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# Disabled Pupils` Use of Assistive ICT in Norwegian Schools

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## 1. Introduction

The subject of this chapter is disabled pupils` use of assistive information and communication technologies (ICT) in Norwegian primary and secondary schools. The chapter investigates how use, or non-use, of assistive ICT at school influences disabled pupils' opportunities for active participation in an inclusive educational system within the regular school system. This investigation draws on a qualitative pilot study carried out in Norwegian primary and secondary schools in autumn 2010.

After years with separate educational systems for disabled children, the prevailing view today is that such educational segregation should be avoided, and that all children should be educated with their peers in regular schools. These inclusive schools are perceived to be "*the most effective means of combating discriminatory attitudes, creating welcoming communities, building an inclusive society and achieving education for all; moreover, they provide an effective education to the majority of children and improve the efficiency and ultimately the cost-effectiveness of the entire educational system*" (UNESCO, 1994:9). This perspective includes more than valuing the inclusion of all in a common education system; it is also perceives an inclusive education system as a means to develop a society that welcomes diversity. Several countries, including Norway, have committed to this view by signing declarations and conventions that intend to provide every child an acceptable level of education, regardless of the child's individual characteristics, abilities, interests and learning needs (ibid.). Moreover, according to the Norwegian Education Act, every child in Norway has the right to attend their local school, and a regular class or group at this local school (Education Act, 1997).

The goal of this inclusive education policy is to provide for the full participation in environments and activities that are common and positively valued, and to remove arrangements that are devalued and stigmatized – such as special arrangements for disabled pupils (Tøssebro & Lundeby, 2002). However, being included is more than being present. Being included in an ordinary school means, "*Being in an ordinary school with other students, learning the same curriculum, at the same time, in the same classroom, with full acceptance by all in a way which makes the student feel no different from any other student*" (Bailey, 1998:184). This means that inclusion is achieved only when the concept has lost its content, and there is no longer any distinction between "ordinary" and "different." To what extent this "all inclusive" education takes place during an ordinary day at school may vary (Wendelborg, 2010). The question asked and answered in this chapter is to what extent the use of assistive

ICT for disabled pupils in Norwegian compulsory school contributes to the full inclusion of these pupils in regular Norwegian schools.

### 1.2 The Norwegian context

Norwegian ICT policy aims at securing an information society for all, emphasizing the importance of technology for all, including disabled people. One priority area for ICT policy is the compulsory school (MD, 2005). Authorities point to accessible and usable ICT as a vital means in securing the basic principle of inclusion, equality and full participation for disabled people (MD, 2005; NOU 2001:22, Report No. 17 to the Storting, 2006). According to the Norwegian Education Act every child in Norway has the right to attend their local school, and a regular class or group at this local school (Education Act, 1997). How the individual school is organised has, however, proven to be of vital importance for disabled pupils' possibilities for participation and inclusion (Wendelborg, 2010; Wendelborg & Kvello, 2010; Wendelborg & Tøssebro, 2010). Even when a disabled child attends a regular school and is a member of a regular class he or she may not be included in the school setting. Research suggests that disabled pupils in Norwegian regular schools participate less in activities at school than their non-disabled peers, and they have less access to curriculum activities (Erikson, Welander & Granlund, 2007; Shevlin, Kenny & McNeela, 2002; Wendelborg & Tøssebro, 2010). The public ideology is that when special education is needed this education shall take place in a regular classroom setting together with classroom peers. Nevertheless, there is a documented development of establishing more and more special classes in regular schools, and of using a variety of segregated arrangements for disabled pupils (Tøssebro et al., 2006; Wendelborg, 2010). Resent research shows that 70 percent of disabled pupils in regular schools attend their classes less than 50 percent of the time spent at school (Wendelborg, 2010). This means that in spite of an effort to promote an inclusive school system, exclusion and marginalization of disabled pupils still takes place in Norwegian schools. Viewed against this background my question is *if* -, and *how* -, use of assistive ICT for disabled pupils promote or hamper their inclusion and participation in ordinary classroom settings. What is really assistive ICT, and how do Norwegian pupils access this technology? We will examine this closer in the next paragraph.

## 2. Provision of assistive technology in Norway

ICT has become a central facilitator in Norwegian inclusion policy. This emphasis on ICT is called the digital inclusion policy. This policy has three main pillars: *digital access* for everyone, *universal design* of all ICT, and *digital skills* e. g. by enhanced use of digital learning resources in education (MD, 2005). Two different strategies are used to promote access to ICT for all. The first strategy, which emphasises the universal design of ICT, has focused on public Web sites, open standards, and open sources (Fossestøl, 2007). The second strategy is a rights-based national assistive technology diffusion system. Every Norwegian county houses an Assistive Technology Centre that provides assistive technologies, free of charge, to people whose ability to function in everyday life is considerably and persistently reduced. These centres provide assistive technology solutions for use at home, school, work, or leisure, and for people of all ages. Common assistive ICT include standard computer devices, ICT tools, and equipment for handling the computer and other communication aids (Hansen, 2007).

Providing and maintaining assistive ICT for disabled pupils requires the involvement of many different professions and services. Professions and services which are involved in this process most often are occupational therapists, assistive technology centres, various centers of expertise, technical suppliers, teachers, school IT consultants, and technical departments of local municipalities, along with the disabled pupils and their parents. These professions and services are required to cooperate in testing, adjusting, educating, implementing, maintaining and upgrading the disabled pupils` assistive ICT. The disabled pupils in the current study were all assigned assistive ICT due to their visual or mobility impairment.

### 2.1 Assistive ICT for persons with mobility or visual impairments

Assistive technology may be defined as any item, piece of equipment, or product that is applied to secure, increase, maintain or improve functional capabilities (Wielandt, et al., 2006). Assistive ICT for mobility- impaired people usually involves equipment that eliminates the requirement of fine hand and finger motor skills. The assistive ICT used by the mobility-impaired pupil in the current study are different software programs, especially an *eye tracking program* called MyTobii, an *enlarged keyboard* called BigKey, and a joystick. These assistive ICT equipment provided access to the computer for this pupil who had very limited control of her fine motor movements.

The main goal of visual assistive ICT is to provide the best possible sight-enhancement or sight-substitution mechanism. For partially sighted people, these goals mean magnifying the screen display in order to facilitate the performance of visual tasks such as reading texts, selecting menus, responding to system prompts, and navigating between different parts of Web sites. Usually this magnification involves the use of a *screen magnifier software application* that runs as a background task. Such screen magnifiers enables users to enlarge text and graphics across a wide range of levels (Chiang et al., 2005).

Providing ICT access to blind persons involves non-visual alternatives for tasks that are traditionally understood as visual, through the use of assistive ICT that translate the visual interface into either tactile or auditory output, or a combination of the two. The most common assistive ICT for blind people is an electronic *Braille display* that produces a refreshable, line-by-line tactile output on a special keyboard. However, as this tactile output is purely text-based, it is less helpful in translating graphic interfaces. To access graphic interfaces a blind person needs *a screen reader*, a software application that interprets and translates text and graphical displays into auditory output. Overall solutions to visual ICT access problems, however successful, require not only that assistive ICT is well-designed, but also that Web site content and layout are flexible and organised to promote accessibility (Chiang et al., 2005). This sight-enhancing and sight-substituting assistive ICT equipment provided access to the computer for two of the pupils in the study, one of them being visually impaired and the other one being blind.

