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CONCENTRATION DIFFICULTIES IN THE SCHOOL
ENVIRONMENT – WITH FOCUS ON CHILDREN
WITH ADHD, AUTISM AND DOWN’S SYNDROME

CATRIN TUFVESSON



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AKADEMISK AVHANDLING

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Abstract

The overall aim of this thesis was to identify environmental factors that affect children with ADHD, autism, and Down's syndrome and their ability to concentrate in their learning environment at school. The issue of this research is not to dismiss any of the additional resources these children are in need of; instead it is to suggest how to arrange learning environments in the most supportive way possible based on the initial needs of these children.

A pronounced ambition concerning the educational policy in Sweden is to organize an all-inclusive school, meaning that schools should be able to meet the needs of all children, irrespective of their capacities and conditions. However, there is no specific guidelines for the school environment as a learning environment considering these children's needs or the needs of those with concentration difficulties. The Human Environment Interaction-model was used to establish the structure of the approach of the thesis, especially concerning the review of previous research, the development of the questions at hand, but also as a holistic method way to fill possible gaps in earlier approaches.

The research has been divided into four empirical studies. The first two studies served as a basis for possible principles of generalization and specifics for each disability concerning influences found in the school environment. In Study I, personal assistants and teachers working on a daily basis with children diagnosed with one of the disabilities were approached. In Study II the professionals approached were working at the Child and Adolescent Habilitation Services, thus having a different relation to the children than the informants in the first study. In both studies questionnaires were being used. The response from the 125 personal assistants and teachers, and 137 professionals at the Child and Adolescent Habilitation Services, revealed school-related environmental factors influencing the children in question and their ability to concentrate. The results sometimes showed different influences depending on which disability the children had. It was shown that aspect, such as, façade apertures and room passages, the view, acoustics, interior furnishing, seating arrangements, size of class and classroom, and decoration could influence the children's ability to concentrate, both positively and negatively.

In Study III six group-work observations were carried out, revealing the need of individual adjustments. The results from that study also highlighted the difficulty in allocating already built classrooms to children with diminished cognitive abilities for the purpose of supporting their different needs. Finally, Study IV demonstrated the application of the principles within the building process, and that the participants tied to school projects in accordance with the cyclic building process has the potential to implement new knowledge.

It may be concluded that these children's ability to concentrate are influenced by the features of their learning environment, which needs to be considered in the allocation of them in the school buildings. It was further concluded, that this knowledge should be implemented in the building process.

Keywords: ADHD, autism, building process, children, concentration, Down's syndrome, the Human Environment Interaction-model, individual adjustment, indoor environment, learning, school environment

To Victor –

who knows how to enjoy life!

Acknowledgment

Before I started to work on this thesis, I was convinced that the environment had an impact on humans and our behaviour through personal experience - especially if we are extra sensitive - but I was still surprised when I saw the results develop! However, this thesis could not have been carried through if it were not for the support of certain people. I am grateful to my supervisor Dr. Thorbjörn Laike and my assistant supervisor Dr. Maria Johansson, at Environmental Psychology, Department of Architecture and Built Environment, Lund University, who guided me and shared generously with their insights and knowledge within the field.

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Lund, in August 2007

Catrin Tufvesson

The thesis is based on the following papers

- I: Tufvesson, C. and Laike, T.
Concentration difficulties in the School environment - A study of children with Attention Deficit Hyperactivity Disorder, Autism spectrum disorders, and Down's syndrome in their learning situation.
Submitted for publication.
- II: Tufvesson, C. and Laike, T.
Learning environments for children with ADHD, autism and Down's syndrome.
Submitted for publication.
- III: Tufvesson, C.
The need for individual adjustments in school concerning children with ADHD, autism and Down's syndrome – an observation of their learning environment.
Submitted for publication.
- IV: Tufvesson, C. and Tufvesson, J.
Avoidance of concentration difficulties among cognitively limited children in the Swedish school environment within the building process.
Submitted for publication.

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Introduction

Research in environmental psychology has shown that the environment has an influence on humans and human behaviour. This fact may be especially pronounced in children who are extra sensitive towards influences from their daily surroundings (Barber et al, 2005, Bieberich and Morgan, 2004, Bauminger et al, 2003). Approximately 15% of the Swedish population between 2-17 years of age have some kind of prolonged illness or disability (HI 2002). These children can be divided into three groups with either limited a) physical, b) medical, or c) orientation capacities. Due to national and international disability acts, it has become more common to include children with disabilities in the same educational environments as their typically developing peers. Given that all children in Sweden are required to attend school on a regular basis (SFS 1985:1100, §3), this will have implications for the design of the school environment. There is, however, a lack of knowledge concerning the influence of specific environmental factors in the classroom on children with orientation disabilities such as Attention Deficit Hyperactivity Disorder (ADHD), Autism spectrum disorders (autism) and Down's syndrome, and their ability to concentrate during formal learning situations at school. Often the problem has been studied in a fragmented way or not with a holistic approach. Moreover, if any influence from environmental factors on these children's ability to concentrate can be identified, it will be of vital importance to the children's learning that the knowledge is implemented in the building process of school environments in accordance with the Swedish legislation.

A pronounced ambition concerning the educational policy in Sweden is to organize an all-inclusive school, meaning that schools should be organized to meet the needs of all children, irrespective of their capacities and conditions (SOU 1998:66). It is also stated in "From Patient to Citizen: A National Action Plan for Disability Policy"¹ that disabled children should have the same rights of access to education as other children, i.e. that schools should be accessible for all children, which is the same intention declared in UN's Standard Rules on the Equalisation of Opportunities for Persons with Disabilities². In practice this includes access to the actual buildings for people with limited mobility (in need of wheelchair or zimmer frame) or orientation capacity (reduced visual, auditive, or cognitive capacities)³, and the intention is for this to be implemented no later than 2010. The Swedish building regulations offer recommendations and guidelines on how to handle limited mobility and reduced visual and auditive capacities in the design and building of schools⁴. However, the term "limited orientation capacity" includes diminished cognitive capacities, for which recommendations and guidelines are rare and hard to find. The work of municipalities and other liable school parties will be to secure the quality of the adaptation of the school environments, i.e. the actual premises but also the access to different teaching and technical aids, as well as special support. The question that arises is how school

¹ Swedish Government Bill 1999/2000:79.

² UN's General Assembly Resolution A/RES/48/96, 1993.

³ BFS 1993:57 – 2006:12 BBR, BFS 2004:15 ALM1 and BFS 2003:19 HIN1.

⁴ BFS 1993:57 – 2006:12 BBR and BFS 2003:19 HIN1.

environments should be designed in order to be all-inclusive for children with diminished cognitive capacities, who are extra sensitive to the design features in their environment.

The sensitivity towards their environment, due to the symptoms of their disabilities, is well documented for children with ADHD, autism, and Down's syndrome. In the Swedish building regulations, the three disabilities mentioned here are defined as being part of a group categorized as having limited orientation capacities, and as such need to be catered for when it comes to the accessibility of schools. However, specific recommendations have not yet been produced (see Study IV). In order to fill this gap, the ambition of this thesis was to identify common aspects for all three disabilities concerning the influences from environmental factors, but also to map differences between the disabilities. The intention was that the results from the studies undertaken within the thesis would then be divided into principles of possible measures that would support the decision-making and building processes surrounding the production and maintenance of school buildings. These principles may be divided into three different levels: 1) an overall level aiming at general principles concerning all of the disabilities, 2) a specific level aiming at principles concerning the specific disabilities, and 3) an individual level aiming at individual needs. The decision-making and building processes contain phases where different actors/parties have distinct tasks, in which the different levels of principles could be included in order to produce and maintain school environments that are as supportive as possible for these children.

Previous research

In studies of children's behaviour it has been shown that there are some environmental factors such as physical and social ones, but also individual factors, which can contribute to longer periods of concentration, and others that can shorten or even interrupt the concentration period (Evans, 2006). For instance, in the school environment, children's ability to concentrate can be negatively affected by noise (Enmarker and Boman, 2004, Lercher et al, 2003, Hygge et al, 2003, Maxwell and Evans, 2000). Research by Norlander, et al (2005) showed that lower levels of noise increased the children's ability to concentrate in the classroom. Research has shown that a lack of daylight (Küller and Lindsten, 1992, Küller, 2002) affect children's behaviour and ability to concentrate. However, research has also found that too much daylight impairs students' performance (Wilson, 2004). A study made by the Heschong Mahone Group Inc. found that access to views through windows in school classrooms improved the students' performance (Wilson, 2004), which would also have implications for the design of the school environment.

There is also an interplay between physical attributes and organisational factors. For example, as suggested by Martin (2002), the classroom settings, but also the size of the classes, will have an influence on the school layout and design, and vice versa (Schneider, 2002, Moore and Lackney, 1993). Large numbers of school children and staff could influence the children's behaviour negatively (Kantrowitz and Evans, 2004,

Legendré, 2003). It has been shown that the teaching methods influence how the children handle a learning situation (Strayhorn and Bickel, 2002). An example of positive tutoring is one-to-one instruction (Bronson, et al, 1997). If the children have the possibility to move about, that would also affect their behaviour positively (Huse, 1995). Individual factors, such as age and gender, also have an influence on the behaviour of the children (Laike, 1997, Reese et al, 2005, Lehnung et al, 2003).

Research concerning the actual seating of pupils, especially those with special needs, showed that it would influence their behaviour, i.e. that a dysfunctional seating arrangement will be negative for their ability to concentrate (Adams, et al, 2000). Organizing children with diminished cognitive abilities to work in smaller groups is considered by pedagogues to be an important part of their social development, but also the most difficult one (Pavuluri, et al, 1999, Cuckle and Wilson, 2002, Singhanian, 2005). Research by Charlop, et al (1983), showed that independent work settings for children with autism gave more individual time with each child for the teacher, compared to a group work setting, which was more time consuming for the teacher. The materials and equipment also need to be accessible, especially concerning children with disabilities, in order to for them to keep their concentration (Doctoroff, 2001). Flickering artificial light has proven to negatively affect the ability to concentrate among those who are autistic (Colman, et al, 1976). Shibata and Suzuki (2004) found that indoor plants had positive effects on emotional state and creative task performance. Indeed, spending time in every day nature⁵ could also lead to a lessening of symptoms in children with concentration disorders, which may indicate that contact with nature supports their attentional functioning (Faber Taylor et al, 2001). The actual disability can also impair the children's capacity for concentration (Faber Taylor et al, 2002), a fact that needs to be taken into account when placing the children in the school environment.

Previous research suggests that school environments contain several different environmental factors, which all in different ways will affect children's ability to concentrate in the learning situation. These factors need to be taken into account when schools are being designed and maintained. This seems particularly important, considering that children who are extra sensitive to the features in their environment will also use school premises.

Description of disabilities

The number of children with disabilities in Sweden can be divided into three groups: 25% have a limitation of physical capacity, another 25% have medical limitations, and the remainder have some kind of limited orientation capacity⁶. Children with limited physical capacity are for instance seated in wheel chairs or have other impairments concerning their physical mobility; children with limited medical capacity could be

⁵ Every day nature in this case is a green environment, which could be found in e.g. parks, gardens, playgrounds, and schoolyards.

⁶ HI 2002.

suffering from allergy, epilepsy, or may have abdominal problems; and children with limited orientation capacity may have diminished perceptive capacity, for instance reduced auditive or visual capacity, reading, writing or speech impairments, or diminished cognitive capacity, where “cognitive” refers to the mental functions and processes connected to comprehension, attention, perception, memory, decision-making, problem solving, and learning (Strickland, (Ed.), 2001, Egidius, 1994), and may be one of the diagnoses ADHD, Autism, Down’s syndrome, Dementia, Dyslexia, or other psychological disorders (Figure 1).

Generally children with Down’s syndrome, Autism spectrum disorders (autism) and Attention Deficit Hyperactivity Disorder (ADHD) often need additional resources in their schools, such as a personal assistant, special pedagogical methods, individual tutoring, technical aids, unique solutions to personal problems, individually adapted teaching material, etc (Strayhorn and Bickel, 2002, Russell, 2002). These children have in common that they are easily affected by their physical and social environments due to their sensory dysfunction, for example through visual (Deacon et al, 2005), auditory (Rogers and Ozonoff, 2005), and emotional influences (Thapar et al, 2006). This has far-reaching effects on their abilities and their well-being (Barber et al, 2005, Bieberich and Morgan, 2004, Bauminger et al, 2003), and as such influences their capacity to concentrate at school.

More specifically, Down’s syndrome is a genetic disorder and the most common cause of neurodevelopmental disorders (Nadel, 2003, Hedov et al, 2002). The disorder includes delayed motor skills affecting functions such as sitting, crawling, and walking in infancy (Lauteslager, et al, 1998), delayed cognitive and communicative skills such as speech and language acquisition (Paterson, et al, 2006, Boudreau and Chapman, 2000), impaired short-term memory (Purser and Jarrold, 2005), and learning limitations (Gathercole and Alloway, 2006). Autism spectrum disorder is also a neurodevelopmental disorder, which typically appears during the first years of life (Singhania, 2005). The disorder affects the functioning of social interaction, social communication, and personal behaviour (Meresse, et al, 2005, Singhania, 2005, Rinehart, et al, 2006).

Attention Deficit Hyperactivity Disorder (ADHD) is the most commonly diagnosed behavioural disorder of childhood (Remschmidt, 2005), and is also considered to be a neurodevelopmental disorder. ADHD is characterized by one or more core symptoms: inattention, hyperactivity, excessive motor activity, and impulsivity (Bruce, et al, 2006). Children suffering from ADHD find it difficult to pay attention and control their own reactions, and as a result they are often fidgety and interrupt others (Archibald et al, 2005, Hastings, et al, 2005, Brody, 2001, Nigg and Casey, 2005). Impairments in cognitive, learning, and social skills can occur (Bruce, et al, 2006). The children with these diagnoses all have in common that they have learning and concentration difficulties due to the symptoms of their disabilities (Singhania, (Autism), 2005, Drechler, et al, (ADHD), 2005, Clibbens, et al (Down’s syndrome), 2002), i.e. they experience great difficulties in staying focused in an environment with a wide variety of sensory input, which results in interrupted study activity.

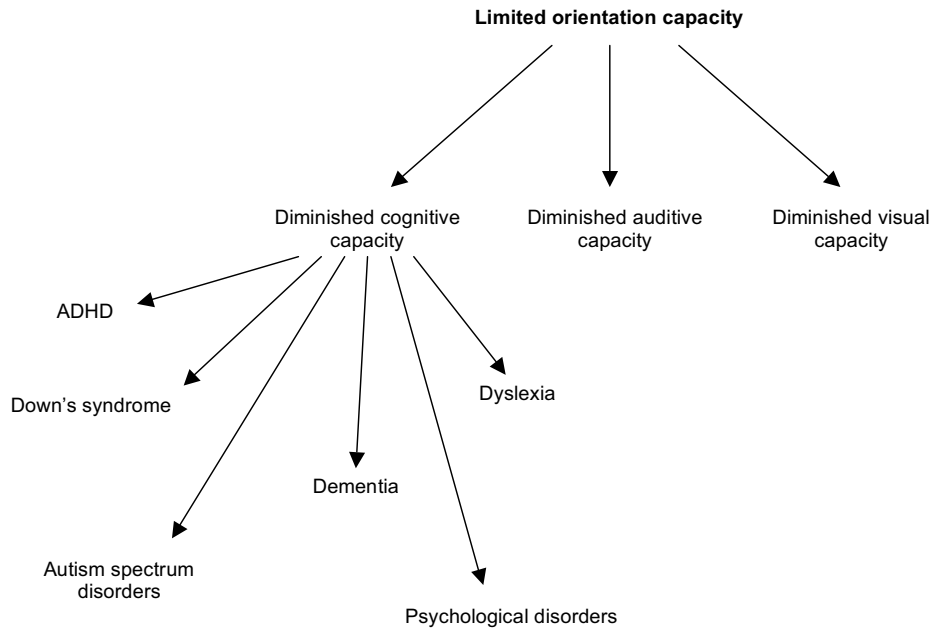


Figure 1: The term *limited orientation capacity* according to Boverket (2001).

Accessibility

The demand for accessible education makes the design features of the school environments an issue of accessibility, which the school property developers, according to the Swedish building legislation, are required to account for in future school projects, but also in the upkeep of existing school properties⁷ (Figure 2). According to the Swedish building act, “Buildings containing dwellings, working premises or premises to which the general public has access, must be designed and built in such a way that the ... premises are accessible to, and can be used by, people with limited mobility or orientation capacity”⁸. In terms of accessibility, newly developed public buildings and premises in Sweden have, so far, mostly been designed and built with respect to people with limited mobility and diminished visual and auditory capacities. Guidelines regarding the design of living and work environments for adults can be found. However, there is no specific guidelines for the school environment as a learning environment considering children’s needs or the needs of those with concentration difficulties (Svensson, 2001, and Månsson, 1999).

⁷ BFS 2004:15 ALM1 and BFS 2003:19 HIN1.

⁸ The Ordinance on Technical Requirements for Construction Works, 1994:1215, §12.

