Participation and ICT

Students with Special Educational Needs in Upper Secondary School

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When a flower doesn´t bloom you fix the environment in which it grows, not the flower.

Alexander Den Heijer

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ABSTRACT

Introduction: The use of information and communication technology (ICT) has been highlighted over the past 20 years as a promising accommodation to improve participation in school activities among students with special educational needs (SEN). However, evidence is still needed. In addition, little attention has been given to students opportunities for participation in school activities, their need for and access to support in school activities among students with SEN in upper secondary education.

Aim: The overall aim of this thesis was to increase knowledge about the participation in school activities of students with special educational needs in regular upper secondary education before and after they received an ICT intervention, and subsequently their participation in productive occupations.

Methods: This thesis comprises four studies in which secondary data from a sample of students with SEN in upper secondary education that had received an ICT intervention was used. Secondary data of students was retrieved from two intervention projects in which school personnel identified students with SEN based on the following criteria: difficulties in achieving educational goals, or completing school assignments and/or high levels of school absence. The first study included secondary data for 509 students with SEN who had given written informed consent to participate in the research. Of these, about forty percent did not have any educational support at inclusion. Based on the pool of 509 students, study-specific criteria was applied in three successive studies. Study I was a psychometric evaluation of the assessment instrument the School Setting Interview (SSI), which measures the student–environment fit and identifies students' potential need for support in 16 school activities. Rasch analysis was used to examine the targeting, model fit, functioning of items and response categories, and unidimensionality of the SSI scale. Study II used descriptive statistics to examine the perceived need for, and access to, support in school activities among 484 students. In addition, a logistic regression analysis was applied to identify factors associated with students who perceived a need for support in school activities to the highest extent.

   In study III, the influence of an individualised ICT intervention on participation in school activities was evaluated among 300 students with SEN. Descriptive statistics were used to analyse students SSI assessments before

and after the intervention, their school attendance, and pass grades. A Wilcoxon's signed-rank test and a t-test investigated differences in support needs and the interval measure of student–environment fit, generated via Rasch analysis, before and after the ICT intervention. Chi-square analyses and t-tests were performed to investigate differences between students who had and had not achieved a significant improvement in student–environment fit after the intervention.

Study IV applied an embedded mixed-methods approach. Participants who had agreed during study III to be contacted one year after upper secondary education (n = 244) received a questionnaire to investigate their participation in productive occupations. Eighty-one answered the questionnaire. In addition, 20 participated in a semi-structured interview using the Swedish version of the Worker Role Interview (WRI) to investigate their perceived work ability. Data from the questionnaire and the participants' WRI ratings were analysed using descriptive statistics, and group comparisons were performed between participants who were and were not established in productive occupations. Written notes from the WRI rating forms were analysed using a deductive content analysis.

Findings: The students with SEN perceived a need for support in several school activities (*Mdn* 7) and were rarely satisfied with the support that the school had provided (study II). It was demonstrated that the academic school activities: Remember things, Write, Do homework, Read and Take exams, in which more than two-thirds of the students perceived a need for support, were in need of most improvements to promote students' participation. Study II further showed that students with a high level of school absence, enrolled in a vocational programme or with a neuropsychiatric disorder were those who perceived the greatest need for support in school activities.

The psychometric evaluation of the SSI in study I provided support for the construct validity of the SSI for measuring the student–environment fit among students with SEN in upper secondary education. Furthermore, the analysis revealed that the rating categories of the scale did not function as intended which led to a post hoc categorisation of items with disordered thresholds in Study III in order to obtain reliable measurements of student–environment fit before and after the ICT intervention.

Study III showed that an individualised ICT intervention, including computer, tablet and/or smartphone with software, and services to use the ICT as support in school activities, increased the student–environment fit. After the intervention, the decrease in students' support needs and improved student–environment fit were found to be statistically significant

with large effect sizes. Just over half of the students had increased or maintained their school attendance and obtained pass grades in all the courses in which they were enrolled in English, Mathematics and Swedish. The ICT intervention proved to be most beneficial for students who experienced fewer than the median number of support needs in school activities (*Mdn* 6), who had been without previous support in school and for students with pass grades.

One year after upper secondary education, almost two-thirds (63%) of the participating 81 former students with SEN were either working or enrolled in further studies. The group that was established in work or further studies had obtained pass grades in all subjects to a greater extent and had received time-assisting ICT to a lesser extent during the intervention in their upper secondary education than the group that was not established (study IV). The former students with SEN believed in their work ability and were optimistic and motivated about future work or studies. During the process of finding and obtaining a productive role as an employee or student, the participants perceived social support from friends and family.

Conclusion: This thesis demonstrated restricted participation in several school activities among the students with SEN in upper secondary education and students were rarely satisfied with the support that the school had provided. Findings indicated that the academic school activities: Remember things, Write, Do homework, Read and Take exams were in need of most improvements to promote participation among students with SEN. Attention should also be given to identifying the need for support in school activities among students with a high level of school absence, enrolled in vocational programmes or with a neuropsychiatric disorder. In this process, the SSI can be used as a valid assessment instrument. An individualised ICT intervention has the potential to provide students with SEN better opportunities to participate in school activities. Findings also indicated that the former upper secondary school students with SEN who had received an individualised ICT intervention had belief in their work ability.

Keywords: Accommodations, assessment, education, environment, information technology, occupational therapy, rasch analysis, school activity, support, work

SAMMANFATTNING PÅ SVENSKA

Titel: Delaktighet och IKT: Elever i behov av stöd i gymnasieskolan

Bakgrund: En godkänd gymnasieexamen är ofta en förutsättning för ungdomars möjlighet att etablera sig på arbetsmarknaden eller för att studera vidare. Ungdomar som inte lyckas etablera sig i arbete eller vidare studier löper ökad risk för ohälsa. Gymnasieelever som har behov av stöd i skolaktiviteter tar i lägre utsträckning gymnasieexamen. Elever som av olika anledningar har svårt att nå kunskapsmålen är berättigade adekvata stödinsatser för att stimulera deras lärande och utveckling. Kunskapen om gymnasieelevers behov av och tillgång till stöd i skolaktiviteter är dock begränsad. Dessutom saknas det valida och reliabla bedömningsinstrument för att identifiera elevers behov av stöd i skolaktiviteter och för att utvärdera stödinsatser som syftar till att öka elevers möjlighet till aktivitet och delaktighet. Informations- och kommunikationsteknik (IKT) har under de senaste 20 åren lyfts fram som en möjlig och lovande stödinsats för att möjliggöra ökad delaktighet i skolaktiviteter och ge elever i behov av stöd bättre förutsättningar att nå kunskapsmålen. Forskning saknas dock kring vilken påverkan användning av IKT i skolaktiviteter kan ha för elevers delaktighet. Dessutom efterfrågas longitudinell uppföljning av deltagande i arbete och vidare studier bland elever som erhållit stödinsatser under sin gymnasieutbildning.

Syfte: Det övergripande syftet med denna avhandling var att öka kunskapen om delaktighet i skolaktiviteter för gymnasieelever i behov av stöd innan och efter de erhöll en IKT-intervention, och sedermera elevernas deltagande i arbete och vidare studier.

Metod: Avhandlingen består av fyra delstudier där undersökningsgruppen utgörs av gymnasieelever i behov av stöd som sedan tidigare deltagit i två interventionsprojekt. I projekten blev eleverna identifierade av skolpersonal utifrån deras svårigheter att nå utbildningsmål, genomföra skoluppgifter och/eller hade hög skolfrånvaro. Eleverna erhöll en IKT-intervention som stöd i skolaktiviteter. I avhandlingens första studie inkluderades sekundärdata för 509 elever i behov av stöd som gett skriftligt informerat samtycke till att delta i forskning. Av dessa hade cirka 40% inte erhållit något stöd i skolan sedan tidigare. Dessa 509 elever utgör basen för de efterföljande tre studierna som tillämpade studiespecifika kriterier. Studie I var

en psykometrisk prövning av bedömningsinstrumentet Bedömning av Anpassningar i Skolmiljön (BAS). BAS syftar till att undersöka i vilken grad förutsättningarna i 16 vanliga skolaktiviteter överensstämmer med elevens förutsättningar (student–environment fit), och identifierar elevens eventuella behov av stöd i skolaktiviteter. Data analyserades med Rasch-analys för att undersöka hur väl BAS fångar målgruppens behov av stödinsatser i skolaktiviteter, hur ingående variabler och skattningsskalan fungerar samt huruvida BAS mäter det som instrumentet avser att mäta. I studie II användes deskriptiv statistik för att undersöka 484 elevers upplevda behov av stöd i skolaktiviteter och deras tillgång till adekvat stöd för kunna delta i skolaktiviteter. Dessutom tillämpades en logistisk regressionsanalys för att identifiera faktorer som var associerade med elever som upplevde behov av stöd i många skolaktiviteter.

Studie III syftade till att undersöka om en individuellt utformad IKT-intervention inverkade på 300 elevers delaktighet i skolaktiviteter. Deskriptiv statistik användes för att analysera elevernas BAS-bedömningar före och efter intervention, deras skolnärvaro och godkända betyg. Skillnad i antal upplevda behov innan och efter intervention undersöktes med Wilcoxons teckenrangtest. T-test genomfördes för att jämföra elevernas student–environment fit, genererad via Rasch-analys, före och efter intervention. Chi-två-test och t-test genomfördes för att undersöka skillnader mellan elever som hade, och inte hade, uppnått en statistiskt signifikant förbättrad student–environment fit.

I studie IV kontaktades 244 deltagare, som i studie III accepterat uppföljning ett år efter gymnasiet, i syfte att undersöka deras deltagande i arbete och vidare studier samt deras upplevda arbetsförmåga. Data samlades in via ett frågeformulär (n=81) och semistrukturerade intervjuer (n=20) där den svenska versionen av instrumentet the Worker Role Interview (WRI) användes. Formulärdata och deltagarnas WRI-skattning analyserades med deskriptiv statistik och gruppjämförelser genomfördes mellan deltagare som var och inte var etablerade i arbete eller eftergymnasiala studier. Skriftliga anteckningar från de 20 WRI-sammanställningsblanketterna analyserades med en teoriguidad (deduktiv) innehållsanalys.

Resultat: Eleverna upplevde behov av stöd i flertalet skolaktiviteter (median=7) och bristfällig tillgång till tillfredsställande stödinsatser (studie II). Mer än två tredjedelar av eleverna upplevde behov av stöd inom akademiska skolaktiviteter: Komma ihåg saker, Skriva, Göra läxor, Läsa och Göra prov. I dessa skolaktiviteter hade endast en liten andel elever (4-24%) erhållit stödinsatser som de ansåg var tillfredsställande och majoriteten hade inte erhållit något stöd alls. Studie II visade att hög skolfrånvaro, att gå ett yrkesinriktat gymnasieprogram eller att ha en neuropsykiatrisk diagnos var associerat med att uppleva behov av stöd i många skolaktiviteter.

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Den psykometriska prövningen av BAS visade att bedömningsinstrumentet uppvisade validitet för att mäta student–environment fit bland gymnasieelever i behov av stöd. Vidare upptäcktes att skattningsskalans kategorier inte fungerade som tänkt, vilket ledde till en bearbetning av kategorierna i studie III för att erhålla reliabla mätningar av student–environment fit före och efter IKT-interventionen.