In addition to examining the disabled pupils` use of these technologies, we will also scrutinise what premises are required for the full utilization of the anticipated possibilities inherent in these technologies. As this chapter will show, this investigation provides deeper insight into the significance of some decisive details, as well as contributing new knowledge to this field. However, before we investigate these circumstances in more detail, I will provide a short overview of (i) relevant research, (ii) theoretical perspectives, and (iii) a methodological approach in the current study.

## 3. Relevant research

For several years Norwegian authorities` have emphasized the significance of using ICT and digital learning materials in Norwegian compulsory school. Nevertheless, knowledge about the use of ICT and digital teaching materials is still very limited (Juul et al., 2010; Norwegian Research Council, 2008), and even more limited regarding the use of assistive ICT for disabled pupils (Murchland & Parkyn, 2010). Therefore, the following overview of relevant research will look into research about (i) the use of ICT and digital teaching materials, (ii) the significance of ICT for disabled children and young people, and (iii) the significance of assistive technologies for disabled children and young people.

### 3.1 Use of ICT and digital teaching materials in Norwegian schools

Even though ICT are widely disseminated throughout Norwegian society, and especially among young people, it turns out that Norwegian compulsory schools lag behind this development. Furthermore, a digital differentiation among pupils in compulsory school is documented (Arnseth et al., 2007; Hansen et al., 2009).

Digital differentiation denotes variables in the use of ICT among those who supposedly have equal access to ICT. More importantly is the focus of digital differentiation on the implications of these differences (Peter & Valkenburg, 2006; Sassi, 2005; Yu, 2006). While a digital differentiation perspective perceives the characteristics of the users as more important for his/her use of ICT than the characteristics of the ICT, studies on young disabled people finds the characteristics of the ICT to be of vital importance for their use of ICT (Söderström, 2009a, 2009b; Söderström & Ytterhus, 2010).

Available research shows that Norwegian compulsory schools employ ICT and digital teaching materials as an integrated part of the teaching only to a very small degree (Kløvstad, 2009; Juuhl et al., 2010; Vavik et al., 2010). While approximately 20 percent of teachers in compulsory schools use ICT regularly, the majority state that they use ICT "sometimes." The reason for this low use of ICT is because teachers lack experience with ICT, lack technical and educational support, and experience a shortage of time and equipment (Vavik et al., 2010). Moreover, there is very little research on how decisions are made when teachers choose which learning materials to use in their teaching (Juuhl et al., 2010). Available digital learning materials are only occasionally universal designed, and are inaccessible to disabled pupils, for the most part (Begnum, 2008; Bekken, 2009). These circumstances point to the need for more research on how the school may employ ICT, and especially assistive ICT, to implement the principle of inclusive education.

### 3.2 The significance of ICT for disabled children and young people

Western people, and especially young people, use objects, technologies and ICT equipment as symbols of identity and belonging. However, to display a desired self-identity, people have to use adequate symbols in appropriate ways, i.e. in ways that are culturally and historically contextualised (Buckingham, 2006; Hocking, 2000). In this way the use of technology in general and of ICT in particular, may promote or inhibit appearance, performance, and identity (Haraway, 1991; Latour, 1992; Söderström, 2009b). While this applies to most people in general, it is especially the case for children and young people.

Disabled children and young people are first and foremost ordinary children and young people with the same desires, aspirations, and needs as any other children and young people. The significance of ICT for disabled children and young people is quite similar to that of other children and young people. This means that ICT is above all valued for its social, interactive and communicative potential in networking and identity negotiations (Lonkila & Gladarev, 2008; Storsul et al., 2008; Söderström, 2009a, 2009b). However, these characteristics of ICT lead to a permeability of the virtual and the material world. This means that the material world and the virtual world are no longer separate entities, but are permeable, mutually constituted, and embedded in s young peoples` everyday lives (Buckingham, 2006; Peter & Valkenburg, 2006; Söderström, 2009a). This permeability involves some challenges in disabled children and young peoples` participation and inclusion in the peer group. One of these challenges is connected to the accessibility and usability of ICT. While accessible ICT is ICT a person can operate, usable ICT is ICT a person can use for his or her intended purposes (Söderström, 2009b).

Another challenge is the permeability of the virtual and the material, which leads to a dependency on usable ICT (McMillan & Morrison, 2006). This dependency is a double-edged sword because it embraces more and more of young people`s everyday lives. Consequently, the social, interactive and communicative use of ICT is vital for young people`s social inclusion and participation in the peer group. Furthermore, withdrawal from the use of ICT, or the inability to engage in digital forms of communication, is perceived to represent one of the most damaging forms of exclusion for young people (Livingstone & Helsper, 2007; McMillan & Morrison, 2006; Söderström, 2009a). Therefore, accessible and usable ICT holds great significance in disabled children and young people`s lives.

### 3.3 The significance of assistive technologies for disabled children and young people

Assistive technologies are technologies used to improve, expand or extend people`s performances, actions and interactions, and thus they are often experienced as an extension of the body (Lupton & Seymore, 2000; Moser, 2006; Winance, 2006). However, using assistive ICT involves more than overcoming environmental barriers; it also involves symbolic, historical and cultural contexts. Assistive technologies are loaded with collective cultural traditions, symbols and values, and subjective feelings and meanings are assigned to the technology (Pape et al., 2002; Wielandt et al., 2006). While young disabled people find the use of ICT to symbolise competence, belonging, and independence, they find the use of assistive ICT to symbolise restriction, difference and dependency. Therefore, to pass as ordinary young people, they reject using assistive ICT whenever possible. However, those disabled young people without the option to participate online without assistive ICT make a "forced choice" to adopt these technologies. Disabled young people who adopt assistive technology seek to make the technology coherent with their preferred self-identity, and if this is not achieved they reject the technology (Söderström & Ytterhus, 2010). This contradiction makes the combined use of ICT and assistive ICT of special interest to disability studies, the field of the current study.

## 4. Theoretical perspective

The current study draws on a perspective rooted in social science and the cross-disciplinary field of Nordic Disability Studies, and therefore it holds a relational perspective on

disability. This perspective conceptualises disability as a social construction, which takes place in interpersonal relationships, in encounters between individuals and environments, and between individuals and society (Gustavsson et al., 2005). Consequently, this chapter's perspective is that it is not the disabled pupils' impairments as such that governs their use of ICT or assistive ICT, but rather the social practices in which the use of these technologies takes place.