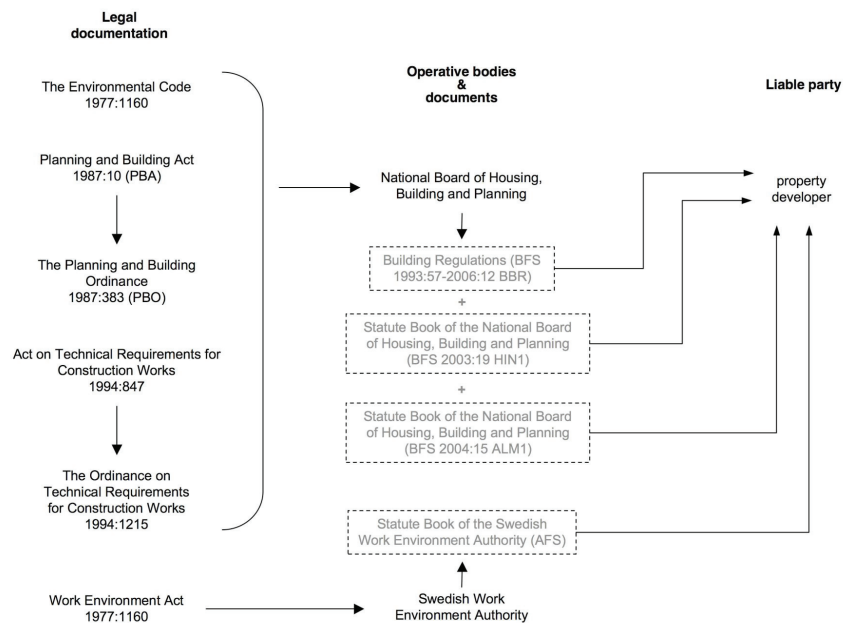


Figure 2: The legislative control of accessibility issues in the Swedish school building design process, 2006.

Aims, theoretical considerations, and definitions

Previous research suggests that environmental factors affect children's concentration. Obviously, a child with any kind of disability is still a child. However, a vital question in this matter is whether these children react in the same way as existing research suggests in a learning situation? The overall aim of this thesis was to identify environmental factors in the school environment that affect children with ADHD, autism, and Down's syndrome and their ability to concentrate in the classroom. The issue of this research is not to dismiss any of the additional resources these children are in need of; instead it is to suggest how to arrange learning environments in the most supportive way possible based on the initial needs of these children.

These children have certain behavioural aspects in common, but there will also be differences between the disabilities. The objectives were to identify environmental factors that have common influences on the three groups of children, as well as to find aspects with specific influences on the children with the different disabilities. Furthermore, the need for individual flexibility due to the children's personalities was considered. The focus was directed towards factors in the physical environment as well as individual aspects such as the disabilities, and to a lesser extent towards the social environment such as the pedagogical atmosphere. Another objective was to find

the stages in the building process where knowledge about influences of the physical environment could be applied in order to benefit the children's ability to concentrate.

The research has been divided into four empirical studies. Study I and II will serve as a basis for possible principles of generalization and specifics for each disability concerning the classroom environment, whereas Study III shows the need for individual adjustments. Study IV shows the application of the principles within the building process. Studies I, II, and III are closely connected and will therefore be presented jointly, whereas Study IV is reported separately.

In Sweden, the area of Environmental Psychology was developed from a co-operation between architects and psychologists (Küller in Johansson and Küller, eds, 2005). In the study of the interaction between man and environment, there is a continuum between how strongly the individual aspects or the environmental aspects are focused in the research. It should be noted that the empirical studies in this thesis move a long this continuum, with Study I and III focusing on observations of concrete individual behaviour among the children. Study II generalises the same kind of behaviour for each of the observed disabilities separately. Study IV focuses on the application of influential environmental factors within the building process.

The HEI-model

The theoretical framework of the thesis is based on the Human Environment Interaction model (the HEI-model) by R. Küller (1987, 1991a, 2004) and assumes that environmental factors influence the emotional status of the child. Environmental factors consist of both physical and social variables, but the emotions are also affected by the choice of activity, and mediated through the characteristics of the individual (Figure 3). The work with the HEI-model began at the end of the 1960s with studies of the perception of the built environment (Küller, 1972). In the 1970s this was followed up in the laboratory, where the impact of the visual environment on people's emotions and physiological responses was studied (Küller, 1986). This led to the definition of the basic emotional process. In a number of separate studies at the end of that decade, the social environment was analysed and added to the model (Küller, 1979). During the 1980s the individual's activities were added through research on naval environments (Küller, 1980). The theoretical model was finally tested in a large study made at a meteorological station at the Sturup Airport (Küller and Janssens, 1999). Since then the theory has been applied in a large number of research projects, including daycare environments for children (Laike, 1995, 1997), housing for elderly and hospitalised persons (Küller, 1988, 1991b; Küller and Küller, 1994), and research on traffic environments (Drottenborg, 2002; Johansson, 2006). The HEI-model established the structure of the approach of the thesis, especially concerning the review of previous research, the development of the questions at issue, but also the holistic method used.

In the present research situation, the influences affecting the emotional status of the children were divided into physical factors, i.e. the layout of the room, the view through windows, the interior furnishing, noise and light conditions, and social factors, i.e. the pedagogical atmosphere containing spatial function, social density, and teaching method. The individual factors studied were disability, age, and gender. The evaluated activity was the children's ability to concentrate in learning situations in their school environment. These factors were expected to interact and influence the children's level of concentration.

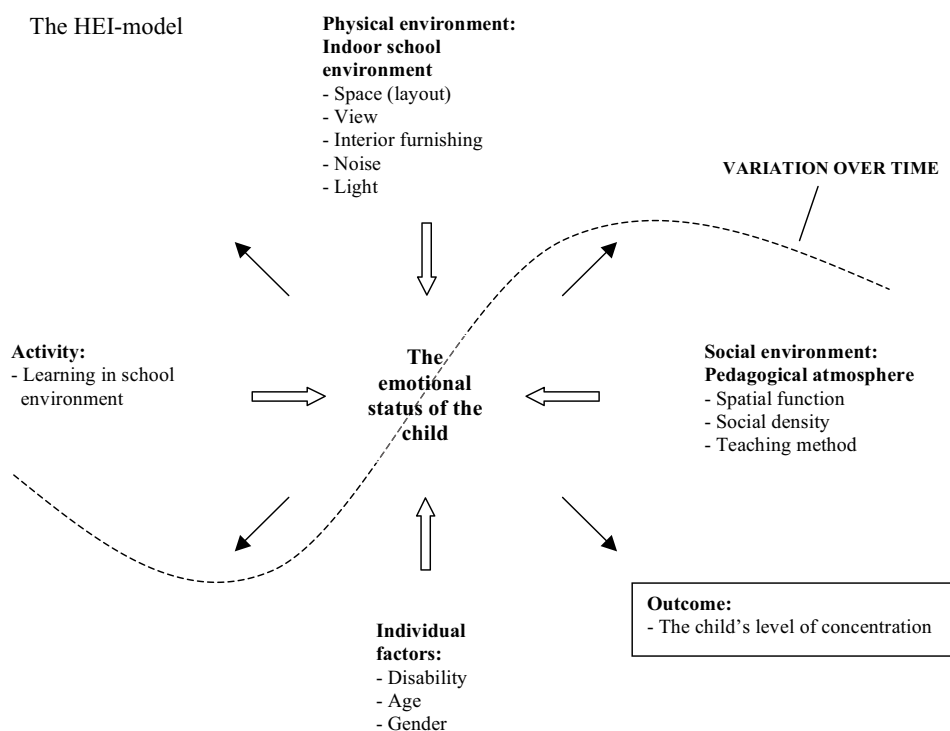


Figure 3: The Human-Environment-Interaction model shows the interaction between the child and its environment based on a model by R. Küller (1991a).

The HEI-model is based on a four-step emotional process linked to the neuro-psychological operation of the reticular activation system (Küller, 1991a). The model describes four consecutive steps where the first step is *activation*, which is similar to physiological arousal. The second step will elicit *orientation*, where the child directs attention and concentration on the task. In the second step the choice of work equipment will be considered by the child, e.g. a computer, pen and paper, video etc,

either in company with their personal assistant, their peers, or independently. The work equipment is further *evaluated* in the third step, according to its efficiency with respect to the current situation, and once the work equipment has been chosen and the assignment has been satisfactorily carried out, the last step *control* will be obtained. The outcome of this process is the child's level of concentration. If the initial choice of work equipment proved unsatisfactory to the child, the experience will likely result in a different evaluation the next time a similar situation occurs (Laike, 1995, Johansson, 2000). The order of the steps in the emotional process will be the same irrespective of the situation. When applying the model on circumstances that influence children's ability to concentrate, the emotional process within the child begins when the child needs to focus on a set assignment (Laike, 1997, Johansson, 2006).

Laike (1997) describes, with the HEI-model and the basic emotional process, how pre-school children's *activation* during meal-situations in groups was due to individual factors, while the social environment influenced *orientation*, and the social and physical environments influenced the *evaluation*. The ability to *control* was dependent on background factors and the situation. The situation evaluated required concentration in order to achieve a successful outcome, which can be identified as learning in the school setting. However, the children with ADHD, autism, and Down's syndrome can be described as having problems concerning the completion of the *orientation* and *evaluation* steps due to the characteristics of their disabilities, i.e. that they are easily influenced by their social and physical environments, and thus often lose focus and do not reach the level of control. Consequently, these children generally have relatively short periods of concentration.

A general assumption was that the heightened sensitivity towards environmental influences in the children studied would result in a noticeable response towards those environmental factors that had been substantiated in previous research on other children. Environmental factors, physical, social, and individual ones, were assumed to trigger a break of their concentration period during learning. Physical factors such as the layout of the classroom, background noise, daylight, interior furnishing, and the need for a view would, according to previous research, affect their behaviour. A social factor of importance for children's behaviour is the pedagogical atmosphere that is a result of a combination of the teaching method, the number of people present in the classroom, and the spatial function. The symptoms due to the disabilities are individual factors that will influence the children's ability to concentrate, and as such were assumed to shorten the concentration period. There can be several environmental factors coexisting in the classroom affecting the children's ability to concentrate, both positively and negatively. Based on previous research (Stafford and Stafford, 1995, Pellegrinin, 2001) it was believed that valid results could be obtained without approaching the children themselves, in order to avoid distressing situations. It was decided to approach the different professionals surrounding the children, and it was expected that the different categories of professionals would complement each other, and give a fuller understanding of how a classroom should be designed in order to be supportive for these children. It was also decided to undertake observations of the children, which were to focus on the need for individual arrangements.

The aim for Study I

The aim of Study I was to identify features in the school environment that influenced the children's length of concentration. The question raised was concerned with the features of the design in the school environment and their negative and positive influences on the length of the concentration time among children with Down's syndrome, autism, and ADHD. It was a first attempt to survey the influences from the environmental factors found in classrooms, where the children in question needed to concentrate. Personal assistants and teachers working with children diagnosed with one of the disabilities were approached.

It was anticipated that the children studied, due to their symptoms, were to react notably to the presence of different environmental factors in the classroom. It was also expected to find differences, as well as similarities, regarding the presence and number of physical or social factors, between the children and their ability to concentrate due to their disabilities.

The aim for Study II

In the second study, which is closely related to the first study, the aim was to validate and complement the results deriving from the first study through additional enquiries with further professionals. However, in the second study the professionals were working at the Child and Adolescent Habilitation Services, though having another relation to the children than the informants in the first study.

The different groups of professionals would have the possibility to identify different influences from environmental factors, depending on how they were engaged with the children in question. It was expected to find disability specific knowledge due to divergence in the answers between the groups of professionals, i.e. the personal assistants, professionals working with the children at their schools, and the professionals working with the children at the Child and Adolescent Habilitation Services.

The aim for Study III

One aim of the third study was to test an observation technique whereby the children were observed in a group without approaching the children in question directly. The children's need for individual flexibility was also to be considered. Another aim was to evaluate existing school environments based on previous results from the two earlier studies undertaken in respect to the ability to concentrate among children with ADHD, autism, and Down's syndrome.

It was expected that if the observed environmental factors in the classrooms were not supportive according to the previous results, they would be non-supportive, i.e. to have

a negative, or non-significant, effect on the children's ability to concentrate in the observed learning situation. A need for individual arrangements was anticipated, as well as the presence of the observer interrupting the concentration among the children observed during their group work.

Definitions of concentration ability

A prolongation of the concentration time, however short it may be, will be of vital importance for these children in order to increase their possibilities for learning. For someone working closely with these children or observing them, it becomes obvious when they are no longer concentrated during learning. For instance, focus is lost as soon as the children leave their place, focus on other activities or people, are fidgeting but still sitting on their own chairs, or, as some are, motionless on their chair due to the symptoms of their disability, but still not focusing on the actual work. The unfocused behaviour was regarded as a good marker of a break in the children's concentration, which could be noted and observed. Therefore the focused sitting period was defined as an indirect marker of the children's ability to concentrate.

Methodological considerations of Study I-III

Early on, it was decided to avoid approaching the children directly, since they are hard to question due to the symptoms of their disabilities, such as difficulties with perception of time and space, communication, and social interaction (Bruce, et al, 2006, Singhania, 2005, Paterson, et al, 2006). There was also a wish not to make changes and experiments in their ordinary environment, since there is a problem for these children with avoiding and ignoring physical and social inputs from their surroundings at school (Gumenyuk et al, 2005, Bebeko et al, 2006, Guralnick, 2002). A solution to this problem, which was employed in the first two studies, was to approach different categories of professionals working with these children, both at the children's schools and at the Child and Adolescent Habilitations. It should be noted that the school professionals have insightful knowledge concerning one specific child at his or her school. They work in the same environment as the child, and are therefore likely to be focused on the individual aspects of that specific child. Professionals at the Child and Adolescent Habilitation Services generally have profound knowledge concerning group specific symptoms relating to one of the disabilities in focus for this research. They meet with several different children with the same diagnose, either when visiting them at their school or when they come to one of the Child and Adolescent Habilitation Services for treatment. However, the children they meet most frequently are likely to be those with more problems, hence the contact. In Study III, the actual possibility for observers to carry out visual observations while these children took part in group work was empirically tested. These methodological approaches had consequences for the operationalisation of concentration ability. In Study I, the children's ability to concentrate was operationalised as sitting time, i.e. the length of the time (in minutes) the children could sit on a chair and stay focused in their

ordinary classroom. In Study II, the respondents were asked to generalize the children's ability to concentrate. In Study III, the author observed the behaviour of children with regard to their ability to concentrate on the work at hand.

Pellegrini (2001) suggests that a variety of assessment methods should be used when young children are to be evaluated. The observation method is regarded as an important component when children should be assessed in, for instance, school environments; but it is also important that data from other sources should be used, e.g. from teachers, parents, and peers. As de Nijs et al, (2004), point out, teachers may be the best to judge the behaviour at school, and parents at home, and both judgements could be of equal importance for getting cross-information concerning the children's behaviour. Shapiro et al (1985) also argue that a multi-method matrix containing assessments made by different response types should be used when children's behaviour is to be observed, such as the duration and occurrence of aggressive behaviour in school environments. Stafford and Stafford (1995) use diaries written by members of staff, informal interviews with pupils and staff, as well as specific classroom strategies implemented by the class teacher, in order to evaluate playground behaviour among 7-8 year old children with emotional and/or behavioural difficulties. Another way of gathering data from experienced professionals working with children is through distributing questionnaires, which can be both cost effective and easily distributed (Robson, 1994). Using questionnaires is a standardised way of performing indirect observations based on the respondents' experience. Anonymity can also be withheld more easily. It may also be important that observations are made during the same time of day, since analyses of the behaviour of children with ADHD show increased hyperactive behaviour in the afternoon (Antrop, et al, (2005). The presence of an observer may affect the possibility for the observation of "natural" behaviour among the children, since some children may react to the presence of a stranger, which Fox, et al (2000) suggest can be avoided by letting the teacher undertake the observations. However, as the research by Lambert, et al (2001) shows, the observers note more problems with the children's behaviour than the teachers. A factor that will have implications for the observation of children is the knowledge concerning the children's behaviour that professionals working with them have gained with time, which an outside observer does not have. As Nock and Kurtz (2005) point out, the advantages and disadvantages of for instance the use of trained, or non-trained, observers in comparison with the use of teachers, should be weighed against the outcome. In this thesis the problem with assessing children with dysfunctional behaviour, and determining which observers can gather the most information on the children's ability to concentrate, has been taken into consideration.

Procedure

At the first stage, the categorization and selection of the disabilities was made in conjunction with a habilitation physician and the Head of unit at the Child and Adolescent Habilitation Services, Lund. In both Study I and II, data were then collected by means of questionnaires in the relevant groups. The questionnaires were

distributed to the legal guardians of the children through the administrators at each Child and Adolescent Habilitation Services in the Region of Skåne⁹, and in this manner the children stayed anonymous to the researcher¹⁰.