Studie III visade att en individuellt utformad IKT-intervention, innehållandes dator, surfplatta och/eller smart telefon med anpassade mjukvaror och stöd för att använda tekniken i skolaktiviteter, ökade elevernas student–environment fit. Efter interventionen upplevde de 300 eleverna statistiskt signifikant färre behov av stöd i skolaktiviteter och statistiskt signifikant högre student–environment fit. Drygt hälften av eleverna hade ökat eller bibehållit sin skolnärvaro och fått godkända betyg i samtliga kurser i engelska, matematik och svenska. IKT-interventionen visade sig vara mest fördelaktig för elever som upplevde något färre antal behov av stöd i skolaktiviteter, som inte hade stöd i skolan innan IKT-interventionen och för elever med godkända betyg.

Ett år efter gymnasiet hade nästan två tredjedelar (63%) av de deltagande 81 före detta eleverna etablerat sig i arbete eller vidare studier. Gruppen som etablerat sig i arbete eller vidare studier hade i större utsträckning godkända betyg och hade i mindre utsträckning erhållit tidsassisterande IKT under gymnasiet. I den kvalitativa analysen framkom att de före detta eleverna hade tro på sin arbetsförmåga, de var optimistiska och motiverade i relation till framtida arbete eller studier. De upplevde att de hade stöd från vänner och familj i processen att etablera sig i en produktiv roll och i att upprätthålla den.

Slutsats: Avhandlingen visade att gymnasieelever i behov av stöd upplever begränsad delaktighet i flertalet skolaktiviteter och att de sällan har erhållit anpassningar som de är nöjda med. Resultaten indikerade att skolmiljön främst i akademiska skolaktiviteter behöver förbättras för att främja delaktighet bland gymnasieelever i behov av stöd. Behov av stödinsatser var störst bland elever med hög skolfrånvaro, i yrkesinriktade program eller med neuropsykiatrisk diagnos. Dessa elevers behov av stöd bör uppmärksammas och utredas. I enlighet med avhandlingens fynd kan BAS användas för att ta fram valid information om behov av stöd i skolaktiviteter, varpå stödinsatser kan planeras och utvärderas för att öka elevers delaktighet i skolaktiviteter. Avhandlingen visade att en individuellt utformad IKT-intervention kan öka delaktigheten i skolaktiviteter för elever i behov av stöd i gymnasieskolan. Resultaten indikerade också att elever som upplevt behov av stöd i gymnasieskolan och som erhållit en IKT-intervention hade tro på sin arbetsförmåga.

LIST OF PAPERS

This thesis is based on the following papers, which will be referred to in the text by their Roman numerals.

I.   Yngve, M., Munkholm, M., Lidström, H., Hemmingsson, H., & Ekbladh, E. (2018). Validity of the school setting interview for students with special educational needs in regular high school–a Rasch analysis. *Health and Quality of Life Outcomes*, 16(1), 12.

II. Yngve, M., Lidström, H., Ekbladh, E., & Hemmingsson, H. (2019). Which students need accommodations the most, and to what extent are their needs met by regular upper secondary school? A cross-sectional study among students with special educational needs. *European Journal of Special Needs Education*, 34(3), 327-341.

III. Yngve, M., Ekbladh, E., Lidström, H., & Hemmingsson, H. Information and communication technology to improve school participation for students with special educational needs. [Manuscript submitted for publication].

IV. Yngve, M., Lidström, H., Hemmingsson, H., & Ekbladh, E. Productive occupations and perceived work ability among former students with special educational needs one year after regular upper secondary education: A mixed methods study. [In manuscript].

ABBREVATIONS

ADHD	Attention deficit hyperactivity disorder
AOTA	American Occupational Therapy Association
DIF	Differential item functioning
ICF	International Classification of Functioning, Disability and Health
ICT	Information and communication technology
MOHO	Model of Human Occupation
SEN	Special educational needs
SNAE	Swedish National Agency for Education
SSI	School Setting Interview
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization

INTRODUCTION

Participation in education and work is considered important in relation to an individual's health and wellbeing (AOTA, 2014; WHO, 2001; Wilcock & Hocking, 2015). In Sweden, children and young people must attend compulsory school for ten years beginning in the year they turn six (The Education Act, SFS, 2010:800). Thereafter, upper secondary education is voluntary; however it is considered a basic qualification for successful establishment on the labour market and enrolment in further studies.

Young people's right to full participation in education and work is promoted in Swedish government policy (Prop. 2016/17:188). However, environmental aspects of their school experience could either facilitate or hinder participation in school activities and thus influence students' chances of graduation. The use of information and communication technology (ICT) is proposed to remove environmental barriers to participation and provide better opportunities for students with special educational needs (SEN) to achieve their educational goals. For this reason, the focus of this thesis is the participation in school activities in regular upper secondary education among students with SEN before and after they received an ICT intervention. Improving students' participation in school activities could positively influence their opportunities in adult life and decrease the risk of poor health outcomes and dependence on the welfare system. Therefore, participation in productive occupations and perceived work ability among the former students with SEN were investigated one year after they left upper secondary education.

Students with special educational needs (SEN)

Many students experience difficulties at some point during their schooling, either temporarily or permanently. The term special educational needs (SEN) is applicable in both cases and embraces students at risk of failing to achieve educational goals for a wide variety of reasons (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1994), making them eligible for additional or different educational services and support to meet their learning needs in school (European Agency for Special Needs and Inclusive Education [European Agency], 2020). Students with SEN show poorer academic achievement in upper secondary school (Cox & Marshall, 2020; Hakkarainen, Holopainen & Savolainen, 2013; Yoder & Cantrell, 2019), higher levels of school absence (Attwood & Croll, 2015; Havik, Bru & Ertesvåg, 2015) and a greater drop-out rate (Hakkarainen et

al., 2015; Korhonen, Linnanmäki, & Aunio, 2014; Yoder & Cantrell, 2019) than students without SEN. Furthermore, they are less likely to graduate from upper secondary school (Yoder & Cantrell, 2019). Because of unequal opportunities to access quality education and lifelong learning, under the Incheon Declaration for Education 2030, adopted by the member states of the UNESCO, students with SEN may be recognised as a 'vulnerable group' of learners (UNESCO, 2017).

Research recognises that environmental aspects related to the physical, cognitive and/or social demands of school activities may challenge students' opportunities to participate in school (Bedell, Khetani, Cousins, Coster & Law, 2011; Coster et al., 2013; Egilson & Traustadottir, 2009; Hemmingson & Borell, 2002; Şahin, Kara, Köse & Kara, 2020; Sandall, Schwartz & Gauvreau, 2016). Consequently, the physical design of the school or classroom, how school activities are organised and expected to be performed and the extent to which they are modified influence students' need for support in order to live up to schools expectations. For example, a student with writing difficulties may not be able to complete an exam within the timeframe assigned to the task when using paper and pens, but with the use of ICT such as a computer with word-processing software that enables the student to write more efficiently, s/he may be able to complete the exam in accordance with expectations. When the demands of a school activity and the abilities of a student are not in agreement, that student may be prevented from performing in line with school expectations and may thus be identified as having SEN.

Even though this thesis assumes that SEN originates in the interaction between a student and their environment, student characteristics have been found that are associated with being identified as a student with SEN. Studies have shown that boys are overrepresented among compulsory school students being identified by teachers as having SEN and that there is a significant association with low socioeconomic status (Bruggink, Goei & Koot, 2013; McCoy, Banks & Shevlin, 2012; Smeets & Roeleveld, 2016; van der Veen, Smeets & Derriks, 2010). Furthermore, research has often concerned students' specific difficulties in relation to SEN, such as behavioural and emotional difficulties, problems with communication and social skills and specific learning difficulties in reading, writing and mathematics. Some of the specific difficulties mentioned above might be related to different medical diagnoses, which may explain why much research has focused on students with diagnoses when investigating SEN. Students with neurodevelopmental disorders (attention deficit/hyperactivity disorder [ADHD] and autism spectrum disorder), dyslexia or other specific learning disabilities, or physical disabilities such as cerebral palsy, are frequently reported to experience SEN (e.g., Egilson & Hemmingsson, 2009; Hakkarainen et al., 2015; McCoy et al., 2012; Porter, Daniels, Feiler &

Georgeson, 2011; Smeets & Roeleveld, 2016). However, Bruggink et al. (2013) found that fewer than a quarter of 151 primary school students identified by teachers as having SEN had a medical diagnosis. Thus, SEN is not reliant upon a medical diagnosis or fully captured by a medical focus, because a diagnosis does not automatically imply SEN and not all students with SEN have a diagnosis (Lebeer et al., 2010).

Definitions, policy and practice for identifying and supporting students with SEN vary between countries. This affects the identification rate, which differs significantly between European countries (Ramberg & Watkins, 2020), making it difficult to estimate the overall prevalence of SEN. Furthermore, studies reporting the prevalence of SEN are not common and have primarily focused on students in compulsory education. Several European researchers have reported the prevalence of SEN in primary school to be about 25% (Banks & McCoy, 2011; Smeets & Roeleveld, 2016; van der Veen et al., 2010) and a prevalence as high as 40% has been reported in a retrospective Swedish study among 17 000 students in compulsory school (Giota & Lundborg, 2007), based on students with registered access to special educational services. Based on an official decision of SEN, backed by a formal assessment process and a legal document of eligibility for educational support, agreed upon by the member countries in the European Agency, the mean SEN identification rate in Europe was 2% in 2018 (European Agency, 2020), which is lower than the total average of 4.5% in the data from 2014 and 2016 (Ramberg & Watkins, 2020). When comparing the SEN identification rate among students in primary school and lower secondary school, Ramberg and Watkins (2020) found a higher proportion of students with SEN at the higher school level in most European countries. Recent estimates of SEN prevalence among 17-year-old students in the European member countries range from less than 1% to 23% (European Agency, 2020).

In Sweden, there is no legal definition of SEN; rather, education follows the principle of 'education for all' (SFS, 2010:800). The Swedish National Agency for Education (SNAE) reported that 5.5% (n=59 800) of students in grades 3 to 9 in compulsory school had an established Individual Education Plan (IEP) during the school year of 2019/2020 (SNAE, 2020b), indicating that they had clearly stated support needs to reach educational goals. As in previous reports, boys were overrepresented and the highest proportion of students with an IEP was found in grade 9, where 8.5% (n=9 700) of students had an IEP. Corresponding information for IEPs among students in upper secondary education is missing. Consequently, statistics for the proportion of upper secondary school students who receive support in their schooling is inadequate. The upward trend of established IEPs during compulsory school and the higher proportion of students with an IEP in grade 9 could indicate that SEN might be even more prevalent in Swedish

upper secondary education, as found in other European countries (Ramberg & Watkins, 2020).

To conclude, students with SEN are a heterogeneous group. The origins and manifestations of difficulties in reaching educational goals differ, implying that SEN arises in interaction with the specific learning environment. Therefore, students with SEN are defined in this thesis in accordance with the Salamanca statement (UNESCO, 1994), as students who for various reasons, temporarily or permanently, are in need of support to reach educational goals. Thus, SEN could be indicated by students' low school attendance, difficulties in conducting or finishing school tasks, i.e. poor achievement, or by activity limitations caused by symptoms of a diagnosis.

Theoretical framework

In this thesis, the International Classification of Functioning, Disability and Health (ICF) published by the World Health Organisation (WHO) (WHO, 2001) was used to relate students' participation in education to health. Education, and the execution of related activities, is one of the major life areas in the ICF that is considered to influence health and well-being (WHO, 2001). Since the ICF has been recognised as insufficient to fully understand the concept of participation (Hemmingsson & Jonsson, 2005; Imms, Granlund, et al., 2016), the Model of Human Occupation (MOHO) (Taylor, 2017) was chosen as the theoretical framework in this thesis to explain students' occupational participation and need for support in school as being influenced by the interaction between personal and environmental aspects. Even though the two models differ in how they define activity and participation, they are used in a complementary way because they recognise that individual and environmental characteristics determine an individual's activity and participation outcomes.