Furthermore, this study employs an actor-network theory (ANT) perspective to elaborate on its findings. This perspective seeks to reveal what is happening, how it is happening, and what is involved in that which is happening (Moser, 2003). This perspective refuses to make *a priori* distinction between entities and actors, or define in advance what kind of entities might be granted agency and explanatory force. According to an ANT perspective one should have as few assumptions as possible about what there is in the world and how the different entities in the world are related. Also, one investigates what something is by asking what and how it is made to be, what its possibilities are and what relations it emerges from, what is done in practice, and what effects it brings along (ibid.). These conditions materialise in *socio-material practices* in which facts, objects, and nature are not given but are effects of interactions, relations and orderings. Such socio-material practices may be how disabled pupils use their assistive ICT, how the assistive ICT influences a disabled pupil's possibilities for actions and interactions, and how these possibilities affect the disabled pupil. Or in other words; how a disabled pupil's actions, participation, and identity are made and unmade in specific relations and interactions holding both social and material elements. This chapter investigates such socio-material practices in the Norwegian compulsory school.

The actor-network theory was originated by Latour (1987). He claimed that objects, machines, technologies and humans are all equal parts in reciprocal networks of connections and joining actions, all actively influencing each other, and all being actors (Latour, 2008). *Actors* generate effects. Therfore, any object, artefact, or person who generates an effect by making a difference is an actor. Actors may indicate, encourage, permit, influence, make possible, determine, or obstruct actions. Therefore, who and what enter into an action, or s*ocial practice*, need to be carefully scrutinised. While human actions, communication and symbols only constitute one part of social practices, things, objects and technologies constitute the other part. In social practices the connections and joining of actions create network effects that constitute *social structure.* Follow the actor, reveal their actions, and show how the social is created says Latour (ibid.). What I find promising in an actor-network perspective is its sensibility to the ways in which technologies are made to be and people are made to do.

However, the ANT perspective does have its critics. Some have attacked it for being a reductionist perspective, while others are disturbed by its liberal argument for extending the notion of actors to non-human entities. Some critics accuse the perspective of being too preoccupied with productivity and network building, and consequently losing sight of contradictions, ambivalence and complexities. Feminist researchers in particular used in this criticism of an ANT perspective. However, studies employing the ANT perspective are executed in so many different locations and contexts that the perspective is constantly developing (Moser, 2003). Law (1994) is one of the present ANT perspective's proponents, emphasising the perspective's constructivist elements and pointing out that the researcher

adopting this perspective also takes part in shaping reality, just as the socio-material practices the researcher studies do (ibid.). While the ANT perspective has developed from focusing on network building and the production of objects, to focusing on complex socio-material practices and enactments, to the collectives which make these practices possible, and to the actions and identities they enable (Moser, 2003). In this chapter I use this latter version of the ANT perspective to investigate how the use, or non-use, of assistive ICT in schools influence disabled pupils' opportunities for active participation in an inclusive educational system within the regular Norwegian school system.

## 5. Methodological approach

This chapter draws on a qualitative pilot study with three disabled pupils, their parents and teachers, and two employees at an assistive technology centre. The participating pupils are between 10 and 15 years of age, and they attend primary or secondary ordinary local schools in Norway. One of the pupils uses an electric wheelchair and has considerable mobility difficulties, one of the pupils is visually impaired, and the last pupil is blind.

While this study is a pilot study it was vital to recruit a purposeful sample. A purposeful sample selects potential information-rich cases for in-depth study and, therefore, maximises the potential for discovering as many dimensions and conditions related to the investigated phenomenon as possible (Patton, 2002; Strauss & Corbin, 1998). Thus, the current sample was selected after purposeful criteria about who might best generate theory. The participants were voluntarily and anonymously recruited through an assistive technology centre. The two groups of disabled pupils were chosen due to previous research that points out that people with mobility impairments encounter few ICT-related barriers, while visually impaired people encounter the most ICT related barriers (Fuglerud, 2006; DCR, 2004). Therefore, these two groups of youth might represent different aspects of knowledge to the study. All participants gave their informed consent, and they were assured full anonymity and confidentiality.

The data collection took place as individual semi-structured qualitative interviews with the three pupils, their parents, teachers and the employees at the assistive technology centre. Each interview lasted for approximately one hour. An interview guide was used to ensure that the same basic lines of inquiry were pursued with each participant (Patton, 2002). The subjects of the interviews were the participants` experiences of use of assistive ICT in the school, and what they thought might promote or hamper the use of assistive ICT in school. In addition to the interviews, participant observations were made of the three pupils` use or non-use of assistive ICT during a school day. Notes were taken during the interviews and the observations, and complementary notes were taken right after each interview or observation.

The analysis started right after the first interview was conducted and continued throughout the data collection period and the writing of this chapter. The data collection took place during autumn 2010. Data were analyzed using a *constructivist grounded theory* approach characterized by a continuously content comparative method. While traditional grounded theory is criticized for being too positivists and reductionist a *constructivist* grounded theory adopts grounded theory (GT) guidelines as tools but does not subscribe to the objectivist, positivist assumptions in GTs early formulations. The *constructivist GT* approach details

processes and contexts and goes into the social world beyond the investigative story (Charmaz, 2005). These guidelines for analysing the data were very much in line with the theoretical perspective of the actor-network-perspective (Latour, 2008) employed in this study.

Even though this process is inductive, no qualitative method rest on pure induction. All knowledge arises through interpretation of the data: theoretical analyses are interpretive renderings of a reality and not solely objective reporting of it (Charamz, 2005). Out of this continuous content comparative interpretive approach the following categories emerged: (i) technological properties, (ii) interdisciplinary collaboration, and (iii) school administration and management. These categories will be expanded and discussed in the following section on the study's findings.

## 6. Findings

The findings that are described and discussed in this section are presented using case descriptions and quote excerpts. All descriptions are real and all excerpts and correct. The description and excerpts used are selected because they illustrate circumstances which are common for all participants. However, to ensure the participants` anonymity, some personally identifiable details are changed. For the same reason all pupils are referred to as *she*, the teachers are referred to as *he*, the parents are referred to as *mother*, and the employee from the assistive technology centre as *they.* All three pupils participating in this study were assigned a personal computer, both at school and at home, with the necessary assistive technologies to make the computer accessible for them. We will now look closer into how the participants experienced the use of assistive ICT in school and what they thought of their experiences.

### 6.1 Technological properties

Sometimes the technologies the disabled pupils were assigned worked just fine, and sometimes it did not work as they were supposed to work, and sometimes they did not work at all. The question is what the consequences of this are for the possibilities of inclusion of the disabled pupils and their participation with classmates.

#### 6.1.1 Useful and compatible assistive ICT

One of the disabled pupils participating in the current study, Lisa, is a girl in fifth grade with severe mobility difficulties. Lisa uses a lot of assistive ICT at school. Sometimes she receives her teaching in class along with her classmates, and sometimes in a separate room alone with one teacher.

