TIME FOR TIME
Assessment of time processing ability and daily time management in children with and without disabilities

Gunnel Janeslött
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ABSTRACT

In the time-dependent society of today, those with limited ability to manage time will show a heightened dependence on others and more need for support, exacerbating their inferior role and vulnerability. There are many children who cannot learn to tell the time from a clock and children who, although they are able to tell the time from a clock, still cannot use this information in their everyday lives; they cannot “manage” time. The general aim of this thesis was contributing to knowledge of children with and without cognitive disabilities for supporting children with difficulties in their daily time management (TM). The focus of this thesis was further development of instruments for assessing Time Processing Ability (TPA) and daily TM in children, focusing on the constructs measured and investigating differences in TPA and daily TM between children with and without cognitive disabilities.

The purpose of Study I was to examine aspects of construct validity of a new instrument, for assessing TPA in typically developing (TD) children. Data from 5-10 year-old TD children (n=144), was collected with a multi disciplinary instrument: Kit for assessing Time processing ability (KaTid), a Parent scale for daily time management and Self-rating of autonomy. Data was analysed using modern test statistics, Rasch models. A step-by-step procedure was carried out, omitting items that did not fit the model. 51 items in KaTid demonstrated acceptable goodness-of-fit to a Rasch model indicating evidence of internal scale validity. The performances of the children in KaTid demonstrated acceptable goodness-of-fit to the Rasch model indicating evidence of validity in response processes. The items in KaTid separated the children into four different levels of TPA. Relationships between the KaTid measures and the parents’ estimations of the child’s daily time management indicated further evidence of construct validity. The results from this study indicate that the items in KaTid measures and the parents’ estimations of the child’s daily time management indicated further evidence of construct validity. The results from this study indicate that the items in KaTid, initially defined as time perception, time orientation and time management, all demonstrate acceptable internal scale validity, based on the actual goodness-of-fit statistics used in the analysis. All 51 items support a potential unidimensional construct, here named TPA. In this unidimensional construct time perception, time orientation and time management can be seen as different levels of complexity in time processing ability rather than as separate constructs.

The aim of Study II was to empirically investigate the hypothesized relation between children’s TPA, daily TM and self-rated autonomy. Participants were children aged 6 – 11 years with disabilities: Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), mild or moderate intellectual disabilities, or with neurological disease such as CP or MMC (n=118). TPA was measured with the instrument KaTid, daily TM with a parent scale and a scale for Self-rating of autonomy. All data were transformed to interval measures using applications of Rasch models and then further analysed with correlation and regression analysis. The results demonstrate a moderate significant relation between the parents’ ratings of daily TM and the TPA of the children (r = .513, p<.001), and between the self-rating of autonomy and TPA (r = .306, p<.001). There was also a significant relation between self-ratings of autonomy and the parents’ rating of the children’s daily TM (r = .366, p<.001). Parents’ ratings of their children’s daily TM could explain 25% of the variation in TPA, the child’s age explains 22%, whilst the child’s self-rating of autonomy can explain 9% of the
variation in TPA. The three variables together explain 38% of the variation in TPA. The results indicate the viability of the instrument for assessing TPA also in children with disabilities, and that the ability measured by KaTid is relevant for daily time management.

Children with cognitive disabilities, e.g. ID or autism, are reported to have problems in time perception, time orientation or time management, i.e. time processing ability (TPA). It is not known whether the problems described are diagnosis specific or reflect differences in age or in level of TPA. The aim of Study III was to investigate if there were different patterns in TPA in children with disabilities and TD children, if there are individual differences in patterns and if such differences were related to the type of diagnosis using a person-oriented approach. With a cluster analysis, this study investigated if there were different patterns in TPA in 6 - 10 year-old children with (n=77) and without disabilities (n=89) and whether differences were related to the type of diagnosis or chronological age. The results indicated that four of the five clusters differed mainly in chronological age and in levels of TPA. Children within the same diagnostic category do not share membership in a subgroup with specific pattern of TPA. Daily TM as estimated by the parents and self-rated autonomy differs between clusters and was related to the TPA. Overall the level of TPA seems to be a more valid base for planning interventions in daily TM than type of diagnosis.

The aim of Study IV was to further investigate if there were differences between the response patterns of children with disability compared to those of TD children indicating bias/differential functioning in items or scale. Participants were children with disabilities (n=144) and TD children (n=115), totally 259 children aged 5-10 years. Data was analysed with differential item functioning (DIF) and Standardized z-comparison. The DIF analysis demonstrated that the two samples responded similarly in 36 of the 51 items (70%) in KaTid and revealed a difference in challenge in 15 items, most of them in the subcategories time perception and time orientation. However, the Standardized z-comparison resulted in a trivial degree of differential functioning at individual level.

This thesis contributed a new model for assessing TPA and daily TM. The three instruments KaTid, Parent Scale and the Self-rating scale complement each other, underlining the advantages of collecting information from all these sources. This is a step towards providing evidence-based instruments that might help professionals to structure the intervention planning process for children with difficulties in daily TM. There is still a need to examine the utility of the KaTid and the Parent scale in planning and documenting the effectiveness of interventions for children with difficulties in daily TM, both in research and in clinical practice. Further research is needed to examine inter- and intra-reliability and if there are differences in TPA related to specific diagnoses or other child characteristics. This method for assessment can contribute to a unified language for use when communicating with the parents about TPA and daily TM. More research is needed to examine the differences between children with and without cognitive disability. This thesis informs our practitioners of the importance of addressing the issue of TPA and daily TM, aiming at increasing daily TM and autonomy in children with cognitive disabilities. It is time for time!
Populärvetenskaplig sammanfattning på svenska

Bakgrund: Det finns behov av att utveckla evidensbaserade metoder för stöd till barn med olika funktionshinder som har problem i vardagen i form av bristande tidshantering (daily time management).

Syfte och frågeställningar: Projektet som helhet syftar till att utveckla kunskap om barn med svårigheter i vardagsfungerande relaterat till bristande tidsuppfattning (dvs. tidshantering) genom att utveckla och validera ett instrument för att mäta tidsuppfattning och ett för tidshantering i vardagen samt att jämföra barn med och utan funktionshinder.

Metod och material: Målgruppen är barn med typisk utveckling och barn med funktionshinder som A D H D, A utim spektrum störning (A S D) tex A sperger syndrom, lindrig/måttlig utvecklingsstörning eller rörelsehinder (CP eller ryggmärgsbråck). Ett antal utbildade arbetsterapeuter och speciallärare har under 3 års tid samlat in data till sammanlagt 4 olika studier. D data har analyserats med personbaserade metoder; med Rasch analysmodeller (studie I, II, IV) och med klusteranalys (studie III). Dessutom har variabelbaserade metoder använts för att beskriva samt i analys av förklaringsvärde i (studie II, III).

Presentation av studierna med resultat

Den första studien som omfattar bedömningar från 144 barn 5-10 år gamla barn med typisk utveckling, analyserat med modern teststatistik (Rasch Modells) visar att instrumentet för Kartläggning av Tidsuppfattning (K aT id) har god validitet och tycks mäta en förmåga. Det finns också en koppling mellan hur dessa barn skattar sitt självbestämmande, deras vardagsfungerande i situationer som kräver tidshantering och den tidsuppfattning som de har vilket ytterligare stärker att det är god kvalitet på KaTid. Denna studie påvisar också att barn redan i förskoleåldern vanligen har utvecklat grunden för tidsuppfattning, långt innan de lär sig att avläsa klockan.


Barn med olika typer av diagnoser som A D H D, A S D, mild eller måttlig utvecklingsstörning eller med rörelsehinder som Cerebral Pares (CP) eller ryggmärgsbråck (M M C) har i tidigare forskning beskrivits som barn med bristande
tidskänsla, tidsorientering eller med bristande tidsplanering, i alla tidigare studier med diagnosspecifika målgrupper. Den bakomliggande tanken har varit att tidsuppfattning troligen skiljer sig mellan olika målgrupper med olika diagnoser. Kliniskt torde det i så fall vara intressant att veta om det finns barn med olika eller övändade mönster i tidsuppfattning likaväl som att identifiera om det finns grupperingar med speciella styrkor eller svagheter som man kan behöva ta hänsyn till när man planerar stöd/insatser till barnet. Den tredje studien har därför fokuserat på om det finns typiska mönster i tidsuppfattning hos 6 – 10 år gamla barn (n=166) med och utan funktionshinder med frågan om dessa mönster i så fall är typiska för olika diagnoser eller åldersgrupper, samt om mönstren i så fall kan kopplas till nivå av självbestämmande. I studien gjordes en klusteranalys som visar att barnen hamnar i fem signifikant olika grupper. Grupperna skiljer sig åt i ålder, i fyra av de fem grupperna är den genomsnittliga åldern på barn utan funktionshinder 5, 6, 7½ respektive 9 år. Detta kan tyda på att grupperna delar sig efter kronologisk ålder och därmed också möntrad av tidsuppfattning hos de barn som är utan funktionshinder i grupperna. I varje grupp finns också barn med funktionshinder, några få av dem i samma åldersnivå som barnen med typisk utveckling, men flertalet av barnen med diagnos är signifikant mycket äldre, ofta ett år sent eller mer än barnen utan diagnos. Detta kan tyda på att dessa barn har en senare möntrad i just tidsuppfattning. Det finns också ett samband mellan gruppens nivå på tidsuppfattning, deras tidshantering och deras självbestämmande. Barn med god tidsuppfattning har bättre tidshantering i vardagen och skattar sitt självbestämmande högre.

I den fjärde och avslutande studien i denna avhandling gjordes en analys av skillnaden i hur 5-10 år gamla barn med (n=115) och utan funktionshinder (n=144) svarar på frågorna i KaTid. Resultatet visar att det finns skillnader. Några uppgifter i tidsupplevelse och i tidsorientering tycks vara speciellt svåra för barn med funktionshinder. M öjliga är dessa uppgifter särskilt svåra för någon grupp av barn med funktionshinder t.ex. barn med autism. Ytterligare analyser visar att det inte tycks ha några avgörande konsekvenser när man kartlägger tidsuppfattning hos de olika barnen.

Slutsatsen är att KaTid är ett evidensbaserat instrument för kartläggningsidan av tidsuppfattning som kan användas till barn med typisk utveckling och med kognitiva funktionshinder i åldrarna 5 – 10 år. A avhandlingen bidrar till ny kunskap om tidsbegrepp som tidsupplevelse, tidsorientering och tidsplanering, hur de relaterar till varandra, till tidshantering i vardagen och till självskattad autonomi. Resultatet tydliggör att det kan finnas behov av stöd till barn som halkat efter sina jämnåriga både i tidsuppfattning och i tidshantering vilket kan påverka deras autonomi/självbestämmande. Detta instrument behöver också i en framtida studie prövas om det kan användas till att utvärdera intervention för att kunna ingå i en metod för att ge riktat stöd till de barn som behöver det. Resultatet av denna avhandling innebär att professionella nu kan få tillgång till en ny evidensbaserad modell för att mäta både barnets tidsuppfattning och tidshantering därmed, tillsammans med annan information, få underlag för hur man kan forma en intervention efter barnets och omgivningens förutsättningar och önskemål.
LIST OF PUBLICATIONS


# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AAMR</td>
<td>American Association on Mental Retardations</td>
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<tr>
<td>ADHD</td>
<td>Attention Deficit Hyperactivity Disorder</td>
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<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
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<tr>
<td>ASD</td>
<td>Autism Spectrum Disorders</td>
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<tr>
<td>ASEZD</td>
<td>Average Squared Euclidean Distance</td>
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<tr>
<td>CTT</td>
<td>Classical Test Theory</td>
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<tr>
<td>Daily TM</td>
<td>Daily Time Management</td>
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<tr>
<td>EESS</td>
<td>Explained Error Sums of Squares</td>
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<tr>
<td>HC</td>
<td>Homogeneity Coefficient</td>
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<tr>
<td>ICF-CY</td>
<td>International Classification of Functioning- Children and Youths</td>
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<tr>
<td>ID</td>
<td>Intellectual disability</td>
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<tr>
<td>IRT</td>
<td>Item Response Theory</td>
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<tr>
<td>KaTid</td>
<td>in Swedish: Kit for assessing Time Processing Ability</td>
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<tr>
<td>M</td>
<td>Mean</td>
</tr>
<tr>
<td>MMC</td>
<td>Myelomeningocele</td>
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<tr>
<td>ns</td>
<td>Not significant</td>
</tr>
<tr>
<td>OT</td>
<td>Occupational Therapist</td>
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<tr>
<td>SD</td>
<td>Standard Deviation</td>
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<tr>
<td>TD</td>
<td>Typically Developing</td>
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<tr>
<td>TM</td>
<td>Time management, in daily TM</td>
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<tr>
<td>TPA</td>
<td>Time Processing Ability</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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In this time-dependent society of today, those with limited ability to manage time are more dependent on others and in need of more support (Alice Karlsson, photo G. Janeslätt, photomontage Sara Holm)
1 INTRODUCTION
1.1 BACKGROUND AND RATIONALITY OF THIS THESIS

There are many children who cannot learn to tell the time from a clock. Professionals in habilitation and paediatric rehabilitation in Sweden also meet children who, although they are able to tell the time from a clock, still cannot use this information in their everyday lives; they cannot "manage" time. Adults orchestrate their occupations into a pattern across time by anticipating, planning, using familiar routines, keeping goals in mind, and fitting into the synchrony of the social world which coordinates their occupational patterns through the use of calendars, clocks and cultural expectations (Pierce, 2003). In today's time-dependent society, those with limited ability to manage time will show a heightened dependence on others and more need for support, exacerbating their inferior role and vulnerability.

During the last decade, occupational therapists (OT's) - and other professionals working with adults with ID or dementia - have played an important role in developing knowledge on the use of assistive technology (time aids) to compensate effectively for difficulties in time management (G. Avidsson & Jonsson, 2006; Davies et al., 2002; Gatu, 2003; Nygard & Johansson, 2001). There is, however, a need to improve methods of intervention, including an evaluated assessment instrument also usable for children. Using validated and reliable instruments is the basis of planning, carrying out and evaluating the intervention.

In response to this need, an instrument was developed by the author and a colleague: the KaTid, Kartläggning av Tid suppfattning hos barn, based in unitary concepts defined in The International Classification of Functioning, Disability and Health (ICF). The instrument was created using a method described by Benson and Clark (1982). The process can be described in four main phases; Phase 1: planning, Phase 2: constructing the scale, Phase 3: a quantitative evaluation and Phase 4: a main study.

Phase 1: when developing a new instrument, the first step is to formulate the purpose of the assessment. (Coster, 1997; Miller, 1989). Our initial purpose was to find or develop an assessment instrument for evaluating intervention, including time aids, in children. The next step was to identify the operational definition of each construct or function to be measured. The ICF is the framework used by the World Health Organisation (WHO) to describe and measure health and disability. Its aim is to provide a scientific basis for the consequences of health conditions and to establish an internationally agreed language for health information systems and research. The ICF-Child Y ouths (CY ) was recommended for use as an integrated system to clarify constructs, and to improve communication and coordination of health services for children and youths (Lollar & Simeonsson, 2005). The domains are classified from body, individual and societal perspectives by means of lists of domains: a list of body functions and structure, a list of activity and participation and a list of environmental factors. The three categories of time on the list of body functions and structure are experience of time/time perception, time orientation and time management (WHO, 2001). At our starting point there were no concepts of time at the activity and participation level, so in this thesis the concept used is daily time management (TM). In ICF-CY (2007) there are two concepts related to time at the activity and participation level: Managing one's time and Adapting to time. Daily TM is here defined as managing one's time. This thesis focuses on the first four of these five concepts. One "external"
construct is used, autonomy, chosen for several reasons. In the Swedish National action plan “From patient to citizen” one of the national goals for youths and adults with disabilities is independence and autonomy (reg. 1999/2000:79). According to the UN Convention on the rights of Persons with Disabilities people have the right to be respected and to be an active participant in family, school and community life. Autonomy is strongly related to the degree of participation (Almqvist & Granlund, 2005; Eriksson, 2006). In section 1.2 all key concepts are presented and defined.

Also within phase 1 of the instrument development process, a manual search and a literature search were done to locate any scales for measurement useful for the purpose identified, alternatively to find existing useful items. No evaluated instruments were found solely focusing on measuring any of the key concepts; six usable scales containing single items are presented in section 1.5.1. The decision was therefore to proceed with the development of a new instrument, the next step being to devise a number of possible items. This involved a new extensive literature search to find a valid knowledge base for creating items, some of which is presented in section 1.3. The last step in phase 1 was to decide how to scale the responses.

Phase 2 (constructing the scale) included selecting what items to use and a first content validation, to ensure that the scale had enough items to cover adequately the domain under investigation. In this phase experts were consulted, namely a few colleagues in habilitation centres with experience of children with disabilities and of intervention, including time aids. This phase resulted in a revised scale. Phase 3 (quantitative evaluation) involved a pilot study including short interviews with the children after the data was collected. Analyses of the items and the scale, in terms of validity and reliability, led to further revision.