In the second study, professionals such as speech therapists, occupational therapists, physiotherapists, psychologists, remedial teachers, medical personnel, welfare officers, and recreation instructors working at the Child and Adolescent Habilitation Services were to complete a questionnaire concerning the design features in the school environments and their perceived effects on the concentration ability among children with Down's syndrome, autism, and ADHD, age 7-12. The distribution and collection of the questionnaires was made at a decided occasion at each Child and Adolescent Habilitation Services in the Region of Skåne¹¹. The respondents were asked to select and focus on only one of the three different disabilities, before completing the questionnaire anonymously.

In Study III, a non-participant observation method was employed (Stafford and Stafford, 1995). Principals, who had been randomly contacted, selected the observation environments based on the interest from the pedagogues and the presence of the categories of disabilities at the schools. The observer was introduced to the class before the observation occasion, but did not take any part in the activity. The observer was seated outside the gathering, but with visual and auditory observation access (Shores, et al, 1993). The observation took place in the students' ordinary classrooms (Bronson, et al, 1997). The observer made the observations during the early hours of the day (Antrop, et al, 2005). Usually these children had a morning gathering followed by group work adapted to the children's capacities (which was the intended observation period), ending with individual work before the morning break. The group work lasted on average 20 minutes. The observer made a note of the child's / children's behaviour once every minute continuously during the whole group work session¹². All of the children went to schools within the Region of Skåne. In addition, the observer took photos of the view and the layout of the classroom, and drew a plan of the classroom and the seating of the participants.

The procedures of the Studies were approved by the Board of Ethics at Region Skåne¹³. Parental consent was also received for all of the children concerned, as well as from the school principals and teachers involved (Hodgens, et al, 2000). The research project was also approved by the Head of unit at the Child and Adolescent Habilitation Services, the Head of unit at the Research and Development Department, Habilitation and Assistive Technology, Region Skåne, and the Head of operations, Child and Adolescent Habilitation Services, Region Skåne.

⁹ Eslöv, Helsingborg, Hässleholm, Kristianstad, Landskrona, Lund, Malmö, Trelleborg, Ystad, and Ängelholm.

¹⁰ The distribution of questionnaires was made in September 2004, and the questionnaires were received during the two following months.

¹¹ The collection of questionnaires was made between November 2005 and February 2006.

¹² The observations took place in January and February 2007.

¹³ Dnr 145/2004

Instrument

The questionnaires used were designed in order to gather gained experience and knowledge from different categories of professionals working with children who were diagnosed as having limited cognitive abilities. The items in the questionnaires for Study I and Study II were concerned with factors found in the school environment and were based on the HEI-model, which meant that physical, social, and individual variables were included (Table 1). The physical variables were based on the layout of the room, the view through the windows, the interior furnishing, and perceived noise and light conditions. The social variables were spatial function, social density, and the teaching method. The individual conditions were disability, age, and gender of the children.

Table 1. Environmental factors used in Study I and Study II.

Physical environment: Indoor school environment				Social environment: Pedagogical atmosphere				Individual factor
1. Space (layout)	2. View	3. Interior furnishing	4. Noise	5. Light	6. Spatial Function	7. Social density	8. Teaching method	9. Personal
Doors	Sky	Plants	Background	Daylight	Study room	Relation time	Individual	Disability
Windows	Green	Aquarium	Sound filtration	Artificial	Classroom	Staff size	One-to-one	Age
Window placement	Built	Pillow seat			Group room	Class size	Group work	Gender
	School yard	Window curtains			Purpose	Group size	Class teaching	
		Computer				Seating places		
		Books				School population		
		Wall decoration				Floor levels		
		Open shelf storage						
		Boxes						
		Cupboards						

The respondents in Study I, were encouraged to make generalisations concerning the child's overall learning when seated at his or hers ordinary seating place. It was a general perception of a child's ability to concentrate performing any kind of task demanding focus and concentration e.g. reading and writing, while known to the respondents during a longer period of time. The first part of the questionnaire for Study I focused on the description of the individual conditions of the child, but also on issues concerning the respondent. The second and third part asked the respondents to observe the actual presence of different environmental factors, and the last part asked the respondents to make judgements concerning the child's behaviour in relation to different situations (Appendix I).

In Study II, the respondents were asked to generalise how different physical and social environmental factors found in the school environment, as well as individual factors, were perceived to influence the children's ability to concentrate. First, there were questions concerning the features of the classroom, then questions concerning social aspects, ending with individual factors. The last part of the questionnaire was related to the respondent (Appendix II).

In Study III, an activity diagram for the observation of the children's behaviour was used (Appendix III). The categories in the diagram were selected to account for the behaviour found among children with Down's syndrome, autism, and ADHD. Appropriate and inappropriate behaviour is found in almost the same frequencies among children with developmental disorders (Sigafoos, et al, 1999). The choice of categories was influenced by the Revised Edition of the School Observation Coding System (REDSOCS; Jacobs et al, 2001), which consists of three behavioural domains: appropriate versus inappropriate behaviour, compliant versus noncompliant behaviour, and on-task versus off-task behaviour (Nock & Kurtz, 2005). However, the first inter-observer occasion showed difficulties in distinguishing positive behaviour among the children in question, as well as differentiating between certain negative behaviours. Therefore, only two categories (No. 1 and 7) were chosen for positive behaviour, and five categories (No. 2-5) for negative behaviour.

Categories for group work observation in study III:

- Agrees / expresses positive feelings / takes part in activity
- Disagrees / expresses negative feelings / takes no part in activity
- Wants to do something else
- Focuses on other inputs than activity
- Releases tension
- Confusion
- Affection

According to the Cheffers' Adaptation of the Flanders Interaction Analyses System (CAFIAS), which is an observation instrument for systematically and objectively measuring verbal and non-verbal interaction every 3rd second, or when there are changes in the behaviour, an observer notes the behaviour according to the categories

of interactions occurring (Roland, 1983). However, it was decided that readings of the children's behaviour for this study were to be conducted once every minute, since this was anticipated to be adequate due to the symptoms of the disabilities in question.

The inter-observer agreement concerning the activity diagram was tested in a separate class. Two children, one boy and one girl, were observed at the same time by the author and one non-trained observer, during a group work session. After the initial test, the inter-observer agreement was 70%. However, after changes made in the categorisation of the behaviours, the inter-observer agreement was 82,5%, and this version of the activity diagram was finally used (Shores, et al, 1993). There was also a checklist used by the observers in Study III (Appendix IV) for the purpose of recording the presence of physical factors in the classroom.

Sample

Study I was based on 125 questionnaires (corresponding to a response rate of 29%) completed by a person close to a child (at school) with one of the diagnoses Down's syndrome, autism, or ADHD, between 7-12 years of age. Out of the processed questionnaires, 27% of the children had the diagnose Down's syndrome, 46% had autism, and 26% had ADHD. 70% were boys and 30% were girls (Table 2). Out of the professionals completing the questionnaire, 51% were teachers, 23% were personal assistants of the children, 22% were remedial teachers, and the rest were mostly recreation instructors. Half of the children attended special school classes for disabled children, one fourth of children were integrated individually in ordinary classes, and the rest attended classes with special pedagogical methods.

Table 2. Distribution of gender in Study I

	Boys	Girls
Down's syndrome	15	19
Autism	46	12
ADHD	27	6
Total %	70	30

In the second study, 137 professionals completed the questionnaires, of which all could be used and processed (100% response rate). Out of the processed questionnaires, 42% were focused on Down's syndrome, 32% were focused on autism, and 26% were focused on ADHD. 38% of the respondents met with the children both at school and at the Child and Youth Habilitation Services, while the rest of the respondents met the children at the Child and Youth Habilitation Services only. The profession of the respondent was missing in five of the questionnaires.

In the third study, the sample consisted of eleven students: seven girls and four boys. There were four children with Down's syndrome, three with autism spectrum disorders and four with either ADHD or ADHD tendencies, aged 7-13, in six different

observation (school) environments. One student was individually integrated in a class at an elementary school¹⁴, the rest of the students were part of a class in a special school¹⁵ or training school¹⁶, which were space-integrated at an elementary school, usually within the same building as other elementary students. One of the schools had a building purposely built for students with special needs, integrated within the school area.

Data treatment

The data in Study I were treated with Pearson's χ^2 , with $p < 0.01$, which examined the differences in sitting time in relation to disability and environmental variables. Further, multi-linear regression analyses were made to determine the proportion of variance of the dependent variable (sitting time) explained by the most powerful (environmental) predictor variables (Brace et al, 2000, Tabachnick and Fidell, 2006). The sitting time was based on the respondents' judgments of how long the children generally could concentrate on a certain task in their ordinary school environment, i.e. their classroom, divided into intervals of "less than 15 minutes", "between 15-30 minutes", and "longer than 30 minutes". Based on the HEI-model, the variables used in the multi-linear regression analysis were divided into six categories: Space; which was concerned with the façade apertures and room passages; View, which was concerned with the children's view through the windows; Interior furnishing, which was concerned with the furnishing of the classroom; Spatial function, which was concerned with the number of people in the classroom and the selected teaching method; Social, which was concerned with the number of people and the teaching method; and Individual, which was concerned with the children's disability, age, and gender (Table 1). However, when the internal reliability was tested for by means of Cronbach's alpha, the environmental factors in each category were not sufficiently coherent statistically in order to be used as indices. Thus they are treated as separate items in the statistical analyses. To avoid problems of collinearity in the regression analyses (i.e. two or more variables contributing to the same variance), correlation analyses (Pearson r) between the various predictor variables entered in each block for each of the disability was carried out and the strength of the correlation coefficients was scrutinized. Most of the variables were not correlated, except for some of the indoor interior variables concerning the children with ADHD, but the coefficients were modest and therefore maintained. The results concerning the influences of noise and light conditions could not be used due to ambient data. The respondents made subjective individual assessments, presented as descriptive data. With multinomial logistic regression analyses, the fit of the model used on the data was tested.

First, in Study II, a non-parametric Pearson's χ^2 with $p < 0.001$ was undertaken to test if the influences from each of the environmental factors differed significantly from a random distribution. Secondly, further non-parametric Pearson's χ^2 with $p < 0.001$

¹⁴ Individually enrolled into the mainstream curriculum, integrated in the elementary subjects.

¹⁵ Enrolled into the curriculum of the Special school, with fewer subjects.

¹⁶ Enrolled into the curriculum of the Training school, with focus on participation in society.

was processed to see if influences from each of the environmental factors on each group of children differed significantly from a random distribution. The results of the influences of the environmental factors were divided into the same categories as employed in Study I. On average, the number of missing cases was 6% and the “do not know” response was on average 15%. Statistically, there were no significant differences between analyses including missing values and “do not know” responses and analyses with replaced missing values and “do not know” responses left out. There is an uncertainty when the respondents have not filled in an answer, to be compared with when the respondents have chosen actively to answer, “do not know”. Therefore, the “do not know” responses were left out and the missing values included (Table 3). All statistical analyses were performed with SPSS version 14 for Windows.

Table 3. The number of “do not know” answers and missing values among the professionals in Study II (%).

	Do not know	Missing values
Remedial teachers	13.8	4.6
Psychologists	12.8	2.6
Occupational therapists	16.4	2.9
Speech therapists	9.6	2.0
Physiotherapists	18.7	5.8
Medical personnel and welfare officers	17.3	8.2
Other	13.8	6.7

The size of the sample in Study III made it non-representative, and therefore the results were only treated with descriptive analyses (Moore, 1998). The seven categories used for the observation of the children’s behaviour in the classroom were reduced to six categories in the presentation of the results. The category affection was deleted, since it was regarded both as a positive as well as a negative behaviour when evaluating the ability to concentrate. The six remaining categories were presented as two categories of behaviours; positive and negative. The positive behaviour contained the categories agrees / expresses positive feelings / takes part in activity. The negative behaviour contained the following categories: disagrees / expresses negative feelings / takes no part in activity, wants to do something else, focuses on other inputs than activity, releases tension, and shows confusion. This merging was due to the few observations of children, occasions, and noted differentiating behaviours.

Results

Main results from Study I

General description of classroom factors

The personal assistants and teachers regarded supervised tuition on a one-to-one basis (one child and one pedagogue) to work well for 94% of the children. Individual work was regarded to work well for 84% of the children. According to the respondents, 81% of the children needed to have the possibility to sit at the same seating place in the classroom when concentrating, a place that they regarded as their own. A place suited for a special purpose was also regarded to work well for 87% of the children. To have closed storage systems, such as cupboards and drawers, was regarded by the respondents to work well for 88% of the children.

The respondents made their subjective individual assessments of the disturbance of light and noise. Most of the children had their concentration interrupted when there were different noises made in the classroom, such as the use of CD-players (71%), someone singing/playing (89%), noise made by other children (91%), and someone else talking (67%). Every second child reacted by either leaving their seat or turning their head when being exposed to sunshine.

Individual factors

There was a statistically significant relationship between the sitting time and the disabilities ($\chi^2 = 14.428$, $df = 4$, $p = 0.006$). The greater part of the children who sat the longest period of time was children with Down's syndrome ($m=2.29$). Many of the children with ADHD could sit down and concentrate for a period between 15 and 30 minutes ($m=1.97$), and many of the children who sat shorter than 15 minutes were children with autism ($m=1.94$). The value 1 corresponds to "less than 15 minutes", 2 to "between 15-30 minutes", and 3 to "longer than 30 minutes".

It could be seen that there were more girls who sat longer periods of time (more than 30 minutes) and that there were more boys than girls sitting shorter periods of time (between 15 and 30 minutes) ($\chi^2 = 7.308$, $df = 2$, $p = 0.026$). However, there were no differences found in the perceived influences from environmental factors in relation to gender within the different groups of disabilities. There was also no significant relationship between the children's age and the length of their sitting time.

Differentiating between the disabilities

In order to explore the possible differences between the influences of the environmental variables and their effects on the three disabilities, multi-linear regression analyses were made separately for each disability. Sitting time was used as the dependent variable. In order to be able to exclude statistically non-significant variables, all the variables within each of the seven categories (Table 1, all categories except noise and light due to ambient data) were run through multi-linear regression analyses as single variables in separate levels for one group of disability at the time. Variables with statistically significant BETA results were kept in their specific categories when tested together in a new multi-linear regression. The multi-linear regression analysis was run until only statistically significant values remained. The analyses were halted when the results showed less statistically significant results as more values were dismissed. Therefore, the blocks in the results of the multi-linear regression analyses contained different environmental variables for each group of disability, depending on how statistically significant the results turned out to be (Table 4). Using the entering method, significant models emerged for the children with Down's syndrome (Adjusted R square = .525; $F_{8,25} = 5.56$, $p = 0.000$), autism (Adjusted R square = .352; $F_{7,50} = 5.43$, $p = 0.000$), and ADHD (Adjusted R square = .557; $F_{6,26} = 7.71$, $p = 0.000$).

Down's syndrome

In the first block, the layout of the room, the results from the BETA-values of the multi-linear regression analyses concerning the children with Down's syndrome showed a positive influence regarding the length of the children's sitting time when the windows were placed on the same wall (.24), and the more windows there were in the classroom the longer sitting time for the children (.54). The variables in the layout of the room in block 1 explained 23.5% of the variance of the sitting time. In block two, which was concerned with the view through the windows, the possibility to see the sky had a positive influence (.37) on the length of the sitting time for these children, but the possibility to see greenery had a negative influence (-.55) on the length of their sitting time. The influences of the views in block two accounted for 12.7% of the variance of the sitting time.

In block three, the interior furnishing such as the presence of computers had a positive influence (.27) on the the children's sitting time, but the presence of plants (-.29) had a negative effect on their sitting time. The interior furnishing in block three explained 10.3% of the variance of the sitting time. In block four, which focused on the function of the room, a room with the qualities of a study room had a positive influence (.46) on the children's sitting time and accounted for 9.5% of the variance of the sitting time. In block 5, which was concerned with social factors, a greater number of staff had a negative influence (-.31) on the children's length of sitting time and accounted for another 8.0% of the variance of the sitting time. In total, the five blocks together

explained 64.0% of the variance of the dependent variable, i.e. the sitting time for the children with Down's syndrome.

Autism

The BETA-results from the multi-linear regression analyses regarding the children with autism showed, in the first block concerning the layout of the room, that the number of windows had a positive influence on their sitting time (.18), i.e. the more windows there were in the classroom the longer sitting time for the children. The remaining variables in the layout of the room, in block one, explained 4.9% of the variance in sitting time. In block two, the interior furnishing such as the presence of pillow seats (.39), cupboard storage (.36) and curtains (.38) had a positive influence on the length of the sitting time, but the presence of computers (-.29) and aquarium (-.28) had a negative effect on the children's ability to stay concentrated. The interior furnishing in block two accounted for 31.9% of the variance of the sitting time. In block three, which was concerned with social factors, a school with a greater number of children, more than 251, had a positive influence on the children's length of sitting time (.27), and accounted for another 6.4% of the variance of the sitting time. In total, the three blocks together explained 43.2% of the variance of the dependent variable, i.e. the sitting time for the children with autism.