When Lisa is learning mathematics she attends her regular class. Lisa sits in an electrical wheelchair at a large desk in the front of the class. The teacher asks the class to solve the math tasks on some specific pages in the math book. A teacher`s assistant helps Lisa start the math program on her computer, and Lisa uses a joystick to navigate the marker on the screen to solve the same math tasks as the rest of the class. One by one the math tasks appear at the screen, proposing several possible answers. Lisa uses the Joystick to click on the answer she thinks is correct. Clicking on the right answer she is given points, more

points for more difficult math tasks, clicking on the wrong answer she is given no points. Lisa navigates the marker quite quickly around on the screen using the Joystick. Because she has some involuntary movements in her upper limbs it is sometimes a little bit hard for her to stop the marker exactly at the correct answer. However, most of the time she stops the marker at the correct answer, and at the end of math class she has a lot of points. Lisa proudly shows all her point to some of her class mates, who stop at her desk and compliment her before storming out to recess.

In this math class the assistive ICT Lisa used functioned as an actor enabling her to be in control of things, participate in class, and to show a positively valued identity as a competent pupil. In this way the compatible software mathematics program and the usable Joystick functioned as an actor empowering Lisa in her education, and making her no different from the other pupils. Through the provision of this assistive ICT in this setting Lisa was made able to demonstrate her competence in "doing being ordinary" and thus, pass as ordinary. In as much as people do every day ordinary things people pass as ordinary (Goffman, 1963). These properties of the assistive ICT, the usefulness and the compatibility, are vital prerequisites for disabled pupils` possibilities to participation and inclusion in ordinary schools. When the assistive ICT works as expected the disabled pupils find them very intriguing. When asked about what they think of assistive ICT expressions such as *"I think ICT is an ingenious invention"*, *"I would be lost without it"*, and *""It would be a boring life without it"* illuminates this technologies' central role in the disabled pupils` everyday lives.

However, action is not an activity done by one actor alone. Action involves many actors, human and non-human, in a network of connections (Latour, 2008). In that respect the possibilities of actions provided the disabled pupils by useful and compatible assistive ICT are made possible by a set of actors in network of connections. Lisa`s empowerment in math class is, thus, not solely due to the properties of the technologies used. It is also due to the combined interaction between, and properties of, Lisa, the assistive ICT, and the classroom setting. Thus, Lisa`s empowerment is made possible through three interrelating circumstances; (i) her mastering of the useful and compatible assistive ICT, (ii) her presence and participation in the classroom, and (ii) her classmates recognition of her competence.

I find this investigation of what is done in practice, what relations it emerges from, and what effects it brings along to illuminate how the *socio-material practices* in which the these things takes place are not given but effects of socio-material interactions, relations and orderings. Or, in other words what relations, people and objects interrelate and contribute to the full inclusion of, in this case Lisa, in the regular local school. This investigation of what actually takes place and what effects are brought along when Lisa employs useful and compatible technology is quite illustrative for all of the three disabled pupils in this study. However, it is not always that the assistive ICT is useful or compatible; quite frequently it turns out to be errors and shortcomings of the assistive ICT.

### 6.1.2 Errors and shortcomings of the assistive ICT

While Lisa sometimes experiences the assistive ICT as useful and compatible she just as often experiences it having errors or shortcomings. For writing and reading Lisa is assigned the assistive technologies MyTobii, which is an eye tracking software program for the

computer, and BigKeys, which is an enlarged keyboard for the computer. Lisa enjoys writing and reading, she is expresses herself very well, and she wants to become an author. However, due to quite a bit of involuntary head and upper limb movements it is quite strenuous for her to focus her eyes long enough at one particular point when using the MyTobii, or to control her finger movements to hit the right key at the BigKeys. Consequently she needs a lot of time to solve reading and writing tasks which really is quite simple for her and it is quite exhausting for her to work on the computer over some time.

Lisa receives her writing and reading lessons in a separate room alone with one teacher. The assignment today is to write about the night before when she attended the local youth club. Lisa chooses to use MyTobii for this assignment, and she and her teacher sit close side by side at the computer. Lisa concentrates on focusing her eyes on the letters she wants to write in order to tell her story. It takes quite some time to write a whole sentence, and after a while she gets tired and they switch over to using the BigKeys. Every time Lisa tries to write the letter "A" nothing happens. She tries over and over again, but nothing happens. Lisa gets very upset by this, and after some time the teacher also gets a little bit frustrated. The teacher tries to figure out what is wrong, and after a while he discovers that the key for "A" really functions as a "delete" key. Both Lisa and the teacher appear to be happy to figure this out, and Lisa continues to write her story. But now she deliberately tries to avoid writing any word with the letter "A" in it. This is not easy, and it takes some creativity on Lisa's behalf. After approximately 45 minutes (one class hour) Lisa has written four or five sentences about the local youth club she went to the night before.

When the writing lesson is over the teacher asks Lisa if she wants to print out her story and share it with the rest of the class later that day. Lisa thinks this is a great idea, and they start to print out her story. However, it turns out that the printer which is supposed to be connected to Lisa`s computer is not connected after all. The teacher says this is the responsibility of the school`s IT manager, and that he himself is not able to do anything about this shortcoming. They have to notify the IT manager and wait for him to connect Lisa`s computer to the printer. Consequently, at the last class hour that day, when everyone is supposed to share their stories with one another, Lisa is not able to share her story with her classmates.

The missing letter "A" at the enlarged keyboard BigKeys was an obvious error of the assistive ICT, but whether the missing connection between the computer and the printer was an error or a shortcoming is hard to tell. Regardless of what the technical barrier consisted of it constituted a barrier in Lisa`s participation in her class. Thus, in this setting the technical error or shortcoming excluded Lisa from her classmates` sharing of their writings, and placed her outside the classmates` fellowship. Such consequences of technical errors and shortcomings are usually ascribed the disabled person, and not acknowledged as the consequence of the technology`s property (Söderström, 2009b). Lisa`s mother tell about the same errors or shortcomings of the same assistive ICT Lisa is allocated at home;

> *"When the letter "A" is not working this represent a barrier for Lisa. The missing "A" means that she has difficulties reading and writing e-mails and chatting with friends, thus she misses out on a lot of information and interaction. The assistive technology equipment just has to work. Why do they not check this out at the assistive technology centre before delivering it to us? Do they not expect her to need the letter "A", what do they think she uses the computer for? It is vital for her quality of life that all her assistive ICT just work all the time".*

Here Lisa`s mother describe how little strokes fell great oaks, and what consequences this may have. An assistive technology`s usability is reflected by its impact on the user's activity and social participation (Arthanat et al., 2007). To obtain a high level of usability assistive technology must reduce physical, cognitive, and linguistic efforts, promote convenience, efficiency, and productivity. And even more importantly, it must support a positive impression of the user on significant others.

Assistive technologies which do not work as anticipated or needed creates frustrations which very often lead to the rejection of the technologies (Pape et al., 2002; Ravneberg, 2010; Söderström & Ytterhus,, 2010). Especially children and young people have low tolerance for technical errors or shortcomings which hamper their self-presentation or interactions with peers. Encountering such technological barriers disabled children and young people feel that their impairment is placed on the front stage to use Goffmans terminology (Goffman, 1963), and this is something they strongly want to avoid. Consequently many of them avoid using any technology which makes them stand out as disabled, especially in their interaction with classmates and peers. As far as disabled children and young people have a choice most of them will chose to manage without using assistive ICT, because they experience the use of assistive ICT as stigmatising. However, many of these children and young people do not have this choice if they want to participate and be included in the peer group.

