In Paper II the children focused on the search for facts about bridges. In Paper III, the girls probably did not learn any chemistry at all. In Paper IV the pupils were expected to valuate and judge information on the Internet, but focused on the retrieval of facts. The historical case studies presented in Papers I and V show a central tension between educational purposes. On the one hand, pupils are expected to learn pre-defined facts and, on the other hand, they are supposed to find and discuss different views on various subjects.

Second, different expectations have been expressed about the children’s participation in shaping the educational use of technology. Even though the shaping of technology on some levels has reached closure, there is always a potential possibility of multiple meanings in practice. I will elaborate on this issue for a moment.

Meanings of technology are constituted in actual use, which means that the struggle between different social groups shaping the meaning of technology does not end in a final closure. In educational situations this means that the pupils’ experiences of using information technology, their habits and customs, in combination with the problems they are to solve in specific situations, shape the meaning of the artefact in action. In the classroom studies I have shown how it can be reasonable for the children to use information technology the way they do. For example, they use their earlier experiences of searching the Internet for information while it could have been constituted as an arena for discussion, or as a source where different voices could be heard as well (Paper II and IV). It is obvious that they take this specific way of usage for granted. In the terminology introduced by Wittgenstein it stands fast for them. The study presented in Paper III, of children’s conversations while working with an edutainment-disc, shows that the problems the children were supposed to solve, in combination with their earlier experiences, constituted the information technology a tool for entertainment and not for edutainment.

Even though meanings are constituted in action, it is not the case that we can do whatever we want to do with artefacts, at least not without breaking the customary rules for their use (or the laws of nature). In the course of
history different pedagogical problems were expected to be solved with the help of artefacts (Paper V). Some of them take the form of wishes and hopes, while others take the form of regulations and demands. We can, for example see that using technology in a specific way may be regarded as the “right” or “good” way. However, this is only the case in the Government Communication. The curricula from 1962 to 1980 express the possibility of using technology in multiple ways, even though the problems expected to be solved with the help of artefacts differ between the texts.

The fact that the meanings of artefacts do not always come from outside into practice calls attention to the question of who is to decide how and for what purposes technology is to be used (Paper I). As shown in Paper V there can be several customs of use and different expectations of the users. In the early 1960s the experts, that is the teachers, were expected to decide the use of artefacts. This shifted in the late 1960s and 70s, and above all in the 1980s, towards expectations for the pupils to contribute as well. In the late 1990s, a new kind of expectation was expressed. Now the technological development itself was regarded as the determining force and educational practices were expected to adjust to it. These expectations were expressed at a certain time in history. Other social groups, such as teachers, might have expected other things from technology usage. This is, however, also a question for further research.

If we leave assumptions about technological essentialism and determinism behind, technology does not determine how it shall be used. This opens for questions about who is to decide if and how technology ought to be used in educational settings. It also opens for discussion about the potential for users to participate in the shaping of educational practices. We can now make a third conclusion about the relationship between different expectations on, and actual use of, artefacts regarded as an empirical question: learning to use an artefact involves learning whether or not we can take part in its shaping.

On the confusion

So, is the confusion about the relationship between technology and action solved? Of course not, there will probably always be possibilities to emphasise one or the other of the opposite positions. My point is rather that it can be avoided if empirical studies focus on the processes in which people use artefacts.

When it comes to the relationship between expected and actual use of artefacts in educational settings, the answer must be that it depends on the circumstances. On some occasions there is a very weak connection between expectations and use. In other situations people are more or less forced to follow someone else’s, or their own, expectations. This means that
expectations can take the form of everything from wishes to demands. Obviously, it is not possible to do whatever we want with technology. Both the artefact and the sociocultural context set limits. My point is, though, that the interpretative flexibility is much wider than is often assumed. In this perspective a central empirical question within educational research is how individuals-are-acting-with-technology-in-educational-settings.