ADHD

In block one, the BETA-results for the children with ADHD and their ability to concentrate showed that having windows with a view containing a built environment (.21) had a positive influence on their sitting time and accounted for 3.4% of the variance of the sitting time. In block two, the interior furnishing such as the presence of box storage (.59) and cupboard storage (4.56) had a positive effect, but the presence of computers (-4.62) had a negative effect on the children's ability to stay focused. The interior furnishing in block two explained 44.2% of the variance of the sitting time. In block three, which was concerned with the social factors, the number of floor levels (.31) was positive for the children's sitting time, i.e. the more floor levels the school had the longer sitting time for the children, but a greater number of staff had a negative influence (-.24) on their sitting time. Block three accounted for another 16.3% of the variance of the sitting time. In total, the three blocks together explained 64.0% of the variance of the dependent variable, i.e. the sitting time for the children with ADHD.

Table 4. Predictors from multi-linear analyses by disability with sitting time as dependent variable.

Down's syndrome (N=34)				Autism (N=58)				ADHD (N=33)			
	mean	SD	Beta	p	%		mean	SD	Beta	p	%
Block 1 Space						Block 1 Space					
Amount of windows	4.27	2.0	.54	.010		Amount of windows	3.52	1.9	.18	.123	
Placement of windows	1.74	.45	.24	.157		R ² change					4.9
R ² change					23.5	ANOVA					
ANOVA				.016							.302
Block 2 View						Block 2 Interior furnishing					
Sky	1.88	.33	.37	.033		Pillow seat	1.62	.49	.39	.002	
Greenery	1.91	.29	-.55	.044		Cupboard storage	1.96	.18	.36	.049	
R ² change					12.7	Curtains	1.89	.31	.38	.001	
ANOVA				.009		Computers	1.87	.33	-.29	.025	
Block 3 Interior furnishing						R ² change	1.22	.42	-.28	.024	
Plants	1.88	.33	-.29	.038		Aquarium					31.9
Computers	1.88	.33	.27	.110		R ² change					
R ² change					10.3	ANOVA					
ANOVA				.006		Block 3 Social density					
Block 4 Spatial function						School population	196	227	.27	.022	
Study room	1.42	.49	.46	.019		R ² change					6.4
R ² change					9.5	ANOVA					
ANOVA				.002							.000
Block 5 Social density											
Staff	3.5	1.8	-.31	.027							
R ² change					8.0						
ANOVA				.000							
R ² (in total)					64.0	R ² (in total)					43.2
											64.0

In order to validate the results from the multi-linear regression analyses, due to the different scales of the variables used, a multinomial logistic regression analysis was executed, which also analyzed the fit of the model regarding the data. The results showed significant values concerning the fitting of the model for the children with Down's syndrome ($p = 0.002$), for the children with autism ($p = 0.000$), and for the children with ADHD ($p = 0.000$). The significance of the Goodness-of-fit analyses for the children with Down's syndrome was 1.00, for the children with autism 0.69, and for the children with ADHD 1.00 (Table 5).

The results from the Cox and Snell analyses showed significance levels of 0.67 for the children with Down's syndrome, 0.53 for the children with autism and 0.69 for the children with ADHD, implying that the model used explained a large part of the variation in sitting time for the three categories of disabilities. The analyses by Nagelkerke gave the significant results of 0.79 for the children with Down's syndrome, 0.60 for the children with autism, and 0.88 for the children with ADHD (Table 5).

Table 5. The Goodness-of-Fit of the model

	Pearson Chi ²	Cox and Snell	Nagelkerke
Down's syndrome	1.00	.67	.79
Autism	.69	.53	.60
ADHD	1.00	.69	.88

Main results from Study II

First the general influences, both positive and negative, from factors found in the school environment by the respondents in Study II affecting all the children and their ability to concentrate was presented. Secondly the specific influences of the environmental factors on the three different groups of disabilities as perceived by the respondents in Study II were described. Finally, the general and specific influences identified, both from Study I and II, were synthesised in the suggestions for rooms supportive for learning adapted to the three groups of disabilities.

General positive influences

The environmental factors perceived, by the professionals working at the Child and Adolescent Habilitation Services, as having positive influences on all of the three groups of children and their ability to concentrate were smaller schools with less social density, as well as using small classrooms. Closed storage systems with cupboards and drawers, as well as one-to-one teaching, were also looked upon as supportive environmental factors (Table 6).

General negative influences

Environmental factors considered by the respondents as having a negative influence on all of the children's ability to concentrate were having several entrance doors into the classroom, windows on several walls, a view of the schoolyard, background noise, sound infiltration, open shelf storage, large classrooms, and schools with large numbers of students. Furthermore, class teaching and the actual disabilities were also perceived as influencing the children's ability to concentrate in a negative way (Table 6).

Table 6. General influences from environmental factors found in the school on all of the children and their ability to concentrate, results from Study II. Non-parametric Pearson's Chi² (p<0.001).

	Down's Syndrome, Autism, and ADHD					<i>p</i>
	N	Negative	Not Affected	Positive	Chi ²	
	Observations in %					
1. Physical factor: Space (layout)						
Several doors	100	82	12	6	107.1	0.000
Windows on several walls	92	84	12	4	110.1	0.000
2. Physical factor: View						
School yard	110	80	4	14	113.7	0.000
3. Physical factor: Interior furnishing						
Cupboards and drawers	121	4	14	80	121.2	0.000
Open shelf storage	120	78	8	13	109.8	0.000
4. Physical factor: Noise						
Background noise	129	96	3	0	228.9	0.000
Sound filtration	131	98	1	0	123.1	0.000
6. Social factor: Spatial function						
Smaller classroom	128	0	5	93	210.7	0.000
Larger classroom	130	88	6	4	177.9	0.000
7. Social factor: Social density						
Smaller school	134	2	4	92	211.4	0.000
Larger school	128	94	5	0	101.5	0.000
8. Social factor: Teaching method						
One-to-one	131	0	2	97	119.3	0.000
Class teaching	123	81	5	13	128.3	0.000
9. Individual factor: Personal						
Disability	109	84	8	7	127.9	0.000

Specific influences on the different disabilities

However, specific influences from environmental factors were found concerning one or several categories of disabilities. Several windows in the classroom were regarded as a negative influence on the children with autism and ADHD, but as being non-significant for the children with Down's syndrome. Windows placed on one wall in

the classroom was regarded as having a positive effect on the children with Down's syndrome, and as being non-significant for the children with autism and ADHD. To have a view consisting of the sky, as well as a view of greenery, was perceived as positive for the children with Down's syndrome, but of no significance for the others. To be without a view in the classroom was perceived as having a negative effect on the children with Down's syndrome and their ability to concentrate, but of no relevance for the other children. To have a pillow seat was only regarded as positive for the children with Down's syndrome, and of no significance for the others. Wall decorations in the classroom were regarded as having a negative influence on the children with autism and ADHD, and as being non-significant for the children with Down's syndrome. Loose boxes were regarded as having a negative influence on the children with ADHD, but as being of no statistical relevance for the children with Down's syndrome and autism. The presence of one computer was regarded as positive for the children with Down's syndrome and as being non-significant for the children with autism, and the presence of several computers was regarded as negative for the children with ADHD. Group work was considered as having a positive influence on the children with Down's syndrome, but as being negative for the children with autism and ADHD. The gender was regarded as having no effect on the children with Down's syndrome and autism and their ability to concentrate, and was statistically non-significant for the children with ADHD (Table 7).

Table 7. Specific influences from environmental and individual factors affecting children with Down's syndrome, autism and ADHD and their ability to concentrate, results from Study II. Non-parametric Pearson's χ^2 ($p < 0.001$).

	Down's syndrome				Autism				ADHD			
	N	Negative	Not Effected	Positive	χ^2	p	N	Negative	Not Effected	Positive	χ^2	p
Observations in %												
Physical factor: Space (layout)												
Several windows	40	22	37	40	2.2	n.s.	33	78	12	9	30.7	0.000
Windows on one wall	37	8	32	59	14.6	0.001	24	41	20	37	1.7	n.s.
Physical factor: View												
Sky	45	4	20	75	37.7	0.000	31	16	25	58	8.9	n.s.
Green	49	10	8	81	51.5	0.000	30	23	23	53	5.4	n.s.
No view	44	75	11	13	34.4	0.000	35	28	22	48	3.8	n.s.
Physical factor: Interior furnishing												
Pillow seat	48	18	18	62	18.4	0.000	29	24	37	37	1.1	n.s.
Wall decoration	41	31	21	46	3.7	n.s.	36	69	13	16	21.2	0.000
Boxes	44	52	38	9	12.9	n.s.	38	52	15	31	7.7	n.s.
One computer	44	13	15	70	27.3	0.000	32	25	12	62	13.0	n.s.
Several computers	38	34	2	47	4.8	n.s.	27	48	14	37	4.7	n.s.
Social factor: Teaching method												
Group work	51	29	3	66	30.5	0.000	40	95	0	5	32.4	0.000
Individual factor: Personal												
Gender	40	2	95	2	68.5	0.000	26	7	84	7	30.8	0.000
												n.s.

Three rooms

Three rooms were composed that would be likely to support the children's perceived ability to concentrate. The rooms were made in accordance with the results from Study I, in which personal assistants and teachers gave their point of view, together with the results from Study II, where professionals working at the Child and Youth Habilitation Services gave their perceptions. However, environmental factors perceived by the respondents to be non-supportive were also presented, in order to increase the possibility for learning through avoiding those factors. Only those factors that showed statistically significant results were considered.

A room for learning intended for children with Down's syndrome

In a room designed for the purpose of learning and intended for children with Down's syndrome, having several doors was regarded as a negative influence on their ability to concentrate, as well as the placement of window on several walls. However, several windows were regarded as having a positive influence. The view through the windows should be of the sky, definitely not of the schoolyard, and the issue of greenery was inconsistent. It was also regarded that the children with Down's syndrome should not be without a view when learning. Loose interior furnishing, such as a pillow seat and a computer, was anticipated to have a positive influence on their ability to concentrate (Table 8).

Storage systems such as open shelf storage were regarded as a negative influence on the children's ability to concentrate, which was substantiated by the perception of the positive influences from a closed storage. Sounds filtrating into the room, indoor plants near the working place, as well as direct daylight on the child's work place, were regarded as negative influences. Smaller rooms such as group rooms were considered to have a positive influence on the children's ability to concentrate. Individual work, a seating place that could be regarded as the child's own place, as well as purposely-suited places, were other environmental factors perceived as positive. Schools with high population numbers were regarded as having a negative influence, and a greater number of staff was also perceived as shortening the period of concentration among the children. Large rooms such as regular classrooms, with class teaching, were also regarded as having a negative influence on their ability to concentrate. In contradiction, a study hall, which is usually a large room, was considered to have a positive influence. However, in a study hall, environmental factors regarded as positive such as group work, individual work, and a place of their own could be implemented, and thus make the study hall into a positive influence (Table 8).

There were environmental factors that the respondents in Study I and II pointed out as being of importance for the children's ability to concentrate. For children with Down's syndrome, placement of windows on one wall, closed storage systems such as cupboards and drawers, and one-to-one teaching were regarded as having a positive

influence on their ability to concentrate, and background noise was regarded as a negative influence (Table 8).

A room for learning intended for children with autism

It was regarded by the respondents that a room for learning intended for children with autism should not contain the environmental factor of several doors. The respondents also regarded the children with autism as benefiting from not having a view during learning, which is confirmed by the perceived negative influence from windows placed on several walls. However, this contradicts the positive influences perceived from having several windows, but the contradiction can be explained by the children's diverse ways of being able to handle views due to their disability. This contradiction can also be found concerning the different influences from schools with high populations, meaning that there were children who could handle larger populations as well as children who were more comfortable with schools with smaller populations (Table 8).

A view of the schoolyard was regarded as having a negative influence on the children's ability to concentrate, as well as direct daylight on the children's work place. Loose interior furnishing such as curtains and a pillow seat were regarded as having a positive influence on the children, whereas computers and wall decorations were regarded as a negative influences. Open shelf storage and loose boxes were regarded as having a negative influence, which was confirmed by the positive influence from the closed storage system such as cupboards and drawers. Other negative environmental factors influencing the children's ability to concentrate, which were perceived by the respondents, were background noise and sound filtrated into the room. Individual work, a personal seating place, a purposely-suited place, and one-to-one teaching were all regarded as having positive influences on the children. A smaller room such as a group room was positive, even if group work was regarded as negative, and a classroom as well as class teaching was regarded as negative (Table 8).

The environmental factors of closed storage, background noise, and one-to one teaching, were perceived by the respondents in both Study I and Study II to influence the children with autism and their possibility to concentrate (Table 8).

A room for learning intended for children with ADHD

According to the respondents in this study, a room for learning intended for children with ADHD should neither have several doors nor several windows. To have windows placed on several walls was regarded as having a negative influence on the children and their ability to concentrate. There was a contradiction found regarding the perception of loose boxes, the population size of the school, and the number of floor levels. This can be explained by the fact that there were children who could handle these environmental factors at the same time as there was a group of children who

could not handle them, possibly due to the wide spectrum of concentration difficulties within the disability (Table 8).

To have a view of the schoolyard, and to have direct daylight on the work place, was regarded as having a negative influence on the children's ability to concentrate. Loose interior furnishing such as wall decorations had a negative influence on the children. Open shelf storage was regarded as having a negative effect on the children, which was confirmed by the respondents' perception of a positive influence from closed storage such as cupboards and drawers. Background noise and sound filtration were also regarded as having negative effects on the children. A smaller room such as a group room was regarded as positive for the children, even if group work was regarded as negative. A classroom as well as class teaching was regarded as negative, and a greater number of staff was perceived to shorten the period of concentration among the children. The presence of several computers was also a negative influence. A personal seating place, individual work, a purposely-suited place, and one-to-one teaching were all regarded as having positive influences on the children's ability to concentrate (Table 8).

The respondents in Study I as well as Study II perceived environmental factors such as closed storage, background noise, and one-to-one teaching to have an influence on the children with ADHD and their ability to concentrate (Table 8).

Table 8. Results from Study I and Study II: Regarding influences on the concentration ability for the three groups of disabilities in the School due to environmental and individual factors.

Study	DS		Autism		ADHD	
	1	2	1	2	1	2
	P.A.	Prof. Hab.	P.A.	Prof. Hab.	P.A.	Prof. Hab.
1. Physical factor: Space (layout)						
Several Doors		-		-		-
Several Windows	+		+	-		-
Window placement on one wall	+	+				
Window placement on several walls		-		-		-
2. Physical factor: View						
Sky	+	+				
Green	-	+				
Built					+	
School yard		-		-		-
No view		-	+			
3. Physical factor: Interior furnishing						
Plants	-					
Aquarium			-			
Pillow seat		+	+			
Window curtains			+			
Computer	+	+	-		-	-
Wall decoration				-		-
Open shelf storage		-		-		-
Boxes		-		-	+	-
Cupboards / drawers	+	+	+	+	+	+
4. Physical factor: Noise						
Background	-	-	-	-	-	-
Sound filtration		-		-		-
5. Physical factor: Light						
Daylight	-		-		-	
6. Social factor: Spatial Function						
Study room	+					
Classroom		-		-		-
Group room		+		+		+
Purposely-suited place	+		+		+	
7. Social factor: Social density						
Staff	-				-	
Seating place	+		+		+	
School population		-	+	-		-
Floor levels					+	
8. Social factor: Teaching method						
Individual work	+		+		+	
One-to-one teaching	+	+	+	+	+	+
Class teaching		-		-		-
Group work		+		-		-
9. Individual factor: Personal						
Disability		-		-		-

+ = regarded by the respondents to have a positive effect on the children's ability to concentrate

- = regarded by the respondents to have a negative effect on the children's ability to concentrate

P.A. = Personal assistants or teachers working with the children in their classroom

Prof. Hab. = Professionals working at Child and Youth Habilitation Services meeting the children in their classrooms and at the Habilitation

Main results from Study III

Results from observation environments 1-6

The classrooms of the observed children were located in one- or two-storied buildings, in residential areas surrounded mostly by single-family houses or smaller three- or four-storied blocks of flats. There was one pedagogue and one (personal) assistant during the group work periods, except for one occasion when there was one pedagogue and two (personal) assistants. The seating of the children and how they were facing the windows differed both between and within the categories of disabilities (Table 9).

Table 9. Different seating of students in the observation environments

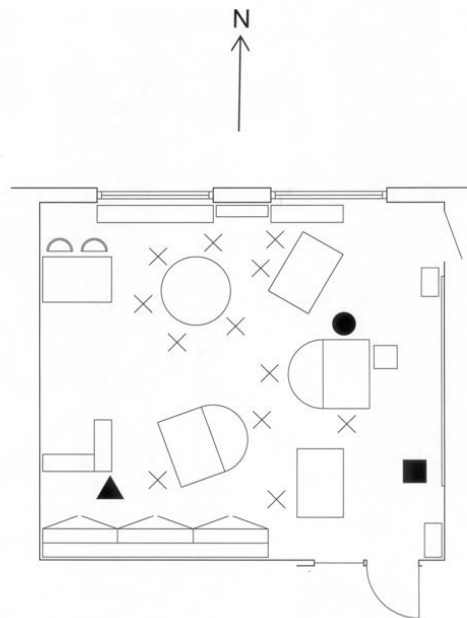
	Down's Syndrome				Autism			ADHD			
Observed child (N=11)	1	4	5	7	6	8	9	2	3	10	11
Observed env. (N=6)	No. 1	No. 3	No. 3	No. 5	No. 4	No. 5	No. 6	No.2	No. 2	No. 6	No. 6
Facing window	no	no	no/yes	side-ways	side-ways	yes	yes	yes	no	side-ways	no
Seating position	table	chair	chair	table	chair	table	table	floor	floor	table	table

On average, the occurrence of positive behaviour among the students with ADHD was the highest observed, with the students with Down's syndrome slightly less, and the students with autism the lowest. However, the largest difference between the minimum and maximum of observed positive behaviours was among the students with Down's syndrome. The students with ADHD and autism had a smaller range between their noted minimum and maximum occurrence of positive behaviour (Table 10).