One of the other participants in the current study, let us call her Anna, is visually impaired, having a progressive condition. Some time ago Anna was assigned a lot of sight enhancement assistive technologies. She did not want to use them because she felt embarrassed using them, feeling they ascribed her as different from her classmates. After some years her condition became worse, and now she realises that she has to use assistive ICT to be able to do any schoolwork at all. Anna`s teacher comments that he thinks Anna has gone through a maturation process which has helped her realise the long term consequences of not using the assistive ICT. Adopting assistive technology is a time consuming process which very often is conflicting, and also associated with individual functioning and maturity level (Craddok, 2006; Söderström & Ytterhus, 2010). However, even when the assistive ICT is well integrated in the disabled pupils' everyday activities and all technical details are in place, there still occur barriers to overcome.

### 6.1.3 Useless and incompatible assistive ICT

Anna is now in seventh grade, and she very often experiences her assistive ICT to be incompatible with ordinary ICT. At school Anna uses the following assistive ICTs screen magnifier, screen reader, speech synthesis, and Braille display. She also uses assistive technologies such as whiteboard camera and reading TV at school. Anna enjoys school and takes pride in her homework. She attends her regular class the whole time at school, but because she needs a lot of space for all her assistive technologies she is seated a bit on the side of the rest of the class. Her classmates is seated in pairs at one desk, but Anna needs two desks by herself in order to make room for all her technologies. When I ask Anna what she thinks about using all these technologies at school she answers:

> *"I don`t mind. It is convenient to have all these assistive technologies, but sometimes it is quite tiring too. Especially with the screen magnifier and the screen reader… For the most part I really use the school`s desktop PC".*

Why Anna for the most part uses the school`s desktop PC when she is allocated her own portable PC is illustrated by the following case excerpts.

At a history class the pupils are asked to choose one of the history's famous explorers, to gather information about the person, and then write an essay about this person. For this assignment they have two history classes (90 minutes). Anna`s group goes to the computer lab. Each pupil sits down with a desktop computer and starts surfing the web, looking for information about the one explorer they want to write about. Even though Anna is allocated her own portable PC and the assistive technologies necessary to make the PC accessible to her, she now chooses to use the schools ordinary desktop PC in the computer lab. The teacher explains that the assistive technology centre quite recently have installed a new software program called Supernova on Anna`s portable computer. Unfortunately it turns out that after this new software program has been installed Anna`s computer is no longer compatible with the web.

Nevertheless, Anna embarks with great enthusiasm for the task she is given. She decides to write about the Norwegian explorer Nansen, and starts searching the web for information about him. However, to be able to read anything on the school`s computer screen she has to enlarge the font to the size of font 36. When she tries to read the enlarged text on the screen she sits with her nose almost inside the screen and reads one word at the time. Reading on the screen Anna has to move along one line at the time, and word for word. This takes a lot of time, and many times she has to go back and read the line once more, probably to get the context right. After a long time spent on reading Anna writes one sentence about Nansen fairly quickly, even though she has to stare hard on the keyboard to hit the right keys when she writes. After writing one sentence she goes back to searching the web for more information.

The menu keys at the top of the screen can, however, not be enlarged, and Anna is not able to find the right menu key when she needs one of them. One of Anna`s class mates is sitting right next to her at the computer lab, and every time Anna needs one of the menu keys her class mate helps her out by point directly at the menu key Anna needs. During the two history classes (90 minutes) spent at the computer lab Anna manage to write seven sentences about Nansen. The most of this time Anna has spent on searching the web, moving along one line on the screen, reading one word at the time about Nansen. When her class mates tells Anna they have to stop because the time is out Anna gets very stressed saying; "*But I am far from done*". Her class mate, who have finished her assignment a long time ago, says; "*Well done, you are clever*".

This case excerpt illustrates how incompatible technology creates barrier in disabled pupils school work. Furthermore, incompatible technology creates barrier for Anna`s possibilities to show her competence and similarity to class mates. During the two history classes Anna was only made able to write seven sentences about Nansen. This was not due to her having poor writing or reading skills, but to inaccessible menu keys on the computer and almost unreadable web sites. If her allocated portable PC had been compatible with the web Anna could have acquired information about Nansen much more quickly, solved her task in time, and proved herself as a competent seventh grader. Anna`s class mate`s comment at the end of the session about Anna being clever might suggest that the class mate do not expect Anna to produce the same amount of text as she herself and the other class mates did. Or, maybe she did understand what a struggle it was for Anna to work on an inaccessible computer?

The relation between universal design of ordinary ICT and individual adaptation of assistive ICT is central in research on disabled people and ICT. While some researcher focus on the inaccessibility of ordinary ICT to promote the need for flexibility and universal design, other researchers argue for the necessity of individual adaptations of assistive technology, and others calls for the combination of the two. However, it turns out that such experiences with incompatible technology creating barriers for activity, just as Anna experienced in history class, are quite common (cf DCR, 2004; Söderström, 2009b; Söderström & Ytterhus 2010; Wielandt et al., 2006). For assistive ICT allocated disabled pupils to promote enhanced inclusion and participation in school settings these technologies have to be compatible with the ordinary ICT used at school. Moreover, for this to work satisfactorily it requires commitment from several sources, and close interdisciplinary cooperation.

### 6.2 Interdisciplinary collaboration

To ensure disabled pupils the benefits of using ICT tools in school life requires a concerted effort from many different actors. Regular testing, customization, training, operation and maintenance of equipment are prerequisites for appropriate usage of the equipment. Actors involved in this work are local occupational therapists, assistive technology centre, various centers of expertise, technical suppliers, teachers, the local school`s IT manager, and the municipality. To coordinate efforts of all these actors through interdisciplinary collaboration proves to be difficult. In this pilot study especially two aspects of collaboration around the use of the individual pupil's ICT tools turns out to create barriers to pupil participation and inclusion. The first thing we will investigate is the consequences of things taking time.

#### 6.2.1 Things takes time

The third pupil who participated in this pilot study is a severely visually impaired girl in ninth grade. Let us name this girl Eve. Eve is a clever pupil and she is allocated the same assistive technologies as Anna is. As the other disabled pupils Eve has a double set of assistive ICT, one set at school and one set at home, and she does virtually all school work using the assistive equipment allocated her from the assistive technology centre. As long as all the equipment works all goes well, but as soon as something doesn't work everything falls apart. Eve is totally dependent on her ICT tools in order to do school work. When an error occurs on the assistive ICT the assistive technology centre is responsible of repairing this (Svendsen, 2010). Eve`s mother tells:

> "*It feels like it takes years from the time we send in assistive equipment to the assistive technology centre until it is repaired. In the meantime, Eve must do without this equipment and this has major consequences for her schoolwork. I get so tired of calling in to the assistive technology centre and nag at them, it's so tiring! And then it's a little hard to complain too, for we are really grateful for all the help we get. But it is so much that is missing, and we're totally dependent on them.*"