In Phase 4 a main study was conducted, collecting data from 61 six-year old children. The data was analysed and reliability tested with classical statistical methods. This procedure has been described in a Master’s thesis [in Swedish] (Alderman & Janeslätt, 2004). The thesis includes further validation of the instruments for assessing time processing ability and daily TM in children, using modern statistical methods, including a focus on the measured construct. William J. Friedman wrote in “About time – inventing the Fourth Dimension” (1990a) that his book was “based on a belief that we are more likely to understand the nature of temporal experiences by examining its different facets than by searching for a common core”. This thesis provides something of a challenge to his statement. The data generated will also be analysed for information on the individual differences in TPA and daily TM in children with and without disabilities.

### 1.2 KEY CONCEPTS, DEFINITIONS

#### 1.2.1 Time perception

Time perception is defined in ICF-CY as the experience of time, comprising the specific mental functions of the subjective experiences related to the length and passage of time. This is part of the experience of self and time functions, specific mental functions related to the awareness of one’s identity, of one’s body, of one’s position in the reality of one’s environment and of time (WHO, 2001, 2007). The title of this category, time perception, was chosen for this thesis, being the concept most commonly used to classify research on time sense e.g. interval timing, and on experience of time. In this thesis, time perception also includes the perceived duration of activities.
1.2.2 Time orientation

Time orientation is defined in ICF-CY as Orientation to time [b1140], comprising the mental functions that produce awareness of today, tomorrow, yesterday, date, month and year (WHO, 2001, 2007). This includes concepts of time units (day, month etc.), frequency (“How often?”) and sequence e.g. knowing the temporal order of activities in a morning routine. Time as a sequence or succession includes models focusing on perceptions of moments in time such as “yesterday”, and time-ordered sequences of experiences. Other aspects of time orientation are our awareness of and ability to understand physical time and our location in time (W.J. Friedman, 1990b). The abilities to understand both quantity and temporal concepts are essential to the use of information from a clock or a calendar (Iris Levin et al., 1984). In this thesis time orientation includes units, frequency, sequence and location in time, quantification and awareness of physical time and telling the time from a clock.

1.2.3 Time management

Time management [b1642] is a super ordinate concept, part of higher-level cognitive functions. Time management is used to describe the mental function of ordering events in chronological sequence and allocating amounts of time to events and activities (WHO, 2001, 2007). Time management is also referred to as the ability to know what tasks to do, when to do them and for how long e.g. to judge which activity to do in a set period of time (Davies et al., 2002).

1.2.4 Time Processing Ability (TPA)

Time Processing Ability, TPA, is a concept chosen to define the summation of three concepts of time, in this thesis named subcategories; Time perception, Time orientation and Time management, each of them defined in ICF-CY at the level of body functions (WHO, 2007). The three are summated to define what is measured in the instrument KaTid.

1.2.5 Cognitive functions

There are many definitions of cognitive functions, and some examples will be presented here. Cognitive ability is the ability of the brain to process, store, retrieve and manipulate information (Block, 1990). The definition of cognition as a process of using hindsight, foresight and insight in determining a course of action (Abreu & Toglia, 1987) might be considered a description of higher level cognitive functions.

In ICF-CY, higher-level cognitive functions [b164] are defined as specific mental functions especially dependent on the frontal lobes of the brain, including complex goal-directed behaviours such as decision-making, abstract thinking, planning and carrying out plans, mental flexibility, and deciding which behaviours are appropriate under what circumstances. These are often called executive functions. Included in higher-level cognitive functions are: functions of abstraction and organisation of ideas; time management, insight and judgement; concept formation, categorisation and cognitive flexibility. Excluded are: memory functions [b144]; thought functions [b160]; mental functions of language [b167]; and calculation functions [b172] (WHO, 2007).
There is no consensus on how the concept of executive functions is used. In ICF it is equivalent to higher-level cognitive functions including time management. Time management is often disregarded when talking of executive functions. In the theoretical discussion on ADHD and time (Barkley, 1997) four executive functions that compose self-regulation are mentioned: non-verbal working memory; the internalisation of speech; the self-regulation of affect, motivation and arousal; and reconstitution. In this model, diminished sense of time, defective hindsight and forethought were classified within the non-verbal working memory. The developmental delay in sense of time is one of many factors leading to a behaviour that is less purposeful, less goal-directed, less governed by or oriented towards time. The concept of time management is not used, but in this model the non-verbal working memory is considered an executive function, as opposed to the definition in ICF. This is one of many examples of the need to unify the use of these concepts.

1.2.6 Daily Time Management (TM)

The ability of managing one's time is defined in ICF-CY as managing the time required to complete normal or specific activities, such as preparing to depart from the home, and is classified at the activity/participation level (WHO, 2007). This concept was stated in 2007 in ICF-CY, but available internationally at the WHO website only in late 2008, so in this thesis the concept used for managing one's time is daily TM. Daily TM includes managing the time required to carry out normal or specific activities and the child's performance or behaviour concerning time management in everyday situations, like waiting, and is thus influenced by environmental and personal factors (see Figure 1).

1.2.7 Autonomy

Autonomy is the right to govern oneself or to organise one's own activities (Woodford & Jackson, 2003). A autonomous person is independent, having the capability and the right to take responsibility for decisions on matters concerning him/herself (FSA, 2004; Proot et al., 1998). A autonomous behaviour is a person acting according to his/her own preferences, interests and/or abilities, and independently, free from undue external influence or interference (M. L. Wehmeyer & Schwartz, 1997). There are indications that autonomy and independence might be two separate constructs (G. Arvidsson & Jonsson, 2006). In this thesis, however, the definition above including independence is used. Occupational therapists place great emphasis on the client's autonomy - in theories, in ethical codes and in client-centred practice (Coster, 1997; FSA, 2004; Kielhofner, 2004). The concept of autonomy is not to be found within ICF-CY, but is considered a personal factor. The closest description is: Making decisions, making a choice among options, implementing the choice, and evaluating the effects of the choice, such as selecting and purchasing a specific item, or deciding to undertake and undertaking one task from among several tasks that need to be done. The management of time, how to organise and spend the time e.g. outside of school, is a part of the planning- and decision-making skills related to being autonomous (Perez & Gauvain, 2001).

1.2.8 Adapting to time

Adapting to time demands is defined as carrying out actions and behaviours appropriately in the required sequence and within the time allotted, such as running to the station when in danger of missing the train (WHO, 2007). This concept was stated in 2007 in ICF-CY, but available internationally at the WHO website only in late 2008, and
was therefore not included when constructing the instruments in this thesis. In the current definition it might not even be applicable for children. The concept of temporal adaptation, as used in occupational therapy science and in occupational science, is defined as achieving competence over time in the context of one’s temporal environment (Farnworth & Fossey, 2003; Segal & Frank, 1998). There is today no evidence as to how the concepts adaptation to time (ICF-CY) and temporal adaptation are related. There are no instruments adapted for children measuring adaptation to time, thus adaptation to time is not in focus in this thesis.

1.2.9 Maturing and Development

Functional cognitive maturation refers to age-related, intrinsic, intra-individual biological processes that culminate in the emergence of individual behavioural characteristics. Individual cognitive maturational changes can trigger changed expectancies and care behaviour, which in turn can influence on behavioural development variability (T. D. Wachs, 2000). When infants show increasing competence in age-appropriate developmental tasks, parents decrease their dependency fostering and increase their independence-fostering behaviour e.g. refraining from helping the child in situations s/he is expected to manage on his/her own (ibid).

The term development has been expanded to include surrounding people and environments. In the transactional model, development is defined as the mutual and dynamic interactional processes between the child and parents or significant others within the environment/s, that directly or indirectly influence the child in the family over time (Sameroff & Fiese, 2000).

1.2.10 Occupation and activity

“Occupation” (lat. Occupare seize or occupy) is an occurrence, a particular person’s experience, unique to a moment in time, a place and a set of social circumstances (Pierce, 2003). Put in other words: seizing or occupying the time, the space and the roles of one’s life, and activity that is both purposeful and meaningful to the person who engages in it (Fisher 1998). Occupations have a temporal context; a beginning, a sequence of actions, duration, an end and a location in time e.g. a certain time of the day. Occupations are the means by which individuals fill their time, create the circumstances of their daily existence and make their place in the world (Christiansen, 2005). Occupation is a dynamic process through which people maintain the organisation of their bodies and their minds; engaging in play, work or leisure activities which serve to organise the self (Kielhofner, 2004).

Activity is the idea, a reflection about the concept of doing e.g. brushing teeth. It is the concept built up from many experiences of doing or experiences of communicating about an activity e.g. bungee jumping or laying a jigsaw puzzle (Christiansen 2005).

1.2.11 Summary and uses of the concepts in this thesis

Finding a valid base for an assessment necessitated examining the existing body of knowledge. In this thesis the concepts of time perception, time orientation, time management, TPA and daily TM are in focus. The mental function of time management is not abbreviated, to separate it from the daily TM.
Figure 1. Describing the relation between the key concepts of time perception, time management, time orientation, TPA and daily TM.

Short summaries of existing knowledge related to TPA and/or daily TM will be presented in section 1.3. Many disciplines have shown interest in “time”, yet the research is still relatively sparse in some areas, possibly causing the lack of consensus surrounding concepts and definitions (Christiansen 2005). There have been various ways of conceptualising time in different areas of earlier research, so whenever possible the concepts according to the ICF will be used, as defined in section 1.2 (WHO, 2001).

1.3 RESEARCH ON TIME

1.3.1 Time and occupation in past and present

Early humans recognised the relation time – activity; that time passes when activity is undertaken and that certain occupations need to occur or recur at particular times, e.g. when to do what in cultivating and what had to be done before sunset. Today time is sometimes referred to as a commodity; we talk about spending time and that time is money (Christiansen, 2005; Peloquin, 1991).

Occupation was first emphasized as a therapeutic agent in the late 18th century within the Moral Treatment, used to restore persons with mental illness to healthy habits of living. It was considered an environmental therapy; physical, social and temporal environments were engineered to correct the person’s “faulty” habits. The Moral Treatment is considered the pre-paradigm of occupational therapy (Kielhofner, 2004). In these early days of occupational therapy the unifying idea, articulated in many ways, was the importance of occupation. In 1921 Adolph Meyer (1922/1977) claimed that the proper use of time in a meaningful activity was fundamental. The OT should view the patients within the context of time through the unfolding of their daily lives. Balance between activities in daily living was considered important for health. The aim of occupational therapy was to support patterns of habit, the daily rhythm of work, play, rest, and sleep over time. This occupational paradigm was consistent for many decades.
In recent years there has been a new interest in the effects of time in occupation and its relation to health and illness. The need for knowledge about occupation also within the temporal context was influential in the establishment of the discipline of occupational science. Occupational sciences focused on relating occupation to human development, personal well-being and health. Farnworth & Fossey (2003) suggested an occupational terminology of the concepts of time, based on the existing body of knowledge in the area and identifying Time Use, Temporality and Tempo as key concepts. Time Use is the area of social sciences that focuses on what we do with our time and why (Farnworth & Fossey, 2003). Temporality was defined as the subjective perception of time, one’s sense of past, present and future. Tempo concerns the pace of life within the biological rhythms in relation to environment. Tempo consists of two sub concepts; time understood as knowing the day or the hour and time felt as the experience of time. Within the latter, tempo as the experience of time, there is a renewed interest in the importance of balance in daily activities, now dealing with health problems of contemporary society, e.g. occupational imbalance and overload.

There is a lot of knowledge on time use; how adults in the western world use their time due to the requirements of working life and politics, mostly as descriptive studies focusing on adults without disabilities (Christiansen, 2005). Lately there has been an interest in time use also for people with disabilities, suggesting that disability has a negative impact both on time use (in terms of the number of activities participated in) and on how time is allocated, compared to the general population (Farnworth & Fossey, 2003). Families of children with ADHD often feel that the flow of everyday life is disrupted, and that they must work extraordinarily hard to schedule their daily life within the ordinary patterns of time use (Segal & Frank, 1998). In children with disabilities the use of time is reported as being different from that of Typically Developing (TD) children; for instance, students with physical disabilities often experience lack of time to perform regular daily school tasks such as reading and writing (Hemmingsson et al., 1999).

The time concepts used in occupational science can possibly be classified in ICF domains; tempo and temporality at body function level and time use at activity/participation level. Still there is little research in children in this area. The existing studies points towards time use being influenced by many factors apart from the daily TM of the child and to scheduling of the daily life of children being, to a great extent, decided by parents and other adults. These issues must be addressed if attempting to create an assessment instrument including time use for children. Also the methods used, e.g. the time geographic method, almost exclusively include writing a diary (Christiansen 2005). This would be problematic for many of the children included in this thesis. Some children are too young, having not learned how to write, whilst others cannot write due to cognitive problems. Using the writing of a diary for data collection in these samples would exclude many of the children, and even more problematically, all children from certain types of disabilities and from young ages. Thus, the knowledge available when the development of these instruments was initiated was not adaptable to children with developmental disabilities. There was, at the point when this project started, no valid base for a new assessment in this area of research.

1.3.2 Daily routines and structuring time

There is convincing evidence of the importance of structuring time and daily routines. Lack of temporal and physical structuring in the home, i.e. little is scheduled or nothing has its own place, can adversely influence the development of a child and is associated
with lower cognitive, academic competence (T. D. Wachs, 2000). It can also increase the risk of learned helplessness (ibid).

Recurring temporal patterns such as the shift between day – night and week – weekend provide a natural frame within which daily routines unfold (Christiansen, 2005; Eisler, 2003; W. J. Friedman, 1990a; Pierce, 2003). When repeating behaviour in a constant or predictable context, one learns to attend to aspects of the environment sculpting the actions that become part of a role or a habit. Habits regulate how time is typically used in a given environment (Kielhofner, 2008). Habits, as time-space routines, are linked to what time it is, the sequence of activities and where they are done. One can shape routines within the day, the week and the month etc. Routines provide a degree of structure and predictability to life. Habituation, as in patterns of daily occupation, is also a guide to action, being the recurrent environmental signal for routine actions. For example, when the alarm clock buzzes in the morning it signals time to rise and enter the bathroom, and the environment in the bathroom guides the routines there. Habits are also ways of making more efficient use of time. When actions unfold in an automated temporal sequence, time and focus are freed for other purposes and two or more behaviours can be managed simultaneously. Thus, while in a morning routine, one can engage in planning for what to do later in the day.

Habituation is defined as an internalised readiness to exhibit consistent patterns of behaviour guided by habits and roles, and fitted to the characteristics of routine temporal, physical and social environments. Habituation refers to the process of organising doing into patterns and routines (Kielhofner, 2008). The importance of time is emphasized for habituation. Habituation connects people to, and makes them functional within, their physical, social and temporal context.

There are indications that people with some types of disabilities have difficulties in establishing daily routines and yet may influence their quality of life (Clark, 2000). There can be no environmental structure without considering the aspect of time, and environmental structure is frequently used in children with autism to make their life more predictable (Peeters & Gillberg, 1999). In children with ADHD one main intervention used and considered effective is structuring certain activities or the day (M. Owen, 2001). The research in this area points at the importance of daily routines and structuring time, both for children in general and for children with disabilities including means of intervention.

1.3.3 Research on time perception, interval timing

The research of time sense/time perception on the level of body structures (Grondin, 2001; Meck & Benson, 2002) and on body functions like interval timing (Eisler & Eisler, 2001; E. R. Friedman, 1977) is extensive and has a long history in experimental psychology and chronobiology focusing on the brain’s internal clock. Recent studies demonstrate that timing seems to be a fundamental capacity in the nervous system (Rubia & Smith, 2004). According to a systems-theory perspective all of the brain is needed for a fully functioning cognition (Luria, 1980, 1981) thus also for TPA. Some structures, e.g. the dorso-lateral prefrontal cortex and the timing mechanisms of cerebellum, seem to be necessary for the time keeping function, shaping two systems for time measurement: the cognitively controlled timing system and the automatic timing system. However, those two systems are not sufficient to explain the complex ability of TPA (Lewis & Miall, 2003) indicating that some parts of the system are more important than others for the functioning of the system.
There are different models describing time perception. The scalar timing theory uses the information-processing (IP) model as a metaphor to describe the functional and neural mechanisms of interval timing. The IP model contains a pacemaker, a switch and an accumulator for perceived time. Those three functions together form an automatic timing system, “the clock”, a function connected to a reference memory. In the reference memory a large number of unorganised examples of activities and their duration are stored. The duration of each new experience is put into the memory as a new example. This provides ways of explaining the difference between perceived time (in the accumulator) from remembered time, a base for psychological experimental research. The accumulator and reference memory are both connected to the cognitively controlled timing system, the decision level. A decision is made based on the comparison between perceived and remembered time, using a criterion for response in a threshold function (Meck, 2003, pp. 7 - 9). The decision level would in ICF be defined as time management. The concepts used in the limited research area of interval timing seem to be more congruent than other areas of research in time.

Time is experienced differently by culture, gender and age, e.g. children perceive time as slow and the adults experience it as flowing quickly (Eisler, 2003). How we perceive time in daily activities is also linked to many factors like the quality of the activity and the context (Larson, 2004). Time perception is essential for interpreting reality (Eisler, 1993; Grondin, 2001; Meck & Benson, 2002) and for analysis and understanding of when, why and how things happen (Brown, 1996). It is also a determining factor for one’s identity (Melges, 1990).