Methodological considerations

In this thesis three classroom studies and two historical analyses have been used with the purpose of developing and applying an approach that can be used to deepen the understanding of the relationship between expectations of, and the actual use of, artefacts in educational settings. In the project we have tried to interfere as little as possible with the children’s work in order to study computer usage (and other kinds of actions) when the technology is already in place. Of course this has its limits. First, it leads to a recorded material that we cannot control. What we see is what we get. If one wants to place special focus on certain questions it is necessary to interfere to a higher degree. This is the case of the recording for the study presented in Paper IV. We constructed the task with which the children worked. Second, and related to this, the selection of material is limited by the fact that information technology actually is being used to a very small degree in the educational settings we recorded. Third, here the use of computers is taken out of context. In the project, however, there is much more recorded data that have worked as a base for the formulation of my research questions. For other research questions it may be valuable to study the actions that precede and follow the practice in focus. It would probably give a deeper understanding of how it can be reasonable for the participants to act in the way they do. However, regardless of these limits the case studies can be used to illustrate practice. In this thesis they have been used for studies of how people act in actual situations.

Once more, I would like to emphasise that one of my ambitions has been to call for empirical studies of the circumstances that surround the use of artefacts in educational settings to determine what role artefacts may play in learning and socialisation processes. The distinction made by Wittgenstein between “following a rule” and “acting in accordance with a rule”, and the implication this has for the role of the researcher as a third person trying to understand how it can be reasonable for people to act in this or that way, have guided my empirical work. The cases have been used as illustrations of an approach that can be used for studies of the relationship between expectations and actual use, without assuming beforehand that one factor determines the other. It is my hope that this approach can contribute to a clarification of relevant educational issues without falling into the trap that
Wittgenstein warned against, namely, yielding to the temptation to look behind the obvious to establish what has caused what, once and for all.

**Future perspectives**

It would certainly be valuable to make a more extensive collection of cases from this perspective. Issues that could be analysed include the use of information technology in situations other than the ones used for illustration here. Comparisons between action in different groups of pupils can be made, such as between groups of boys and of girls respectively, or different groups in different schools or different school subjects.

Another issue that can be dealt with is the development and design of the use of technology in educational settings and of digital resources for educational purposes, both of special software like edutainment discs and of resources on the Internet. In the latter case, it would be interesting to study different attempts that have been made to facilitate access to information and communication via the Internet. The sociotechnical perspective on artefacts points to the importance of involving the agents who are expected to use the resources in everyday educational practices.

I have mainly focused on the use of information technology. An interesting future study would be to enlarge the perspective to involve studies of other kinds of artefacts like textbooks and laboratory work. The material collected within the Lärnot-project consists, as said above, of approximately two hundred hours of recorded classroom practice. In many of these recordings different kinds of technologies are being used. Using the approach developed and used in this thesis could produce valuable insights into the practices we have recorded.

Artefacts do not, in a simple and direct way, determine action. This means that in a sense it is impossible to plan the future use of an artefact. However, there is always the potential for choosing which ways to privilege. Pupils’ possibilities to learn with technology might depend on their opportunities to participate in decisions about how it shall be used. This could be the subject for development and research projects.
References


Apple, Michael W. & Jungck, Susan (1998). “You don’t have to be a teacher to teach this unit”: Teaching, technology, and control in the classroom. In Hank Bromley & Michael W. Apple (Eds.), Education/technology/power. Educational computing as a social practice (pp. 133-154). Albany: State University of New York Press.


Jedeskog, Gunilla (2000). *Teachers and computers. Teachers’ computer usage and the relationship between computers and the role of teacher, as described in international research*. Uppsala: Uppsala University, Department of Education.


Lidar, Malena, Lundqvist, Eva & Östman, Leif (submitted). Teaching and learning in the Science Classroom- the interplay between teachers’ epistemological moves and students’ practical epistemology.


SOU 1995:68. IT-kommissionens arbetsprogram.


Acta Universitatis Upsaliensis

Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Social Sciences 3

Editor: The Dean of the Faculty of Social Sciences

A doctoral dissertation from the Faculty of Social Sciences, Uppsala University, is usually a summary of a number of papers. A few copies of the complete dissertation are kept at major Swedish research libraries, while the summary alone is distributed internationally through the series Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Social Sciences. (Prior to January, 2005, the series was published under the title "Comprehensive Summaries of Uppsala Dissertations from the Faculty of Social Sciences".)