That things take time is something most of us have experienced, especially where multiple agencies have to collaborate on complex matters. This also applies to the dissemination and maintenance of assistive ICT equipment. This is confirmed by many users of this sort of equipment, and also by various service providers in the municipalities. Especially is

information about what happens along the way, where the equipment is, and how long it takes before it is repaired something which is missing (Svendsen, 2010). Many disabled pupils are completely dependent on their ICT tools to work at any time in order to do their school work. When the parents have to take responsibility and to make calls to check and nag, it feels both frustrating and tiring for them. They also experience it as a dilemma to complain about a service they basically are not happy with, but which they are totally dependent on, and also thankful for. The assistive technology centre confirms that it takes a long time to repair assistive ICT, and they explain:

> "*When the assistive technology is sent to be repaired it is being sent directly to the engineers at the assistive technology centre, without notifying us who provide the users with the necessary equipment. We want to be notified to follow up the user when he or she is without any assistive ICT, or to provide them a replacement for the equipment while they are waiting. These things we have discussed here at the assistive technology center, we want to do something about it, but so far nothing has happened".*

However, it is not only the assistive technology centre which is involved in maintaining the assistive ICT, and even though it takes a long time to get the equipment repaired just to find out who is supposed to repair the equipment may take just as long time. One of the teachers explains:

> "*It's been a lot of back and forth with the assistive equipment for this pupil, not least when it comes to figuring out what to do when the equipment does not work. For instance; it is the IT manager at the local municipality who is responsible for providing access to the web. The printer, which, for the time being does not work, is the responsibility of the IT manager at our local school, and the eye tracking program is it the technical supplier which is responsible for, while the enlarged keyboard is the responsibility of the assistive technology centre. Whatever can be fixed here at our school runs more smoothly, but anything that needs to be done by the municipality, the supplier or the assistive technology centre takes an incredibly long time.*"

The teachers in this pilot study all report that they spend a lot of time figuring out things which they feel it really should be clear procedures for, such as who is responsible for what. This leads not only to the fact that many things take longer time than necessary, but also that many other important things are not done.

### 6.2.2 Unclear responsibilities

One of the teachers wants to show how the braille display on Anna`s laptop is working. After much trial and error he must give up this attempt. It seems like he is a little confused and unsure whether it really is the Braille display that is not working properly, or whether it is actually he himself who do not remember quite hoe to use it. Somewhat resigned he exclaims:

> *"The hardest part is actually finding out who is responsible for what when it comes to maintenance, upgrading and training in using the equipment. That is how the formal division of responsibility is between the school, the assistive technology centre and the resource centre".*

This teacher started to work with Anna about one year ago. When he started to work with Anna he got no training or guidance in how to use her assistive technologies, and he still have not received any training in use of this technology. He is, however, a young and

dedicated teacher and not afraid to try out new things, so he has taught himself how to use the most of Anna`s assistive technologies. In the beginning he felt it a little overwhelming as it was so much equipment to being so much equipment to learn to use at once. It took really a long time before he felt he had some kind of overview. To be able to do his job reasonable proper he believe it has been imperative that he is not afraid to try out new things, and that he is interested in technology. Both the assistive technology centre and resource centre offers various courses in use of the assistive technology equipment that Anna uses. However, the teacher has not received any information about these courses, and he is not aware that this service exists. It is one of the other teachers who are responsible for providing training and education for teachers when needed. This teacher is also responsible for providing information about relevant courses. This information has, however, for some reason Anna`s teacher not received. Usually it is not the lack of relevant courses which is the problem, but rather that the teachers don't get the opportunity to attend them (Bekken, 2009). According to this pilot study this might be due to lack of information about relevant courses.

The assistive technology centre organizes a lot of courses about use of various assistive ICT. These courses are intended for teachers, parents and other persons working close to the pupils who use assistive ICT. The courses are free of charge, and the assistive technology centre distribute information about their courses to the local municipality`s contact person for assistive technology. This contact person is then supposed to disseminate this information to teachers, parents and other persons working close to the persons using assistive ICT. This means that it is of vital importance that the contact person for assistive technology in each municipality is able to keep track of everyone who is assigned assistive technologies. It appears that this is not always the case. In addition information about the courses has to go through several segments before reaching its target. In our case first from the assistive technology centre, through the local contact person, then to the local school, and finally to Anna`s teacher. It appears that somewhere along this road the information get lost. Moreover, in cases where this information do reach the local school it is entirely up to the school if they want to make use of the courses they are offered or not. Even though the courses are free of charge, nevertheless, to attend these courses turns out to be an economic issue. If one teacher attends a course for one day the school has to hire a substitute, and this involve an expense. In times where budgets are thigh the schools have to make priorities, and courses and education are usually not prioritized areas when resources are scarce.

The assistive technology centre does not have the capacity to follow up everyone who is assigned assistive ICT. Thus, the courses they offer are the only arena for guidance and training in use of the assistive ICT equipment, which can be very complicated and specialized. The courses are also intended to provide an arena for sharing experiences, successes and frustrations. Thus, from the assistive technology center's point of view it is up to the individual person working close to the user of the assistive ICT how well they make use of the potential of the assistive ICT. However, this argument makes the presumption that everyone who needs it is given the opportunity to attend their courses. This is, however, not always the case, which the excerpts from Anna`s teacher on the previous page illustrates.

From the assistive technology center's point of view the cooperation with the teachers varies a lot. While they experience some teachers as very interested and eager to learn, others are

quite reluctant and appear to have mental blocks when it comes to technology. Similar experiences are also known from other studies in the field, describing professional helpers either as enthusiasts who makes everything possible, or as plugs that stops everything (Bekken, 2009; Egilson, 2010, Lundeby & Tøssebro, 2006). Further, the assistive technology centre experiences the cooperation with the different teachers as dependent on the teachers working culture. That is what kind of subject or discipline the teacher belong to, or the workplace milieu the teacher is socialized into. Last, but not least, the assistive technology centre also finds the frames and structures under which the teachers work to be very influential on how the teachers are made able (or unable) to employ the potential of assistive ICT.

Unclear responsibilities are not only an issue for the cooperation between different departments. Clear distribution of responsibilities inwards at the individual local school is also a challenge. Such unclear distribution of responsibilities involve an extra strain for parents of disabled pupils in that they take on responsibility which actually is the school`s responsibility. One of the mothers expresses this as follows:

> *"In general the teachers lack creativity when it comes to adaptation of the curriculum to my child. It appears that they do not plan anything ahead. They tell me that they want to make the adaptation that is necessary, but that they have no time for this kind of work. Especially in math classes it is important that they make the necessary adaptations for her. It is so hard for her to figure out a calculation if she has to navigate herself through a divided text".*

Further on this mother tells that she constantly has to remind the teachers about what her child needs. This mother finds that all the teaching is organised for sighted pupils, and that the special teacher then has to help her daughter to acquirer what she can of this teaching. The mother thinks it should be an easy task to adapt the teaching for the class so that her daughter too could participate in math class together with her classmates. *"It ought to be easy to use enlarged text on the blackboard, sheets handed out, and power point presentations"* she says. This mother experience that she has to do half the job the school is supposed to do by her herself making the teaching material accessible to her visually impaired daughter. This is in accordance with Bekken (2009) who found that parents of disabled pupils put a lot of voluntary work into adaptation of curriculum, teaching material and technology. Unclear distribution of responsibility inwards at the individual local school does not only hamper cooperation with external partners, but it also involves an enhanced strain on parents of disabled pupils (Lundeby, 2008; Wendelborg, 2010). This is actually a question of the individual school`s incorporated routines about how to meet pupil`s individual needs. How the individual school is organised and administered is of vital importance when it comes to evaluating to what extent the school is an inclusive school or not (Wendelborg, 2010; Wendelborg & Kvello, 2010; Wendelborg & Tøssebro, 2010).