Person-environment interaction

International Classification of Functioning, Disability and Health (ICF)

The ICF was developed to provide a common framework for the description of health and health-related components. The model takes a biopsychosocial perspective, under which functioning and disability are influenced by the interaction between personal and environmental factors. In the context of health, functioning refers to a non-problematic interaction between personal and environmental aspects, while disability implies a problematic interaction resulting in impairment, activity limitations and/or restrictions

to participation. Both personal and environmental factors are seen to be contextual, with environmental factors including the physical, social and attitudinal aspects of the individual's immediate and general environment. Personal factors are not listed in the ICF because they are closely related to social and cultural variance. However, they include aspects concerning the individual's background that may have an impact on disability, such as gender, age, social background etc. (WHO, 2001).

In the ICF, activity is defined as the execution of a task or action and participation is defined as 'involvement in a life situation' (WHO, 2001). It is proposed that involvement be interpreted as "taking part, being included or engaged in an area of life, being accepted or having access to needed resources" (WHO, 2001, p.15). In terms of both activity and participation, functioning and disability are indicated by the two objective qualifiers 'performance' and 'capacity'. Downward deviation from the population standard in either performance or capacity is interpreted as disability (activity limitation or participation restriction) (WHO, 2001). From this perspective, functioning in relation to participation in education could be understood as attending school regularly and displaying knowledge in accordance with course-specific objectives in an exam, which are expected from a societal perspective. This objective approach to measuring participation strictly through performance has been criticised for not recognising the subjective experience of participation (Hemmingsson & Jonsson, 2005). A second dimension, focusing on the experience of involvement when taking part in life situations, has therefore been suggested (Granlund et al., 2012; Imms, Adair, et al., 2016).

Model of Human Occupation (MOHO)

The MOHO (Kielhofner, 2008; Taylor, 2017) is a conceptual occupational therapy model that explains human occupation and participation as being influenced by the dynamic interaction between personal and environmental factors. Human occupation refers to the doing of activities related to productivity (work/study), play and daily living (Taylor & Kielhofner, 2017). This thesis focuses on activities related to productivity. According to the American Occupational Therapy Association (AOTA), education as an occupation refers to the activities needed for learning and for participating in the learning environment (AOTA, 2014). Moreover, being a student and achieving 'the student role' refers to organising and performing school activities, as shaped by societal expectations (Taylor, 2017). The term 'school activities' is used throughout this thesis and includes everyday activities that students encounter in school, both academic (e.g. mathematics) and non-academic (e.g. break-time activities) (AOTA, 2014). It includes activities both inside and outside the classroom, such as reading, mathematics

and taking exams, cooperation and interactions with peers and teachers, and students' opportunity to organise their time and school/home work. This thesis also includes productive occupations that former students engage in after leaving upper secondary education, primarily focusing on activities carried out as an employee in paid work or as a student in further studies (Taylor, 2017), even though unpaid work and activities carried out to increase the likelihood of finding employment are also mentioned in the literature (AOTA, 2014; WHO, 2001).

The MOHO recognises that the environment, in which the doing of an activity occurs, offers potential opportunities and resources, demands and constraints that could either be facilitating or hindering for the individual. This environmental influence stems from physical spaces and objects, social relationships and interactions, and cultural, political and economic conditions (Fisher, Parkinson & Haglund, 2017). In relation to education, economic aspects, laws and regulations affect a student's access to education and obligation to attend compulsory school. Environmental factors within the school could include, for example, the physical classroom and the properties of writing objects such as a pen or a computer, the social demands of school activities in terms of instructions and cooperation with peers, and the sequence and timing for carrying out an activity. As such, a student's occupational performance of school activities is dependent upon the agreement between the requirements of the school activity and the student's personal factors. Personal factors shape how and why occupations are performed, including a person's volition (motivation for engagement), habituation (roles and routines) and performance capacity (physical and mental ability) (de las Heras de Pablo, Fan & Kielhofner, 2017). This further implies that a change in activity requirements will influence an individual's performance, and accommodations in the occupational setting may be used to enable a facilitating environment to promote occupational participation (de las Heras de Pablo, Parkinson, Pépin & Kielhofner, 2017). In this thesis, learning is considered to occur as a result of participation in school activities, and it is therefore crucial to eliminate environmental barriers to participation in school activities (Sandall et al., 2016).

Within the MOHO, occupational participation, or participation in occupational roles, is the broadest dimension of doing (de las Heras de Pablo, Fan et al., 2017). Occupational participation is described as involvement in activities and occupations that are desired and/or necessary for the individual's well-being and health, acknowledging both the individual's objective performance and subjective experience (de las Heras de Pablo, Fan et al., 2017). In order to understand and operationalise participation as including both objective and subjective dimensions, Imms, Granlund et al. (2016) have proposed 'attendance', defined as being physically present, to measure frequency of attendance and/or range or diversity of activities,

and 'involvement', to capture the experience of participation while attending. These dimensions, attendance and involvement, will be used in this thesis to capture the participation in school activities in upper secondary school among students with SEN. Imms, Adair et al. (2016) predict attendance to be related to the availability, accessibility and affordability of activities, and involvement to be related to how accommodating and acceptable the activity setting is. In this thesis, involvement is captured by the concept of student–environment fit, as perceived by the student.

Measuring Student–environment fit

In this thesis, the concept of student–environment fit is used as a measure of each student's perceptions of the agreement between her/his abilities and the demands of school activities, including the potential need for support to accommodate environmental barriers to participation. The greater the perception of support needs to engage in school activities, the lower the student–environment fit, indicating an unaccommodated environment with negative influence on the student's experience of the involvement dimension of participation. To measure the level of student–environment fit, the assessment instrument the School Setting Interview (SSI) (Hemmingsson, Egilson, Lidström & Kielhofner, 2014; Hemmingsson, Lidström & Egilson, 2020) was used. In the SSI, the student–environment fit is operationalised as the level of a student's perceived need for support to participate in school (Hemmingsson et al., 2014; Hemmingsson et al., 2020), which could be compared to 'having access to needed resources', one aspect of the interpretation of participation that appears in the ICF (WHO, 2001). The perceived need for support refers to whether the student is able to perform what is required or desired in a particular school activity and acknowledges the student's feelings of involvement, satisfaction and acceptance when performing the activity (Hemmingsson et al., 2014).

In Sweden, schools' work with special educational support has been recognised as an area with potential for improved quality (Hammarberg, 2015; SOU, 2017). It has been recommended that the educational system establishes procedures to ensure that services provided to students are person-centred and possible to evaluate (SOU, 2017). To ensure quality in the service provision of educational support, school personnel and/or student health units must have opportunities to identify support needs, and the information on which decisions are made must be adequate (Lebeer et al., 2010). It is suggested that assessments consider the student's interaction with the environment in a systematic way using a needs-based approach (Egilson & Hemmingsson, 2009; Lebeer et al., 2010; Lidström, Hemmingsson & Ekbladh, 2020; Simmeborn Fleischer, Adolfsson & Granlund, 2013). Since a student's participation and need for support is

influenced by their perception of the environment in which the activity occurs (Maxwell, Alves & Granlund, 2012), scholars have emphasised the importance of including the experiences of the individual student (Cahill & Beisbier, 2020; Gibson & Kendall, 2010; Hammarberg, 2015; Kramer, Olsen, Mermelstein, Balcells & Liljenquist, 2012; Şahin et al., 2020). Furthermore, in terms of promoting participation and engagement in the student role, the assessment and provision of support must not be limited to only academic activities; it is also important to consider non-academic activities (Cahill & Beisbier, 2020). As of today, standardised assessment instruments within the school context are rare, specifically in addressing students' opportunities for participation in school (Lidström & Munkholm, 2018), which would enable the identification of intervention goals and strategies that optimise students' participation (Chantry & Dunford, 2010). The SSI has been successfully used to identify the need for support to promote participation in school activities among students with different diagnoses and difficulties in school (Egilson & Hemmingsson, 2009; Hemmingsson & Borell, 2000; Kocher Stalder, Kottorp, Steinlin & Hemmingsson, 2017), yet the construct validity has not been investigated for students with SEN in upper secondary school.

Participation in school activities among students with SEN

The upper secondary school environment places high demands on students, in terms not only of reaching educational goals but also of their independence and taking personal responsibility for planning and performing school tasks. These progressively more challenging and higher demands on students have been described by young adults as hard to live up to (Lundahl & Olofsson, 2014). This may explain why perceived difficulties in school can increase during secondary education (Hemmingson & Borell, 2002; Mortimore & Crozier, 2006) and cause barriers to participation. Among students aged 12–17, Coster et al. (2013) reported lower participation patterns in school activities both inside and outside the classroom for students with SEN, compared to their peers without SEN, and similar findings have been reported by Şahin et al. (2020) among students aged 5–17. In both studies, students with SEN had a lower frequency of attendance in school activities and were reported to be less involved. Furthermore, significantly more environmental barriers to participation and greater need for support in the school setting were reported among students with SEN (Coster et al., 2013; Şahin et al., 2020). Some studies, primarily with a qualitative design, have focused on participation and the need for support in specific school activities among students with SEN. For example, students with neuropsychiatric disorders were shown to experience difficulties with

learning in literacy and mathematics, fail to complete homework assignments (Bolic Baric, Hellberg, Kjellberg & Hemmingsson, 2016) and have difficulties with concentration during class (Bolic Baric et al., 2016; DuPaul, Weyandt, O'Dell & Varejao, 2009). In addition to difficulties with literacy and mathematics, difficulties in sporting activities and in taking exams were most frequently reported among 9–17-year-old students with psychosocial or physical limitations. Furthermore, a significantly larger proportion of students with psychosocial limitations perceived a need for support in relation to structuring and planning school tasks, than students with physical limitations (Egilson & Hemmingsson, 2009). Difficulties with reading and writing are common among students with specific learning disabilities (American Psychiatric Association [APA], 2013), and students with dyslexia have stated, for example, that it negatively affects notetaking during lectures and their ability to express ideas in writing (Jacobs, Parke, Ziegler, Headleand & De Angeli, 2020; Mortimore & Crozier, 2006), but difficulties related to the organisation of school tasks, concentration and remembering have also been reported (Jacobs et al., 2020; Mortimore & Crozier, 2006; Pino & Mortari, 2014). Currently, studies with a quantitative design investigating participation in school activities among students with SEN are rare and there is a knowledge gap, particularly concerning the regular upper secondary school level (Bolic Baric et al., 2016; Coster et al., 2013; Hammarberg, 2015). The research field agrees that students with SEN need support during their upper secondary school years to reduce the risk of school failure and negative outcomes in adult life, but knowledge about their support needs in school activities is limited. Thus, studies investigating participation and the need for support to improve participation in school activities in upper secondary education with a quantitative design and large samples are called for.

Supporting students with SEN in school activities

Education in Sweden is based on an inclusive strategy, where all students' access to equivalent education is to be ensured by schools, which have an obligation to attend to students' diverse needs in order to reach educational goals (SFS, 2010:800). The Education Act (SFS, 2010:800) regulates and guides schools' health-promoting work and the provision of services to support students' educational development. The Act stipulates that, in order to ensure students' medical, psychological and psychosocial well-being and the provision of special educational support, the student health unit in upper secondary school must include school doctors, nurses, psychologists, counsellors and professional competence around how to support students in need of special support. In order to promote the development and learning of students who show difficulties in achieving educational goals, two

levels of individual support focusing on improving the learning environment exist. The first is, support provided within regular teaching which is the class teacher's responsibility and is not prompted by a formal assessment. The second is, an IEP, which is prompted by an assessment and includes support of an extensive nature that it is not possible to provide within regular teaching, such as an individually adapted curriculum (SFS, 2010:800). The school principal has overall responsibility for allocating resources and organising the provision of special educational support. In the Swedish upper secondary school, guidance and recommendations for identifying and supporting students with SEN are provided by the SNAE (SKOLFS2014:40, 2014). However, it is the principal who sets the framework for the assessment and no formal assessment instruments are required.