On average, the students with autism had the highest occurrence of observed negative behaviour. The students with Down's syndrome had, on average, a lower occurrence of noted negative behaviour than the students with autism, but a higher occurrence in comparison with the students with ADHD, who had the lowest. Among the students with Down's syndrome both the highest and the lowest occurrence of negative behaviour was noted (Table 10).

This should be compared to the previous results from Study I concerning the length of sitting time, in which it was found that the greater part of the children who sat the longest period of time was children with Down's syndrome. The children with ADHD could sit down and concentrate for a shorter period of time than the children with Down's syndrome, and many of the children with autism sat the shortest period of time.

Observation environment 1

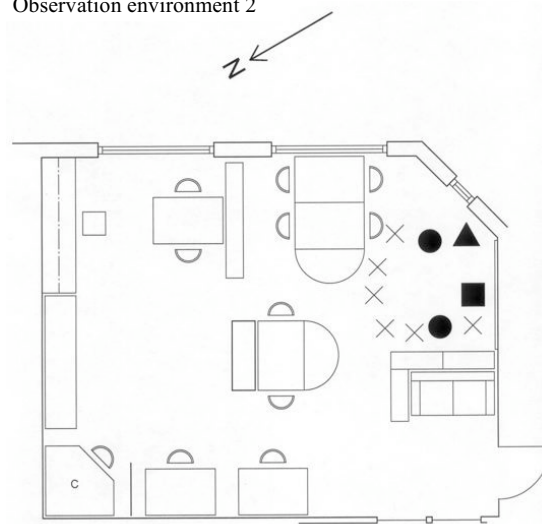


In the 1st observation environment, a student with Down's syndrome was observed, resulting in a noticeably higher occurrence of positive behaviour than negative behaviour, where most of the negative behaviour was due to the student's curiosity of the observer (Table 11). The observed child was seated at the child's ordinary seat at the table during the group session, with 12 other pupils at their ordinary seats (Observation Environment 1). The observed environment had a large number of supportive environmental factors: few doors into the classroom, several windows on one wall, the student turned away from

the windows when seated, i.e. no disturbing view but a fair amount of daylight, and a personal assistant (except for the pedagogue) in the class, and no background noise (Table 12). There was sound filtration from students in the corridor, but that did not seem to affect the child's ability to concentrate. However, the student was individually

integrated in an elementary class, meaning that the student had been evaluated to be able to participate in the education, without too many of the environmental factors interrupting the ability to concentrate.

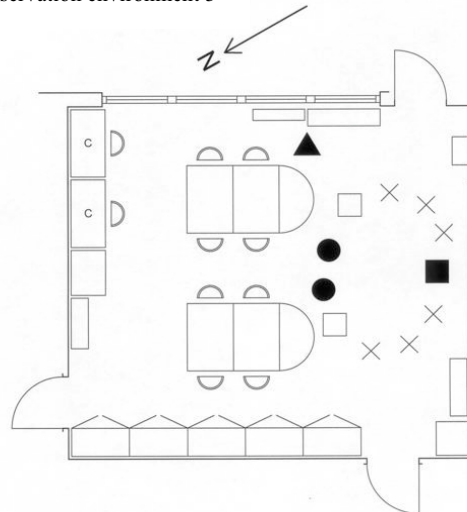
Observation environment 2



There were two students with ADHD observed in the 2nd observation environment, resulting in an average of a higher occurrence of positive and a lower occurrence of negative behaviours (Table 11). The two students had similar behaviour. During the group session, the observed

children were seated in a circle on the floor, together with six other pupils (Observation Environment 2). There was a computer in the classroom, but it was located behind a screen. There were environmental factors noted as being supportive for children with ADHD such as one door, closed storage in the form of cupboards and drawers, and no background noise. However, there were also non-supportive environmental factors observed such as open shelf storage, a view consisting of several factors, such as the sky, built environment, and a schoolyard, and sound filtration from children playing outdoors (Table 12). However, the open shelf storage was low-levelled and structured pedagogically. One of the students was not facing the windows, and the sound filtrated during the group work did not seem to influence this pupil's ability to concentrate. The students were part of a class in a special school, which was space-integrated, and was led by one pedagogue and one assistant. The pedagogue was close at hand during the whole group work session. The two students were placed on opposite sides of the group, one of the students facing the windows while the other facing away from the windows.

Observation environment 3

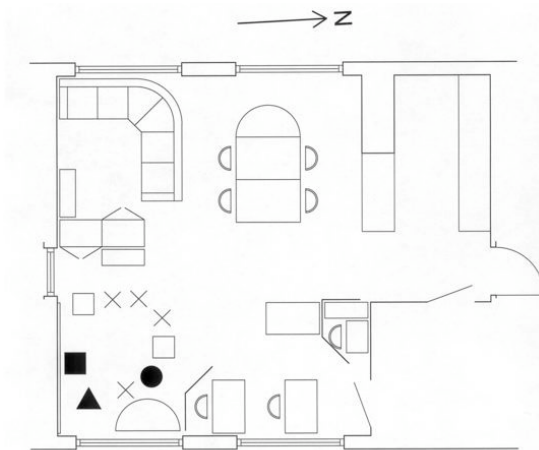


In the 3rd observation environment, two students with Down's syndrome were observed, one student with only positive behaviour, and another student with a low occurrence of positive behaviour and a higher occurrence of negative behaviour (Table 11). During the group session, the observed children, together with six other pupils, were seated on chairs in a circle (Observation Environment 3). Environmental factors not supportive for children with Down's syndrome were observed, such as three doors, the view being

partially blocked, and background noise (Table 12). The background noise resulted from all the doors being used during the group session, from staff and students talking, from the sound filtration as well as from children playing outside the windows. Most of the time, the two students were not facing the windows. The view was partially blocked due to direct sunlight and for the purpose of not influencing the teaching; however, it caused the children to actually walk up to the window that was not blocked to take a look outside. However, most of the storage, but not all of it, was in cupboards and drawers, which was perceived to have a positive influence on the children's ability to concentrate. The students were part of a class in a training school, which was space-integrated. There was one pedagogue and two personal assistants during the group session in order to keep the group focused, but even so, one of the students observed

was influenced by the presence of the observer and lost focus on the activity. The other student observed did not participate actively in the group work, but did not focus on anything else either.

Observation environment 4

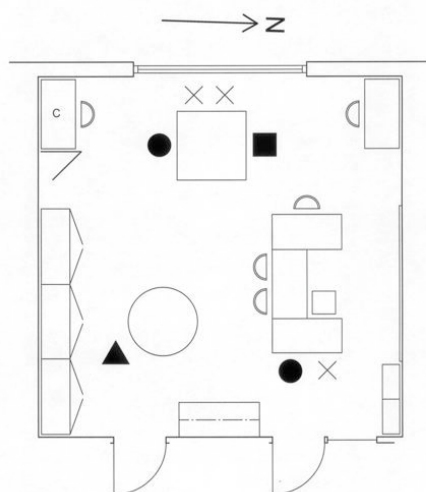


There was one autistic student observed in the 4th observation environment, resulting in a higher occurrence of positive behaviour than negative behaviour (Table 11). The observed child was seated on a chair in a circle during the group session, with four other pupils (Observation Environment 4). Environmental factors found to be negative for children with autism were observed during the group session. There were several doors, both passage doors and doors leading to storage areas, background noise, and sound filtration. The view

was not blocked as a result of the high number of windows on several exterior walls. The background noise originated from the ventilation, and filtrated sound could be heard now and then from children playing outdoors and from passing traffic (Table 12). However, it was a smaller group with one pedagogue and one assistant, the observed student was not facing the windows directly and was seated beside the assistant, and most of the material was in cupboards and drawers. These environmental factors were all considered as having positive influences on children with autism and their ability to concentrate. According to the pedagogue it would have been easier not to have group sessions due to the children's difficulties to concentrate, but the group session was regarded as a necessary part of the development of their social skills, and thus other well-known disturbing environmental factors such as certain interior furnishing were kept to a minimum. The decoration was either part of the visual guidance related to the teaching or of the children's daily schedule. The observed student was part of a special class located in a purpose-built area-integrated building.

In the 5th observation environment, one student with Down's syndrome and one student with autism were observed, resulting in a slightly higher occurrence of positive behaviour for the student with Down's syndrome than for the student with autism. The student with Down's syndrome also had fewer negative behaviours noted (Table 11). The observed children and three other pupils were seated at their tables during the group session (Observation Environment 5). Background noise from children in the room next-door was noted, which was regarded as having a negative influence on the children's ability to concentrate, but the closed storage was supposed to have a positive influence.

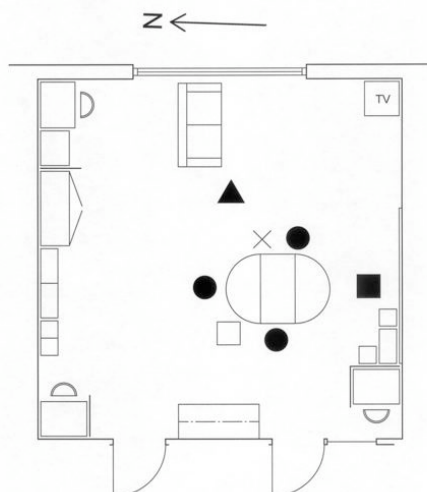
Observation environment 5



The wall decorations (not part of the teaching) observed were perceived as negative for children with autism. There were also windows on one exterior wall and a computer that were regarded as having a positive influence on children with Down's syndrome (Table 12). The view consisted of several factors, but mostly of snow. The student with Down's syndrome was facing the windows sideways, and was sometimes concerned with the fact that it was snowing. The autistic child was facing the windows from a distance. However, at the time of

observation the student was mostly concerned with the presence of the observer when not concentrating on the activity. The pedagogue had installed blinds to be able to block out the view and disturbing reflections, particularly to cater for the needs of the student with autism. The two students observed were part of a class in training school and were space-integrated. The group was divided into two smaller groups with one observed child in each group during the group session, to cater for the different needs due to different learning capacities.

Observation environment 6



In the last observation environment, the 6th one, three students were observed: one autistic student and two students with ADHD tendencies. The observed children, together with one other pupil, were seated at a common table during the group session (Observation Environment 6). The two students with ADHD had a higher occurrence of positive behaviours noted during the group work than the child with autism. The student with autism also showed a higher occurrence of negative behaviour than the other two students with ADHD (Table 11). The three students

List of symbols:

-  = Observer
-  = Observed child
-  = Personal assistant
-  = Pedagogue
-  = Other child
-  = Computer
-  = Television

observed were part of a class in training school and were space-integrated. According to the pedagogue, the classroom was furnished with respect to the children's diagnoses, with no open shelf storage, loose boxes, materials or other distracting factors, such as computer or wall decorations, which was in line with the results from Study I and Study II. The view consisted of several factors, including a railway track in use (Table 12). However, one of the students with ADHD was not facing the window, and another student in the group blocked the view for the other student with ADHD, but the autistic student was facing the windows and mostly kept his eyes shut or was focusing deeply on the work at hand. At the occasion of the observation, the

morning gathering was extended into a group session, and the students did well according to the pedagogue considering they usually do work sessions at their individual places. The size of the groups and the teaching method were felt by the pedagogues in observation environments 5 and 6, to be compromised due to lack of accessibility to several, and different forms of, classrooms in order to form work sessions better adapted to the level of each child.

Table 10. Occurrence of positive and negative behaviour among the children with ADHD, autism and Down's syndrome.

Behaviour	Positive				Negative			
	N	Mean	Min	Max	N	Mean	Min	Max
Disability								
Down's syndrome	4	16	12	22	4	5	0	9
Autism	3	12	11	14	3	6	3	8
ADHD	4	16	15	17	4	3	2	4

Table 11. Observed frequencies of positive and negative behaviour among the children with ADHD, autism, and Down's syndrome in the observed environments.

Observation environment	Positive behaviour					Negative behaviour				
	Down's Syndrome		Autism		ADHD	Down's Syndrome		Autism		ADHD
No. 1 (N=1)	16					4				
No. 2 (N=2)					16 15					2 3
No. 3 (N=2)	22	12				0	9			
No. 4 (N=1)			11					3		
No. 5 (N=2)	13		12			6		8		
No. 6 (N=3)			14		17 17			7		4 4

Table 12. Observed environmental factors in the school environments from Study III.

<i>Observation environment:</i>	Down's syndrome			Autism			ADHD	
	No. 1	No.3	No. 5	No. 4	No. 5	No. 6	No. 2	No. 6
<i>Number of environmental factors:</i>								
Physical factor: Space (layout)								
Doors	2	3	3	4	3	3	1	3
Windows	6	4	5	9	5	8	5	8
Physical factor: Interior furnishing								
Computers	0	1	1	0	1	0	1	0
Social factor: Social density								
Students	13	8	5	5	5	4	8	4
Staff	2	3	2	2	2	2	2	2
<i>Observed environmental factors:</i>								
Physical factor: Space (layout)								
Windows on one exterior wall	yes	yes	yes	no	yes	yes	yes	yes
Physical factor: View								
View of the sky	yes	yes	yes	no	yes	yes	yes	yes
View of greenery	yes	yes	yes	yes	yes	yes	yes	yes
View of built environment	yes	yes	yes	yes	yes	no	yes	no
View of school yard	no	yes	no	yes	no	yes	yes	yes
Other view	traffic/road	no	snow	traffic/road	snow	railway	passage	railway
Blocked view	no	yes	no	no	no	no	no	no
Physical factor: Interior furnishing								
Plants	yes	yes	yes	yes	yes	yes	yes	yes
Aquarium	no	no	no	no	no	no	no	no
Pillow seat	no	no	no	no	no	no	no	no
Window curtains	yes	yes	yes	yes	yes	yes	yes	yes
Wall decoration	yes	yes	yes	yes	yes	yes	yes	yes
Open shelf storage	yes	yes	no	no	no	no	yes	no
Boxes	yes	yes	no	no	no	no	yes	no
Cupboards / drawers	yes	yes	yes	yes	yes	yes	yes	yes
Physical factor: Noise								
Background noise	no	yes	yes	yes	yes	no	no	no
Sound filtration	yes	yes	no	yes	no	yes	yes	yes

Individual arrangements due to influences from environmental factors

There were individual arrangements made by the pedagogues in order to increase the children's ability to concentrate during group work. Group work was regarded as being of importance for the children's social and cognitive development (Pavuluri, et al, 1999, Cuckle and Wilson, 2002, Singhania, 2005), but also a difficult teaching method due to the symptoms of their disabilities. The placing of façade apertures influenced where the group work could be held due to the number of windows and their placement on the walls, which the number of doors into the classroom also did. The size of the classes and classrooms, style and placing of storage systems, and the placement of white boards, which many of the observed groups were in need of to put

pedagogical material on, influenced the possible seating arrangements. With different seating arrangements, placing of personal assistants or pedagogues, access to a view, and selection of loose interior furnishing some of the individual needs could be catered for (see Table 8 for previous results concerning positive and negative influences). The individual adjustments were often made in order to avoid disturbing factors such as a view of a schoolyard through the placing of the child with its back to the window (No. 1 and 6), installing blinds (No. 5), or blocking the view (No. 3). The child could also be seated in the direction of the pedagogue who then was in the child's field of vision, which was found in all of the observed environments. Seating arrangements were also made to provide for group work in different ways such as having the children seated on the floor in a circle (No. 2), on chairs in a circle (No. 3 and 4), or at tables either their own individual one (No. 1) or at a common table (No. 5 and 6). The arrangements were made in order to meet the need of the children due to their diagnoses and make it possible for the pedagogues to guide the children back to the tasks at hand. Some of the children also needed personal closeness such as a personal assistant in order to be able to focus during group work, since the other participants in the group enhanced disturbances (No. 3, 4, 5 and 6). Open shelf storage was avoided intentionally where possible (especially in No. 4, 5 and 6), as well as the presence of computers through the placing of shields (No. 2) or none at all (No. 1, 4 and 6). Decorations such as plants, drawings, artwork and curtains were kept to a minimum, and the wall decoration found were mostly related to the teaching or part of the visual guidance of the children's daily schedule in all of the observed environments.