Children with ASD and children with ADHD have been reported to exhibit problems in time perception/time sense when compared to children with typical development (TD) (Barkley et al., 2001; Peeters & Gillberg, 1999; Smith et al., 2002; Szelag et al., 2004).

There are indications that it is possible to improve time processing skills. Intervention with an aim to remediate time estimation was described by Friedman (1977), reproducing a 15-sec. time interval on 22 preschool children. The conclusion was that time perception appears to respond to training.

Altogether the research in children in this area provides evidence that interval timing seems to be a fundamental capacity, that we all have a clock function in our brain. The research on children with ADHD and ASD provides evidence that there is also a need for assessing perception of time duration in activities, time orientation and time management, forming the start of a valid base for a new assessment.

1.3.4 Research on time orientation

Piaget, the father of knowledge about child development, did much to point out the importance of time in this process. He emphasized two parallel components of importance for developing the understanding of time; sequencing and duration. Sequencing means the child must learn to understand “before” and “after”, both perceptually and verbally. Duration is about understanding for how long something will last e.g. the duration of daily activities. For both components, sense of time and the ability to share focus are needed (Piaget, 2006). Three-year-olds can compare the duration of daily activities, such as drinking water or watching a cartoon, and mark on a scale which activity takes “a very short time” or “a very long time” (W. J. Friedman, 1990b). Friedman has presented knowledge pointing out the non-verbal aspects of time
e.g. the sense of past and future in child development (W. J. Friedman, 1990b, 2002, 2003).

Time as a sequence is one of the three types of psychological time identified by Block (1990) e.g. a 5 year-old can place pictures of daily activities in temporal order (W. J. Friedman, 1990b).

Most of the knowledge on how children learn time concepts (Bylholt, 1997; Nelson, 2002) is age-related. For example, 3-4 year-olds know the temporal order in which everyday events take place (Nelson, 2002) and a six-year-old child will usually know the duration of daily activities and be able to describe a temporal sequence in words (Bylholt, 1997).

To be oriented in time, one needs to learn the time concepts of frequency, units e.g. the names of the seasons, weekdays, hours etc. and location, i.e. “educated time” (Nelson, 2002). Location, e.g. being oriented within the week, includes knowing what day it is today, the names/labels of the weekdays, what order the days of the week always come in and considering what days have passed and which ones are still to come (W. J. Friedman, 1990b). Knowing what order the days of the week always come in is so-called stable time, meaning that the weekdays always come in the same order, and is often learned as the recitation of a list (W. J. Friedman, 1990b).

The ability to read an analogue clock by hour, half-hour and minute is usually in place by the age of eight (Cohen et al., 2000). Drawing a clock (Katz et al., 1989) is clinically useful for screening cognitive impairment (Cohen et al., 2000). This type of clock-related item is the traditional way of measuring time ability in children, included in instruments like the Griffiths Mental Developmental scale (Alin-Åkerman & Nordberg, 1980). There are many indications of a close relation between time and number in the nervous system, e.g. knowing the number of days in a week (Brannon & Roitman, 2003).

1.3.5 Research on time management

Adults and youths with ID seem to be able to develop time management skills, and expertise using specially adapted time aids and seems to be related to autonomy in these persons (Sundin, 2004). Understanding the passage of time is a key skill for the ability to be able to control and make decisions about when and for how long to perform an activity (Granlund et al., 1995). Time perspective, hindsight and forethought are aspects of psychological time and possibly connected to time management (Barkley, 1997; Melges, 1990). Many activities in daily living are done in a temporal sequence, e.g. making a snack, and managing such activities is a part of learning time management (Bambara & Ager, 1992; Davies et al., 2002). Time management skills across a child’s various life environments provide valuable data that connect closely to self control and coping skills (Dunn, 1991).

The research on time management in children is scarce, possibly due to the lack of instruments for measuring it in children. The skill is in fact not expected in children at all, since “higher cortical functioning (e.g. planning, impulse control, rapid problem solving and time management) is not expected to be functioning and measurable until the frontal lobes of the brain complete their development in adolescence and the person is tasked with those age-level expectations” (Woods et al., 2000).
1.3.6 Research on daily TM

Adults orchestrate their occupations into a pattern across time by anticipating, planning, using familiar routines, keeping goals in mind, and fitting into the synchrony of the social world which coordinates their occupational patterns through the use of calendars, clocks and cultural expectations (Pierce, 2003). Because of the dependence on environmental factors, the daily TM of a person with cognitive disability will vary depending on the complexity of the activity and its context. Time problems might occur in any situations when there is a need to know when and for how long (duration) to perform an activity (Granlund et al., 1995).

Older students with learning disabilities presented better skills when given strategies including a time management-log (Manganello, 1994). Moira Toomey (2001) describes a method to enable children to manage their time. There are also indications that organisational skills training helps children with ADHD (Langberg & al., 2008). The problems described (e.g. forgetting to do things, difficulty in planning for the completion of long-term assignments and in allocating time appropriately to study for tests) could all be labelled as problems with daily TM. The intervention given appears to yield benefits above and beyond those provided by medication (ibid).

In a study of high-ability students with learning disabilities who succeed in college, daily TM was considered the most frequently occurring compensation strategy. The students would take notes of the time it took to fulfil different tasks to get a better idea of how to plan for the day and the week. They learned organisational techniques; to use one-month organisers and semester overview calendars, and how to balance their academic course load in light of their learning weaknesses and strengths (Reis et al., 2000).

There is no research found about children with disabilities and daily TM. In a clinical project many of the problematic everyday situations were classified as daily TM (Sundin, 2004). Many parents gave the child frequent support in daily TM without realising how much or that it was in fact in daily TM. Some children tend to lack in initiative or seem inactive, common in children with ID and posing a special risk for learned helplessness. Intervention including time aids made the child more independent (Lagren & Wolf, 1998). Some children learn to compensate with cues in daily life, for example “It’s time to stop doing math when my friend puts her books in the bag”. Most environmental cues are instable, the consequence being either that the child is dependent on his/her parent or a friend, and/or keeps asking questions about time. Some of the children with time processing problems learn to read a watch, but if there is inadequate time perception he/she will still have difficulties knowing when to prepare for the next activity or for how long to continue the present one (Sandberg & Hellström, 2002). One reason for the restricted research in this area is probably the problem of identifying daily TM as a separate phenomenon.

1.3.7 Research on autonomy and time

Participation in optional activities seems to be dependent on the pupils’ autonomy and interaction with peers. In a comparison between children with or without dysfunctions, children with typical development estimate their autonomy and overall participation in optional activities higher than children with dysfunctions do (Eriksson & Granlund, 2004). The most noticeable differences are in perceived autonomy, in daily routines,
“live according to your own wish” and personal style. Variation within the two groups is high and no conclusions about participation and autonomy only dependent on the type and degree of dysfunctions can be drawn. The authors conclude that there is a need for intervention to pupils with dysfunctions with focus on increasing autonomy and helping them to develop an internal locus of control (Almqvist & Granlund, 2005). Other literature provides support for the observation that children with dysfunctions are less autonomous and have more external locus of control than TD children do (M. L. Wehmeyer & Schwartz, 1997).

The level of autonomy in a child contributes to achievements in school (Deslandes & Potvin, 1999). Autonomy is one of the essential characteristics of self-determination and a follow-up study showed that self-determined students were more likely to have achieved more positive adult outcomes, such as a bank account or paid employment. The two groups of students, one with high and one with low self-determination, were not rated differently on intelligence (M. L. Wehmeyer & Schwartz, 1997). Self-rated autonomy is today considered to be a relevant marker of everyday functioning (Granlund & Björck-Åkesson, 2005; M. Wehmeyer & Garner, 2003). One of the aspects of everyday functioning in this project is, therefore, autonomy. Also, there are validated self-rating instruments for children, so self-rated autonomy is the construct used for external validation of KaTid and the parent Scale of daily TM.

1.3.8 A valid base for a new assessment

Existing literature was examined in this section in order to see if existing research could be a valid base for a new assessment. Knowledge possible to use as a base for an assessment was found in time perception; in interval timing and in an agreement on the importance of knowing the duration of daily activities.

In the next section, research on children with developmental and/or cognitive disabilities will be presented. It will be shown that research focused on the dynamic interplay of time perception, time management and daily life functioning within a developmental perspective is scarce, especially for children with developmental disabilities (Eisler, 1993, 2003; A. L. Owen & Wilson, 2006)

1.4 KNOWLEDGE OF CHILDREN, TPA AND DAILY TM

In this thesis, typically developing children and children with cognitive and mainly developmental disabilities and/or diagnoses are in focus; children with ADHD, ASD, ID, physical disability. In Sweden the fourth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) or the ICD-10 are used. In this section there are short presentations of the knowledge on time for each diagnosis.

1.4.1 Typically Developing children

Today, it is known that already in newborn infants, sound duration is processed (Kushnerenko et al.; Sambeth et al., 2006). From birth and on, children learn time in an ongoing process (Droit, 1995). Daily routines in child care make it possible for a small child to integrate temporal order and start learning the duration of everyday activities, i.e. time perception (W. J. Friedman, 1990b; Piaget, 2006). A five month-old child can make self-controlled choices revealing a preference including duration (Darcheville et al., 1993). 8-month-old children can already discriminate the temporal direction of everyday events

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This indicates that children acquire aspects of time perception before establishing verbal skills. During pre-school years, children develop an increasing temporal generalisation (Droit-Volet et al., 2001). Children develop in time perception through experiences of daily routines and in reciprocal interaction with parents and important persons (Barclay et al., 1997; Guralnick, 1997; Piaget, 2006; T. D. Wachs, 2000; Zakay & Block, 2004). Daily routines are saved as “scripts” of the sequence and time duration of daily activities and situations in the reference memory. The scripts are updated throughout one’s life. Daily routines/habituation is the framework in which frequent occurring activities take place. The habituation helps the child to locate him/herself within time. For older children it is the seldom recurring activities that trigger them to learn weekdays and months, to know the weekday for going to the swimming pool or horse-back-riding, extending the time perspective as the child matures (W. J. Friedman, 2003). Habituation enables older children and youths to be where they are supposed to be and to do what they are expected to do over the course of daily, weekly and other cycles (Kielhofner, 2008).

A majority of the literature discussing how children acquire time concepts refers to Jean Piaget (2006) (Alin-Åkerman & Folkeson, 1995; Kylén, 1984; van Scoy & Fairchild, 1993). He described the development of a child in stages, each stage being characterised by the way the child learns and understands within many domains. The child needs to master one stage before moving to the next one, but there might be individual developmental variations within a stage. Research since then has confirmed that children without disabilities seem to develop sensorimotor skills in a predictable sequence (Hodapp, 1998) and the covariance between the different sensorimotor domains seem to be higher in TD children than in children with disabilities (Dunst, 1998). The development of a child is described as processes e.g. time-locked temporal developmental sequences; – implying that children are normally exposed to and process certain stimulation at a given age period and in a given temporal sequence (T. D. Wachs, 2000). The research on time concepts confirms the developmental sequence described by Piaget (Bylholt, 1997; Nelson, 2002), and many of the skills and abilities in time are reported at the same ages from different sources, making it reasonable to believe that development of TPA is a time-locked sequence.

A review by Bylholt (1997) describes how a child learns to read the clock, the calendar and stress the importance of language to learn time concepts. Children learn time concepts sequentially, except sometimes for exceptional children, such as gifted children or children with disabilities (ibid). The development of time concepts (Iris Levin, 1977) and the understanding of space (Luria, 1981; Piaget, 2006; Uyanik et al., 1999) is related to the development of time orientation (Brown, 1996) and to a person’s temporal perspective, the ability to overlook the past, present and future (Melges, 1990).

The connection between time perception as a body function and daily TM at activity level is established by stating that time perception (Barclay 1997) and time concepts are acquired through daily routines and in interaction with others (Bylholt, 1997; van Scoy & Fairchild, 1993). Therefore the knowledge, attitudes and culture of the environment are of vital importance for what TPA a child develops.

1.4.2 **Attention Deficit Hyperactivity Disorder (ADHD)**

Attention Deficit Hyperactivity Disorder (ADHD) is considered an impairment of hyperactivity and impulsivity in DSM-IV. There is evidence that children with ADHD often demonstrate skills regarding time perception that are functionally different from
what can be seen in typically developing children of the same age (Smith et al., 2002). In research most focus has been on the impairment on the level of time sense/interval timing. In a recent study, children with ADHD were found to have selective impairment in making judgements in long intervals, which is consistent with the performance of persons with frontal lobe lesions. The authors suggest there is a deficiency in the use of time information rather than a problem involving a central timing mechanism (Radonovich & Mostofsky, 2004).

We found no studies of time orientation and children with ADHD. In children with ADHD, difficulties to adjust activity level and lack of purpose in actions, are partly considered to be due to difficulties in time perception (Barkley et al., 2001; Smith et al., 2002). Children with ADHD demonstrate difficulties in completing their own daily activities independently (Segal & Frank, 1998) possibly attributable to not knowing what to do or when to do them, i.e. time management. A part from that study, there were no studies found about time management in these children, only suggestions; Barkley (1997) suggests that ADHD gives rise to secondary deficits in four executive functions, depending on it for effective performance, one of them being the working memory related to time sense and time orientation. The deficit in time sense may contribute to children with ADHD having difficulties to fulfil a task within a given time period; they act as if they have more time available than they do. They perceive inactive time, waiting, as longer than TD children do and they are less likely than their peers to be on time for an appointment. It is suggested that the problem for children with ADHD is not one of knowing what to do, but rather of doing what they know they should do, when it would be most adaptive to do it (Barkley, 1997). This indicates that the problem is rather about adaptation to time than about time management.

It is sometimes said that if a child can tell the time from a clock, the problems cannot be due to difficulties in time management. Yet some of these children have difficulties in situations in their daily life in terms of limited daily TM. A nother study found that children with ADHD could benefit from organisational skills training, another indication that daily TM could be a problem (Langberg & al., 2008).

### 1.4.3 Autism Spectrum Disorders (ASD)

Children with ASD, in this thesis mostly children with Asperger Syndrome or high-functioning autism, often demonstrate skills regarding time perception, that functionally differ from what can be seen in typically developing children of the same age (Peeters & Gillberg, 1999; Szelag et al., 2004; Wing, 1996).

Peeters & Gillberg emphasise that these children commonly have a distorted “intuitive feeling of time” that also affects their daily life in a way that is not generally appreciated by people in their vicinity (Peeters & Gillberg, 1999). It has been suggested that difficulties in time perception in children with ASD are related to limitations in daily rhythm/sleep problems (Wimpory et al., 2002), and difficulties with variability in daily routines (Hollander et al., 2003).

In interviews within a clinical project, the parents stated that their teenagers with ASD had problems with time perception, time orientation and time management, and that the lack of daily TM was a major problem. The children needed support 24 hours per day even though they had no physical problems. Using time aids increased independent activity performance and the sense of coherence, predictability and control, reducing the feeling of stress (Söderqvist, 2005).
A widely spread educational method for supporting children and youths with ASD structures each activity and/or a set period of time. The method offers an individualised concretisation of temporal order, using objects or pictures as a help to know when (temporal order) and for how long (duration) to perform each activity. This method offers predictability in space and, most of all, in time, reduces anxiety and increases independence (Peeters & Gillberg, 1999).

1.4.4 Intellectual Disability (ID)

The definitions of ID have changed over time (Simeonsson et al., 2002). Most definitions include a combination of intellectual impairment and limitations in adapting to and managing everyday life. The American Association on Mental Retardations (AAMR) describe it as a disability characterised by a dual deficiency in intelligence and adaptive abilities in three domains; academic, social and practical abilities (DSM-IV, 1994). The development of children with ID is often described as slow, based on the similar sequence hypothesis which predicts that they develop more slowly than, but in same sequence as, persons without disabilities (Hodapp, 1998). Children with ID, being at a concrete level of thinking for a longer time than TD children, will have time to collect more experiences of that same level of maturity but at a different chronological age (T. D. Wachs, 2000).

Children with ID commonly demonstrate problems in everyday life related to time orientation (e.g. using information about hour/date/week/month) and time management (e.g. knowing when and for how long to perform an activity)(Davies et al., 2002; A. L. Owen & Wilson, 2006). Still there is surprisingly little research concerning children with ID and time management (A. L. Owen & Wilson, 2006). There is also a lack of knowledge on the daily TM of children with ID.

1.4.5 Physical disability

Little is known of the time perception or time orientation of children with physical disability; CP or MMC. Having a disability like MMC is time-consuming, and the child is dependent in many everyday situations due to physical impairment. There seems to be a relation between the level of independence in daily activities and TPA in children with MMC (Donlau & Falkmer, Submitted). Clinical studies point to a risk of learned helplessness in children with MMC, with them remaining dependent in daily TM due to lack of time and physical dependence in everyday situations (Svensson, 2003).

In students with severe physical disability the student-environment fit in remembering things (e.g. timetable, special appointments or use of an agenda) was found to be unsatisfactory (Hemmingsson & Borell, 2000).