The concept of support used in this thesis focuses on changes in the activity demands of various school activities, including the modification of physical space and objects, characteristics of the school tasks, social expectations and the students' opportunities to participate in school activities (de las Heras de Pablo, Parkinson et al., 2017). Thus, it involves changing the environmental aspects of school activities to enable a better agreement between the requirements of the activity and the student's abilities. The MOHO recognises that environmental modifications can enable maximal occupational participation when they generate a match that is compatible with the individual's motivation, patterns of performance and capacity (de las Heras de Pablo, Parkinson et al., 2017). In this thesis, the term 'accommodations' is used to refer to an environmental modification that is based on a student's specific needs. Harrison, Bunford, Evans and Owens (2013) defined educational accommodations as changes to practices in school that mediate the impact of a disability on access to the general education curriculum. Accommodations may include changes in how tasks are delivered or presented to the student and how students are expected to respond during tasks; for example, via the use of ICT which may be tailored to students' diverse needs. Furthermore, accommodations may involve changes in the organisation and the amount of time allocated for school tasks as well as changes in the immediate environment, which may include changes in both physical and social aspects (Harrison et al., 2013).

Students with SEN and accommodations in upper secondary school

Within the upper secondary school, educational support and accommodations for students with SEN commonly include support from special education teachers or teacher assistants, teaching in small groups, modified school tasks and various forms of assistive technology (Bolic Baric et al.,

2016; Jacobs et al., 2020; Johansson, 2017; Skolverket, 2020). Despite students having the right to educational support, research has shown that students with SEN might be overlooked regarding available and sufficient accommodations and that educational support is still primarily provided outside the students' regular classes (Hammarberg, 2015; Niemi & Laaksonen, 2020; Ramberg, 2015), as opposed to what is advocated in terms of inclusive education. In interviews, people with ADHD or dyslexia have stated that they rarely received adequate support during upper secondary education (Lundahl & Olofsson, 2014), aligning with other studies reporting that the need for support in upper secondary school among students with SEN is not recognised or fully accommodated by the educational services (Bolic Baric et al., 2016; Gibson & Kendall, 2010; Hakkarainen et al., 2015; Jacobs et al., 2020; Mortimore & Crozier, 2006; Sikirica et al., 2015). Students with dyslexia, for example, reported unmet support needs in relation to academic achievement (Gibson & Kendall, 2010) and in relation to specific subjects, the organising of coursework and access to printed or verbal content of lectures (Jacobs et al., 2020; Mortimore & Crozier, 2006). Meanwhile, students with ADHD or autism spectrum disorder stressed unmet needs related to both the academic and social aspects of their learning (Bolic Baric et al., 2016; Sikirica et al., 2015). Furthermore, students perceived that support and accommodations were provided in a 'one-size-fits-all approach' that did not fully acknowledge their perceived difficulties (Bolic Baric et al., 2016; Gibson & Kendall, 2010; Jacobs et al., 2020; Pino & Mortari, 2014). This might partly be explained by differences in school culture and tradition around offering educational support (Niemi & Laaksonen, 2020), the availability of special education resources (Niemi & Laaksonen, 2020; Ramberg, 2013) and teachers' knowledge of how to support students with SEN in upper secondary school (Hammarberg, 2015; Jacobs et al., 2020; Pearce, Gray & Campbell-Evans, 2010). However, it could also indicate that commonly used educational support may need to be complemented with new or different accommodations. Technology has been a natural part of our lives for several years and may be used to support participation and performance in school activities (Scherer & Glueckauf, 2005).

The literature review presented here testifies that students with SEN perceive environmental barriers to their participation in school activities in upper secondary school, despite schools attempts to accommodate their needs. It is also evident in research that students require flexible and individualised support during school activities. The need for an accommodation and the specific requirements may differ depending on the interaction between the environment in school activities and the student's personal factors. This implies that the accommodation must be tailored to the specific student and current environment in school activities. Various forms of

assistive technology, including ICT, are proposed to remove the environmental barriers to education (McKnight & Davies, 2012; WHO, 2019) and this has been advocated as a promising area to support inclusion, participation and learning among students with SEN (Mølster & Nes, 2018; UNESCO, 2017). Yet, so far, there has been limited research on the influence of ICTs on participation in school activities in upper secondary education.

Information and communication technology (ICT)

In this thesis, the term ICT is used to include technological devices and software that are used to transmit, store, create, share or exchange information (UNESCO, 2019). Devices may be computers, tablets or smartphones that are used in the school setting to support students in various school activities, such as reading, conducting assignments or organising and storing school-work. Software includes different programs and applications that may assist students with writing using a word-processor or to initiate attendance at and performance of activities by means of reminders. The ICT is thus seen as an accommodation, i.e. an environmental modification (Scherer & Glueckauf, 2005), that may be tailored to diverse needs in order to facilitate performance and participation in school activities.

The use of ICT in education is believed to enhance learning and participation for all students, yet most research has focused on students' specific needs or difficulties in school. In a review by Istenic Starcic and Bagon (2014), the authors concluded that the most common categories of identified needs or disabilities addressed with ICT were learning disability and ADHD, followed by different physical and mental disabilities, hearing and visual impairments and autism spectrum disorders. Historically, research on ICT has most often concerned its efficacy in compensating for students' difficulties and for training academic skills and capacity, such as in spelling and reading, whilst today the need for research on ICT as supporting participation and inclusion in education is stressed (Istenic Starcic & Bagon, 2014).

In a meta-analysis of assistive technology for adolescents and adults with learning disabilities, Perelmutter, McGregor and Gordon (2017) concluded that ICT used to improve the writing error rate and reading comprehension had a positive effect. Lidström and Hemmingsson (2014) found in their review that some evidence exists for improved writing ability via the use of computers and special software among students with physical limitations. It has also been reported that students with writing and reading difficulties who used ICT experienced that they learnt more and concentrated better during class (Mølster & Nes, 2018). Students in upper secondary school considered it easier and more time-effective to take notes,

store material and conduct assignments using a computer. Furthermore, they perceived ICT, for example smartphones with applications, helpful for sharing information about school work and as a support for planning (Olofsson, Lindberg & Fransson, 2018). Several literature reviews (Lidström & Hemmingsson, 2014; McKnight, 2016; Perelmutter et al., 2017) have further concluded that ICT and mainstream technology, such as word processing software and mobile devices, may improve students' educational outcomes and lead to improved motivation and satisfaction with learning for students with SEN. This view seems to be shared by teachers, who have been reported to consider ICT as supporting inclusion, in terms of improved learning outcomes for students with SEN (Mølster & Nes, 2018), and as a resource to facilitate teaching and learning approaches that gives students equal opportunities for engagement in the inclusive classroom (Istenic Starcic & Bagon, 2014). However, there appears to be a mismatch between access to technology in school and the competence to use it (Mølster & Nes, 2018). Several researchers highlight the fact that teachers' knowledge of how to use ICT to support participation and inclusion in the learning environment is still insufficient (Andersen & Sorensen, 2017; Mølster & Nes, 2018; Olofsson et al., 2018), suggesting that services and knowledge about how to choose, implement and use the technology as support in school are vital.

Prominent benefits of using ICT as an accommodation in school activities may include its flexibility in removing a variety of environmental barriers encountered by students with SEN (Lidström & Hemmingsson, 2014; McKnight, 2016) and that the portable nature of mainstream ICT, such as smartphones and tablets, may provide support in different school activities as well as enabling lifelong, independent learning because they are also easily at hand in settings outside school (McKnight, 2016). Another benefit of using mainstream ICT as support in school activities is the reduced risk of stigmatisation, which has been reported as a major barrier to students' use of accommodations in school. The risk of being socially excluded from the peer group or perceived as being 'different' by class mates has frequently been reported as a reason for abandoning received accommodations (Hemmingsson, Lidström & Nygård, 2009; Lidström & Hemmingsson, 2014; Mølster & Nes, 2018).

While students consider ICT to be useful in school activities, its effectiveness has not been sufficiently investigated and there is a lack of studies with a quantitative design and large samples in the mainstream classroom (Istenic Starcic & Bagon, 2014; Lidström & Hemmingsson, 2014). Even though research concerning the use of ICT within mainstream education has become more prevalent over the last 15 years (Istenic Starcic & Bagon, 2014), there is a lack of studies focusing on ICT as a means for increasing students' participation in school activities (Lidström & Hemmingsson,

2014). Scholars stress that technology must be based on students' needs and tailored to these in order to be used effectively as support in school activities (Lidström & Hemmingsson, 2014; McKnight, 2016; Perelmutter et al., 2017; Scherer & Glueckauf, 2005). There is, however, a knowledge gap related to ICT as individualised support (Lidström & Hemmingsson, 2014; Perelmutter et al., 2017), and evidence of its proposed flexibility to provide support for students' diverse needs is warranted.

Establishment in work and further studies among students with SEN

The main purpose of upper secondary education is to prepare students for participation in professional and societal life, by providing them with the prerequisites to acquire and develop knowledge and lifelong learning (SNAE, 2013). In Sweden, most students (98%) choose to attend upper secondary education, where 12 vocational programmes and six preparatory programmes for higher education are available. In the vocational programmes, students acquire specific professional expertise for working life, while the preparatory programmes provide students with the necessary qualifications to make them eligible for higher education. For students who do not qualify for the national programmes, five introductory programmes are available (SNAE, 2020a). In 2019, a higher percentage of the students enrolled in the preparatory programmes graduated (79%) than students enrolled in the vocational programmes (72%). Of these graduates, 73% achieved eligibility for higher education (SNAE, 2019b).

After upper secondary education, individuals are expected to enter the labour market or enrol in further education. Students with SEN achieve graduation to a lesser extent than their peers without SEN, which in turn leads to difficulties in entering the labour market or enrolling in further studies (Engdahl & Forslund, 2015; Mazzotti et al., 2016; Tideman, Lövgren & Malmqvist, 2020). Having graduated from upper secondary education decreases the risk of future unemployment among students with SEN (Båtevik, 2019); nevertheless, former students with disabilities and/or SEN are overrepresented within the unemployed population (Engdahl & Forslund, 2015; Organisation for Economic Co-operation Development [OECD], 2016). In a study by Hakkarainen, Holopainen, and Savolainen (2016), difficulties in mathematics and reading predicted delayed graduation from upper secondary school, not enrolling in further education and becoming unemployed and not in education or training. Other studies have also shown that former students with SEN are more commonly reliant on the social security system after leaving upper secondary education (Myklebust, 2013; Myklebust & Båtevik, 2014). Furthermore, experiencing

SEN during upper secondary education increases the risk of mental health problems later in life. As an example, Myklebust and Myklebust (2017) found that upper secondary school students with SEN had an increased risk of mental distress in their thirties.

Taken together, research indicate that students with SEN seem not only to struggle during their educational years but that their difficulties continue into adult life, with an increased risk of poor health outcomes and dependence on the welfare system, compromising their participation in society. The importance of supporting students with SEN in upper secondary school to reduce the risk of future exclusion from the labour market and further studies is therefore stressed, along with the need for studies investigating the longitudinal impact of the support provided to students (DuPaul et al., 2009; Lidström et al., 2020; Tideman et al., 2020).