Results of Observation Method

The actual presence of the observer influenced 45% of the negatively noted behaviours, meaning that the children were focusing on the observer instead of the actual group work. To make an observation once every minute was regarded as the time needed by the observer to be able to interpret the children's behaviour, which with hindsight could have included one more of the criteria's for the CAFIAS model. In the CAFIAS model observations were made continuously at a set time (every 3rd second), but also when actual changes in the behaviour were noted (Roland, 1983). Observations made when changes in behaviour were noted would probably have given a more accurate picture of the situation, but it also requires a skilled observer with intuitive knowledge concerning the different disabilities, usually developed by professionals such as personal assistants, remedial teachers etc.

Discussion of Study I-III

Studies I-III, using different methods, served to identify environmental factors in the school environment that influenced the children in question, and their ability to concentrate, without approaching them in person. Results from the first three studies showed school-related environmental factors influencing the children in question and their ability to concentrate, and they sometimes showed different influences depending

on which disability the children had. There were exterior aspects such as façade apertures, i.e. the number of windows and their placement, the view through the windows in the classroom, the size of the school, and acoustics issues such as background noise and sound infiltration, affecting the children's ability to concentrate. Noise, however, can be produced both inside as well as outside the classroom due to social density, technical aspects, and the orientation of the building. The orientation of the building, including the design of the outside environment, also determines the content of the view. Further environmental factors influencing the children's ability to concentrate were concerned with the interior furnishing, such as the seating of the children, the size of the classes and classrooms, the number of room passages, i.e. the number of doors into the classroom, the type of storage systems, and the decorations.

The results also highlight the difficulty in allocating already built classrooms to children with diminished cognitive abilities that are supportive of their different needs. The user organisation concerned usually has to arrange the allocated classrooms to fit the needs of the children. However, as the results showed, it can be close to impossible to fulfil the needs of the children and make the classrooms totally accessible, since some of the disturbing influences derive from already built-in qualities. The pedagogues also have to use their previous experience and knowledge concerning the children in question to make the environment individually supportive for them when, for instance, the children are attending group sessions, i.e. rearrangements in the classrooms and the placing of the children due to their needs and behaviour, depending on the symptoms of their disabilities, but also on their personalities and day-to-day performance (Martin, 2002).

Background noise and sound filtration are known to interrupt concentration and increase the level of noise (Enmarker and Boman, 2004). Noise produced from outside the school building such as traffic and children playing in the schoolyard, and noise produced inside the building such as talking in waiting areas or corridors outside the classroom, are often factors that the pedagogue cannot influence; they have to be considered when the building is being located on the site.

Another factor, which needs to be considered during the building process, is the architectural conditions for the pedagogical atmosphere. It was perceived by the respondents that the children needed to have a seating place that they regarded as their own and one-to-one teaching to maintain and prolong the children's concentration. The design of the classrooms were many times not supportive enough in order to provide for the different concentration capacities found within the groups, which became even more evident when the children were doing individual work (Pavuluri, et al, 1999, Cuckle and Wilson, 2002, Singhanian, 2005).

Interior furnishing contained several environmental factors (apart from seating arrangements), which were regarded as being of importance for the children's ability to concentrate. The effect from the analysed environmental factors differed between the disabilities, but regardless if the effect was positive or negative, the interior furnishing, which also needs to be considered in the design of the classrooms,

consisted of different storage systems, the presence of computers, and the choice of decorations. The children with autism spectrum disorders could concentrate the longest when they had no view at all, the children with Down's syndrome required a view of the sky, but there was an inconsistency as to whether the view should contain greenery or not, and the children with ADHD were able to stay focused for a longer period of time when they had a view of a built environment outside their windows. It was only a view of the schoolyard that was perceived to have a negative influence on the children's ability to concentrate, regardless of their type of disability. It was observed that the pedagogues had to make spatial adjustments such as installing blinds in the windows to block the views and the daylight, or make personal seating arrangements, either not facing the window or having a personal assistant close by. The actual disability showed to have an effect on the children's ability to concentrate as well. The children with Down's syndrome could sit for longer periods of time than children with ADHD and autism. The need for flexible adjustments due to individual requirements is of great importance for the daily organisation of the learning of these children, and as such ought to be included in the decisions contained within the building process.

The exact number of the different environmental factors has not been the issue within this thesis, neither have they been ranked according to their degree of influence. This will be of utter importance for future research since each school environment is unique and since each child has its own particular needs, meaning that individual aspects such as low or high functioning within the different categories of disability have to be considered in the design of the features of a school environment.

The results from the regression analyses in Study I showed how environmental factors found in the classrooms coexisted at the same time, and influenced the children's ability to concentrate both negatively and positively. However, the results from Study II were concerned with the perceived influences from environmental factors one by one. The professionals in Study I and Study II did also have differing relations with the children. These factors may explain why the perceived influence of some factors was contradictory when comparing Study I and Study II. Another explanation may be that the professionals working at the Child and Youth Habilitation Services met children with difficulties more frequently than personnel working at the schools. Resulting in that influences from some of the environmental factors were perceived by school personnel as being positive but considered by the professionals working at the Services as being negative.

There was also a contradiction found in the results concerning some of the influences regarding the children with autism and ADHD, which can be described as a result of the divergence found within the disabilities. The autism spectrum disorder can be described in terms of different variants of high or low functioning, depending on the number of areas of abnormality included (Klin, et al, 2005, Singhania, 2005, South, et al, 2005). There are three categories that can be defined within ADHD, inattentive (ADHD-I), hyperactive-impulsive (ADHD-H), and combinations (ADHD-C) (Zentall, 2005, Rizzo et al, 2000, Oberlin, et al, 2005, Iwanaga, et al, 2006), depending on one

or more core symptoms: inattention, hyperactivity, excessive motor activity, and impulsivity (Bruce, et al, 2006). The children with Down's syndrome can have different levels of cognitive and communicative skills, such as speech and language acquisition (Paterson, et al, 2006, Boudreau and Chapman, 2000), but also impaired short-term memory (Purser and Jarrold, 2005), motor skills (Lauteslager, et al, 1998), expression (Smith and Dodson, 1996), and learning capacity (Gathercole and Alloway, 2006). In other words, the children can handle influences from environmental factors differently depending on where in the spectrum of the diagnoses they are located. Thus, further research is needed in order to understand the implications of the influences from the different environmental factors on the children's ability to concentrate, and how they interact depending on the type of disability.

The accessibility to the information gathered concerning these children is a result of the consent given by parents, principals, and pedagogues, and since consent is usually given by those who are interested and have the strength and opportunity to participate, which means that the most troubled ones could have been left out in Study I. Though in Study II, the professionals may have met with children in need of more support. However, there was a geographical spread among the parental consent given, all three categories of disabilities were represented, as well as different categories of professionals working at all of the Child and Adolescent Habilitation Services within the Region of Skåne, and all the categories of enrolment forms available for children with different categories of diminished cognitive disabilities were studied. The sizes of the samples also need to be taken into consideration, although statistically significant results were obtained, and the results give indications of influences from certain environmental factors, which are of importance for children with ADHD, autism, and Down's syndrome and their ability to concentrate in the school environment. In order to produce more statistically significant results, further research needs to be undertaken engaging more groups of children, as well as evaluations and observations made on several occasions, and compared to a control-group. The involvement of parents, as well as other experts in the special needs education, would be of interest to uncover more information concerning the children's ability to concentrate (de Nijs et al, 2004). The questionnaires answered by the personal assistants and teachers to the children had a high response-rate. Speech and occupational therapists, psychologists, and remedial teachers had fewer missing cases and "do not know" responses than physiotherapists, medical personnel, welfare officers, and recreation instructors. The closer the respondents were to the child at the school, the higher was the response-rate. However, the perspectives of the different categories of professionals were needed, since they complemented each other and gave a greater understanding, and a fuller picture, of the influences from the environmental factors found in the school environment that were affecting the children's ability to concentrate.

The choice of a non-participatory observation method in Study III needs to be considered. To observe children with some category of disability requires knowledge concerning the individual as well as the actual symptoms of the disability in order to interpret the intention of the observed behaviour. The behaviour observed in the classrooms could be caused by the children's different disabilities. For example, an

apathetic child could be interpreted as showing a positive behaviour, since the observed attention was directed towards the activity although the child was not actually participating, and interruptions could have been interpreted as negative in spite of the fact that the child was only trying to take an active part in the group session. Further, the presence of an observer could also have influenced the observed behaviour to become more positive than usual, i.e. the children wanting to prove themselves in front of the observer, but also more negatively, i.e. the presence of the observer was more of an interest than the actual activity. It also needs to be remembered that these children are easily affected by changes in the environment since they have difficulties with avoiding and ignoring environmental input (Singhania, 2005, Drechler, et al, 2005, Clibbens, et al, 2002), and to have an observer present was a change to the daily and known environment and therefore a disturbing factor. This needs to be considered when evaluating the presence of other environmental factors. However, the method of observation served as a complement to the results gained from the questionnaires, and thus contributed to a fuller understanding of the influences from the environmental factors found in the school environment and the need for individual adjustments.

Although there are some limitations on the representativity of the present results, they provide a first step towards a holistic understanding of the influences of the physical environment on the learning situation for children with limited orientation capabilities. Taken together, the results from the three studies have implications for the design of school environments and ought to be considered in the building process and when allocating classrooms.

Study IV

Introduction to Study IV

The aim with the fourth study was to find out where in the building process the knowledge about influencing factors in the physical environment concerning children with Autism, ADHD, and Down's syndrome could be applied. The purpose was to implement the results from Study I–III in order to support the ability to concentrate among these children, in accordance with the Swedish Education Act¹⁷. The study focused on the practical application within the Swedish building process, and two examples of building processes were discussed and compared with respect to the Swedish building legislation¹⁸.

The professionals within the building process have been working with the same environmental factors for a long time, e.g. spatial layout, capacity and function, and user demography. These are the same environmental factors, which were shown in Studies I–III to influence the concentration ability among children with ADHD,

¹⁷ The Swedish Education Act, SFS 1985:1100.

¹⁸ BFS 2004:15 ALM1 and BFS 2003:19 HIN1.

autism, and Down's syndrome. Due to the Swedish building legislation these are aspects that have to be considered in future school projects and in the upkeep of existing school properties.

The Cyclic building process

The traditional linear phase-divided building process consists of four different phases: the design, preparation, construction, and facility processes, with input received from the user organisation in the different stages of the design process (Figure 4).

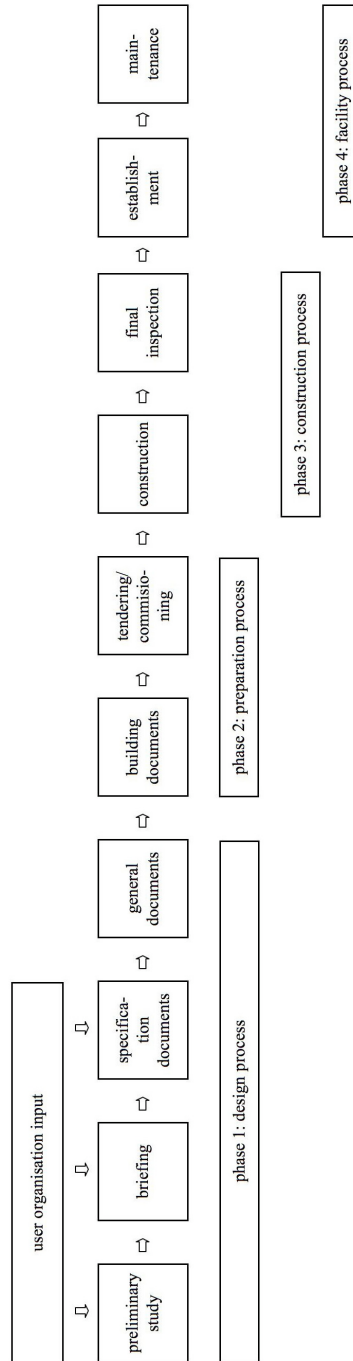


Figure 4. An overview of the traditional linear phase-divided building process.

The cyclic building process contains the same phase-content and the same parts as the linear building process (Figure 5a). However, the main difference between the two building processes is that the linear building process describes the phases and their parts as isolated elements, and does not include the project information-flow (Carenholm, 2002). The introduction of a feedback system between the different phases in the cyclic building process, as well as participation and follow-up procedures, made it possible to include the issues concerning environmental factors affecting the concentration ability among the children in question. The feedback consists of gained knowledge and experience from the different participants. The concept of the cyclic building process proved to be useful as a starting point, even though there are other ways of describing the building process, for a further discussion regarding the implementation of significant environmental factors for the purpose of increasing the access to education among these children.

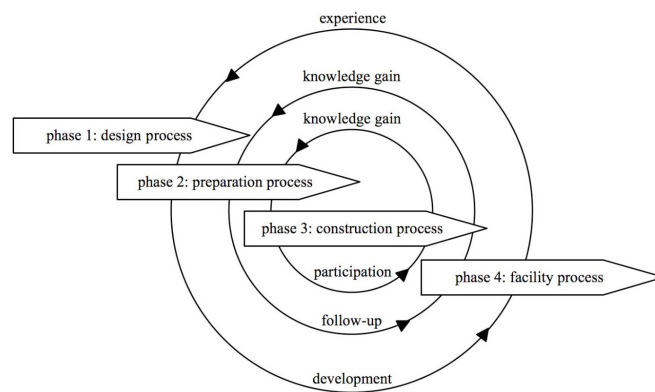


Figure 5a. The cyclic building process, S. Carenholm, 2002, p 55. Reprinted with author's consent.

The cyclic building process is founded on the acquisition of knowledge between the phases and their parts, i.e. between the facility and design processes, the facility and preparation processes, and the construction and preparation processes. These flows of information have always existed, but as the demand for efficient project organisation and an efficient use of resources has increased, as have the user organisations' rights to joint consultation, the need for formalised information flows has increased accordingly. In order to make sure that the environmental factors relevant for children with limited cognitive capacity are included, they need to be addressed in a pre-project decision stage (Figure 5b) and implemented into the cyclic building process.

In connection with pre-project decisions, decisions regarding the pedagogical atmosphere, school size, building orientation, and outdoor acoustics¹⁹ should be considered and made before the first phase of the actual building process begins (environmental factors no. 1-4a in figure 5b). At present, the aspects that affect concentration ability among cognitively limited children have had limited impact on these discussions, both due to the lack of previous knowledge but also due to the fact that these issues often have been addressed outside of the formal building process in an earlier context – in a school-planning context that has usually been political. By linking the pre-project decision stage with the cyclic building process, better conditions for building schools supportive for children with ADHD, autism, and Down's syndrome, could be made available.

¹⁹ Outdoor acoustics is in this case outdoor sounds that affect the indoor acoustic climate.

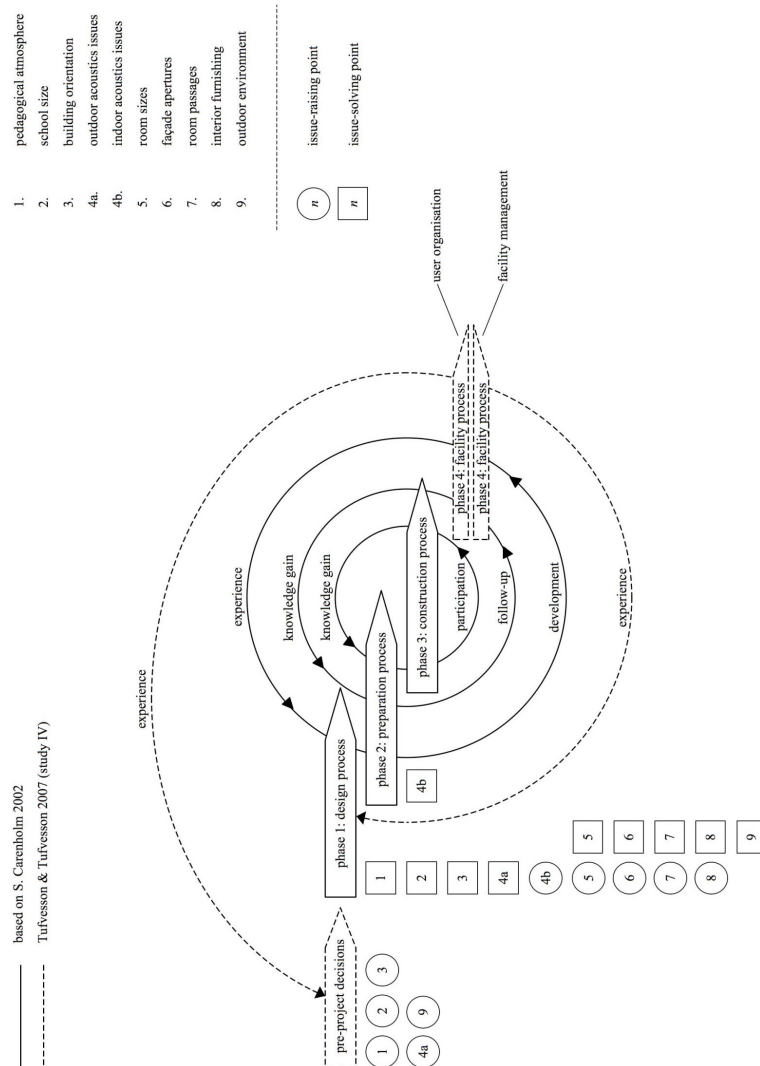


Figure 5b. The cyclic building process with respect to avoidance of concentration difficulties among cognitively limited children.