1.4.6 Summary of children, TPA and daily TM

In this section, knowledge was presented of how children develop time perception and time orientation, and especially of how time concepts are acquired in childhood. Most of the research on children with disabilities was diagnosis specific and concerned time perception. Little is known of time orientation in children with disabilities and, with only a few exceptions, the knowledge in time management and daily TM is hypothesized or non-existing. Also, research focusing on the dynamic interplay of time perception, time management and daily life functioning within a developmental perspective is scarce,

One example of the lack of knowledge of the relation between daily TM and TPA is how the current literature often describes situations of daily TM (e.g. a person not being able to be on time for a meeting). When using explanations at body level, the literature almost exclusively explains the problems with difficulties in short term memory or attention and rarely or never explains the problems with difficulties in time perception. This is a frequent pattern especially in literature on persons with ADHD, and is the case even if research on interval timing is presented in the same book (Christiansen, 2005; Pierce, 2001).

Our conclusion is that there is a lack of research on how difficulties in time perception, orientation in time and time management affect children in their daily activities. However, the knowledge base on how children acquire time perception and time orientation, together with some diagnosis-specific research on children with disabilities, was considered extensive enough to be a valid base for the new assessment to be used for children with and without developmental disabilities.

1.5 ASSESSING TPA AND DAILY TM

1.5.1 Existing instruments

There was a need for an instrument for assessing TPA and daily TM in children, and an investigation was done of existing instruments. No assessment instruments solely focused on daily TM, time perception, time orientation or time management in children were found in a database search in OVID; ERIC; AMED; Journals, Libris and a manual search. All available instruments for the assessment of functional abilities of children, that contained items for assessing TPA, were examined. Some items in each of the following test instruments were identified as assessing categories of TPA (Table 1).

1. Griffiths Mental Developmental scale (Alin-Åkerman & Nordberg, 1980), age 2-8
2. LOTCA, Loewenstein Occupational Therapy Cognitive Assessment (Katz et al., 1989), age 4-12
3. MPU, Motorisk-perceptuell utveckling 0-7 år [Motor-perceptual development 0-7 years] (Holle et al., 1990), age 0-7
4. PEDI. Pediatric Evaluation of disability Inventory (Haley et al., 1992), age 0-7.
5. WPPSI-R, Wechsler Preschool and Primary Scale of Intelligence - Revised (Wechsler, 1999a), age 3-7.

<table>
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<th>Table 1. Type and number of items evaluated in existing instruments in relation to time processing ability.</th>
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<td>Griffiths</td>
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<td>Time management</td>
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Each of the existing instruments contained too few items to give credible information about a child’s TPA. Furthermore, none of them have items in all the three categories: time perception, time orientation and time management. Our conclusion is that there were no standardized tools available, aimed at measuring TPA for children (Study I).

**1.5.2 Developing an assessment instrument**

To plan cost-effective and targeted intervention programs, a professional (e.g. an OT) needs a tool to identify the factors that limit everyday functioning or performance ability (Fisher, 1994). Assessment is a process aiming at focusing or prioritizing. It can take place for different reasons and at different levels, e.g. to determine the degree of cognitive ability/disability compared to a norm group, the ability compared to the information processing demands of a specific task, or the problems in interacting with the environment in daily life. The most efficient and practical way to obtain the information needed is to employ a standardized and evaluated assessment instrument. Standardized assessment instruments are methods that rely upon uniform administration and scoring procedures for obtaining a sample of behaviour. The examiner attempts to keep the context, item administration and scoring procedures consistent with the manual of the instrument (Gyurke & Prifitera, 1989). An evaluated assessment is validated and reliability tested (Coster, 1997; Miller, 1989).

To determine if an instrument is measuring the intended construct/domain, evidence of validity is required. The validity is related to what is being measured (see section 1.6). Reliability is simply assessing if the instrument is measuring something in a reproducible manner. The reliability coefficient is an index of the extent to which measurement of individuals obtained under different circumstances yield similar results (Streiner & Norman, 2003).

Assessing children is considered a challenge, and quite a few factors might affect the results of the assessment. If the child is presented a few alternatives to chose from, the answer from the child is often more reliable, so that standardized tests are often preferred (Smedler, 1993).

**1.5.3 Assessment for explanation of problem**

Assessment is an important part of the intervention process and can occur at different stages (Björck-Åkesson et al., 2000; Meisels & Atkins-Burnett, 2000). The process of intervention has been described in different theories and methods, many of them similar to the Intervention cycle, a model for collaborative problem solving. The intervention cycle is defined in six steps; (1) problem description, (2) explanation of the problem, (3) problem ranking (4) setting goals and objectives (5) intervention strategy design and implementation and (6) outcome evaluation (Björck-Åkesson et al., 1996). Systematic assessment instruments can be useful in step 1-3 and in step 6. An assessment at the first step of the intervention process needs to be open; inviting the child and the family to identify in what everyday situations they need a change. In the second step there is often a need for further assessment to gather the information needed for explaining the problems.

As there is a need of knowledge about the construct TPA, and the instrument in focus is also to be used for children with cognitive disabilities, it will, at this stage and in this thesis, be useful in step 2; explanation of the problem defined in step 1. Assessments used in step 2 can contribute to defining/clarifying or interpreting
causes for problems. Explanation of problems constitutes the foundation of the intervention approach. Numerous and divergent explanations can make it easier to design intervention methods. By explaining a problem with daily TM, the child and his/her family and significant others can learn about skills, both strengths and weaknesses, needed for managing time, and are given opportunities to redefine their perceptions of the problem.

1.6 TEST THEORY

1.6.1 Classic test theory (CTT)

Classical test theory has underpinned most test construction for nearly a century. In classic test theory a measure of reliability is internal consistency, representing the average of the correlations among all the items in the measure e.g. Cronbach’s alpha, Kuder-Richardson, or split-halves yielding similar results. The reliability coefficient is a number between 0 and 1. The degree of agreement between observers or raters is called inter-rater reliability. The agreement between observations made by same rater on two occasions and intra-rater reliability are both measures of the stability of the instrument (Streiner & Norman, 2003). There are many approaches to assessing validity, and the terms of the approaches are many. If other scales measuring same or similar construct exist, the existing scale is administered, together with a new scale, to a sample of people. The correlation between the new scale and the existing scale is evidence of convergent validity or external validity. In this thesis the Self-rating scale of autonomy is used for evidence of convergent validity. If there are no other existing instruments, a hypothetical construct can be tested in CTT using two samples expected to have differing amounts of the property assessed by the instrument. If the expected relationship is found, the hypothesis is confirmed and considered evidence of construct validity.

CTT is based on an assumption that the error is independent of the true score, thus usable in most situations. It is based on raw scores or means and focuses on test-level. A scale constructed in social sciences, with numbers/values assigned to each response category and summated, must still be treated as ordinal data. Item and scale statistics apply only to the specific group of participants who took the test and, if the test is altered in any way, e.g. the order of the items altered or items deleted, it is necessary to re-establish the psychometric properties and develop new norms. All items are summed up irrespective of how much each item correlates with the underlying construct. Also it is not possible to separate the properties of the test from the responses of the participants, forming a circular dependency (Streiner & Norman, 2003).

Statistics based on classic test theory are mainly variable-oriented. In this thesis statistical analysis based on classic test theory was used in descriptive analyses, for determining the reliability (internal consistency) and in Study II; regression analysis.

1.6.2 Person-oriented methods

In a person-oriented pattern approach the main analytical unit is each individual’s specific profile or pattern of operating factors. This can add valuable information about individual differences. Using person-oriented methods as opposed to variable-oriented methods opens up for translation of the results into properties characterizing individuals (Bergman & Magnusson, 1997) and thereby gives a thorough description of individual differences in spite of statistical significance. In this thesis the cluster analysis (Study
III) and the analysis using Rasch models (Study I, II, IV) can be characterized as person-oriented.

1.6.3 Item response theory (IRT)

Models developed in modern test theory, Item Response Theory (IRT) e.g., Rasch models, as opposed to Classical test theory, are suggested as preferable for reducing complex data of qualitative observations to unidimensional measures (Smith Jr et al., 2002; Tesio, 2003; B. D. Wright, 1996). Rasch models have been used to advance the development and validation of new assessments in various fields in human sciences (Bond & Fox, 2007; Embretson & Reise, 2000; Fisher, 1993). In IRT-based models, separation is an index of reliability (Fisher W., 1992). The inter-rater reliability can be calculated. In Rasch models, internal scale validity and person response validity can be stated, both providing evidence of construct validity.

IRT is based on the assumption that the scale is unidimensional i.e. measures only one construct and focuses on item-level information. By using Rasch models, cumulative raw scores can be transformed into linear continuous measures that can be used in statistical analysis based on interval level data (Smith Jr et al., 2002; Tesio, 2003). One of the advantages of the Rasch model is the mathematical way of estimating the difficulty of the items and the ability of the persons separately, ordered on the same, unidimensional, latent trait continuum (Streiner & Norman, 2003).

Independent random samples of items calibrated with the Rasch model will yield equivalent ability estimates for any individual or group from the specified population, and any sample from the population will yield equivalent item difficulty calibrations, also called specific objectivity (Snyder & Sheehan, 1992).

In this thesis, the index of separation with the reliability coefficient is presented, as well as the construct validity of all instruments, including internal scale validity and person response validity.

1.7 SUMMARY OF INTRODUCTION

There was a need for a new assessment model for measuring time perception, time orientation, time management and daily TM in children. Previous research in the area was diagnosis specific and, when it comes to children, rare or non-existing on time management and daily TM. At the moment of creating the new instrument, a valid base for an assessment was found in the knowledge of time perception/time sense (in children with ADHD and ASD) and of time orientation (in TD children). Therefore the main focus was on developing an instrument to measure TPA in children with a complementary parent scale for assessing daily TM.

Also there is little knowledge of how the measurement of time perception, time orientation, time management and daily TM are related.

This introduction shows there was a need for knowledge about; TPA in children with and without disabilities; if there are patterns of TPA related to diagnoses; if TPA is related to daily TM and to self-rated autonomy and if there are signs of differences in the response pattern between children with and without disabilities.
In this thesis, autonomy was chosen as the external construct. There are validated self-rating instruments for children, so self-rated autonomy is the construct used for external validation of KaTid and the Parent Scale of daily TM.
2 RESEARCH AIM

2.1 THE OVERALL AIM

The general aim was to contribute to knowledge of children with and without cognitive disabilities and development of methods for supporting children with difficulties in their daily time management (TM). The focus of this thesis was the further development of instruments for assessing TPA and daily TM in children, focusing on the constructs measured and investigating differences in TPA and daily TM between children with and without cognitive disabilities.

2.2 SPECIFIC RESEARCH AIMS FOR EACH STUDY

2.2.1 Study I

The aim of study I was to examine the construct validity of the assessment instrument KaTid aimed at measuring TPA, by evaluation of TPA in typically developing (TD) children.

2.2.2 Study II

The aim of study II was to investigate empirically the hypothesized relation between children's time processing ability (TPA), daily TM and self-rated autonomy, using data from children with disabilities.

2.2.3 Study III

The aim of study III was to investigate if there were different patterns in TPA in children with disabilities and TD children, if there are individual differences in patterns and if such differences were related to the type of diagnosis using a person-oriented approach.

2.2.4 Study IV

The aim of study IV was to investigate further if there was a difference between the response patterns of children with disability compared to TD children, which might indicate bias/differential functioning in items or scale.
3 ETHICAL CONSIDERATIONS

Ethical approval for first data collection was given by the ethical committee at Mälardalen University and for data collections two to four approval was given by the Regional Ethical committee in Uppsala, Sweden, Dnr 2005:032.

Ethical approval was applied for before initiating these studies. Many children with limitations in daily time management have a disability that might include difficulties in acquiring, processing and using information. This might include difficulties in understanding what is included and expected, when you participate in a study, and difficulties to understand and respond to the questions in a self-rating scale.

Earlier studies indicate that persons with severe disabilities can participate in studies, e.g. answer questionnaires, if the context, the questions and the response alternatives are adapted (Hartley & MacLean, 2006; Missiuna & Pollock, 2000; Sturgess et al., 2002). In this project the data collections were designed with experiences from earlier studies and of years of clinical experience of working with children with developmental disabilities in the ages in focus (Efvergren et al., 2007). One way to adapt collection to children in these ages is to give the child a set of items with clear alternatives to chose from (Smedler, 1993). In this material most items are adapted with pictures to make it easier also for non-reading children.

The raters were asked to participate and they were all trained before collecting any data. The education included information about the ethical pledges, including informed consent and the procedure of coding all material. In exchange for the extra work participation caused, they were also offered training based on the knowledge generated in the research project itself.
4 METHODS

The research in this thesis is based on both CTT and IRT (Rasch models) using person-oriented approach as far as possible. The design of each study etc is presented in Table 2.

Table 2: Summary of the four studies included in this thesis.

<table>
<thead>
<tr>
<th>Characteristics of the studies</th>
<th>Study I</th>
<th>Study II</th>
<th>Study III</th>
<th>Study IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Cross-sectional, instrument evaluation</td>
<td>Cross-sectional, instrument evaluation</td>
<td>Cross-sectional</td>
<td>Cross-sectional, instrument evaluation</td>
</tr>
<tr>
<td>Focus</td>
<td>Investigate psychometric properties of KaTid and of Parent Scale</td>
<td>Investigate the relationship between daily TM - TPA</td>
<td>Investigate patterns in TPA, differences between children TD-NonTD and the impact of diagnoses</td>
<td>Examine differential functioning in items and at individual level</td>
</tr>
<tr>
<td>Sample</td>
<td>TD children</td>
<td>Children with disabilities</td>
<td>Children with and without disabilities</td>
<td>Children with and without disabilities</td>
</tr>
<tr>
<td></td>
<td>Age 5 - 10, n= 144</td>
<td>Age 6 - 11, n= 118</td>
<td>Age 6 - 10, n=166</td>
<td>Age 5 - 10, n=259</td>
</tr>
<tr>
<td>Methods, data collection</td>
<td>TPA, Self-rated autonomy, Parent scale of daily TM</td>
<td>TPA, Self-rated autonomy, Parent scale of daily TM</td>
<td>Cluster analysis, split sample, ANOVA, Chi-square and t tests</td>
<td>Rasch rating-scale model, Differential Item Function (DIF)</td>
</tr>
<tr>
<td>(instruments)</td>
<td>Person oriented</td>
<td>Person oriented</td>
<td>Person oriented</td>
<td>Person oriented</td>
</tr>
<tr>
<td>Approach</td>
<td>Person oriented</td>
<td>Person oriented</td>
<td>Person oriented</td>
<td>Person oriented</td>
</tr>
<tr>
<td>Methods, data analysis</td>
<td>Rasch rating-scale models</td>
<td>Rasch rating-scale models, Regression analysis</td>
<td>Cluster analysis, split sample, ANOVA, Chi-square and t tests</td>
<td>Rasch rating-scale model, Differential Item Function (DIF)</td>
</tr>
</tbody>
</table>

NTD Non Typically Developing= Children with disabilities
TD Typically Developing
TM Time Management
TPA Time Processing Ability

4.1 PARTICIPANTS

The participants were children 5 - 10 years old with and without cognitive disabilities (Table 3). Both children with and without cognitive disabilities were used, as the pattern between sensorimotor development and age indicated that the developmental processes of atypical and TD children exhibit more similarities than differences (Hodapp, 1998). Also, children with many different diagnoses were reported to have difficulties in time perception and/or in time orientation (see section 1.4), indicating that TPA and daily TM might be a continuum rather than separate samples.
4.1.1 Typically developing children

TD children, 5 – 10 years old, were included, as an understanding of the sequences and schedule of maturing in typical development is essential as a framework for interpretation of developmental differences among children (Meisels & Atkins-Burnett, 2000).

4.1.2 Children with disabilities

In this thesis heterogeneously constituted groups of participants with quite varied aetiologies and diagnoses for their disabilities were included. Children aged 5 – 11, with cognitive and mainly developmental disabilities are in focus; children with ADHD, ASD, ID, physical disability or double diagnoses. The trained raters reported the children's diagnoses. Usually the children were diagnosed by the paediatrician at the habilitation centre or at the paediatric clinic at a hospital.

- Children with ADHD or Attention Deficit Disorder (ADD) (n=20)
- Children with ASD e.g. Asperger syndrome, High functioning Autism (n=18)
- Children with mild or moderate ID (n=35)
- Children with physical disabilities: children with Cerebral Palsy (CP) and children with Myelomeningocele (MMC). Children with physical disability were included in these studies as the problems in daily life possibly related to TPA observed in children with other disabilities, seem also to be problems for children with physical disability (n=30)
- The children with double diagnoses of interest in this thesis are those with one or more of the diagnoses above, and/or other dysfunctions e.g. dyslexia or EP (n=15)

Table 3. Description of data collections and participants

<table>
<thead>
<tr>
<th>Data collection</th>
<th>Year</th>
<th>TD/Diagnosis</th>
<th>n=</th>
<th>F/M %</th>
<th>Age</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2003</td>
<td>TD</td>
<td>61</td>
<td>49/51</td>
<td>6</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>2005</td>
<td>TD</td>
<td>24</td>
<td>29/71</td>
<td>5</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>2004-2006</td>
<td>TD</td>
<td>59</td>
<td>58/42</td>
<td>5-11</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>2005-2007</td>
<td>Diagnosis</td>
<td>118</td>
<td>32/68</td>
<td>5-11</td>
<td>X</td>
</tr>
<tr>
<td>N=</td>
<td></td>
<td></td>
<td>262</td>
<td>42/58</td>
<td>144</td>
<td>118</td>
</tr>
</tbody>
</table>

4.2 DATA COLLECTION AND INSTRUMENTS

4.2.1 Data collection procedures

Before initiation of data collection, ethical approval was obtained from the regional ethical committee (Dnr 2005:032). The participants in this thesis were children, 5 - 11 year-olds, with and without diagnosis (See Table 3).