Attaining a job has been found to be associated with belief in one's work ability (Ekbladh, Thorell & Haglund, 2010), representing the person's view on how their environmental and personal factors support or hinder participation in activities related to work or further studies. Perceived work ability is affected by the demands and opportunities in the environment, including specific tasks and circumstances, in interaction with the individual's capacity, competence, values, interests, habits, roles, and expectations in relation to work (Sandqvist & Ekbladh, 2017). Failures at school and perceived difficulties in school activities might decrease perceived work ability among students with SEN. In turn, this may negatively influence their participation in work or further studies because past and present experiences of participation in activities influence future participation (de las Heras de Pablo, Fan et al., 2017; Imms, Granlund et al., 2016). Tideman et al. (2020) in their review of the transition from childhood to adulthood among persons with disabilities, concluded that more knowledge is needed about environmental barriers to successful establishment in productive occupations. Investigating perceived work ability among former students with SEN and their participation in productive occupations can provide new knowledge in this field.

Rationale

Research has concluded that students with SEN are at increased risk of low educational outcomes, including failures at school, low achievement and graduation rates, and future unemployment with negative implications for health. Yet, little research has focused on their participation in school activities in upper secondary education. Knowledge is needed about students' perceived need for, and access to, support in order to participate in school activities. In other words, their student–environment fit has not been sufficiently investigated. Investigating and mapping upper secondary school students' need for support in school activities may guide schools' efforts to improve participation in school activities among students with SEN. However, assessment instruments to identify a student's need for support to participate in school activities are rare. The use of ICT to improve participation in school activities for students with SEN is a promising area, yet; evidence is needed. Large samples within the mainstream classroom have been requested. There is also a scarcity of knowledge about the longitudinal impact of the support provided to students with SEN in upper secondary school in relation to their participation in work or further studies.

AIMS

The overall aim of this thesis was to increase knowledge about the participation in school activities of students with special educational needs in regular upper secondary education before and after they received an ICT intervention, and subsequently their participation in productive occupations.

The specific aims were:

Study I: To investigate the psychometric properties of the School Setting Interview (SSI) for students with special educational needs in regular high school.

Study II: To identify factors associated with a high level of accommodation needs in school activities among students with special educational needs in regular upper secondary education, and to investigate the extent to which schools have met students' perceived accommodations needs.

Study III: To evaluate the influence of an ICT intervention on participation in regular upper secondary education in respect of student–environment fit, grades and school attendance among students with special educational needs. In addition, characteristics of students showing a significant improvement in student–environment fit were investigated.

Study IV: To investigate productive occupations and perceived work ability among former students with special educational needs one year after regular upper secondary education.

METHOD

Design

This thesis consists of four studies with different designs. The population of participants is the same throughout the studies and is derived from two intervention projects conducted by the Swedish Institute of Assistive Technology (SIAT). Data collected in the SIAT projects, hereafter called 'secondary data' (Smith et al., 2011) was used in studies I–IV. Additional data collected by the author of this thesis was also used in studies III–IV. The studies are mainly based on information provided by students, via semi-structured interviews and self-reported answers to questions.

The first study was a psychometric evaluation (Polit & Beck, 2016) of the assessment instrument the School Setting Interview (SSI) (Hemmingsson et al., 2014), which measures student–environment fit. Study II had a cross-sectional design (Polit & Beck, 2016), using the SSI, to describe the student–environment fit of students with SEN in regular upper secondary school. In study III, a quasi-experimental one-group pretest-posttest design (Polit & Beck, 2016) with SSI assessments pre- and post-intervention was used to evaluate the influence of an individualised ICT intervention on participation in education. Study IV took a longitudinal approach (Polit & Beck, 2016), collecting data from former students with SEN one year after leaving upper secondary education. An embedded mixed-methods design was applied (Creswell, Klassen, Plano Clark & Smith, 2011) to investigate productive occupations and perceived work ability among former students with SEN, in which cross-sectional data was complemented with a semi-structured interview using the Worker Role Interview (Ekbladh & Haglund, 2012). An overview of the study designs, participants and the collection and analysis of data are presented in Table 1.

Table 1. Overview of the studies included in the thesis: their design, participants, method of data collection and analysis.

	Study I	Study II	Study III	Study IV
Design	Psychometric evaluation	Cross-sectional	Quasi-experimental, one-group test-retest	Embedded mixed methods
Participants	509 students with SEN[a] in regular upper secondary education	484 students with SEN[a] in regular upper secondary education	300 students with SEN[a] in regular upper secondary education	81 former students with SEN[a]
Data collection	The SSI* Questionnaire I	The SSI* Questionnaire I	The SSI* Questionnaire I Questionnaire II Grades School attendance	Questionnaire II Questionnaire III WRI[b]
Data analysis	Rasch analysis	Descriptive statistics Chi² analyses Logistic regression analysis	Descriptive & inferential statistics (parametric and non-parametric) Effect size Rasch analysis	Descriptive statistics Chi² analyses Fisher's Exact Test Deductive content analysis

Note: *The School Setting Interview (SSI). [a]Special educational needs (SEN). [b]The Worker Role Interview (WRI).

Sampling

Two intervention projects, initiated by the Swedish government, were conducted by the SIAT, in five purposively sampled municipalities during the period 2011–2014. The aim of the projects was to implement ICT with complementary services to cater for upper secondary school students' perceived need for support in school activities. A consecutive sampling procedure was performed within twelve public upper secondary schools in which school staff identified students based on given criteria (Polit & Beck, 2016). The criteria stipulated that students were to show inability to achieve educational goals and/or noticeable difficulties with planning, problem solving, conducting and/or finishing tasks and/or had a high level of school absence. Guardians were required to approve participation in the projects before students under 18 years of age could be included. In total, 647 students were recruited. These students were asked to provide written informed consent for the collected data to be used in future research. One supervisor (HL) in the PhD project was involved in the SIAT projects, which enabled access to the collected data after the projects had ended. Permission to use

the data collected in the SIAT projects and to conduct the studies included in this thesis was granted by the Regional Ethics Committee in Linköping, Sweden, study codes 2013/409-31 and 2015/203-32.
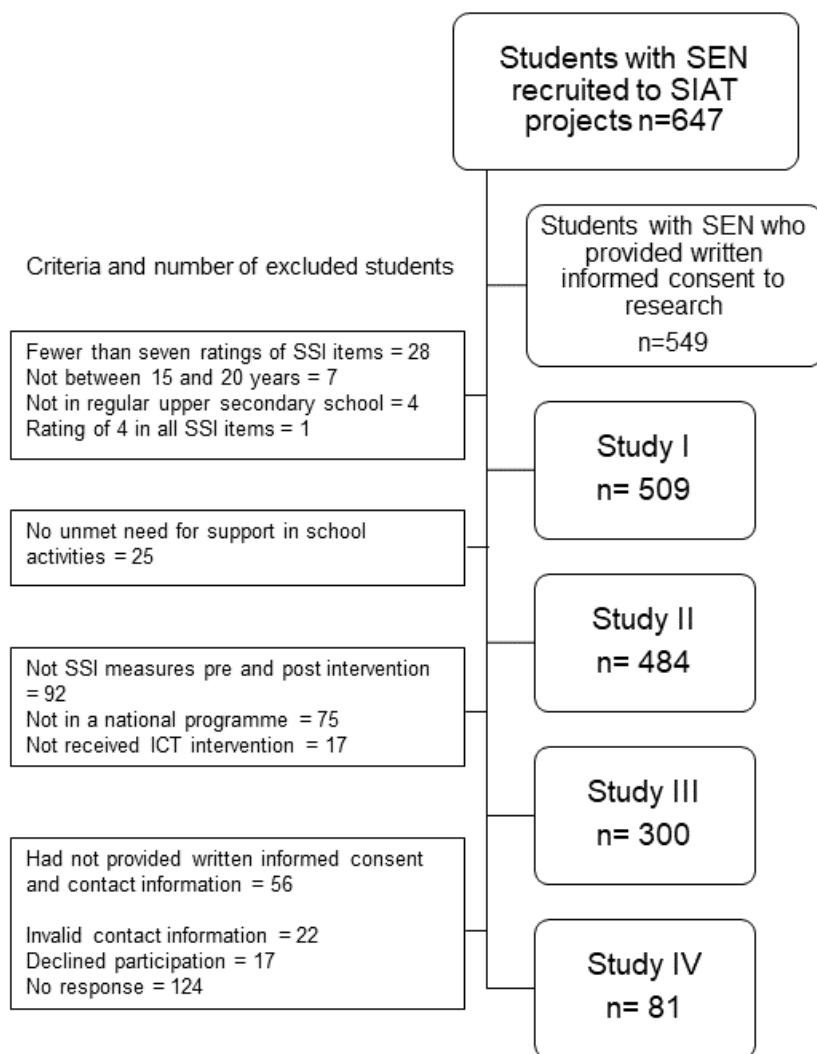
Figure 1. Flowchart over the inclusion.

Participants

A total of 549 students, from 12 schools, provided written informed consent to research and were eligible for inclusion in the studies that constitute this thesis. Inclusion criteria in the four studies varied and narrowed as the requirements for complete data, pre- and post-intervention, increased in the third study. The inclusion criteria for study I stipulated that students: 1) had at least seven ratings of SSI items at baseline, 2) were aged between 15 and 20 years and 3) were in regular upper secondary school. An exclusion criterion was a rating of 4 (the highest rating) in all SSI items, which do not yield any information for the Rasch analysis used in the psychometric evaluation of the SSI. Participants were 509 students with SEN. In addition to the inclusion criteria above, to be included in study II, students were also required to have at least one rating of 1 or 2 in the SSI assessment at baseline, representing an unmet need for accommodations in school activities. This generated a sample of 484 students. Study III included 300 students after adding the inclusion criteria of: 1) having valid pre- and post-measures with the SSI, 2) attending a national upper secondary school programme and 3) had received the ICT intervention. For inclusion in study IV, students had to have provided written informed consent and contact information to be approached one year after upper secondary education. The inclusion process with study-specific criteria is presented in Figure 1 and the characteristics of included students are presented in Table 2.

Table 2. Characteristics of Students included in Studies I–IV.

Characteristics	Study I (N=509)		Study II (N=484)		Study III (N=300)		Study IV (N=81)	
	n	(%)	n	(%)	n	(%)	n	(%)
Age range 15–20								
M	17.34		17.28		17.65			
Mdn	17		17		18			
Gender								
Boy	300	(59)	287	(59)	170	(57)	41	(51)
Girl	209	(41)	197	(41)	130	(43)	40	(49)
Diagnosis								
No diagnosis	270	(53)	250	(52)	153	(51)	36	(44)
Neuropsychiatric disorder	112	(22)	108	(22)	67	(22)	13	(16)
Dyslexia or language disorder	100	(20)	94	(19)	60	(20)	23	(28)
Other	27	(5)	32	(7)	20	(7)	9	(11)
Native language								
Swedish			395	(83)	262	(88)		
Other			81	(17)	35	(12)		
Educational programme								
Introductory			70	(15)				
Vocational			277	(58)	209	(70)	55	(68)
Higher education preparatory			132	(27)	91	(30)	26	(32)
School year								
Introductory			70	(14)				
Year 1			167	(35)	119	(40)		
Year 2			197	(41)	147	(49)		
Year 3			48	(10)	33	(11)		
Presence of support in school[1]								
Yes			274	(57)	208	(69)		
No			210	(43)	92	(31)		
School absence[2]								
Low <5%			165	(40)	20	(14)		
Median 6–20%			128	(30)	70	(48)		
High >20%			128	(30)	55	(38)		
ICT usage in education[3]								
Yes					87	(29)		
No					211	(71)		

Note: Reported data is based on students with valid information and boxes without information mean that data were not used or collected in the specific study. [1]Students had special educational support from a teacher, teaching assistant or special education teacher at inclusion. [2]At baseline. [3]Students used ICT, such as a computer, at baseline.