The Pre-project discussions

In the pre-project discussions, several parties are needed in order to implement previous knowledge and gained information. The property developer, in this case the municipality, is the liable party and as such being responsible for making sure that the school buildings meet the demand for accessibility. Politicians and employees who have the option to start pre-project discussions containing political alignments and directions represent the municipality. The project manager is commissioned by the municipality to co-ordinate the necessary qualifications needed in relation to the building process and the consultants that are to be included depending on the specifications of the building. The user organisation, which is actually going to use the school building, represents the hands-on experience concerning the different needs depending on the disabilities and the individuals, and as such can provide vital information concerning the selection of teaching methods and their need for environmental support. The experience from the facility management should also be included to ensure that future facility management does not come into conflict with the intentions stated in the project plan, i.e. the aim to support concentration among children with ADHD, autism, and Down's syndrome. If these participants are all taking part in the pre-project discussions, the intention of the cyclic building process to implement previous experience and gained knowledge could be achieved.

The same arguments could be used concerning pedagogical atmosphere, school size, building orientation, and outdoor acoustics apply to the interior furnishing. Therefore, the interior furnishing should also be part of the building process, more specifically the design process (phase 1). The interior furnishing in a school project is often treated as a side-contract, commissioned by the school administration or corresponding body, and therefore falls outside of the building process. However, the interior furnishing should be treated as equally important as for example the placement of windows, doors etc, since the ability to concentrate has proven to be affected by the overall spatial impression. Further issues such as the indoor acoustics, room size, façade apertures, room passages, and outdoor environment²⁰ (environmental factors no. 4b-9 in figure 5b) should also be raised and solved within phase 1: the design process. The outdoor environment is also one of those factors, which are usually solved outside of the building process, in a late stage. Considering the importance of the view for the children's ability to concentrate, this matter ought to be an active part of the cyclic building process. Indoor acoustics are usually solved within phase 2: the preparation process, and can continue to be solved there. However, with the developed cyclic building process, the basis for the solutions ought to contain more specific information, which in the end will result in a better school environment.

²⁰ The design of the outdoor environment should follow the building process.

Discussion of Study IV

Study IV suggests that the possibility for creating more supportive school environments could be increased if the knowledge concerning the influences of environmental factors on children with limited cognitive abilities were considered in a pre-project stage connected to the cyclic building process.

In practice there are two aspects to the environmental factors and how they affect children with cognitive limitations that need to be considered in the building process. Firstly, to design environments that have supportive functions for children with cognitive limitations requires detailed knowledge and understanding of limited orientation capacities, and how environmental factors affect children on an individual basis (Janssens and Laike, 2006, p 16). Secondly, previous research has shown that every space is unique and involves different conditions depending on the project content, design, character, etc (Gathorne-Hardy, 2001). Therefore, in each school project that addresses children with cognitive limitations there is a need for specific data which can be implemented and achieved through the development of the cyclic building process as shown in figure 5b.

However, it is not only important where in the building process the environmental factors are to be implemented; an important factor is also which participants address them. The proposed implementations of the environmental factors in the cyclic building process need to be considered by the property developer, which in the case of schools is often a municipality, represented by politicians and employees, together with the project manager, consultants, the user organisation, and the facility management in order to increase the accessibility of school environments for cognitively limited children. All the participants connected to the cyclic building process have an important role to play, in order to make education accessible for all children²¹.

General discussion

Children with ADHD, autism and Down's syndrome often need additional resources in their schools, such as a personal assistant, special pedagogical methods, individual tutoring, technical aids, unique solutions to personal problems, individually adapted teaching material etc (Strayhorn and Bickel, 2002, Russell, 2002). The issue of this research is not to dismiss any of these additional resources; instead it is to suggest how to arrange learning environments in the most supportive way possible based on the initial needs of these children.

The overall aim of the thesis was to identify environmental factors in the school environment that affect children with ADHD, autism, and Down's syndrome and their ability to concentrate in the classroom. These children all have in common that they

²¹ Swedish Government Bill 1999/2000:79, and UN's General Assembly Resolution A/RES/48/96, 1993.

have learning and concentration difficulties due to the symptoms of their disabilities (Singhania, 2005, Drechsler, et al, 2005, Clibbens, et al, 2002). They are also extra sensitive to their environment (Reese et al, 2005, Zentall, 2005, Cuckle and Wilson, 2002), i.e. they experience great difficulties in staying focused in an environment with a wide variety of sensory input, which in the case of learning will result in interrupted study activity. As mentioned earlier in the discussion of the different stages within the four-step emotional process (Küller, 1991a), which the HEI-model is based on, children with cognitive and perceptive disabilities have difficulties with avoiding irrelevant influences from the social and physical environment due to the symptoms of their disabilities. This study pinpoints the factors that have positive or negative influences, so that changes could be made within these children's learning environments in order to make it possible for them to reach the emotional level of control. In doing so, these children would be given an enhanced opportunity to develop even further. It was expected that these children would have certain behavioural aspects in common, but it was also expected that differences between the disabilities would be found. The need for individual flexibility due to the children's personalities was also taken into consideration. Through the application of the Human Environment Interaction-model (Küller, 1991a), environmental factors found in the learning environments and their influences on the children with ADHD, autism, and Down's syndrome and their ability to concentrate could be analysed. The focus was upon the physical environment such as the features of the building, but also interior furnishing, individual aspects such as the disabilities, and the social environment such as the pedagogical atmosphere. Another objective with the thesis was to identify where in the building process this kind of knowledge could be applied to benefit the children's ability to concentrate even further, in accordance with the Swedish action plan for disability²² and the Swedish building regulations²³.

So, how should the school environments be designed to be all-inclusive for children with diminished cognitive capacities who are extra sensitive to the design features in their environment? Below the results could be discussed in three levels in relation to practical applications: 1) an overall level, where general principles concerning all of the disabilities could be found, 2) a specific level, where principles concerning the specific disabilities could be found, and 3) an individual level, where individual needs could be provided for. In addition the demand for the pre-project discussions in the building process were considered, and certain results such as the influences of the view on the children's ability to concentrate, and the requirement of school environments designed to needs of the children were discussed.

General influences on an overall level

The present study points to these children and their ability to concentrate due to influences from environmental factors, that was coherent with previous research concerning the concentration ability of children in general. This would have

²² Swedish Government Bill 1999/2000:79.

²³ BFS 1993:57 – 2006:12 BBR, BFS 2004:15 ALM1 and BFS 2003:19 HIN1.

implications for the features of the school environment and thus would need to be taken into account when designing school environments for children in general as well as children with cognitive limitations. The following factors were perceived to influence the children in question and their ability to concentrate negatively, and also found by previous researchers to have a negative influence on children's concentration in general. Background noise and sound filtration had a negative impact, which was confirmed by Enmarker and Boman (2004) to negatively affect children, and lower levels of noise increased children's ability to concentrate as shown by Norlander, et al (2005). Direct daylight on to the work place interrupted every second child's concentration. Similarly, too much daylight was shown by Wilson (2004) to worsen student's performance. Consistent with the results of Kantrowitz and Evans (2004), Legendré (2003), Schneider (2002), Moore and Lackney (1993), a high number of students and staff nearby could influence children's behaviour negatively. Class teaching was shown by Strayhorn and Bickel (2002) to be a negative teaching method in relation to concentration, which was also found to be the case with the children in question. The actual disability in itself was perceived to have a negative influence on the children's ability to concentrate, which was also interpreted as a negative influence by Faber Taylor et al (2002). An environmental factor perceived by the respondents to have a positive influence on all of the children and their ability to concentrate was one-to-one teaching, which the research by Bronson, et al (1997) also showed. Further environmental factors, such as several doors and window placement on several walls, were also perceived by the respondents to have a negative effect on all of the children's ability to concentrate, but to the author's knowledge these factors have not been studied before.

Other general influences on the children's ability to concentrate were classroom settings, as shown as well by Martin (2002), which were perceived to be of major importance for the children in question, who needed to do individual work at purposely-suited places or personal seating places in order to function well, also supported by the work of Adams, et al (2000). A smaller room such as a group room where group work could be organised was considered to be positive, but as the research by Charlop, et al (1983), Pavuluri, et al (1999), Cuckle and Wilson (2002), Singhania (2005) also shows, group work was considered as time consuming and difficult to pursue. According to Doctoroff (2001), the materials and equipment necessary for a learning task need to be accessible, which in this case would support these children successfully through the whole of the basic emotional process (Laike, 1997). However, it was perceived by the respondents that materials and equipment not used for the moment needed to be stored in closed storage systems such as cupboards and drawers, and not in open shelf storages.

Specific influences concerning specific disabilities

There were also more disability-specific influences found. The children with Down's syndrome were regarded by the respondents as being positively influenced by several windows, window placement on one wall, a view of the sky, a pillow seat, a computer,

a study room, a purposely-suited place, a personal seating place, and individual work as well as group work. The effects of having a view of a green environment or not were contradictory according to the results of the studies performed. Environmental factors, which were perceived by the respondents as having a negative influence on the children with Down's syndrome, were the following: being without a view, having indoor plants near the working place, and a higher number of staff. This means that children with Down's syndrome are in need of both individually designed seating places and of participating in group work, in order to optimise their learning. In order to develop their social and communicative skills they need to practice with other children with similar needs during for instance group work sessions (Cuckle and Wilson, 2002), but individual work is also necessary in order to maintain their attention during learning (Clibbens et al, 2001).

The respondents regarded the children with autism and their ability to concentrate as being positively influenced by environmental factors such as several windows in the room, as well as being without a view, a pillow seat, window curtains, and having a higher school population. Environmental factors regarded by the respondents as having a negative effect on these children and their ability to concentrate was to have several windows, wall decorations, and group work. The contradiction in the results concerning the influences from having several windows could be due to the differences within the disability. Children with autism often have their functioning in social interaction, social communication, and personal behaviour affected by visual, auditive, and emotional inputs (Meresse, et al, 2005, Singhania, 2005, Rinehart, et al, 2006). The results indicate that children with autism are in need of a personal space with very little input, except from the actual task, during individual learning. To have a pedagogue close at hand also increases the possibility for learning, especially during group work.

The children with ADHD were regarded by the respondents as being positively influenced by environmental factors such as a view of a built environment, window placement on one wall, loose boxes, and a higher number of floor levels. Environmental factors that were perceived as having a negative influence were to have several windows, window placement on one wall, wall decorations, and group work. There was a contradiction within these results as well, concerning the window placement on several walls as well as having loose boxes, which can also be explained by the different capacities within the diagnose. Children with ADHD often find it difficult to pay attention and control their own reactions, and as a result they are often fidgety and interrupt others (Archibald et al, 2005, Hastings, et al, 2005, Brody, 2001, Nigg and Casey, 2005). In other words, children with ADHD are therefore in need of a seating place suited for individual learning. However, since impairments in cognitive, learning, and social skills can occur among these children (Bruce, et al, 2006), group work can have a negative influence on their ability to concentrate, but as the pedagogues in the observation pointed out, the social interaction is necessary and should not be excluded in the education, even if it is difficult to implement (Pavuluri, et al, 1999) which puts a demand on the school environments to be supportive and suited to the children's capacities.

The need of individual adjustment

In the third study was existing school environments evaluated based on previous results from the two earlier studies undertaken in respect to the ability to concentrate among children with ADHD, autism, and Down's syndrome, but also to acknowledge the need for individual arrangements. In the observation environments the pedagogues made individual arrangements through using different seating arrangements, placing of personal assistants or pedagogues, making the view accessible or not, and the selection of loose interior furnishing such as the storage system. These environmental factors had the characteristics of flexibility and as such could meet the explicit needs on an individual level and be arranged by the pedagogues to make the learning environment more supportive according to the child's individual needs. Should there be more flexibility? The adjustments were often made due to the built in features of the environment, i.e. openings such as doors and windows, the movement and noise of other children and the size of the classrooms. The interpretation of the observations is that the need of flexibility on an individual level will remain due to the children's disabilities and the different compositions of disabilities within the special / training school. However, the need for flexibility in the allocation of these children within the school buildings ought to be considered according to their environmental needs. In existing school buildings the possibility to cater for all needs are by definition limited, but in new-built structures prerequisite knowledge exist in order to make informed decisions regarding flexibility and specific qualities of the buildings in relation to the needs of the children in question. In line with the discussion, further research is needed with focus on to what extent the level of flexibility or disability specific measures are to be implemented in the school buildings, in relation to the needs of these children.

Implementation in the building process

The demand on the design and function of the school environment today differ since schools are to be all-inclusive, especially newly builds but also when maintained. This raises the issue of implementation of the information of the differing needs concerning these children in question into the building process. The aim with the fourth study was to show how the results from Study I-III concerning the influences from environmental factors found in the school environment could be implemented in the Swedish building process. It was suggested that if a pre-project decision phase was attached and implemented into the cyclic building process (Carenholm, 2002), the environmental factors found to be relevant within this thesis could be applied in order to support the ability to concentrate among the children with ADHD, autism, and Down's syndrome, and as such increase the accessibility to education. The participants (politicians and employees within the municipal, project managers, consultants, user organisations, and facility managements) tied to school projects in accordance with the cyclic building process has the potential to implement this new knowledge. All of the above is in accordance with the school, building, and disability legislations in Sweden.

Methodological considerations

The methodological challenge lay in the difficulty of gathering data through direct contact with the children in question. To achieve greater insight into the issues raised in this thesis, the perspectives of the different categories of professionals were needed since they complemented each other and thus gave a greater understanding of the influences from the environmental factors found in the school environment affecting these children's ability to concentrate. The information gathered through the observation method used in the classrooms complemented the results from the questionnaires used on the professionals, and gave a fuller picture of the need for individual adjustments. The results from the observations of the children's ability to concentrate during group work showed a negative impact from the observer, even if the children seemed to approve of the presence of the observer. Further research needs to be undertaken engaging more groups of children, as well as evaluations and observations made on several occasions, and compared to a control group. The disturbance of the observer can also be calculated for in further research. The involvement of parents, as well as other experts in the special needs education, would be of interest in order to gather more information concerning the children's ability to concentrate (de Nijs et al, 2004).

Considerations of certain results

The implication of some of the results has been considered in more detail concerning its interpretation and application. First, the results concerning the view through windows showed that different contents of the views influenced the children's ability to concentrate differently, as well as the actual access (Wilson, 2004), or a lack of access, to views through windows in school classrooms. If the results from this thesis had supported previous research findings that a view containing a natural environment could restore and prolong the capacity for concentration (Kaplan, 2001), it would have been a pleasant element in the schoolyard that could be arranged at schools already built. However, the results gave the implications of more complex demands regarding the location of the school building, the façade apertures, and the design of its outdoor environments in order to improve the students' performance.

The results could be interpreted to indicate that the level of details was affecting the children's ability to concentrate. If the view from the classroom were without moving or changing objects on a detail level, then the view would have a positive effect on the children. A short perspective with movable objects in focus would have a negative affect, no matter what the content of the view. This could include an influence from a very green dominant view close to the window, since it would probably first result in an increased arousal level, which is positive, but it would probably gradually turn into fatigue, since these children are known to have difficulties in keeping up their concentration for longer periods of time, and therefore would be a negative factor for the children's ability to concentrate since they would become exhausted. These results may have implications for the design of school environments, but further research is

needed in order to establish what kinds of suggestions for architectural applications that can be made concerning the content of the view relating to the different disabilities. The level of details and the depth of the perspective in the view in the school environment, and its influences on the children's ability to concentrate, ought to be investigated further as well. It also needs to be mentioned that the results do not give any evidence that these children do not need a green environment in other situations, such as for recreation and for restoring their concentration capacity (Faber Taylor et al, 2001).

Second, the results from this thesis, as well as from previous research, shows that school environments ought to be designed in relation to the needs of the children, in order to be as supportive as possible for them when they need to concentrate. However, children, who are extra sensitive to their environment, as the children with ADHD, autism and Down's syndrome, are often allocated additional resources, to be able to function as well as possible at school. The question that arises is that if these children are given additional resources because their school environment is not supportive enough for them? The answer is not a simple yes or no. These children do need extra support and individual adjustments due to their diagnoses, but how well do the school environment function together with the additional resources? Many of the pedagogues working with these children today, have to make do with the school environment they are being allocated. The pedagogues' creativity to stay in touch with the children throughout a learning session is immense, but energy demanding and time consuming. Further research could be concerned with the interaction between additional resources and environmental factors found in the school environment in order to facilitate for the pedagogues and the pupils, as well as enhancing the learning among these children in different situations, tasks, methods of teaching and seating arrangements.