All raters were trained on a 2-days course held by the author of this thesis and a colleague. Using trained raters was a way of securing the quality of the data collection, e.g. the raters attempting to maintain consistency of the context, item administration and scoring procedures with the manual of the instrument. Training raters was also a way of implementing knowledge into the clinic.
The first data collection was made in the spring of 2003. Ninety-seven children born in 1996 were invited to participate, all attending one of seven public preschool classes, representative of the socio-economic distribution of the population and located in both rural and densely populated areas. The sample from first data collection was 61 TD children (attrition 37.2%). In second data collection, participation was invited from all 5 year-olds born in the year 2000 attending four mainstream preschool classes in a big town in Sweden (n=36). The parents of 24 children (66%) gave informed consent. The third data collection was a convenience sample of 59 TD children aged 5 - 10 years. Data collections 1 - 3 included a total of 144 TD children, aged 5 - 10 years, (71F/73M, M = 6.41 years old, SD = 1.26).

In a fourth data collection, children from all over Sweden who received outpatient services from paediatric rehabilitation/habilitation centres were invited; it was a convenience sample. The inclusion criteria for participating were: children aged 5 - 11 years with one or more of the following diagnoses: a) ADHD, b) A SD, c) mild or moderate level ID or d) MMC or CP or e) double diagnosis including one or more of the diagnoses above and/or other dysfunctions e.g. dyslexia. Informed consent was obtained from parents and 118 children (40F/78M, M = 8.14 years old, SD = 1.42).

4.2.2 KaTid

4.2.2.1 The instrument KaTid

The KaTid has a detailed manual describing how to proceed with assessment, exactly how to pose each question/each item and how to score. Adaptations that might be needed are described e.g. for children with physical disability. The unique features in this new instrument are a) the items in time perception, aimed at measuring the duration of daily activities and b) that the instrument includes items in time management for children and c) that the instrument includes items from at least three different constructs of time. It was validated and reliability tested with classical statistical methods on 6 year-old TD children (n=61) (Alderman & Janeslätt, 2004). The results indicated no differences in gender, as well as acceptable validity, reliability and significant correlation between KaTid – the Parent scale and the self-rating of autonomy. From August 2004, the development of this instrument and of increased knowledge was continued within a research project supported by the National Health Care Sciences Postgraduate School, resulting in this thesis.

The multi-disciplinary KaTid instrument is used to assess TPA among the participants in this thesis. The instrument was developed to cover the three earlier described aspects of TPA: time perception (P), time orientation (O) and time management (M). If a child is reported to have problems in everyday situations identified as potentially related to TPA, KaTid may be used for further exploration and investigation of time processing skills. The aim is to define/clarify or interpret the causes, or rather one potential cause, of problems of occupational performance in daily life.

The KaTid was primarily aimed for being used for children with disabilities and therefore contains picture support to make it more easily available and accessible (Alderman & Janeslätt, 2004). Using pictures as support is a way of making information less abstract for children with or without cognitive disabilities (Sturgess et al., 2002; Wining, 1996), thus facilitating assessments of those young children who have not learned to read or who have communication problems. KaTid included 61 items in the form of tabletop activities. Most of the items were presented in a flip-booklet with 2
or 3 pictures on one side of the flipbook for the child to see, and the question to pose visible only to the professional. The child can point to the picture or answer verbally.
KaTid has dichotomous response alternatives (can/cannot) in most items, but five items are scored on a three point rating scale.

4.2.2.2 Time perception

The subcategory P=time perception, contained 16 items, P1 – P16. The items P1 – P14 are aimed at measuring if the child knows which activities take a long time/short time to do, i.e. the perceived duration of daily activities (Grondin, 2001). One item, P15 is aimed at measuring the subjective perception of time passing, a so-called prospective time judgement task (W. J. Friedman, 1990b), using a stopwatch with a yellow dot at 10 seconds. First the child is instructed to watch the hand of the stopwatch as it moves to the yellow dot. Then the child is told that the stopwatch will be restarted out of sight, by the child’s ear and s/he is told to say stop when s/he thinks the hand has reached the yellow dot. This item is an adapted version of a task used and recommended by Friedman (1977). In this instrument a shorter time interval is used, ten seconds, bearing in mind that the KaTid aims at children with disabilities. In item, P16, the child is to identify which activity s/he does often, from two given examples.

4.2.2.3 Time orientation

In the subcategory of O=time orientation; there were 35 items, O1 – O35. In the items O2 - O4, the child is asked to place a picture sequence of a daily activity in temporal order. For example, O3 is a sequence of a girl performing a morning routine in 5 pictures. In this instrument the time concepts of sequence, (a) location, (b) frequency and (c) units are included, mostly concepts of “educated time” (Nelson, 2002). Examples of items in (a) location in time: O14 (“Which season is it now?”) is sometimes easy enough, if you can look through the window and see yellow leaves on a tree. For orientation within the week, O5 asks “What day is it today?”, and O8 “Which day was it yesterday?” (Figure 2). An example of (b) frequency concepts: O1 “Which do you do more seldom, brush your teeth or go to the dentist?” Examples of items in (c) units: O10 “Which days are you free from school?” and O7 “Say the names of all the days of the week in the right order”.

The item O19, putting digits on the right place on a clock face, is an adaptation of a frequently used item, drawing a clock (Katz et al., 1989), here using self-adhesive digits. Items O20 – O27 are about telling time from a clock with increasing levels of difficulty. This type of item is the traditional way of measuring time ability included in instruments like Griffiths Mental Developmental scale (Alin-Åkerman & Nordberg, 1980). Item O28 includes objective time in duration, and a similar item is seen in LOTCA (Katz et al., 1989). When starting the assessment a timer is set for 15 minutes, without telling the child. This kind of item aims to measure the subjective time in passing retrospectively (W. J. Friedman, 1990b). Items O29 - O35 are about time quantity with questions like O29 “How many minutes are there in quarter of an hour?”, O31, the number of days in a week (Alin-Åkerman & Nordberg, 1980; Wechsler, 1999a) and O32, the number of days in a month (Wechsler, 1999b).
Figure 2. Items O8 – O10 locating days of the week

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
<th>SATURDAY</th>
<th>SUNDAY</th>
</tr>
</thead>
</table>

The KaTid-rater introduces the items. Instruction: Point at each weekday naming them in the correct order then point at the day of today.

Item O8, say - This is today, which day was it yesterday?
Item O9, say - Which day is it tomorrow?
Item O10, say - Which days are you free from school?
The child can point at the day or answer verbally. Note in protocol, correct answer is 1 point.

4.2.2.4 Time management

In subcategory M = time management, M1 - M10, the items are based on questions about (a) what one would have time to do in a set amount of time, (b) when to do it and (c) for how long to do it (Davies et al., 2002). In items about (a) -what one would have time to do in a set amount of time- the skill of reading the clock is combined with the duration of activities. For example, M3 “If the hands on the clock are like this, and a TV program you want to see starts at six o’clock, what would you have time to do? Make a sandwich or eat dinner?” Items about (b) - when - and (c) -for how long to do it- includes calculation. For example, item M5 “If it takes 10 minutes to go to the dentist and you should be there by 20 past eleven, when will you have to leave?”

During the studies included in this thesis, the analyses have yielded some changes of the instrument. In the earliest data collection there was only one item in the subcategory of time management, as there was no evidence that children at this early age might manage their time at all. In the preliminary analysis of the 6 year olds, this item turned out to be very easy for the sample. Thus another two items were added in the following data collection with 5 year olds. The next analysis indicated a need for even more, and more difficult, items in time management, so another seven were added. Due to this, the subcategory of time management was imputed for some children in order to obtain more data for Study III. In the other studies, using Rasch analysis, the missing values in time management are not as crucial. In the other subcategories there are very few missing data.

In the first study, 61 items were included in KaTid. The step-by-step process of omitting items resulted in 51 items with acceptable goodness-of-fit. Those 51 items are used in studies II - IV.

4.2.3 Parent Scale

Information about the children’s daily TM was obtained with a Parent scale, created by the first author and a colleague, and designed to collect information about the children’s
everyday functioning in situations possibly affected by difficulties in TPA. Items were generated from previous knowledge of the limitations in everyday situations that were often demonstrated by children with difficulties in time perception. For example, it has been suggested that difficulties in time perception in children with ASD are related to limitations in daily rhythm/sleeping problems (Wimpory et al., 2002), leading to the statement “My child has a stable sleep-wake cycle...”. It is also suggested that children with ASD have difficulties with variability in daily routines (Hollander et al., 2003), thus generating item 2. Difficulties in time perception were assumed to be connected to difficulties in adjusting activity level to the specific context (e.g. problems with waiting) (Barkley, 1997; Segal & Frank, 1998), thus generating items 6 and 11. Many activities in daily living are done in a temporal sequence, e.g. making a snack, and managing such activities is part of learning time management (Bambara & Ager, 1992; Davies et al., 2002) (item 3). One statement was added to acquire information on whether the child shows proof of understanding time concepts in everyday situations (item 5) (W. J. Friedman, 1990b). Time perspective, hindsight and forethought are aspects of psychological time (Barkley, 1997; M. elges, 1990), and generated item 9. The Parent scale has a Likert agreement scale with four response alternatives.

4.2.4 Self-rating scale

The children rated their autonomy in daily routines with the help of a short self-rating scale derived from an original validated self-rating questionnaire measuring autonomy (Sigafoos et al., 1988). The Swedish full version for children aged 7 - 12 years has been used in several studies indicating a close connection between autonomy and participation (Almqvist & Granlund, 2005; Eriksson & Granlund, 2004). The full version of this instrument would have been too time-consuming to administer, so the first author and a colleague omitted some items to make a short version, the Self-rating scale. All seven items addressing autonomy in daily routines from the original scale were used, as activities in daily routines are less affected by emotions (Larson, 2004). Also five items in the original instrument categorized as interacting with people, participation or personal style (items 8 - 12) were used. Items 13 and 14 were added to meet the need for some more challenging items. The Self-rating scale has a Likert scale with four response alternatives in a frequency adapted for non-readers with Pictogram pictures.

4.2.5 Missing Data

In the first data collection the attrition was 37.1%. In second data collection it was 33.3%. There were few dropouts among the TD children with informed consent, although some (n=4) were ill at the day of assessment, they are included in the attrition.

Among the children with disabilities there are some missing data. The trained raters have chosen not to pose all the questions in the self-rating of autonomy in a few cases when it was obvious the child did not understand the statements posed. In one case the assessment with KaTid was not done as the child chose not to participate.

There are some missing data due to differing versions of the KaTid. During 2003 - 2005 data was collected using a version of KaTid with only a few items (2 - 3) in the subcategory of time management. The first evaluation of the instrument revealed that many items in KaTid were very easy for the older children in the sample, including the items on time management. Five new items were added in the subcategory of Time orientation and six in Time management. Therefore there are missing data on those items.
4.3 DATA ANALYSIS

4.3.1 Rasch models (IRT-based) data analysis

The data analysis (Studies I, II, IV) was implemented with Rasch models. Cumulative raw scores can be transformed into linear continuous measures that can be used in statistical analysis based on interval level data (Smith Jr, 2002; Tesio, 2003). The raw scores of all children’s performances in KaTid were transformed into measures, so called log odds probability units, logits, using partial credit models in the computer program Facets Version 3.64.0 (J.M. Linacre, 1987-2007) or in Winsteps Version 3.64.2 (J. M. Linacre, 2006). Partial credit models are recommended for Rasch transformation of data containing mixed rating-scales (Bond & Fox, 2007). The computer program also provides goodness-of-fit statistics for each item and each participant to evaluate the degree of fit between the actual patterns of responses from the test and the model assertions. The model assertions in these studies were (a) easy skill items are more likely to be easier for all children compared to hard skill items and (b) the more able the child is, the more likely s/he is to score higher overall, compared to a child less able in the construct measured. In all studies, M nSq <1.4 associated with a z <2.0, was set as the criterion for acceptable goodness-of-fit (J.M. Linacre, 2002); also 95% or more of the items or the person responses are expected to demonstrate goodness-of-fit to the model (Fisher, 1995). If the goodness-of-fit statistics of the items are acceptable, they provide evidence of unidimensionality, supporting internal scale validity (Fisher, 1993). If the goodness-of-fit statistics of the children’s responses are acceptable, they support person response validity. The individual measures for each item and each person shape one hierarchy that can be presented along one mutual linear ruler.

Step-by-step analysis in Study I: It is generally expected that 95% of the measured items and persons should fit the model, in order to provide evidence of acceptable internal scale validity and person response validity (Fisher, 1993). If 5% or more of the items in KaTid failed to demonstrate acceptable goodness-of-fit, the items were removed in a step-by-step removal process until (a) all remaining items demonstrated acceptable goodness-of-fit to the model, or (b) the separation index for the participants decreased substantially. This process has been described in more detail elsewhere (Lautamo et al., 2005).

A fit of data to the Rasch model, careful examination of the principal component analysis of the residuals could provide clues to any remaining multidimensionality of the 51 items in KaTid. The PCA analysis was done in Winsteps Version 3.64.2 (J. M Linacre, 2006). The criterion for unidimensionality was set so that the variance in data explained by measures should exceed 60% to be considered good, >80% was considered excellent and unexplained variance in contrasts 1 – 5 of residuals should not explain more than 5% (Fisher Jr, 2007).

Differential item functioning (DIF) was conducted in Study IV to estimate the relative difficulty of each item for the TD children, separately from the difficulty of each item for the children with disabilities. The estimated item difficulty calibrations define the relative linear hierarchy of item challenge for the two samples. The extent of difference in item challenge between the two samples was calculated using a standardized z comparison (Schulz, 1990) considering the Standard Error (SE) of each
item difficulty calibration (B.D. Wright & Stone, 1982). The SE of the item difficulty calibration provides an estimate of the level of uncertainty (B. D. Wright, 1995). If an item had a z value <2.0 the positioning in the hierarchy was considered stable, whereas if the z was ≥2.0 there was a difference in challenge for that specific item between children with and without disability. To further examine differences, an analysis at scale level was conducted where the item difficulty calibrations were anchored: Each child’s person was measured in a) a hierarchy generated from TD children - a generic scale - and b) a hierarchy generated from the children with disabilities - a specific scale - and respectively analysed with item difficulty calibrations anchored and the person ability measure being allowed to float. The extent of difference in person ability between the two scales was calculated using a standardized z comparison. No more than 5% of the children were expected to have differing results in the two scales solely by chance.

4.3.2 CTT-based statistical analyses

In order to analyze the strengths in the relationships between the self-rating of autonomy, the parents’ ratings of everyday functioning and the measures from KaTid, Pearson product moment correlation analysis was performed in Study I and II (SPSS, 2006). The level of statistical significance was set at p<0.05. Correlations between variables of a psychosocial nature are typically in the range of .10 to .40 (Polit & Beck, 2004) so in this analysis 0.10 – 0.29 was considered to be a weak correlation, 0.30 – 0.49 moderate, and ≥0.5 a strong correlation.

The explained variance (R²) was calculated (Study II) in two ways: a) for each variable in a univariate regression model and b) as a backwards stepwise explained variance model, where the criterion for entry was set at 0.05 and for exclusion at 0.10. This analysis was done with the purpose of characterizing the relationship between the self-rating of autonomy, the parents’ ratings and TPA. TPA was set as the dependent variable. To identify other demographic variables that might also explain the variation in TPA, the age of the participants was also included in the regression analysis. An analysis of covariance, adjusted for age in years and diagnosis, was done to determine whether TPA differed according to the gender of the participants.

In Study III background data on the children in the different clusters were obtained by comparing the clusters with regard to demographic variables (gender and age) using SPSS (2006). The clusters were then compared with one-way analysis of variance (ANOVA) concerning age, autonomy and time management. Chi-square tests were used to analyse differences between the clusters in gender and diagnosis.

4.3.3 Cluster analysis

Cluster analysis is a person-oriented pattern approach and can add valuable information about individual differences. It is preferred when the main analytical unit is each individual’s specific profile or pattern of operating factors (Bergman & Magnusson, 1997). This approach can generate valuable information about the three subcategories of TPA, daily TM and autonomy in everyday life of children with disabilities. Study III investigated if there were different patterns of TPA in children with disabilities and typically developing (TD) children and also if there were individual differences in patterns and whether such differences were related to type of diagnosis.

A hierarchical cluster analysis was carried out using SLEIPNER 2.0 (Bergman & El-Khoury, 2002) with Ward’s method of agglomeration. Hierarchical
cluster analysis allows the researcher to have full insight in the clustering procedure, investigate the structure of the data at the different levels and to determine the number of clusters most suitable according to specified criteria.

To evaluate possible generalizations from, and the explanatory power of the clusters in the present study the following criteria were used: (a) a homogeneity coefficient (HC) of at most 1.00 (preferably < 0.50), (b) a percentage of the total explained error sums of squares (EES) of at least 67%, and (c) a split sample replicability through a total re-run of the cluster analysis. This was performed on a random half of the sample of at least 0.30, the mean in Average Squared Euclidian Distance (ASED) between the clusters in the two solutions (Bergman et al., 2002). The five-cluster solution was chosen, as it appeared to match the data best according to above specified criteria and interpretability.