The ICT intervention

The ICT intervention that was evaluated in study III was implemented in the two SIAT projects. Six occupational therapists and one special education teacher, referred to as 'professionals', were responsible for the intervention process. All these professionals had past experience of working

with ICT and were employed in the projects. In all the cities, the professional/s cooperated with school personnel during the intervention process.

The ICT intervention was designed to cater for students' perceived need for accommodations in school activities and was individualised based on each student's needs. The ICT intervention had two main components, which were provided to all students: ICT devices and/or software, and services from professionals to implement and use the ICT in school activities (see Table 3). Complementary educational support, such as extra time with teachers or modified school tasks, e.g. verbal instead of written examinations, could also be included depending on students' needs in school activities. The ICT intervention could be described as complex (Medical Research Council [MRC], 2019) since it was tailored based on each specific student and thus consisted of varied content with several interacting components. The hypothesis was that the ICT intervention would enhance the student–environment fit by providing individualised support in school activities where students perceived a need for accommodations. In turn, this was expected to improve students' opportunities to participation i.e., to attend and be involved, in school activities.

The students' perceived need for accommodations in school activities was identified in the SSI assessment at baseline. Suitable ICT, potential complementary support and a plan for the intervention were identified in collaboration between the professional and the student. The SIAT projects provided the ICT, and the professionals were responsible for services to implement and use the ICT during school activities. The services provided by professionals included instructions, strategies and training in how to use the ICT as support in identified school activities. The implementation process did not set a predetermined amount of time or number of sessions, and as such varied individually between students. In addition to sessions with professionals, the student could also get assistance with the ICT from school personnel involved in the project (technicians and teachers). As an example, technical support could include hands-on help to install software, adjust settings or solve technical problems, such as software updates. After a few weeks of intervention, the professional made a reconciliation with the student to ensure that the implemented support worked satisfactorily and as intended. The ICT intervention was evaluated after four to six months of use, by means of the follow-up SSI assessment.

The content of the ICT intervention

Below, the content of the ICT intervention is summarised for the 300 students in study III (see also Table 3). The majority, 66% (n=197), of the students had received an ICT device, either a laptop, tablet or smartphone. About one third (32%, n=95) of the students had had their existing ICT tailored or supplemented with additional devices, applications, programs

and/or strategies for how to use the ICT as support in school activities. Of these 95 students, 87 already used computers or other ICT in education provided by the school and eight had personal devices. Time-assisting software was most common and had been received by 85% (n=255) of the students, while software for writing and reading was received by 75% (n=225). Furthermore, 43% (n=128) of the students had received complementary support, such as extra time with teachers, modified school tasks or gadgets to maintain concentration. The median time for the intervention was eight hours.

Table 3. Overview of the content of the ICT intervention.

COMPONENT 1 ICT DEVICES AND SOFTWARE	
Device (n=292, 97%)	Computer/Laptop (n=128), Tablet (n=163), Smartphone (n=114), keyboard (n=8)
Time assistance (n=255, 85%)	Calendars, schedules and/or reminders (n=255), timers (n=37)
Writing and reading (n=225, 75%)	Word processor (n=166), text reader (n=139), scanner (n=55), recorders (n=34)
Complementary support (n=128, 43%)	E.g. extra time with teachers (n=40), modified examinations (n=17), gadgets to maintain concentration (n=17), earphones (n=13), weighted blankets (n=11)
COMPONENT 2 SERVICES FROM PROFESSIONALS	
Planning meeting	**Identify suitable ICT and implementation** Based on the SSI baseline assessment of need for support in school activities.
Individual support	**Implementation** Strategies and training concerning how to use ICT in school activities; technical support.
Evaluation meetings	**Ensure sufficient support** After a few weeks to ensure the implemented ICT provided sufficient support in school activities. **Evaluation of implemented ICT** SSI follow-up assessment after about six months.
SESSIONS	Individual, face to face at student's school
PROVIDER	Professionals*
USER	Student with SEN
TIME (range) Mean, Mdn (SD)	2–100 hours** 9.74, 8 (7.82)

Note. *Occupational therapist (n=6) or special education teacher (n=1) employed in the government projects. **One participant with 100 hours.

Intervention fidelity

One supervisor in the PhD project, HL, a registered occupational therapist and PhD, was involved in the planning and implementation of the SIAT projects. Before the projects started, HL and the project directors planned and held a course and a planning meeting where the professionals involved in the two projects learned about the ICT intervention and the implementation process. The professionals also obtained training in the use and administration of the SSI assessment instrument (Hemmingsson et al., 2014) and the questionnaires to ensure consistency between sites. Furthermore, when necessary, HL held consultations with the project directors and professionals concerning data collection. Thus, measures were taken to ensure intervention fidelity. However, no fidelity criteria or measurements were applied.

Before the projects started, personnel at the included schools participated in meetings where the projects' content and arrangements were presented to ease the implementation and use of ICT as support in the regular teaching. Meetings were held by the project director and the professionals involved in the project in the specific municipality.

Data collection and procedure

Secondary data consists of assessments using the School Setting Interview (SSI) (Hemmingsson et al., 2014) and questionnaires at baseline and follow-up (studies I–IV). Data collected after the projects were completed concerns students' final grades, registered school attendance (study III), cross-sectional questionnaire data about the former students' productive occupations and semi-structured interview data about their perceived work ability using the Worker Role Interview (WRI) (Ekbladh & Haglund, 2012) (study IV). In Table 4, an overview of measurements and outcome measures is presented.

Outcome measurements

As this thesis set out to consider the participation in school activities and productive occupations of students with SEN, the outcome measurements needed to tap into both the 'attendance' and 'involvement' aspects of participation (Imms, Adair et al., 2016). The outcome variables based on students' statements, reflecting involvement, were the SSI, the questionnaires and the WRI covering students' experiences of participation in activities. The objective outcome variables were students' registered school attendance and grades in the core subjects of English, Mathematics and Swedish reported from each student's school. Attending activities is a prerequisite for involvement (Imms, Adair et al., 2016) and school attendance, 'being in classes', measured attendance, while grades were considered to reflect involvement.

Table 4. Overview of measurements and outcomes of included studies.

Measurement		Outcome	Participation		Study			
			Involvement	Attendance	I	II	III	IV
Secondary data	School Setting Interview (SSI)	Student–environment fit	X		X	X	X	
	Questionnaire I (Baseline)	Demographics Educational support	X		X	X	X	
	Questionnaire II (Follow-up)	Provided ICT Amount of time with professional	X				X	X
Data collected by the author of this thesis	Public documents	Final grades School attendance	X	X			X	
	Questionnaire III	Productive occupations Final grade Amount of work/studies Type of housing	X X	X				X
	Worker Role Interview (WRI)	Perceived work ability	X					X

The School Setting Interview (SSI)

The SSI version 3.1 (Hemmingsson et al., 2014) was used in this thesis. The SSI is a student-centred, semi-structured interview instrument that assesses student–environment fit via 16 items relating to everyday school activities, which are presented in Table 5. The assessment instrument includes both academic and non-academic school activities to capture students' opportunities for participation in the student role. In this thesis, academic school activities include the items Write, Read, Remember things, Do mathematics, Do homework and Take exams.

The interview takes about 40 minutes to complete and investigates the students' potential need for support to participate in school activities, as well as their feelings of involvement, satisfaction and acceptance when undertaking the demands of the school activities. School activities where the

student needs support are further explored, focusing on what kind of support the student would need in order to perform and/or participate in the activity. Information obtained during the interview, covering students' accommodation needs and support received, is the basis for the rating on the four-step rating scale, administered by the professionals. A high fit (a rating of 3 or 4) implies that there is a satisfactory agreement between the abilities of the student and the demands in the school environment, and no accommodations are needed. A low fit (a rating of 1 or 2) implies a disagreement between the abilities of the student and the demands in the school environment, whereby the student perceives unmet accommodation needs. A rating of 1 (Unfit) implies that the student perceives a need for accommodations in the specific school activity but has not received any support. The rating of 2 (Partial fit) is obtained when the student perceives a need for accommodations in the school activity, despite already-existing accommodations. When the student has been provided with accommodations that meet their needs in the specific school activity, a rating of 3 (Good fit) is obtained. The rating of 4 (Perfect fit) implies that the student perceives that the student–environment fit is ideal and no accommodations are needed. The rating could be summarised on the Intervention Planning Form to identify school activities where the student is in need of accommodations to improve the level of student–environment fit. The plan for the intervention, including potential accommodations, is established in collaboration with the student.

Initially, the SSI was developed for students with physical disabilities (Hemmingsson, 1998) and its content validity and inter-rater reliability was found to be valid (Hemmingsson & Borell, 1996). Additional items were suggested and incorporated in version 2, which also included a new, four-step rating scale. Hemmingsson, Kottorp and Bernspång (2004) investigated the construct validity of the second version, using the Rasch analysis on the SSI ratings of 87 students with physical impairments, concluding by giving support for the instrument's construct validity and suggesting the addition of more challenging items in version 3. Input from professionals using the SSI in clinical practice and its use as an outcome measurement have developed it to be applicable for students with other disabilities than just physical ones (Egilson & Hemmingsson, 2009). However, prior to this PhD project, the SSI version 3.1 had not been evaluated for students with SEN in upper secondary education. Recently, a new Swedish version of the SSI was released (Hemmingsson et al., 2020).

Table 5. Items and rating scale in the School Setting Interview.

SSI Items	
1. Write	9. Participate in practical subjects
2. Read	10. Participate in the classroom
3. Speak	11. Participate in social activities during breaks
4. Remember things	12. Participate in practical activities during breaks
5. Do mathematics	13. Go on field trips
6. Do homework	14. Get assistance
7. Take exams	15. Access the school
8. Participate in sports activities	16. Interact with staff

The SSI four-step rating scale

1 (Unfit). The student perceives that the school environment needs to be modified but has not received any accommodations.
2 (Partial fit). The student perceives that the school environment needs to be modified although some accommodations have already been received.
3 (Good fit). The student has received the necessary accommodations and is satisfied with them.
4 (Perfect fit). The student perceives that the school environment is ideal and does not need any accommodations.

Questionnaires

Three forms with questions, referred to as questionnaires, were developed. The questionnaires I and II were developed within the SIAT projects. Questionnaire I, used at baseline, collected demographic information about the students, such as gender, age and diagnosis, along with information about their educational programme, access to ICT and special educational support. Questionnaire II, used at follow-up, focused on the intervention: what ICT the student had received and used. The amount of time involved in the intervention was estimated by the professional involved in it. In addition, written informed consent to use data in future research was requested and the student was asked whether they were willing to participate in questionnaire III one year after leaving upper secondary education.

Questionnaire III, used in study IV, was developed after the SIAT projects. This questionnaire concerned information about the former students' educational programme, final grades, current productive occupation and type of housing, with fixed response options. Questions requiring written

responses concerned the number of hours per week the former student was working or studying and what kind of studies or employment s/he was involved in. The questionnaire ended with a question about consent to participate in a telephone interview and requested contact information from those willing to participate. The questionnaire was used either during telephone calls or as a web-based version, administrated in the survey software 'Survey and Report' (Artologik, 2018) via Linköping University. Because potential participants tended not to answer telephone calls, the web-based questionnaire was developed and used as an alternative.