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Nr.: _____

Koncentrationshinder i skolans miljö

Dagens datum: _____

Beskrivning av barnet

1. Kön: _____

2. Ålder: _____ (år, mån)

3. Funktionshinder: _____
_____4. Behov av hjälpmedel (ex. hörapparat, glasögon, tecken, rullstol m.m.):

_____5. Vilken yrkesrelation har du som fyller i enkäten till barnet (ex. lärare, resursperson etc.)?

6. Hur länge har du känt barnet?

a. Mindre än 1 år ☐b. Mellan 1-2 år ☐c. Längre än 2 år ☐

7. Är barnet:

a. individuellt integrerat i en klass? ☐b. i en särskoleklass? ☐c. annat? _____ ☐

8. Hur många elever finns det i klassen? _____ st.

9. Hur mycket personal (lärare, assistenter, etc) finns det i klassen? _____ st.

Beskrivning av er skola

10. Hur många elever finns det på hela skolan?: _____ st.

11. Är skolan byggd i: a. ett plan? ☐ b. två plan? ☐ c. flera plan? ☐

12. Vilka årskurser finns på skolan?

- a. F-2/3 ☐
- b. F-6 ☐
- c. F-9 ☐
- d. annan fördelning: _____ ☐

13. Hur ser utemiljön runt skolan ut? Markera det som finns:

- a. ... träd? ☐
- b. ... gräsmatta? ☐
- c. ... buskar? ☐
- d. ... köksträdgård? ☐
- e. ... gungor? ☐
- f. ... sandlåda? ☐
- g. ... fotbolls-, basket-, och / eller bandyplan? ☐
- h. ... klätterställning? ☐
- i. ... utemöbler? ☐
- j. ... asfalterad gård? ☐
- k. ... grusytor? ☐
- l. ... vattenarrangemang? ☐

14. Hur många gånger i veckan deltar barnet i schemalagd gymnastik? _____ ggr/vecka.

15. Hur lång tid av skoldagen (ej fritids) är barnet ute?

- a. Mindre än 20 minuter. ☐
- b. Mellan 20-40 minuter ☐
- c. Längre än 40 minuter ☐

Beskrivning av klassrummet

(Utgå ifrån det rum som barnet befinner sig oftast i)

16. Vilken färg har:
- a. ... golvet? _____
- b. ... taket? _____
- c. ... väggarna? _____

17. Hur många fönster finns det i klassrummet som barnet *oftast* befinner sig i? _____ st.

18. Är något / några av dessa fönster takfönster?
- ☐ a. Ja, _____ st.
- ☐ b. Nej

19. Är alla fönstren vända åt samma vädersträck?
- ☐ Ja ☐ Nej

20. Hur många dörröppningar finns i det rum som barnet *oftast* befinner sig i? _____ st.

21. Har barnet behov av en personlig plats?
- ☐ Ja ☐ Nej

22. Hur fungerar dessa situationer för barnet?

- | | Mycket
bra | Ganska
bra | Ganska
dåligt | Mycket
dåligt | Finns
ej |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| a. Grupparbete | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Enskilt arbete | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Undervisning i klass | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Handledd undervisning | ☐ | ☐ | ☐ | ☐ | ☐ |

23. Hur väl kan barnet koncentrera sig på en utvald uppgift / aktivitet i följande sammanhang?

- | | Mycket
bra | Ganska
bra | Ganska
dåligt | Mycket
dåligt | Finns
ej |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| a. I en studiehall | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. I ett klassrum | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. I ett grupprum | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Ändamålsenlig plats (ex. bakbord, staffli, läshörna) | ☐ | ☐ | ☐ | ☐ | ☐ |

24. Hur väl kan barnet koncentrera sig i närheten av inredningsdetaljer såsom:

	Mycket bra	Ganska bra	Ganska dåligt	Mycket dåligt	Finns ej
a. ... gröna växter?	☐	☐	☐	☐	☐
b. ... väggdekorationer (ex. tavlor, teckningar)?	☐	☐	☐	☐	☐
c. ... akvarium?	☐	☐	☐	☐	☐
d. ... böcker?	☐	☐	☐	☐	☐
e. ... sittkuddar?	☐	☐	☐	☐	☐
f. ... gardiner eller draperier?	☐	☐	☐	☐	☐
g. ... öppen förvaring?	☐	☐	☐	☐	☐
h. ... datorer?	☐	☐	☐	☐	☐
i. ... skåpluckor/lådor?	☐	☐	☐	☐	☐
j. ... lösa förvaringslådor?	☐	☐	☐	☐	☐
k. ... ljusknappar?	☐	☐	☐	☐	☐

25. Är allmänbelysningen oftast tänd när barnet är i rummet?

Ja Nej
☐ ☐

26. Gå ner till barnets ögonhöjd och försök att "se" vad barnet kan se genom fönstret / fönstren från den plats han / hon *oftast* arbetar vid! Syns några av följande alternativ?

Ser barnet...

	Ja	Nej
a. ... himmel, ex. moln, bar himmel?	☐	☐
b. ... grön växtlighet, ex. träd, buskar, gräsmatta?	☐	☐
c. ... byggd miljö, ex. byggnader, plank?	☐	☐
d. ... skolgården, ex. asfalt, klätterställning?	☐	☐
e. ... annat? _____	☐	☐

27. Hur länge kan barnet sitta på en stol och arbeta strukturerat?

- a. Mindre än 15 minuter ☐
- b. Mellan 15 - 30 minuter ☐
- c. Mer än 30 minuter ☐

28. Hur många elever är det oftast runt omkring barnet under lektionstid:

- a. Färre än 6 elever ☐
- b. 6-10 elever ☐
- c. 11-20 elever ☐
- d. Fler än 20 elever ☐

29. Hur många sittplatser (bord och stol) finns det i klassrummet? _____ st.

30. Hur många datorer finns det i klassrummet? _____ st.

Beskrivning av barnets reaktioner

31. Reagerar barnet genom att vända bort ansiktet eller flytta sig (eller undvika situationen på annat sätt):

- | | Ja | Nej |
|--|--------------------------|--------------------------|
| a. ... när någon tänder / släcker en lampa i rummet? | ☐ | ☐ |
| b. ... när lampor med starkt ljus är tända i närheten? | ☐ | ☐ |
| c. ... på grund av direkt solljus? | ☐ | ☐ |

32. Kan barnet koncentrera sig på sina egna arbetsuppgifter när andra barn:

- | | Ja | Nej |
|--|--------------------------|--------------------------|
| a. ... spelar musik från t.ex en cd-spelare? | ☐ | ☐ |
| b. ... eller vuxna sjunger / spelar? | ☐ | ☐ |
| c. ... stimmar? | ☐ | ☐ |
| d. ... eller vuxna pratar samtidigt i dess närhet? | ☐ | ☐ |

33. Hur ofta sitter barnet:

- | | Alltid | Flera
ggr/dag | 1
g/dag | Aldrig |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| a. ... med överblick av vad andra barn gör i rummet? | ☐ | ☐ | ☐ | ☐ |
| b. ... med ryggen emot andra barn? | ☐ | ☐ | ☐ | ☐ |
| c. ... och tittar ut genom ett fönster? | ☐ | ☐ | ☐ | ☐ |
| d. ... vänd mot en dörröppning? | ☐ | ☐ | ☐ | ☐ |

34. Beskriv gärna en plats som fungerar extra bra för barnet.

Fortsätt på baksidan om du behöver mer plats att skriva på!

35. När barnet själv får välja aktivitet, vad gör han / hon då?
(rangordna efter vad barnet helst gör, och numrera möjliga alternativ från 1 - 5;
där 1 är den mest valda aktiviteten, och 5 är den minst valda aktiviteten)

Rangordna (1-5)

a. Använder datorn, ex. spel, rita, e-post, internetsökning, etc

☐

Ge gärna exempel:

b. Arbetar med händerna ex. rita, lera, klippa, pussel, etc.

☐

Ge gärna exempel:

c. Arbetar med kroppen ex. bollspel, studsatta, klättra etc.

☐

Ge gärna exempel:

d. Myser, ex. högläsning, lyssna på musik, massage etc.

☐

Ge gärna exempel:

e. Går ut, ex. utelek på egen hand eller med andra barn.

☐

Ge gärna exempel:

36. Vilka förändringar i skolans miljö anser du påverkar barnets koncentration i positiv respektive negativ riktning?

Positiv: _____

Negativ: _____

Tack för din medverkan!

Funktionshinder: (välj och markera ett alternativ)

Downs syndrom ☐ Autism ☐ ADHD ☐

Hur anser du att följande miljöfaktorer påverkar barn med det valda funktionshindret och deras förmåga till att sitta på sin egen plats och arbeta strukturerat i skolan?

(Markera med X på varje rad)

Hur påverkas barnens koncentrationsförmågor av ...

1. Rummetts utformning:

	mycket negativt		opå-verkad		mycket positivt	vet ej
... ett fönster i rummet?	☐	☐	☐	☐	☐	☐
... flera fönster i rummet?	☐	☐	☐	☐	☐	☐
... alla fönster på samma vägg?	☐	☐	☐	☐	☐	☐
... fönster på flera väggar?	☐	☐	☐	☐	☐	☐
... en dörr i rummet?	☐	☐	☐	☐	☐	☐
... flera dörrar i rummet?	☐	☐	☐	☐	☐	☐

2. Utsikten genom fönster:

	mycket negativt		opå-verkad		mycket positivt	vet ej
... att se himmeln?	☐	☐	☐	☐	☐	☐
... att se växtlighet (ex. gräs, träd)?	☐	☐	☐	☐	☐	☐
... att se byggd miljö (ex. byggnader)?	☐	☐	☐	☐	☐	☐
... att se skolgården (ex. bollplan, gungor)?	☐	☐	☐	☐	☐	☐
... ingen vy alls (ex. fördraget, fönsterlöst)?	☐	☐	☐	☐	☐	☐

3. Kontraster:

	mycket negativt		opå-verkad		mycket positivt	vet ej
... en brokig färgsättning?	☐	☐	☐	☐	☐	☐
... iögonfallande mönster på golv (ex. rutor)?	☐	☐	☐	☐	☐	☐
... iögonfallande mönster på vägg (ex. prickar)?	☐	☐	☐	☐	☐	☐
... markanta linjer (ex. mörka lister mot en ljus vägg)?	☐	☐	☐	☐	☐	☐

1 (4)

4. Ljus:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... reflekterande ytor (ex. fönsterglas, rostfria)?	☐	☐	☐	☐	☐	☐
... direkt dagsljus?	☐	☐	☐	☐	☐	☐
... skuggpartier (ex. i nischer, hörn)	☐	☐	☐	☐	☐	☐

5. Fysisk miljö:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... en mindre skola (färre än 250 elever)?	☐	☐	☐	☐	☐	☐
... en större skola (fler än 250 elever)?	☐	☐	☐	☐	☐	☐
... ett stort rum (ex. studierum)?	☐	☐	☐	☐	☐	☐
... ett litet rum (ex. grupprum)?	☐	☐	☐	☐	☐	☐

6. Inredning:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... sittkuddar?	☐	☐	☐	☐	☐	☐
... växter?	☐	☐	☐	☐	☐	☐
... gardiner?	☐	☐	☐	☐	☐	☐
... väggdekoration?	☐	☐	☐	☐	☐	☐
... akvarium?	☐	☐	☐	☐	☐	☐
... böcker?	☐	☐	☐	☐	☐	☐
... en dator?	☐	☐	☐	☐	☐	☐
... flera datorer?	☐	☐	☐	☐	☐	☐

7. Förvaring av material:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... materialförvaring i lösa lådor?	☐	☐	☐	☐	☐	☐
... materialförvaring i skåp och fasta lådor?	☐	☐	☐	☐	☐	☐
... materialförvaring på öppna hyllor?	☐	☐	☐	☐	☐	☐

Hur påverkas barnens koncentrationsförmågor av ...

8. Undervisnings former:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... "one-to-one"-undervisning?	☐	☐	☐	☐	☐	☐
... grupparbete (ex. aktivt deltagande)?	☐	☐	☐	☐	☐	☐
... klassundervisning (ex. förmedlande)?	☐	☐	☐	☐	☐	☐

9. Ljud:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... bakgrunds ljud (ex. sorl, ventilationsbrus)	☐	☐	☐	☐	☐	☐
... ljud från angränsande utrymme?	☐	☐	☐	☐	☐	☐

10. Individuella förutsättningar:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... deras funktionshinder?	☐	☐	☐	☐	☐	☐
... deras kön?	☐	☐	☐	☐	☐	☐
... deras ålder?	☐	☐	☐	☐	☐	☐
... närvaron av en personlig assistent?	☐	☐	☐	☐	☐	☐
... närvaron av en special pedagog?	☐	☐	☐	☐	☐	☐
... närvaron av en lärare?	☐	☐	☐	☐	☐	☐

11. Föregående aktivitet:

	mycket negativt		opå- verkad		mycket positivt	vet ej
... datoranvändande (ex. spel, läxor)?	☐	☐	☐	☐	☐	☐
... "handarbete" (ex. rita, klistra, pussla)?	☐	☐	☐	☐	☐	☐
... en lugn stund (ex. läst, massage, film)?	☐	☐	☐	☐	☐	☐
... kroppsliga aktiviteter inne (ex. studs matta)?	☐	☐	☐	☐	☐	☐
... en lugn utevistelse (ex. rollek, funderat)?	☐	☐	☐	☐	☐	☐
... en aktiv utevistelse (ex. fotboll, bandy)?	☐	☐	☐	☐	☐	☐
... schemalagd idrott (ex. simma, rida, gympa)?	☐	☐	☐	☐	☐	☐

12. Orientering:

Vilka miljöfaktorer tror du att barnen använder sig av för att orientera sig i sin närmiljö,
ex. vid förflyttning från ytterdörr till klassrum eller från klassrum till matsal eller idrottshall?

	alltid	ibland	aldrig	vet ej
Färgmarkeringar	☐	☐	☐	☐
Pictogram	☐	☐	☐	☐
Skyltar	☐	☐	☐	☐
Tänd belysning	☐	☐	☐	☐
Möblering	☐	☐	☐	☐
Fönster	☐	☐	☐	☐
Dörrar	☐	☐	☐	☐
Väggar	☐	☐	☐	☐
Personlig assistans	☐	☐	☐	☐
Annat:.....	☐	☐	☐	☐

13. Yrkesrelaterade frågor

Vilken profession har du?

Logoped	☐
Arbeterapeut	☐
Sjukgymnast	☐
Psykolog	☐
Annat:.....	☐

Hur länge har du arbetat med dessa barn?

Mindre än 2 år	☐
Mellan 2 och 5 år	☐
Längre än 5 år	☐

Tack för din medverkan!

Enkät för forskningsprojektet: *Koncentrationshinder i skolans miljö*; Miljöpsykologi, LTH, HT05

4 (4)

Gruppobservation		Datum: _____																					
Aktivitet:		Nr: _____																					
Nr.	Kön	Hinder/ Tecken	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1																							1. Samtycker / deltar
2																							2. Misstycker / deltar ej
3																							3. Vill göra något annat
4																							4. Fokus på annat
5																							5. Avreagerar sig
6																							6. Oförstående
7																							7. Tillgiven
8																							
9																							
Störning:																							
(ex. ljud, obs.)																							
Ritad en skiss över rummets utformning + möblering? JA / NEJ (nr.: _____)																							Tagit foto av vyn? JA / NEJ (nr.: _____)
Observation för forskningsprojektet Koncentrationshinder i skolans miljö; Miljöpsykologi, LTH, VT07, Catrin Tufvesson																							

Appendix III

Grupppobservation		Datum: _____																				
Aktivitet:		Nr: _____																				
Nr.	Kön	Hinder/ Tecken	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
Störning:																						
(ex. ljud, obs.)																						
Ritad en skiss över rummets utformning + möblering? JA / NEJ (nr.: _____)		Tagit foto av vyn? JA / NEJ (nr.: _____)																				
Observation för forskningsprojektet Koncentrationshinder i skolans miljö; Miljöpsykologi, LTH, VT07, Catrin Tufvesson																						

Appendix IV

Gruppundervisning

Datum: _____

Observation av den fysiska miljön:

Nr: _____

Antal dörrar: _____

Sitter alla dörrar på samma vägg? JA / NEJ

Antal fönster: _____

Sitter alla fönster på samma vägg? JA / NEJ

Vad består vyn av? Foto nr.: _____

Himmel? JA / NEJ

Grön växtlighet? JA / NEJ

Byggd miljö? JA / NEJ

Skolgården? JA / NEJ

Annat? _____ JA / NEJ

Allmänbelysning tänd? JA / NEJ

HF-don JA / NEJ

Lysrör JA / NEJ

Glödljus JA / NEJ

Spottar JA / NEJ

Annat JA / NEJ

Antal elever? _____

Antal personal? _____

Finns...

... öppen förvaring? JA / NEJ

... lösa förvaringslådor? JA / NEJ

... skåpluckor/lådor? JA / NEJ

... stora växter? JA / NEJ

... små växter? JA / NEJ

... väggdeko. (verksamhetens)? JA / NEJ

... väggdeko. (inredningskonst)? JA / NEJ

... akvarium? JA / NEJ

... sittkuddar på stolar? JA / NEJ

... gardiner? JA / NEJ

... böcker? JA / NEJ

Antal datorer? _____

Konstant överhörning? JA / NEJ

Konstant bakgrundsljud? JA / NEJ