The EXACON module in SLEIPNER was used to analyse if children with different diagnoses were observed significantly more often than expected in a cluster group. Combinations of diagnosis and cluster group that were observed significantly more often than expected are referred to as types, while those observed less frequently than expected are referred to as antitypes.

4.3.4 Reliability

4.3.4.1 Internal Consistency

The Internal consistency (Cronbach’s alpha) is often used in scale development in CTT. It is a reliability coefficient representing an average of the correlations among all the items in the measure. The alpha value is dependent on the number of items in the total scale, posing a risk at redundancy, so that the alpha value should be above .70 but not higher than .90.

4.3.4.2 Separation

In Rasch models, reliability is estimated for both persons and for items. The person separation reliability is an estimate of how well one can differentiate persons on the measured variable. The estimate is based on the same concept as Cronbach’s alpha and estimates the replicability of the persons’ ordering one could expect, if this sample were given another parallel set of items measuring the same construct (Bond & Fox, 2007). The separation value should be > 2.0 to identify at least three different levels of TPA in the sample and a associated reliability coefficient > .80 was expected (Fisher W., 1992).
5 RESULTS

5.1 RESULTS OF STUDY I - IV

5.1.1 Study I

In the first study, a step-by-step process was conducted, omitting ten items. All the remaining 51 items in KaTid demonstrated acceptable levels of goodness-of-fit with infit MnSq ranging from .22 - 1.39 (M = .94 SD = .25) indicating an acceptable internal scale validity when used with TD children (n=144) (Study I). 137 (95.4%) of the 144 children demonstrated an acceptable goodness-of-fit to the final Rasch model with 51 items, indicating an acceptable level of person response validity. Five of the seven children who did not demonstrate acceptable levels of goodness-of-fit were 5 or 6 year-olds. The mean logit of TPA among the children tested was 0.94 (SD = 2.55). The person separation was 3.21 (reliability .91), indicating that the items could separate this sample into four distinct groups of TPA. The correlation between the KaTid and the children's self-ratings of autonomy was non-significant (.127, ns). The correlation between the measures from KaTid and the Parents' ratings of everyday functioning was however considered large and significant (.519, p < .001), providing further support for construct validity.

5.1.2 Study II

All three instruments used demonstrated acceptable internal consistency (α = .77 - .79) in this sample of children with disabilities (n=118). There is a significant relation (r = .306, p < .001) between children's self-rating of autonomy and their TPA, as measured with KaTid. The regression analysis indicated that the child's self-rating of autonomy could explain 9.4% of the variation in TPA (R² = .094, SE = 1.783, β = .306, p < .001). The relation between the parents' ratings of the child's daily TM and the TPA was also significant (r = .513, p < .001), the regression analysis indicating that the parents' ratings of the children's daily TM could explain 26.3% of the variation in TPA (R² = .263, SE = 1.630, β = .513, p < .001). Finally also, the parents' ratings of the child's daily TM and the children's self-rating was statistically related (r = .366, p < .001). The age of the child explained 22.6% (R² = .226, SE = 1.460, β = .476, p < .001) of the variation in TPA. In an analysis of covariance, gender was found to be non-significant (p = .070) and was therefore excluded in further analysis. In a backwards regression analysis, child self-rating, parent rating and the child's age explained 38.3% of the variance in TPA (R² = .383, SE = 1.494). The child's age (8.364, p < .001) and parent ratings (8.347, p < .001) contributed most to the explained variance, followed by the child's self-rating (8.161, p < .05).

5.1.3 Study III

In study III 204 children were included. Due to missing registrations especially in Time management, an imputation procedure was done. Data from 166 of those children were included in a cluster analysis, none of the participants being defined as an outlier. The cluster analysis in this study revealed different patterns based on subcategories of TPA among children with and without disabilities aged 5 - 10 years. The children form five distinctly and significantly separated profile groups, cluster A - E. The evaluation of the explained variance (78.4%) and generalizability of the clusters demonstrated acceptable values. The homogeneity coefficient of the groups varied between .089 - .632, well
within the acceptable criteria. The results of the reliability analysis of a random split sample, with a total rerun of the cluster analysis on a random half of the sample, demonstrated a mean ASED between the clusters of .094, which is well within the acceptable range, i.e. there was a high structural similarity between the two solutions.

The distribution of gender in the clusters varies between 22.2% - 53.8% girls and 46.2% - 77.8% boys. Still, there was no significant difference (calculated with Chi$^2$) between the clusters with respect to gender. There was a significant difference in age between the clusters ($p<.005$). There were TD children in all clusters (3.4 – 25.8%) as well as children with different diagnoses.

There are children with different diagnoses in all clusters. The analysis with the EXACON module showed significantly more children with certain diagnoses in some of the cluster groups than as would be expected solely by chance. In cluster A children with ID were more frequent than expected, and thus considered a type. In cluster C, children with ASD were more frequent and also considered a type, whilst children with ID were less frequent than expected and thus considered an antitype. In cluster D, which was the most skilled group, TD children were observed more frequently and there were no children with ID in this cluster. In cluster E, which was the less skilled group, children with double diagnoses formed a type and TD children an antitype. However, when a control for mass significance, the Bonferroni analysis was applied, the significance of all combinations of diagnoses and cluster groups disappeared, resulting in no types or antitypes. The result indicates that children within the same diagnostic category do not share membership in a subgroup with a specific pattern of TPA.

The daily TM as rated by parent ratings differs significantly between the clusters ($p<.001$). The more skilled in TPA the children in the clusters were, the higher the parent’s rated their daily TM. The clusters with lowest daily TM were clusters A and E, both with a mean age of less than 7. Generally it seems that having a diagnosis is related to lower daily TM. The self-rated autonomy of children differs between clusters. In general the more skilled a cluster is in TPA, the higher they rate their autonomy - with one exception; children in cluster B rate themselves lower than group A do. The cluster with lowest self-rated autonomy is cluster E.

### 5.1.4 Study IV

Study IV investigated if the response pattern might indicate DIF using standardized z-comparison in two samples, one with typically developing children ($n=144$) and one sample with children with disability ($n=115$). Altogether 259 children participated. The DIF analysis showed that in 36 of the 51 items (70.6%) the item difficulty calibrations were similar, but 15 items (29.4%) demonstrated a significant relative difference in the level of challenge between the children in the two samples, indicating bias on item level. Eight of the thirteen items in the subcategory Time perception (designed to measure the perceived duration of daily activities) were relatively more challenging for children with disability. One of the nine items in Time management was also relatively more challenging for children with disability. Six items in the subcategory Time orientation showed differing levels of challenge: two of the items were relatively more challenging for children with disability and four items seem relatively easier for the children with disabilities. Since 15 of the items did offer different levels of challenge for children with disability, analysis at an individual level was done. The person ability measure of each child was now estimated in the scale generated from the hierarchy of the own group and the scale generated from the hierarchy of the other group. This offered an analysis of the
extent of difference and how the DIF might influence the estimations of TPA at individual level. When comparing the values each child generated in the two scales, there was a difference ranging from -0.04 to 0.31 logits. No child demonstrated a difference larger than 1 mean SE when comparing the measures generated from the two relative item difficulty calibrations. The analysis using the standardized z comparison considering the individual SE of person ability measure in each scale resulted in only six children (2.3%), all 9 - 10 year-old TD children with a z value ≥2.0, also well within the set criterion of 5%.

5.2 ASSESSING TPA AND DAILY TM

The results of this thesis include further development of a method for assessing TPA, daily TM and self-rated autonomy using the instruments: KaTid, Parent Scale and Self-rating scale.

5.2.1 KaTid

TPA was in this thesis measured with the KaTid instrument. The results of the evaluation of KaTid were as follows:

5.2.1.1 Internal consistency of KaTid

The KaTid demonstrated acceptable internal consistency in both children with and without disabilities (α=.78 -.86) (Study I, II).

5.2.1.2 Internal scale validity:

In the first study, a step by step process was conducted, omitting ten items, all the remaining 51 items in KaTid demonstrating acceptable levels of goodness-of-fit with infit MnSq ranging from .22 - 1.39 (M .94, SD .25) indicating acceptable internal scale validity when used with TD children (n=144) (Study I).

In children with disability (Study II) the analysis revealed that 45 of the 51 items, 88.3%, met the criteria of goodness-of-fit. Since the number of items not demonstrating goodness-of-fit exceeded 5%, further analysis was undertaken to evaluate whether any systematic patterns were found. The individual responses in the six unexpected items not showing acceptable goodness-of-fit demonstrated no systematic patterns of age, gender or diagnosis. Since no systematic patterns were found, a second method for evaluating the item goodness-of-fit was undertaken, evaluating the overall percentage of unexpected responses (Fisher, 1993; Goto et al., 1996). When examining the total number of responses only 119 responses out of 5144 responses were unexpected (2.3%) indicating that the overall proportion of miss-fitting ratings was acceptable. No ceiling or floor effects were found in the sample tested.

In the total sample of children with and without disability in study IV (n=259) the analysis revealed four of the 51 items (7.8%), did not meet the criteria of goodness-of-fit, indicating a close-to-acceptable goodness-of-fit.

5.2.1.3 Person response validity

The responses from 137 (95.4%) of the 144 TD children demonstrated acceptable goodness-of-fit to the final Rasch model with 51 items, indicating acceptable level of
person response validity (Study I). 113 of the 118 children with disabilities (95.8%) met the criteria of goodness-of-fit, providing further evidence of person response validity.

In the total sample of children with and without disability (n=259) 16 children (6.17%) did not demonstrate goodness-of-fit to the model, still being a close-to-acceptable goodness-of-fit.

5.2.1.4 Separation

The person separation in TD children (Study I) was 3.21 (reliability .91) and the item separation was 8.94 (reliability .99). In children with disabilities (Study II) the separation value of person responses was 3.48 (reliability .92) and for items 5.56 (reliability .99).

In the total sample of children with and without disability (n=259) separation was 3.31 (reliability .92), indicating that the items in KaTid could separate this sample into four distinct groups of TPA.

5.2.1.5 Further evidence of construct validity/convergent validity

The correlation between the KaTid and the TD children’s self-ratings of autonomy was non-significant (.127, ns) (Study I). In children with disability the correlation analysis showed a significant relation ($r = .306, p<.001$) between the KaTid and the children’s self-ratings of autonomy, and the regression analysis indicated that the child’s self-rating of autonomy could explain 9.4% of the variation in TPA (Study II).

The correlation between the measures from KaTid and the Parents’ ratings was considered large and significant in TD children ($r = .519, p < .001$) (Study I) and in children with cognitive disabilities ($r = .513, p < .001$). The regression analysis indicated that the parents’ ratings of the children’s daily TM could explain 26.3% of the variation in TPA, providing further support for construct validity (Study II).

5.2.1.6 Differential Item Functioning (DIF)

The DIF analysis demonstrated that the two samples, children with and without disability responded similarly in 36 of the 51 items (70.5%) of KaTid. The first analysis revealed a difference in challenge in some specific items in KaTid between children with or without disability. Eight items in the subcategory Time perception, two in Time orientation and one in Time management were relatively more challenging for children with cognitive disability, and four items in time orientation relatively easier. However, the following analysis resulted in a trivial degree of differential functioning at individual level.

5.2.1.7 Principal Component analysis (PCA)

In the Principal Component analysis (PCA) (in Winsteps) of a sample of children with and without disabilities (n=259), variance explained by measures was 98.9%, and unexplained variance in first contrast 1.1% (not published).
5.2.1.8 Validity and reliability of the KaTid

Altogether the results reveal acceptable or close-to-acceptable values in the psychometric properties. In Study II, the item goodness-of-fit was lower than expected (88.3%). In the further analysis, the overall proportion of miss-fitting ratings was acceptable. The KaTid can be used to measure the individual level of TPA, a separation value of at least 3.21 indicating that the instrument is sensitive enough to separate this sample into four distinct groups of TPA, and also indicating the possibility to measure change over time. The results from the second study indicate the viability of the instrument for assessing TPA also in children with disabilities, and that the ability measured by KaTid is relevant for daily TM for these children. The DIF and scale level analysis revealed acceptable values and the PCA showed a high level of variance explained by measures. The preliminary reliability analysis indicates acceptable values. KaTid is an instrument that can be used to measure the individual level of TPA to clarify or interpret the cause of problems in everyday situations.

The results from Study I also indicate that the items in KaTid, initially defined as time perception, time orientation and time management, all demonstrate acceptable internal scale validity, based on the actual goodness-of-fit statistics used in the analysis. They statistically support a potential unidimensional construct, here named TPA. In this unidimensional construct time perception, time orientation and time management can be seen as different levels of complexity in time processing ability rather than as separate constructs. There is a need for further research on children with disability to confirm this hypothesis.

5.2.2 Parent Scale

The Parent scale included fourteen items in the first study, and one item was excluded in Study II due to the possible overlap between that item and one item in KaTid.

5.2.2.1 Internal consistency

The internal consistency (Cronbach’s alpha) for the Parent scale in the data from TD children was $\alpha = .86$ and for children with disabilities ($\alpha = .79$), and thus the Parent scale demonstrated acceptable internal consistency in both samples (Study I, II).

5.2.2.2 Internal scale validity and person response validity

In the first study of TD children ($n=144$) all fourteen items in the Parent scale met the criteria of goodness-of-fit in a Rasch Rating scale model (Separation 6.24, reliability .97) (Study I).

In children with disabilities ($n=118$) (Study II) the thirteen items used in the Parent scale met the criteria of goodness-of-fit (Separation 4.80, reliability .96), hence supporting internal scale validity. 93.5% of the children with disabilities demonstrated goodness-of-fit to the model (Separation 2.01, reliability .80), further indicating close-to-acceptable person response validity in the Parent scale (Study II).

This scale, including thirteen items, was found to be psychometrically sound, indicating that it can be used to measure the parents’ estimations of the child’s daily TM. The Parent scale was significantly correlated with TPA, indicating that the ability measured is related to the TPA of the child (Study I, II).
5.2.3 Self-rating scale

The Self-rating scale included ten items in the first study. Most of them suited the youngest children in difficulty level. There was a need to add items suited for older children, thus from Study II, four new items from the original scale was added.

5.2.3.1 Internal consistency

The internal consistency (Cronbach’s alpha) for the Self-rating scale in the data from TD children was $\alpha = .65$ and for children with disabilities $\alpha = .77$. The Self-rating scale demonstrated moderate internal consistency in TD children, possibly due to the 5 year-old participants being too young for this scale (Study I). In 6 - 11 year-old children with disability the internal consistency was acceptable (Study II).

5.2.3.2 Internal scale validity and person response validity

In TD children ($n=144$) the Rasch rating scale model, ten items of the self-rating scale met the criteria of goodness-of-fit ($MnSq <1.4$ associated with a $z < 2.0$) and were then used in the following data analyses (Separation 1.28, reliability .94) (Study I).

In the Rasch analysis of the self-rating scale for children with disabilities ($n=118$), all fourteen included items used met the criteria of goodness-of-fit (Separation 3.76, reliability .93), indicating evidence of internal scale validity. 93.4% of the children demonstrated goodness-of-fit to the model, indicating close-to-acceptable person response validity (Separation 1.44, reliability .67) (Study II).

This Self-rating scale was found psychometrically sound and was significantly correlated with TPA (Study I, II).

5.2.4 Summary on assessing TPA and daily TM

The aggregated results from the studies in this thesis indicate that the items in KaTid, initially defined as time perception, time orientation and time management, all demonstrate acceptable internal scale validity. This is based on the actual goodness-of-fit statistics used in the analysis, and statistically supports a potential unidimensional construct. In this unidimensional construct, time perception, time orientation and time management can be seen as different levels of complexity in TPA rather than as separate constructs.

Both the Parent Scale and the Self-rating scale were found to be psychometrically sound, indicating that the Parent Scale can be used to measure the parents’ estimations of the child’s daily TM. Both scales were significantly correlated with TPA, indicating that the ability measured is related to the TPA of children both with and without disabilities (Study I, II).

5.3 TPA AND DAILY TM IN CHILDREN

The cluster analysis in Study III revealed that the children included ($n=166$) were divided in five significantly different cluster groups. There seem to be at least four typical patterns for children with typical development related to the chronological age of the TD children. The differences in age among members within each cluster, with children with disabilities being significantly older than their TD peers with same pattern
of TPA, indicated a difference in maturity between children with and without disabilities. In addition, the pattern of TPA did not clearly separate children with different diagnoses into different groups. Children with different cluster membership showed differences in daily TM, and the more competent in TPA, the better the parents’ rating of daily TM.
6 GENERAL DISCUSSION

The focus of this thesis was the further development of instruments for assessing TPA (focusing on the constructs measured) and daily TM and investigating differences in TPA and daily TM between children with and without cognitive disabilities. In summarizing the findings of the four studies the following topics will be further discussed; the validity of KaTid and unidimensionality, differing expressions of TPA during childhood, assessing TPA and daily TM, unified use of the concepts TPA and daily TM, the relation between self-rated autonomy, TPA and daily TM. The differences between children with and without disabilities focus on diagnosis, chronological age, and ordinality of developing TPA. First some methodological considerations will be presented and discussed.