In total, 244 students gave permission to be contacted one year after upper secondary education. At the time of data collection, the contact information provided by 22 students was found to be invalid and another 17 students declined to participate when approached. A link to the web-based questionnaire was sent as a text message or email by the author of this thesis, using up to two reminders as necessary, which generated 46 respondents. A further 35 former students with SEN responded to telephone calls, by which the author of this thesis collected data for 20 respondents and two research assistants (registered occupational therapists) collected data for a further 15. In total, 81 former students answered the questionnaire and 124 students did not respond, giving a response rate of 40%.

Neither the reliability nor the validity of the three questionnaires was evaluated.

Public documents of school attendance and grades
Public documents, used in study III, included students' final grades in three core subjects, English, Mathematics and Swedish, along with their registered school attendance per semester. Two out of 12 schools did not provide either grades or school attendance records (21%, n=64) and one school only provided grades, because records of school attendance were not stored after students graduated (18%, n=55). Internal drop-out in the collected data was also present, 16% (n=49) for grades and 12% (n=37) for attendance. This was due to incomplete information of decoded students, students changing educational programme or dropping out before graduation. In total, grades were obtained for 187 (62%) students and school attendance for 144 (48%).

Depending on which educational programme the student was enrolled in, the number of courses in the core subjects varied. In general, vocational programmes include fewer courses in English, Mathematics and Swedish than preparatory programmes. However, grades in all the admitted courses for the three core subjects were reported for each student. Grades were reported in two different grading systems, depending upon when students started upper secondary education. Therefore, the author of this thesis dichotomised all courses as 'pass' or 'fail' based on guidelines from the SNAE.

Students were then categorised as 'pass' if they had passing grades in all courses, or 'fail' if they had a failing grade on any course. The school attendance was reported as a percentage covering the school semester at baseline and at follow-up. The percentages were compared, and students' school attendance was categorised as 'worsened', 'same' or 'improved'.

The Worker Role Interview (WRI)

In study IV, the Swedish version of the WRI (WRI-S) (Ekbladh & Haglund, 2012), which is theoretically based on the MOHO (Taylor, 2017), was used. The WRI is a person-centred assessment which aims to identify how psychosocial and environmental factors influence a person's perceived work ability. Via the WRI interview, conducted by using a non-standardised semi-structured interview guide, information about how the individual's motivation, daily routines and surrounding social environment affects the person's perception of work ability is collected. After the interview, a therapist-administered rating scale is used to assess the 16 items with standardised definitions, each item corresponding to one of the content areas related to six theoretical MOHO concepts: Personal causation, Values, Interests, Roles, Habits and Environment (Sandqvist & Ekbladh, 2017).

The interviewer takes notes during the interview, which are used to in addition to the rating, write comments to explain person specific circumstances for the rating of each item. The four-point rating scale, is divided into two values (1 and 2) which imply that the item interferes with the person's work ability and two values (3 and 4) which imply that the item supports the person's work ability. The rating of 1 implies that the specific item *strongly interferes* and a rating of 2 implies that the item *interferes* with the individual's work ability. A rating of 3 implies *support* while a rating of 4 implies that the item *strongly supports* the person's work ability. An item that is not applicable to a specific person's circumstances or for which there is insufficient information to perform a rating the 'NA' (not applicable) is used (Ekbladh & Haglund, 2012).

The WRI-S has been revised several times since it was first launched in 1996, and today the fourth version (Ekbladh & Haglund, 2012) is used. Several studies have investigated its validity and reliability and found support for its psychometric properties (Ekbladh, Haglund & Thorell, 2004; Ekbladh et al., 2010; Haglund, Karlsson, Kielhofner & Lai, 1997; Yngve & Ekbladh, 2015). An initial evaluation of the validity of the first version of the WRI-S indicated that it was valid for use in a Swedish context (Haglund et al., 1997). The predictive validity of the WRI for return to work after long-term sick-leave was further investigated and supported in two studies (Ekbladh et al., 2004; Ekbladh et al., 2010). The findings from these studies showed that WRI items related to personal causation had the best predictive validity for return to work after long-term sick-leave and that the other

content areas in the WRI also included items with abilities to predict return to work (Ekbladh et al., 2004; Ekbladh et al., 2010). The clinical utility of the WRI-S was investigated among 187 professional users, who considered the assessment instrument to be a valued tool in their clinical practice (Yngve & Ekbladh, 2015).

Procedure

The SSI assessments and questionnaires I and II were retrieved from the SIAT after completion of the projects. A quality assurance of all secondary data was performed by the author of this thesis to obtain familiarity with the collected data (Smith et al., 2011). When performing the quality assurance, all original data in paper format, stored at Linköping University, was read and checked against an existing data file. The existing data file was updated with missing values and information to create valid data files to be used in the studies. During this process, students' consent to participate in research was confirmed (n=549). This thorough work led to good knowledge of the secondary data.

The collection of students' final grades and school attendance, used as outcome measures in study III, was conducted between 2016 and 2018 via contact with the administration within the municipality or with the specific school. The request was initiated via email and/or telephone and at least three reminders were sent before the data collection was cancelled. The data was obtained via email, regular mail or a visit to the school.

In study IV, eligible participants (n=244) were contacted one year after leaving upper secondary school via telephone and/or email depending on what contact information s/he had provided. The data collection was conducted between 2014 and December 2017. Of the 81 former students who answered the questionnaire, 41 gave consent to participate in the WRI interview and were contacted via telephone to schedule a time for the interview. In total, 20 WRI interviews were conducted, 15 by the author of this thesis and five by the two research assistants. The other 21 potential interview participants did not respond to the invitation or did not answer the phone when the interview was scheduled, despite at least two reminders. During the interview, the WRI interview guide was used, and questions were adapted in relation to each former student's answers and situation. The interviewer took notes during the interview, and the rating of items was completed shortly after the interview. For each item, an explanatory note was written, which could consist of a short summary of what the respondent had talked about in relation to the specific item and/or a quote or statement from the respondent. The interviews conducted by the author of this thesis lasted between 22 and 50 minutes (*M*=33), with no time range of interviews performed by the research assistants being available. Both the author of this thesis and the research assistants had knowledge of the

MOHO and had obtained training in the use and administration of the WRI.

There were no differences in demographics between the 244 eligible participants and the 81 former students who answered the questionnaire. No differences in demographics were found between the responders who gave consent for the WRI interview and those who did not. Neither were there any differences between the 41 who initially gave consent and the 20 who actually participated in the interview.

Data analysis

The statistical analyses were performed using the Statistical Package for Social Science (SPSS) versions 23 and 24 (studies II–IV) (IBM, 2016), and Rasch analyses (studies I & III) were performed in the software RUMM2030 using the polytomous unrestricted model (Andrich, Sheridan & Luo, 2013). Missing data differed in the variables and analyses, and the results are based on students who provided valid information.

The written notes from the WRI interviews in study IV were analysed using deductive content analysis with guidance taken from Graneheim and Lundman (2004) and Graneheim, Lindgren and Lundman (2017). The theoretical base used in the analysis was the MOHO (Taylor, 2017).

Rasch analysis (studies I & III)

Belonging to modern test theory, Rasch analysis focuses on the mathematical relationship between a person's unobservable measure of a construct and his/her probability of responding to one of the categories of an item (Andrich et al., 2013; Hobart & Cano, 2009). In this thesis, the construct is student–environment fit. Thus, the student's rating of SSI items is a function of her/his ability and the difficulty of the item, located within the same construct of student–environment fit. In the Rasch analysis, the ordinal ratings derived from the SSI are transformed into interval-level measures to compute a person location for each individual, representing an individual measure of student–environment fit. At the same time, the total score for each item is calculated and the item's location on the construct is estimated. Thus, an equation for the probability of a specific person's response to an item is generated through an iteration process. Estimates derived from this process are used to test how well the observed data fits the expected values from the mathematical model and interpreted to investigate the psychometric properties of the scale (Andrich et al., 2013; Hobart & Cano, 2009). In addition, the Rasch analysis accommodates missing data by computing an estimate based on available data (Hobart & Cano, 2009),

which enabled SSI assessments with missing ratings of items to be included.

To investigate the psychometric properties of the SSI for students with SEN in regular upper secondary education (study I), different fit statistics were examined, both statistically and graphically, to investigate whether the SSI data was consistent with the model's theoretical expectations regarding model fit, the targeting and reliability of the SSI scale, the functioning of items and response categories, the unidimensionality of the construct 'student–environment fit' and local independence among items. The significance level was overall set at $p<.05$ and the Bonferroni correction was applied, $p<.001$. Model fit was evaluated by analysing the total item-trait interaction using Chi-square statistics and item-trait residuals, acceptable in the range ±2.5 (Andrich et al., 2013). The person separation index (PSI), equivalent to Cronbach's alpha, was used to investigate the reliability of the SSI scale. Furthermore, the targeting of the scale was evaluated by investigating the relationship between persons and items, where a well-targeted scale generates a mean sample location that is close to the mean item location of zero. The accuracy of item response categories was inspected graphically and expected to be presented in an ordered set. The presence of differential item functioning (DIF), regarding gender and diagnosis, was analysed statistically by means of an analysis of variance (ANOVA) and graphically by inspection of the item characteristic curve (ICC) (Andrich et al., 2013). Items with identified DIF were split into two items, representing the different groups (boy/girl and diagnosis/no diagnosis), and a new analysis was performed using the resolved data set. A residual-based principal component analysis (PCA) with a varimax rotation, interpreting generated eigenvalues, was used to investigate the unidimensionality of the SSI scale. Local independence of items was investigated via the residual correlation matrix, where correlations of items are expected to be less than 0.3 (Hobart & Cano, 2009).

In study III, Rasch analysis was used to generate individual interval-level measures of student–environment fit at baseline and follow-up, with associated standard errors. Data was organised by assessment time-point in a stacked format. Items with disordered response categories were rescored and Rasch-based statistics were considered.

Descriptive statistics (studies I–IV)

Information collected via the questionnaires, e.g. demographics, educational programme, educational support and ICT before and after the intervention, and productive occupations were investigated using descriptive statistics (Field, 2016). The central tendency of ratings in SSI items at baseline (studies II–III) and follow-up (study III) was investigated to present

the sample's perceived need for accommodations in school activities. Descriptive statistics were also used in study III to summarise the content of the ICT intervention and to investigate students' grades and school attendance in terms of passing or failing grades in core subjects and change in school attendance between baseline and follow-up semester.

Inferential statistics (studies II–IV)

Bivariate analyses (Chi-square or Fischer's Exact Test) (Field, 2016) were performed to identify independent factors to be incorporated into the logistic regression analysis in study II. Chi-square or Fischer's Exact Test was also used to investigate systematic differences between groups in student characteristics and outcome measures (studies II–IV), such as comparing pass grades and school attendance between students who had shown a significant improvement in student–environment fit in study III, and between former students who were established in work or further studies and those who were not in study IV.

To evaluate the influence of the ICT intervention in study III, differences in students' accommodation needs in school activities at baseline and follow-up were investigated at a group level using a Wilcoxon signed-rank test. The effect size r was used to evaluate the magnitude of the difference, and was expressed as small (.10), medium (.30) or large (.50) (Field, 2016). A paired t-test was used to examine the change in students' measures of student–environment fit between baseline and follow-up (Field, 2016) and Cohen's d effect size was interpreted as small (.20), medium (.50) or large (.80) to evaluate the magnitude of the difference (Cohen, 1988). Furthermore, if students' follow-up location fell outside the 95% confidence intervals (CI) of their baseline location, their change in student–environment fit at an individual level was considered significant. The calculation and categorisation of the significance of change for each student were performed with guidance from Hobart, Cano and Thompson (2010). T-tests were performed to investigate group differences between students showing significant improvement in student–environment fit and the rest of the students, regarding student–environment fit and accommodation needs in school activities at baseline.