### 6.3 School administration and management

According to Tronsmo (2010) school administration is to take responsibility for achieving good results. Additionally, the school administration has an indirect impact on the teachers' level of ambition, the educational setting, norms and culture, in addition to the schools collaborative relationships with external partners (ibid.). How the school day is organised for pupils with disabilities has proven to be of vital importance for their possibilities of inclusion and participation with classmates (Bekken, 2009; Wendelborg, 2010).

At one of the schools in the current pilot study it appears that the way in which the school administration organizes the school provides enhanced possibilities for disabled pupils` participation and inclusion. There are several disabled pupils at this school, and the school administration is very keen on including all pupils regular teaching settings. *"The administration is very good at facilitate individual adaptation"* the teacher at this school explains. When the partially sighted pupil attended this school the administration told the teacher to let them know if he needed anything special in order to adapt his teaching to this particular pupil. In other words, the administration was not only aware of the pupils' potential special needs it was also very forthcoming and benevolent in its attitude to make an effort to include this pupil in the ordinary school setting. The teacher at this school has also been given the opportunity to get an education as a special educator for visually impaired pupils. Consequently this visually impaired pupil receives all her teaching in the classroom together with her classmates, which is a prerequisite for being included.

This particular school has gathered a number of disabled pupils in the same class. The teacher tells how all the teachers teaching in this class have been carefully chosen according to their ability to be flexible, creative and innovative. Nevertheless, even though the school administration appears to be very forthcoming, and the teachers highly qualified, the teacher participating in the pilot study experience that the other teachers lean a lot on him. He feels he has to take responsibility for many things that are not really his responsibility, e. g. universal design of classrooms etc. He thinks this is partly because he has some special education in the area, and partly because this is no one else's responsibility in particular. This illustrates the necessity of having a clear distribution of responsibility, inward in the individual school, and for the special areas of universal design and of individual adaptation. In total, it still appears that the school administration`s deliberate and positive focus on the issues of individual adaptation and full inclusion of disabled pupils is a prerequisite for the participation and full inclusion of disabled pupils.

At one of the other schools in the pilot study, however, it appears that the school organization and administration may hamper the disabled pupils` possibilities for participation and inclusion. The teacher at this school tells that there are no other disabled pupils at this school besides the one participating in this study. Universal design and individual adaptation for pupils with special needs are not an issue among the teachers. *"The school administration does not have a clue about disabled pupils' rights"* says this teacher, referring to the Education Act of 1997, which proclaim that all children have the right to attend their local school, and a regular class or group at this local school (Education Act, 1997). Even though the participant having mobility difficulties attend this school, which is her regular local school, it turns out that she rarely attends her ordinary class. Most of her teaching she receives in a separate room and alone with one teacher.

The argument for this exclusion from the ordinary classroom setting is that the assistive technologies this pupil uses requires a lot of space, and is best kept in a separate room. This argument is in line with the developmental trend of exclusion ordinary local schools which Wendelborg (2010) discovered. Wendelborg (2010) found that about 70 % of disabled pupils attending ordinary schools receive their education in separate settings, excluded from their classmates, in more than 40 % of the time spent at school. Moreover, Bekken (2009) found that when it comes to the exclusion of blind and partially sighted pupils this is due to the schools lacking competence, and the lack of follow-up at all levels. This development trend

is quite contrary to the inclusive ideology of the Norwegian Education Act (1997) and other public documents in the area. In addition, this trend illustrates that no matter what potential assistive ICT holds for disabled pupils the technology itself do not contribute to enhanced participation and inclusion in the ordinary school setting. The triggering factor for the full utilization of assistive ICT`s anticipated benefits is first released when it is employed in an inclusive setting with classmates.

To be familiar with assistive ICT takes time and to learn how to utilize all its potentials takes time. Time for this kind of testing and preparation is, however, something the teachers feel they do not have. Even though some of the teaching is done by means of quite advanced technical equipment none of the teachers in this pilot study are given any extra time to prepare how to use this advanced technical equipment. This means that very often the pupil`s assistive ICT is not fully utilized, and sometimes not used at all. The non-use of available technical equipment is also well known from research on teachers' use of technology in general (Vavik, et al., 2010). It appears as if the introduction of new technological equipment provokes insecurity and that many teachers have an indefinable resistance towards employing new technology. The parents in this study all strongly point out that they experience the teachers' technological competence as insufficient. One of the younger teachers tells, however, that he has to use some of the time intended for teaching to get acquainted with the assistive ICT. This is absolutely necessary he claims, in order to be able to use it, but this time is also valuable teaching time which is lost. The question is if the school administration`s organization of the teachers` time, the teaching and the pupils` schooldays is a question of resources, of competence or of attitudes?

When a pupil is allocated a new kind of assistive ICT the pupil`s teacher is offered an introduction in how to use its core functions, either by the assistive technology centre or by the supplier of the technology. However, in order to be able to make use of all its possibilities the teachers say they need regularly courses and guidance in use of the technology. Such courses are offered twice a year by the assistive technology centre, though without any of the teachers in this study being aware of this. To disseminate information about these courses throughout all levels of services is an organizational challenge, a challenge which obviously is not met. The school administration`s lack of focus on individual adjustment and the significance of advanced assistive ICT have an impact, not only on the teachers premises and competence in this area, but also on the disabled pupils' possibilities for participation and inclusion in school. It might be that school administrations perceive this as a resource question, or as a question of priorities. It most certainly is a question of organization and management. Even though some teachers do a very good job in adjusting the teaching to the individual needs of their pupils they are still quite dependent on the school administration`s support. Securing individual adjusted teaching to disabled pupils requires a combination of thorough planning, collaboration, competence and the full utilization of individually assigned assistive technologies.

## 7. Perceived barriers and recommended solutions

All parents participating in this study accentuated the lack of competence in school when it came to assistive technologies. Further they pointed to lack of focus on the significance of individual adjustment of the teaching material and teaching situation. The parents pointed

to these two conditions as the two greatest barriers for the full employment of the potential in assistive ICT. Even though the parents experience that some teachers do their best, the parents think this is still not enough. The parents think it is important that the teachers can be good examples to their children, also when it comes to using technology. This includes making use of assistive ICT an ordinary task in line with use of any other kind of technology. *"Actually, school administrations` competence regarding individual adjustments and inclusion of disabled pupils are in general quite inadequate and especially inadequate when it comes to the significance of assistive technologies"*. This is a statement re-occurring in the interviews with the parents.