6.1 METHODOLOGICAL CONSIDERATIONS

6.1.1 The sample characteristics and generalizability

In this thesis the samples were relatively small. The data collected for studies I and II were further examined and also used also for Studies III and IV, presenting a possibility of bias if the sample is skewed. This is true especially in variable-oriented statistics based on classic test theory. The sample used is mixed, data collections 1 and 2 (see Table 3) are strategic and the rest are convenience samples. In the first two data collections all 5 and 6 year-old children in chosen classes were invited to participate. Pre-schools representative of the socio-economic distribution of the population and located in both rural and densely populated areas were invited. However, the strategic samples contributed to an over-representation of younger children in the TD sample. One of the arguments for including 5 and 6 year-old children in the samples was the opportunity to build upon information from earlier studies of what can be expected from 6 year-old TD children in their understanding of time concepts (Bylholt, 1997). The overrepresentation of younger children in the sample is less crucial in statistics based on IRT-theory than for classical test statistics due to the specific objectivity (see section 1.6.3) (Bond & Fox, 2007). The children in the convenience samples were selected from the caseload of the professionals and cannot be considered representative of all children with cognitive disabilities. The professionals asked for informed consent if the child had one of the included diagnoses, was within the age range and was already in their caseload or had been referred with an issue possibly related to difficulties in TPA or daily TM. They came from both urban and rural areas all over Sweden. The sample may therefore represent children with cognitive disabilities within the defined diagnoses that were referred to OT’s and special teachers at habilitation centres in Sweden during the years of these data collections, but it is not known if the proportions/frequencies of each diagnosis are representative of this population. In the methods used (Rasch models) any sample from the population is assumed to yield equivalent item difficulty calibrations, which partly reduces the threat of bias in this aspect (Snyder & Sheehan, 1992). Studies I, II and IV were based on Rasch models. Also Study IV was initiated to examine possible bias at the item or individual level, and indicated such bias at the item level with minimal impact at the individual level.

The heterogeneity of the participants may also be considered a limitation of this thesis, as children with specific diagnoses/syndromes might be unevenly represented or have a differing pattern of TPA than TD children and/or children with other diagnoses. One reason for evaluating children with different types of disabilities was that children with all these diagnoses have previously been identified as demonstrating difficulties in TPA and/or in daily TM, but only in studies with
homogeneous samples (Barkley, 1997; Davies et al., 2002; A. L. Owen & Wilson, 2006; Peetters & Gillberg, 1999; Segal & Frank, 1998). Thus this is something that the included groups have in common. Another reason was that the relation between autonomy in children and the type and degree of their disability/diagnosis has been low or questionable in earlier studies (Almqvist & Granlund, 2005; Granlund & Björck-Åkesson, 2005). As there have been indications of a relation between self-rated autonomy and TPA/daily TM (Alderman & Janeslått, 2004), the type and degree of diagnosis may not be crucial for predicting TPA or daily TM. Earlier research based on cognitive stage theories has found that young children with cognitive impairments of varied aetiologies and diagnoses (e.g. M. Down, CP, Autism, delayed development) acquire sensorimotor competencies, including cognitive skills, in a sequential manner similar to that of TD children (Dunst, 1998). If this is true also for TPA, the type of diagnosis is of less importance. Also the authors believe that the inclusion of different groups contributes to a new perspective and enriches the development of the instruments. However, there were some indications that the sample of children used in this present thesis was too heterogeneous, indeed an issue worth discussing. In the DIF analysis in study IV, there was a difference between the challenge offered to children with or without disabilities by specific items in KaTid, mainly in the subcategories of Time perception and Time Orientation. This is an indication of measurement bias at item level (Stark & Chernyshenko 2004). It could not totally be excluded that the systematic differences in item skill difficulty may be related to disability and/or diagnosis. In study III, using cluster analysis, there were children with different diagnoses in all five clusters. Still, the analysis with the EXACON module showed significantly more children with certain diagnoses in some of the clusters than would be expected solely by chance. In one cluster (C), the second most skilled group, children with ASD were more frequent. In cluster E, the least skilled group, exceeding one SD less than the mean of the total sample in Time Perception and Time Management, children with double diagnoses (many of them including Asperger Syndrome) were more frequent and TD children less frequent. This could be in line with earlier reported indications that children with autism may not show the same kind of covariance between age and developmental level (Dunst, 1998). A new DIF analysis of data, comparing children with autism with TD children and/or children with other disabilities, might shed some light on this issue.

However, in study IV the secondary analysis resulted in a trivial degree of DIF at the individual level. Even if numerous items exhibit DIF, item level biases can cancel out to produce tests that have little or no bias at individual level (Stark et al., 2004). The results from the DIF analysis demonstrate that the net effect at individual level is of negligible magnitude. The KaTid instrument can thus be used clinically children with or without disability. The clinical relevance of the differences identified in the cluster analysis may be questionable since the number of individuals required to identify the difference indicates only small real life variation compared to the diagnostic group. When, in study III, a control for mass significance (the Bonferroni analysis) was applied, the significance of all combinations of diagnoses and cluster groups disappeared, indicating that there were no distinct diagnosis-specific patterns in the sample. The overall indications are such that the heterogeneity of the participants cannot be considered a major limitation for the research questions used in this thesis.

6.1.2 Use of classical statistics vs. Rasch models

Development of an assessment instrument includes validity and reliability testing of the instruments (Streiner & Norman, 2003). The focus of this thesis is on validation of the instruments, using modern test statistics. The reliability was analyzed using internal
consistency (Cronbach’s alpha) based on CTT theory. The internal consistency for each instrument was acceptable. The alpha value is variable-oriented and dependent on the number of items in the total scale and the magnitude of the correlations among the items, posing a risk of redundancy (Streiner & Norman, 2003). Therefore, the reliability coefficient related to the separation value was also presented in this thesis and contributed preliminary positive indications of the reliability. The KaTid is however a comprehensive instrument of 51 items, and need further analyses of inter- and intra-reliability using Rasch models.

6.1.3 Methodological and ethical considerations on assessment

In studies II and IV some age-related patterns were found. These results must be interpreted with caution as intra-individual development require longitudinal data, and can only be crudely approximated from cross-sectional data (Dunst, 1998).

One particular issue was raised in measuring time management, namely the perceived duration of daily activities. There is, in fact, a clear difference in the duration of some daily activities for children with physical disabilities e.g. in toileting. The manual suggests adaptation of the items at risk, but how this was tackled may have affected the results, possibly resulting in the DIF in the items in subcategory Time perception. This issue, also including inter-rater reliability, needs to be dealt with in more depth.

TPA was related to daily TM as rated by parents and in children with disabilities also to self-rated autonomy. These results indicate conceptual relations that support the construct validity of KaTid. The relations between these measures also indicate that TPA can be used for explaining or interpreting difficulties in daily TM (Study II). Assessments still only provide limited information about everyday functioning. To collect valid knowledge of the everyday functioning in daily TM of a child, it has to be assessed at participation level i.e. in daily life. The Parent scale is a first step towards assessing daily TM as rated by the parent, but there is still a need to develop an instrument for measuring daily TM, preferably self-rating. The self-rating of autonomy measure a broader construct than daily TM does.

During the data collection for this thesis, there have been no incidents related to ethical concerns. The trained raters have chosen not to pose all questions in the self-rating of autonomy in the few cases when it was obvious the child did not understand the statements posed. In one case the assessment with KaTid was not done as the child chose not to participate. No considerations were reported apart from these.

6.2 FURTHER DEVELOPMENT OF INSTRUMENTS

6.2.1 Validity of KaTid and unidimensionality

The results from these studies indicate that the items in KaTid, initially defined as time perception, time orientation and time management, all demonstrate acceptable internal scale validity (here based on the actual goodness-of-fit statistics used in the analysis) and statistically support a potential unidimensional construct, here named TPA (Figure 3). The PCA presented in this thesis indicated a high level of variance explained by measures, further indicating unidimensionality. In this unidimensional construct, the three subcategories can be seen as different levels of complexity in TPA rather than as separate constructs, see Figure II (Study I). The hierarchy of the items and thereby the
level of challenge of each item were in line with previous research concerning time concepts (Bylholt, 1997; E. R. Friedman, 1977; W. J. Friedman, 1990b) and orientation in time (A. L. Owen & Wilson, 2006) indicating that the construct measured is TPA and not something else.

Figure 3: presenting the relation between the key concepts; Time perception, Time orientation and Time management as one construct, TPA, and daily TM.

The statistical analysis of internal scale validity including the PCA, the person response validity and the theoretical base all support unidimensionality of the construct TPA. However, there are some indications of possible bias. In the very first analysis (Study I) ten items were omitted to obtain a scale with full item scale validity. Also the cluster analysis (Study III) and the DIF analysis (Study IV) provide exceptions in the unidimensionality. There might be systematic differences in item skill difficulty related to disability and/or diagnosis. Based on today’s knowledge the difference might be sought in the diagnosis ASD being more frequent in cluster C and E, and indications in earlier reports that children with autism may not show the same kind of covariance between age and sensorimotor level (Dunst, 1998). An alternative would be to seek differences from a disability perspective, with further examination of the children with disabilities in cluster E. However the analyses and theoretical base do provide arguments for unidimensionality in TPA in TD children and among many of the children with cognitive disabilities.

6.2.2 The differing expressions of TPA in different ages of childhood

The results from this thesis indicate that TPA may be unidimensional. The result challenge the common belief that we are more likely to understand the nature of temporal experiences if examining its different facets than by searching for a common core(W. J. Friedman, 1990b). This thesis indicates that the different facets of time might
be due to the skills in TPA varying with age. From birth and in early childhood the existing research is within time perception: integrating the fundamental skill of processing time duration (Kushnerenko et al.; Sambeth et al., 2006) with the temporal order of daily routines and thereby starting to learn the duration of everyday activities (Darcheville et al., 1993; W. J. Friedman, 1990b; Piaget, 2006) including the temporal direction of everyday events (W. J. Friedman, 2002). During preschool years time perception is developed through experiences of daily routines and in reciprocal interaction with parents and important persons (Guralnick, 1997; Lagerberg & Sundelin, 2000; Piaget, 2006; T. D. Wachs, 2000; Zakay, 1992). The parents and significant others manage the time for the child and for the family (Segal & Frank, 1998).

Time orientation - including time concepts (Bylholt, 1997; Iris Levin, 1977; Luria, 1981; Nelson, 2002; Piaget, 2006; Uyanik et al., 1999) and the temporal perspective (W. J. Friedman, 2003; Melges, 1990) is sometimes referred to as educated knowledge of time (Nelson, 2002). During late pre-school or early school years a child usually learns to read the clock and use the calendar (Bylholt, 1997) indicating that learning time orientation usually peaks during early and mid-school years.

Even if this thesis argues that also young children learn time management, the developmental peak of time management is not taking place until teenage years or adulthood. Thus, the expressions of TPA differ in different ages and the daily TM of a child varies in different situations, depending on the activities and also on the context. This makes it very difficult to see TPA as one construct, but does not contradict the arguments for unidimensionality. Even though this thesis argues that TPA could be one construct, the three subcategories Time perception, Time orientation and Time management will be reflected upon next.

6.2.3 Assessing TPA

6.2.3.1 Time perception

There were few items measuring time perception found in the existing instruments (see section 1.5.1), and none of them measured the perceived duration of activities. During this process of instrument development a need to clarify the subcategory time perception in KaTid emerged. The items included measured time sense and perceived duration of events. Items measuring time sense would, according to the IP model (see section 1.3.3) be related to “the clock function”. The measuring of the perceived duration of daily activities related to the reference memory. However, when step-by-step omitting process was implemented in the first study some items did not fit under this subcategory. One of the omitted items, P15, was the only item where the child was asked to estimate time duration in a traditional way by reproducing 10 seconds with a stopwatch (E. R. Friedman, 1977). Another, partly similar item: O28 measuring retrospective time judgement, did not demonstrate acceptable goodness-of-fit either. This indicates that the skill aimed to be measured with these items, prospective and retrospective time judgement i.e. time sense, may not measure the same construct as the other items included in the time perception category in KaTid. There is, however, another possible explanation: In preliminary calculations with only the 6 year-old children (n=61) both item P15 and item O28 did demonstrate acceptable goodness-of-fit. The same two professionals assessed all these children whilst other professionals made later data collections. There are indications that the instructions in the training course and the manual were unclear, leading to possible rater error. In the studies included in this thesis, only the thirteen items in the time perception category that demonstrated goodness-of-fit were included. Thus, in this thesis, the subcategory of time perception includes only
items measuring the perceived duration of activities. Previous research has shown that children with ADHD and ASD demonstrate skills regarding time sense that are functionally different from those seen in typically developing children of the same age (Peeters & Gillberg, 1999; Smith et al., 2002; Szelag et al., 2004; Wing, 1996). The results of this thesis confirm that children with disabilities, such as ADHD, ASD and ID might have difficulties not only in time sense but also in the perceived duration of activities. Further studies of time perception within a developmental framework are needed to clarify this issue.

Most of the least able 5 and 6 year-old TD children managed the items in time perception and also one of the items placing pictures in temporal order, confirming that young children usually have a general knowledge of the duration and temporal order of daily activities (Bylholt, 1997; E. R. Friedman, 1977; W. J. Friedman, 1990b). This result highlights the level of TPA acquired among TD children even before they have learned to read the clock. The methods for promoting TPA used today focus mainly on how to learn time concepts and to tell the time (Nelson, 2002). Perhaps these results and this instrument reveal opportunities to develop methods of promoting time perception – in a playful way – by comparing the duration of different activities. Children learn to process time information in interaction with the family and significant others (Adler & Holmgren, 2000; Guralnick, 1997; A. L. Owen & Wilson, 2006; Piaget, 2006; T.D. Wachs, 2000). Therefore this thesis suggests a possibility to develop methods for promoting TPA that can help parents and significant others to promote TPA in children already at pre-school age.

6.2.3.2 Time orientation

Adults with ID commonly demonstrate problems in everyday life related to time orientation (e.g. using information about hour/date/week/month) and time management (e.g. knowing when and for how long to perform an activity) (Davies et al., 2002). The results from this thesis confirm that this is also applicable to children with ID (A. L. Owen & Wilson, 2006). In the cluster analysis (study III), cluster A, a low performing group, contained children with all different diagnoses but also more children with ID than would be expected solely by chance. This cluster seemed to perform lower than expected in Time orientation. One reason might be the low mean age of this group; it is known that knowledge in time orientation usually is learned at school but it cannot be excluded that the higher frequency of children with ID might contribute to the differing pattern. When controlling for mass significance this pattern did however disappear. Children with all types of disabilities included have similar patterns of TPA, indicating that children with ADHD and ASD also have difficulties in time orientation compared to their TD, as part of a delayed pattern of TPA.

6.2.3.3 Time management

No items measuring time management were found in the existing instruments (see section 1.5.1). One possible reason might be that the skill is not expected in children at all as “higher-level cortical functioning” (e.g. planning, impulse control, rapid problem solving and time management) is not expected to be functioning and measurable until the frontal lobes of the brain complete their development in adolescence and the person is tasked with those age-level expectations” (Woods et al., 2000). The lack of instruments measuring time management might also be a reason for the sparsity of knowledge in this area. This thesis shows that the skills of ordering events in chronological sequence and allocating amounts of time to events and activities, and
learning what tasks to do, when to do them and for how long, are processed already among children at ages 5 - 10. The KaTid offers a first option to assess time management as part of TPA in children. This opens up possibilities to gather new knowledge of what can be expected in these ages, possibilities for promoting and, if needed, for supporting children at risk of delayed time management development when related to problems in daily TM.

6.2.4 Assessing daily TM

No existing assessments for measuring daily TM were found in the first literature search (see section 1.5.1); possibly due to difficulties in knowing what daily TM really is in children. Time problems might occur in any daily situation when one needs to know when and for how long (duration) to perform an activity (Granlund et al., 1995). Also, because of the dependence on environmental factors, the daily TM of a person with cognitive disability will vary depending on the complexity and context of the activity. Considering that time itself is suggested to be one of three theoretically fundamental contexts (temporal, physical and social) (Kielhofner, 1980), most everyday situations require time management, which indicates the challenge of designing a comprehensive instrument. The Parent Scale was constructed based on the literature available and includes a limited number of everyday situations where skills in TPA are assumed to be needed. The Parent scale is, de facto, estimations made by the parents. They base their ratings on previous experiences of children’s time management in daily life (for example with siblings) and their frame of reference as well as what they allow the child to do. Thus other factors than children’s observed daily TM may have an impact on what ratings they assign.

The psychometric properties of the Parent Scale were generally acceptable. The children’s levels of TPA as measured by KaTid were related to the children’s daily TM as rated by parents. The more skilled in TPA, the more able a child is in daily TM, regardless of whether s/he has a disability or not. The results indicate that the construct measured by KaTid is relevant for the daily TM of children. In other studies of the relation between cognitive functions and everyday functioning it was argued that the relation between cognitive skills and everyday activity is weak. Kielhofner (2004) suggested that if instruments are developed and used in research that measure perceptual and cognitive ability (e.g. TPA) that conceptually are linked to occupational tasks and contexts (e.g. daily TM) one might find stronger relations between impairment level and everyday functioning. The second study in this thesis does show a relation of at least moderate strength between TPA and daily TM, in line with this suggestion.

The univariate regression analyses (Study II) indicated that the parent rating of children’s daily TM was the strongest predictor for TPA, explaining 26% of the variation in TPA. In the backwards regression analysis parent ratings had almost as strong predictive power as age. Possibly, in this sample of children with disabilities, the child’s age and level of TPA are both of importance for daily TM. The results support the idea that difficulties in TPA affect the children’s daily life, possibly in a way that is not generally appreciated by people around them (A. L. Owen & Wilson, 2006; Peeters & Gillberg, 1999). Also, the context for children varies particularly with age possibly reinforcing problems for children with delayed development in TPA.
6.2.5 Unified use of the concepts TPA and daily TM

One initial problem was to find a valid base for the new assessment, due to lack of consensus surrounding concepts and definitions (Christiansen, 2005). One contribution of this thesis is therefore the effort to operationalize the ICF-CY concepts of time empirically, both on a body function and an activity/participation level. Having one method for assessing time perception, time orientation and time management, the KaTid, and the Parent scale for daily TM, actually gives the professionals a unified language to use when communicating with the parents about TPA and daily TM (Lollar & Simeonsson, 2005; Simeonsson et al., 2006). Many of the trained raters report that after using this assessment instrument, new and better-informed discussions take place. This can also contribute to improving communication used within the family, and between parents and significant others. With everybody using unified concepts of time, we open up for describing present skills in TPA and the daily TM of the child, setting concrete and reachable goals and discussing and planning how to reach the goals. The relation between TPA and daily TM emphasizes the importance of the context and is in line with recent studies stating that the context is crucial for a child’s skill development (in this thesis skills in TPA) and for learning how to manage time in his/her everyday life. This, in turn, leads to parents and significant others needing knowledge about how to promote/support the child to make development possible. Using concepts of TPA and daily TM in a unified way may also bring new opportunities to develop knowledge of daily TM and could contribute to improving the coordination of health services for children with restrictions in daily TM.

6.2.6 The relation between self-rated autonomy, TPA and daily TM

How children with disabilities perceive their autonomy is, in this thesis, related to their TPA. In TD children no such relation was found (Study I). The different results may be explained by the sample, the participants with disabilities being older than the participating TD children. They have lived with a certain level of TPA for a longer time than their TD peers, and are thus more able to estimate TPA demands for autonomous acts than TD children. The relationships between self-rated autonomy, children’s TM and TPA indicate that when TPA matures with age and/or intervention, the autonomy of the child may also be affected.

The Self-rating scale and the Parent scale seem to measure related but separate constructs of time management in daily life. The moderate correlation, as well as the regression analysis, indicates that there are also other factors involved, and the two scales - together with the KaTid - supplement each other, underlining the advantages of collecting information from all these sources for optimal intervention planning.

6.3 COMPARING CHILDREN WITH AND WITHOUT DISABILITIES

The second overall aim was to investigate differences in TPA and daily TM between children with and without cognitive disabilities. There was no previous research about TPA including both TD children and children with different diagnoses.

In study III, a cluster analysis identified five different patterns, based on subcategories of TPA, among children with and without disabilities. There were children with different types of diagnosis in all five clusters, which indicates that diagnosis is not a strong predictor of functioning in TPA. This constitutes new
knowledge and is of great interest also when discussing the strategy of using heterogeneous groups of participants with varied aetiologies and diagnoses.

There seem to be four typical patterns for TD children. The patterns of TPA seem to be congruent with the chronological age of the TD children, one pattern for 5 year-olds, one for 6 year-olds, one for 7½ year-olds and one for 9 year-old TD children. These clusters differ both in profile form and profile level, indicating increasingly complex levels of TPA. The results seem congruent with other studies, research in time concepts describing when children usually acquire time concepts in relation to their chronological age (Bylholt, 1997; Nelson, 2002). Children are normally exposed to and process certain stimulation at a given age period and in a given temporal sequence (T. D. Wachs, 2000). Earlier findings support research on TPA based on Rasch analysis, indicating that there is a relation between the chronological age of a TD child and TPA, i.e. that TPA matures with age (Study I) and that subcategories should be seen as levels within TPA rather than functionally different aspects of TPA. There is evidence that children without disabilities are developing at least sensorimotor skills in a predictable sequence, with a high correlation between different domains and the chronological age of the child (Hodapp, 1998). Thus, the developmental processes of children with and without disabilities seems more similar than different (Dunst, 1998). The results of this thesis indicate that the subcategories can be seen as levels within TPA rather than functionally different aspects of TPA. However, this conclusion must also be confirmed in studies using a longitudinal design.

The group of children with diagnoses in each cluster was significantly older than the TD children in the same cluster, indicating that they have a lower level of TPA compared to their peers of the same age. This is in line with a study by Forer and Keogh (1971). Boys with serious school learning problems had less mastery of cognitive and perceptual aspects of understanding time (items described as similar to Time perception and Time orientation) than TD children of comparable age and IQ. The boys functioned equivalent to TD children three grades below them in time understanding. Also in Study III, it generally seems that having a diagnosis is related to lower daily TM. It is possible that this is an indication of the similar sequence hypothesis which predicts that children with disabilities develop more slowly than, but in the same sequence as, those without disabilities (Hodapp, 1998). Earlier studies focus was mainly on children 0 – 2 years of age. The correlations between sensorimotor domains and chronological age were strong in these young children, but seemed to decrease in older children, becoming low after 11 years of age. The children in this thesis were aged 5 – 10, and perhaps the children of these ages have a wider variety of development of TPA. The cluster analysis revealed different patterns of TPA among the children in the sample. They shaped five distinctly and significantly separated profile groups with an acceptable explained variance, generalizability and homogeneity coefficient. The results of Study IV reveal that the item hierarchy is the same or similar for children with and without disability in only 70% of the items. Still, a vast majority of the previous studies examined had found that young children with quite varied aetiologies and diagnoses for their disabilities (e.g. M b Down, CP, delayed development) acquire sensorimotor competencies in similar stages to those of TD children, with the form of progress across time being very similar. Children with autism were an exception with a partly different typical developmental order. In Study III, children with ASD were more frequent in one cluster (C) and in another cluster (E) children with double diagnoses, many of them including Asperger Syndrome were more frequent. According to the theories of Piaget, a child needs to master one stage before moving to the next one even though there might be an individual variety within a stage (Dunst, 1998). It is not known whether the differing items in the
results of this DIF analysis are still within the same developmental stage, as discussed by Piaget. There is a need for further research into the developmental order of TPA as intra-individual development requiring longitudinal data, since it can only crudely be approximated from cross-sectional data (Dunst, 1998).

One pattern of TPA in the cluster analysis (Study III) was rare for TD children; the children in this pattern perform lower, are delayed by at least one year in all subcategories compared to all other children and seem to have severe difficulties in both time perception and time management (Study III). According to Wachs (2000) the impact of deviations from time-locked temporal sequences varies but when deviations do occur for sub elements of a larger biological system, then the consequences are likelier to be negative. The extent of the detrimental outcome from the age-linked developmental sequence is related to how the deviation is viewed by the context (ibid).

When the gap increases between a child with time-processing difficulty and his/her peers of the same age, observed as maintained dependence of others in daily TM whilst peers become more independent, the acceptance might vary. The bigger the gap is between a child with problems in daily TM and his/her peers the bigger the gap will be between the ability of the child and the expectations from the context, leading to an increased probability of the child being considered deviant. The increasing problems in daily life are defined in different ways depending on many factors e.g. a child with previous problems in attention and an intensive personality may develop behavioural problems. If the child is already dependent e.g. a child with physical disability, the gap to peers of the same age may not be as obvious (Donlau & Falkmer, Submitted; Lagren & Wolf, 1998; Svensson, 2003). If the deviations are viewed as expected and acceptable, it is likely the context will adapt to giving the child extra support, or at least maintain the support given, instead of withdrawing and giving the child the opportunity to experience and process new situations.

Many children with cognitive disabilities seem to develop TPA in the same or similar order as TD children. The correlation between TPA and age is one argument for this conclusion. Also in children with disabilities the age of the child explained 22.6% of the variation in TPA. In a backwards regression analysis the child’s age and parent ratings contributed most to the explained variance. The hierarchy of item difficulty was same or similar in 70% of the items for children with disability as for those without. It is not known whether some or all of the differing items are still within the same developmental stage (as suggested by Piaget). Still one cannot exclude the possibility of exceptions from this pattern, possible exceptions being children with one particular type of disability (e.g. children from cluster E) or children with one diagnosis like ADHD/Asperger Syndrome.

In general, this thesis suggests that TPA may be one and the same construct, for TD children and for many of the children with cognitive disabilities, indicating that the development of this ability is really an ongoing process from birth through early into late childhood with differing expressions over time. The integration of time sense and learning time perception, exemplified by the duration of time within daily routines being necessary for acquiring time orientation etc., means that one subcategory builds upon the other. A lot of effort is often placed on learning to tell time from a clock. In Sweden children often get their first watch when starting school and the first wrist-watch is a symbol for a shift to a new developmental stage (Figure 4). Still, telling time from a clock is only the very first step in a complex cognitive process needed to use the information gained from the clock, in everyday situations (Figure 5) and for events that occur more seldom (Moyer 1983).
In children with ADHD, one intervention method used commonly, and considered effective, is structuring the day (M. Owen, 2001). Also in children with ASD and ID, structuring the activity or the day is used as an intervention, often involving pictures to make the temporal order of the activities more concrete (Davies et al., 2002; Newman et al., 1995). This thesis may provide the missing link to explain why such interventions are in fact effective. Structuring the activity or the day actually supports time orientation and can compensate for difficulties in TPA. Structuring the day with pictures or time aids facilitates daily TM for children with time processing difficulties. The indications that training in organizational skills helps children with ADHD are further evidence in that direction (Langberg & al., 2008). Some children develop into skilled college students who can manage their time and adapt to changes in our western time-dependent society. Others, including some of these children with cognitive disabilities, are at risk and may benefit from the early promotion of time perception in preschool to acquire the basis for TPA, such as knowing the differences between the duration of everyday activities. Children with cognitive disabilities, who have problems in daily TM, need support, and in this intervention process the new model for assessing daily TM and TPA will be useful.
CONCEPTUAL CONSIDERATIONS

The parent scale was aimed at measuring daily TM, in this thesis equalized to the ICF concept managing one’s time. Most items of the Parent scale can be defined according to this definition but there is a need for some conceptual considerations. In ICF-CY both the concepts of time at activity/participation level; managing one’s time and adaptation in time are classified under Carrying out daily routine. The difference between the two concepts is not clear. The definition of managing one's time “Managing the time required to complete usual or specific activities” indicates both usual activities, such as those in daily routines, but also specific activities (i.e. seldom or rarely occurring activities) thus not in daily routines. Adapting to time demands in daily life is defined as “carrying out actions and behaviours appropriately in the required sequence and within the time allotted, such as running to the station when in danger of missing the train”.

Adaptation is a concept closely related to the context (P. Arvidsson et al., 2008). Adaptation to the context of time means that a change in behaviour is needed to adapt in the context of time; either to hurry up or to change your course of action in the time left until the deadline. In the Parent scale three items could be within this definition of adaptation to time; stable daily rhythm/sleep (F1) and problems adjusting the level of activity to time, like waiting (F6, F11). These activities are special also from an occupational perspective. Sleep itself cannot, if using that definition, be considered as an occupation, since it represents an unconscious process that cannot be influenced and cannot engage a person (Persson et al., 2001). Sleep was one of the “big four” occupational forms supporting the daily rhythm, identified by Meyer (1922/1977): Work, play, rest and sleep. Later categorizations of occupational form are basically variants of those four, with one exception. Sleep (and to a certain extent, rest) have diminished in importance and self-care and activities of daily living (ADL) are currently part of how OT is conceptualized (Jonsson, 2008). Waiting is by definition a non-activity, a period of time between two activities. Both sleep rhythm and waiting are frequently described as problematic in children with impairments in time sense/time perception. Children with ASD often exhibit limitations in daily rhythm/sleep problems (Wimpory et al., 2002). Difficulties in time perception have been assumed to be connected to difficulties in adjusting activity level to the specific context (e.g. problems in waiting) (Barkley, 1997; Segal & Frank, 1998). Both these situations are included in the Parent scale, suggested for measuring daily TM, and are possibly both aspects of adapting to time, perhaps indicating that focus on occupation is not sufficient when adaptation to time is needed.
CONCLUSIONS AND CLINICAL IMPLICATIONS

The findings of this thesis have clinical implications, primarily concerning children with cognitive disabilities and problems in daily TM. As the context is crucial for the daily TM of a child this thesis will also have implications for the parents and significant others as well as for the professionals working with these children and their families. The conclusions of Studies I-IV will be addressed according to the two aims; further development of instruments for assessing TPA and daily TM in children, focusing on the construct measured, and investigating differences in TPA and daily TM between children with and without cognitive disabilities.

- The findings from Studies I-II and this thesis suggest that there is now an instrument, the KaTid, with acceptable psychometric properties. The instrument can be used for assessment of the individual level of TPA, for children with or without cognitive disability. The results have positive clinical implications. Professionals - OT’s, psychologists and teachers - may benefit from a validated instrument that can generate linearized estimates of TPA from children. The relation between TPA and daily TM indicate that the construct measured by KaTid is relevant for the daily TM of the child as rated by the parents, and can be used for defining possible causes of problems with managing time in daily life.

- The findings from Study IV indicated bias at item level of the KaTid, possibly due to some disability or diagnosis like physical disabilities or ASD. The following analysis resulted in a trivial degree of differential functioning at individual level indicating the instrument can be used for children with or without disabilities.

- The instrument KaTid includes items in time perception (measuring the child’s perception of duration of daily activities), in time orientation and in time management for children, earlier considered as at least three different constructs of time. Based on the results of these studies and the preliminary PCA, TPA is now in this thesis suggested to be a unidimensional. It indicates that the development of this ability is an ongoing process during childhood with differing expressions over time in childhood.

- The findings from Studies I-II suggest that the Parent scale has the potential for valid assessment of a child’s daily TM, useful in clinical and research work for children with or without cognitive disability. Children with problems in daily life, possibly related to TPA, and their families, may benefit from the professionals’ use of evidence-based instruments for a clarification of the cause and explanation of these problems.

- The findings from Studies I-II suggest that when TPA matures with age and/or intervention also the self-rated autonomy of the child may be affected in a positive direction.

- The findings from Study II suggest that TPA as a factor related to children’s daily TM, need to be taken into account when planning and evaluating interventions which are designed to facilitate everyday functioning for children.
needs unmet may threaten their rights to be active participants in family, school and community life.

This thesis has thus contributed a new model for assessing TPA and daily TM usable for children. The three instruments KaTid, Parent Scale and the Self-rating scale all complement each other, underlining the advantages of collecting information from all these sources. This is a step towards evidence-based instruments that, together with other information, can help the professional in structuring the intervention planning process for children with difficulties in daily TM. This model for assessment can contribute to a unified language for communicating with the parents about TPA and daily TM. This model of assessment will be of value for further exploration of daily TM and may reveal possibilities for new methods in promoting and supporting TPA and daily TM.

• The findings from Study II-III suggest that the chronological age of the child and the level of TPA are both of importance for the daily TM of a child. Also, there might be a difference between children with and without cognitive disability in their level of TPA and in chronological age, indicating that children with disability might have a pattern of TPA and level of daily TM comparable to TD children 1 – 3 years younger. If so, this difference might lead to heightened dependence on others and need for support, exacerbating their inferior role and vulnerability. Thus these studies inform practitioners about the need to pay attention to the TPA of children with disabilities, there might be a need for early intervention – in time.

• The diagnosis is not a strong predictor of functioning in TPA, and in general the level of TPA seems to be a more valid base for planning interventions than the type of diagnosis (Study II). This conclusion may indicate that methods developed for children with one diagnosis e.g. training organizational skills, might be just as effective for children with another diagnosis as long as daily TM is in focus. It opens up for a wider range of possible interventions and indicates the importance of individually tailored plans of intervention.

• Time aids have been proved effective for decreasing problems with time management in everyday life for adults and youth with ID. (Davies et al 2002; Granlund et al 1995; Granlund 1996). This thesis confirms that children with disabilities such as ADHD, ASD and ID may have difficulties not only in time perception/time sense, but also in perceived duration of activities, in time orientation, time management and daily TM. They would thus also probably benefit from being provided with time aids.

Finally, this thesis informs our practitioners of the importance of addressing the issue of TPA and daily TM, aiming at increasing daily TM and autonomy in children with cognitive disabilities. It is time for time!
7.1 FUTURE STUDIES

There is a continuing need to examine the utility of the KaTid and the Parent scale in planning and documenting the effectiveness of interventions for children with difficulties in daily TM. There is also a need for a new self-rating instrument for assessing daily TM. Further research is needed to examine inter and intra-reliability, and whether there are differences in TPA related to specific diagnoses or other child characteristics.

There is also a need to further investigate the developmental order of TPA, longitudinal studies to investigate if the developmental sequence is according to the stages identified by Piaget.

More research is needed to clarify if the ICF-CY concepts of managing one’s time and adapting to time are separate constructs.
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9 REFERENCES