The teachers also experience encountering barriers in their work with pupils who are allocated assistive ICT. They accentuate the lack of time to prepare and learn how to use the assistive ICT as the greatest barrier. Moreover, the teachers point to technical properties as barriers, such as non-working keys and missing software programs. One of the teachers also point out that resistance among teachers to employ new and unknown technologies also represent a barrier.

From the assistive technology center`s point of view it is the lack of environmental accessibility that represent the grates barrier in using assistive technology in school. They think the lack of universal design of school buildings and classrooms hamper the full utilization of the potential of assistive ICT, and of inclusion of disabled pupils in classroom settings. They also turn the focus in another direction; the inclusion of non-disabled pupils in the teaching of disabled pupils. This kind of a somewhat reverse thinking might also facilitate the inclusion of disabled pupils according to their point of view. Eventually they also accentuate the significance of teachers' competence, attitudes and experiences in the area as a possible barrier.

Parents, teachers and the assistive technology centre all experience barriers in using assistive ICT. They experience these barriers somewhat different, and they perceive the causes of these barriers different. However, all of them express the same concern; the lack of technological and digital competence in using assistive ICT. The parents emphasize the significance of school administrations` attitudes towards disabled pupils, the teachers emphasize the lack of time for preparations, and the assistive technology centre emphasize the practical adjustment and inclusion of non-disabled pupils in the teaching of disabled pupils.

The recommended solutions also differ according to ones point of departure. The parents think the solution must be providing all teachers enhanced competence in use of technology and in individual adjustment of the teaching. The teachers think the solution must be providing them more time for preparation, planning and testing of the assistive ICT. And the assistive technology centre thinks the solution must be a much more active effort in adjusting the environments to include disabled pupils in the ordinary classroom setting.

While the findings in this study to a certain degree is colored by the participants' different relationships to the participating pupils, the finding also correspond with previously research in this area (cf. Bekken, 2009; Craddok, 2006; Murchland & Parkyn, 2010; Söderström & Ytterhus, 2010; Wendelborg, 2010).

## 8. Conclusion

The subject of the current pilot study is disabled pupils` use of assistive ICT in Norwegian primary and secondary schools. Taking this pilot study as a point of departure this chapter has investigated how use, and non-use, of assistive ICT at school influence disabled pupils' opportunities for active participation in an inclusive educational system within the regular Norwegian school system. The findings elaborated on in this chapter illuminate the existence of barriers on several levels for the utilization of assistive ICT in Norwegian schools. Some of these barriers are technical barriers connected to the equipment, some barriers are human barriers connected to competence and attitudes, and some barriers are at a system-level connected to interdisciplinary collaboration and school administration.

The first barrier described is the technical barrier which occurs when the assigned assistive technology does not work as intended. This might be due to simple technical errors, or incompatible software or hardware. Such technical barriers put an effective end to any attempt of participation or inclusion of the disabled pupils in the teaching or the interaction between classmates.

Another barrier is the unclear distribution of responsibility among collaborative professionals, both between different levels of services and within the same service level. It is a huge amount of service providers involved in the provision of assistive ICT to pupils, e.g. the local occupational therapist, the assistive technology centre, the technical supplier, various resource centers, the local municipality, the local school, the teacher etc. While all these actors spend time figuring out who is responsible for what the disabled pupils who are dependent on assistive ICT is left at a dead end, so to speak.

This study illuminates how the individual school is organised and administrated is of great significance for disabled pupils' possibilities in participation and inclusion at school. School administrations` attitude towards making an active effort to include disabled pupils in the ordinary school settings set the framework for teachers` possibilities to make individual adjustments in their teaching. While the administration at one of the participating schools in the current study had a positive and active approach in including disabled pupils in the ordinary school setting, this was not an issue at all in the two other participating school administrations.

This study highlights phenomena and practices which have an impact on the use and non-use of assistive ICT in Norwegian primary and secondary schools. In sum these phenomena and practices turn out to be about teachers`, school administrations` and collaborative partners` knowledge, competence and attitudes towards technology and disability. These findings are also in line with previous research in this area (cf. Bekken, 2009; Craddok, 2006; Murchland & Parkyn, 2010; Söderström & Ytterhus, 2010; Wendelborg, 2010).

This current study points out how practical details and situations make a difference in disabled pupils` every day at school. When the assistive ICT works as intended and use of this technology is integrated in the teaching in ordinary classroom settings use of assistive ICT facilitate enhanced participation and inclusion of disabled pupils. It appears, however, that this integration of assistive ICT in ordinary classroom settings takes place only to a limited extent. When the assistive ICT does not work as intended, is not put to use, or is used only in separate and excluded teaching settings it is perceived as a symbol of difference which hamper participation and inclusion.

Further, there are two factors which emerge in this study which are found to be of special importance to underline and repeat in conclusion. First and foremost it is the significance of integrating use of assistive ICT for disabled pupils in the ordinary classroom setting. This integration will restrain potential stigmatization and subsequent rejection of the assistive ICT (Lupton & Seymour, 2000; Murcland & Parkyn, 2010; Söderström & Ytterhus, 2010). The other factor which is found important to underline and repeat is the assistive technology center's suggestion about turning the focus on inclusion into another direction; namely the inclusion of non-disabled pupils in the disabled pupils` use of assistive ICT. This suggestion is found very interesting, and might be a new strategy in promoting appreciation and inclusion of disabled pupils.

When it comes to what new knowledge this study provides the current pilot study highlights two conditions not described in previously research. First and foremost the study provides new insight into the consequences for the individual disabled pupil of the complexities of actors involved in allocating, operating and maintaining the assistive ICT. The second new insight this study provides is the consequences for the individual disabled pupil of her/his teacher`s perceptions of technology and disability.

The current study is a small pilot study and, thus, is perceived as a preliminary study in a relatively new combination of research area. The study`s intention is, however, to provide a basis and direction for further and more comprehensive research in this field. Besides investigating the current subjects on a larger scale, further research in this field should also look closer at the perspectives of school administrations, municipal authorities and the various service providers on technology and disability. In a Norwegian setting there still exist some gaps in the knowledge of what significance use of assistive technologies holds for disabled pupils in ordinary schools. This knowledge gap is especially present when it comes to how purposeful and efficient use of ICT and assistive technologies may provide new inputs to the principles of adapted learning environments and inclusion of disabled pupils. In this context it is important to note that how use of assistive ICT for disabled pupils creates possibilities, or barriers, in their participation and inclusion can only be revealed by closely investigating the cultural context and interactive processes in which the persons, technologies and environment are embedded. In practice this means to ethnographically study the phenomenon over time.

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This book offers the reader new achievements within the Assistive Technology field made by worldwide experts, covering aspects such as assistive technology focused on teaching and education, mobility, communication and social interactivity, among others. Each chapter included in this book covers one particular aspect of Assistive Technology that invites the reader to know the recent advances made in order to bridge the gap in accessible technology for disabled or impaired individuals.



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