Multivariate statistics (study II)

To identify factors associated with a high level of accommodation needs in school activities, a logistic regression analysis was used in study II. Based on significant bivariate analyses, five independent factors (school absence, educational programme, diagnosis, presence of educational support at baseline and gender) were incorporated into the analysis, which was conducted using a stepwise backward method and likelihood ratio statistic as the removal criterion. The model's overall fit was assessed by the -2 log-

likelihood statistic, Hosmer and Lemeshow's goodness-of-fit statistic, Nagelkerke and Cox-Snell. Confidence intervals (CI) of 95% and odds ratios (OR) were used to interpret the results (Field, 2016).

Embedded mixed methods (study IV)

Study IV applied a mixed-methods approach to contextualise information and to include individuals experiences (Creswell et al., 2011). The embedded mixed-methods approach were used where quantitative data was complemented with qualitative data, despite having different priorities in relation to the focus of the study (Creswell et al., 2011; Plano Clark et al., 2013). The analyses of quantitative and qualitative data were kept separate in study IV. Quantitative data was analysed using descriptive statistics (Field, 2016) to address the primary research question concerning the former students' participation in productive occupations one year after leaving upper secondary education, and qualitative data was embedded within this in order to address and illustrate their perceived work ability via the use of a deductive content analysis (Graneheim et al., 2017).

Deductive content analysis

A deductive qualitative content analysis uses an existing theory to guide the analysis (Graneheim et al., 2017). In study IV, the MOHO (Taylor, 2017) was used to analyse the manifest content of the written notes on the WRI rating forms. Predetermined, theoretical concepts from the MOHO were used as a frame for the analysis and informed the coding. The six MOHO concepts from the WRI: personal causation, values, interests, roles, habits and environment, were used as content areas. The content areas were inserted into a table, along with their theoretical definitions. The content areas were then sorted into three themes: motivation, daily routines and social environment, based on their theoretical anchoring within the overarching MOHO concepts. The manifest content of the written notes for each WRI item was assembled under the associated content area. The author of this thesis read the manifest content several times in order to fully grasp the meaning of the text before short and concrete meaning units were identified. Identified meaning units with the same meaning were organized into codes. The codes were inspired by the MOHO concepts used as content areas. No categories were developed since the codes already were categorised under the six content areas. During the abstraction process, the author of this thesis engaged in an ongoing dialogue with a co-supervisor (EE), in order to reach consensus.

Ethical considerations

Ethical approval to conduct the studies included in this thesis was granted by the Regional Ethics Committee in Linköping, Sweden, study codes 2013/409-31 and 2015/203-32.

Students identified as potential participants in the SIAT intervention projects were provided with written and verbal information about the projects before inclusion. In addition, guardians' approval was requested for students under 18 years of age. Information provided to potential participants and their guardians further included contact information for the regional and national project directors if there were any questions about the projects. Additionally, all potential participants were informed that participation in the projects was voluntary and that the ICT they received would accrue to them after the projects were completed. Once included in the projects, participants were asked for permission to use the data in future research, and written informed consent was obtained for each of the different data collection time points (baseline and follow-up). Participants were assured that the collected data would be coded, handled and stored in a secure way and that findings would be presented on a group level, ensuring anonymity and confidentiality. All personal data, such as names and contact information, was handled according to the General Data Protection Regulation (European Commission, 2016). Through the use of secondary data collected in the SIAT projects, the usefulness of existing data was maximised and shed light on findings that would otherwise not have been revealed. Even though the use of existing data is encouraged across disciplines, concerns need to be recognised in relation to the inclusion of participants, the study population and collected data (Smith et al., 2011). Conducting a quality assurance of the secondary data was important to ensure that participants had consented to the data being used in research because the author of this thesis had no control over the inclusion of participants or the data collection at baseline and follow-up.

When involving young people in research, discussions about ethics must be undertaken to ensure that they understand the consequences of participation. This group of students was 15 years or older; nonetheless, written information was simple in wording to make it easy to understand. Another aspect to consider was that the participating students would receive ICT as support in school activities, which may either discourage or encourage participation. By using mainstream technology, such as tablets and laptops, any potential stigmatisation of participating students was minimised. On the other hand, the ICT could be interpreted as status devices, which might potentially attract students for the wrong reasons. In-

formation provided to potential participants clearly stated that participation in the projects was a commitment, with a focus on supporting students in their school activities, which it would not be justifiable to withdraw.

An ethical concern was noted in the data collection process in study IV. A large proportion of the students who had provided information to enable contact one year after upper secondary education did not answer phone calls when approached, nor did they respond to the web-based version of the questionnaire. The participants may have felt obligated to give consent to the data collection after upper secondary education because they were allowed to keep the received ICT after the projects ended. A decision was made to use two reminders, giving potential participants the opportunity to respond, yet respecting their potential desire not to participate.

When conducting the WRI interviews (study IV), the potential risk of emotional reactions was considered. On one occasion, a participant was considered in need of contact with healthcare services, which the author of this thesis suggested in the following dialogue. In all cases, the author of this thesis clarified the purpose of the interview and explained that the collected data would result in a scientific publication in which all participants were anonymous. Each interview was ended by asking the participant if any questions had arisen during the interview. Some participants asked questions about the number of participants, where the findings would be presented and the overall aim of the PhD project, while most did not have any further questions.

RESULTS

Student–environment fit among students with SEN in upper secondary school

Students' perceived need for support in school activities

The students who were included in this thesis were identified as students with SEN by school personnel. About half of these students did not have a medical diagnosis. Among students with a medical diagnosis, the largest proportions had a neuropsychiatric disorder or dyslexia (studies I–IV). At inclusion, two-thirds of the students stated that they were receiving support from school personnel, from either a teacher, a teacher assistant or a special educational teacher (studies II–III). A third of the students stated that they had access to ICT during school activities (study III).

Students did not consider the support that their schools had provided to fully accommodate their perceived difficulties with school activities. Out of the 16 school activities included in the SSI, the median number of activities in which students perceived a need for support was seven in study II and six in study III (range 1–15 in study II and 1–13 in study III) (see Table 6).

In study II, a logistic regression analysis identified characteristics of students that was associated with perceiving a high level of support needs, defined as eight needs or more in school activities. These were: students with a high level of school absence (OR = 3.5), students in vocational programmes (OR = 2.8) and students with a neuropsychiatric disorder (OR = 2.2). The odds of students perceiving a high level of accommodation needs in school activities rose with the level of school absence. Being absent for more than one school day per week tripled the odds of perceiving a high level of accommodation needs in comparison to a low level of school absence (<5%). Students enrolled in a vocational programme had more than twice the odds of perceiving a high level of accommodation needs in school activities, compared to students enrolled in the introductory or preparatory programmes. Furthermore, having a neuropsychiatric disorder was associated with twice the odds of perceiving a high level of accommodation needs in school activities, compared to not having a medical diagnosis.

Perceived student–environment fit in school activities

The findings indicate a low student–environment fit for the students included in this thesis. More than two-thirds of the students stated that they needed support in the academic school activities Remember things, Write, Do homework, Take exams and Read (studies II–III). Of the 484 students in study II, the proportion of students who perceived a need for accommodations in these school activities ranged between 89% (n=433) in Remember things to 72% (n=350) in Read. These activities are all central elements of schoolwork, yet only a low proportion of students had received support that they considered sufficient to meet their need for support to participate. In the school activity Remember things, only 4% (n=11) of the students in study III and 7% (n=30) of the students in study II were satisfied with the support they had been given. A greater proportion of students was satisfied with their support in Take exams (24%, n=81). The majority (51–58%) of the students stated that they had not been provided with any support in these school activities, despite a perceived need for support (study II).

In the academic school activity Do mathematics, 65% of the students' perceived a need for support. In contrast to the other academic school activities, almost one third of the students had received support they were satisfied with for this activity (study II). The largest proportion of students stating they were satisfied with the support their school had provided was found in the school activities Get assistance, Participate in social activities during breaks, Go on fieldtrips, Access the school and Do mathematics (30-41%). However, fewer students perceived a need for accommodations in these school activities.

A relatively low proportion of the students with SEN (5–22%) perceived a need for accommodations in school activities related to physical accessibility, practical activities or interactions with peers and school personnel. This indicate that the student–environment fit in these school activities was good because most students did not perceive barriers to participation (studies II–III).

Table 6. The students' median accommodation needs and the mean interval measure of student–environment fit at baseline in study I-IV.

Baseline	Study I		Study II		Study III		Study IV	
Accommodation needs								
Mnd	5		7		6		6	
Student–environment fit								
M (SD)	.56	(.6)	.50	(.54)	.59	(.84)	.59	(.79)

Note: In the SSI, the possible range of accommodation needs is 0-16.

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The School Setting Interview – valid measurement of student–environment fit

The Rasch analysis performed in study I provides support for the construct validity of the SSI for measuring the student–environment fit for students with SEN in upper secondary school. This suggests that the SSI assessment can be used for identifying and evaluating students' perceived need for accommodations in school activities in upper secondary school.

Study I revealed that the SSI items had good targeting for the included students with SEN, indicated by the fit statistics and the functioning of items, which were in accordance with the Rasch model (overall model fit χ^2 = 135.1; *df*=112; *p*=.07, mean item fit=-.15, SD=1.28 and mean person fit=-.25, SD=.73). The SSI items showed no response dependence, and a unidimensional construct was indicated by the PCA that did not reveal any additional structures besides the construct of student–environment fit. As well as these findings, disordered thresholds of rating categories in all 16 SSI items of school activities and DIF for gender in the item 'Remember things' and for diagnosis in the item 'Homework' were found, which warranted further exploration.

Because study I revealed that the rating categories of SSI items did not operate as intended, which could jeopardise the transformability to valid measurements of student–environment fit, stabilising measures were taken in study III. Items with disordered rating categories were rescored post-hoc to generate reliable and valid measures of student–environment fit at baseline and at follow-up, to enable a reliable evaluation of the influence of an ICT intervention on participation in school activities in upper secondary school with respect to student–environment fit. By using Rasch analysis in study III, students' difference in student–environment fit between data collection time-points was captured.

The rescoring of SSI items with disordered thresholds of rating categories (n=14) resulted in seven dichotomous items, seven items with three categories and two items with the original rating structure of four categories. The overall model fit was considered acceptable even though the total Chi squared value was significant (χ^2 = 210.29; *df*=144; *p*=<.001, mean item fit=-.18, SD=1.18 and mean person fit=-.29, SD=1.02).

ICT as support in school activities for students with SEN in upper secondary school

The findings in study III demonstrate that an individualised ICT intervention, involving ICT devices and software which were complemented with services to implement and use the ICT in school activities, had a positive influence on students' school participation, in respect of student–environment fit, grades and school attendance. After the intervention, the student–environment fit in school activities had improved, students perceived fewer accommodation needs in school activities and they were satisfied with the support that the ICT intervention had provided in school activities. In addition, about half of the sample had maintained or improved their school attendance and obtained pass grades in English, Mathematics and Swedish.

After the ICT intervention, students had increased their interval measure of student–environment fit, which was found to be statistically significant at a group level (t(299)=18.71, p=<.001) with a large effect size (d=1.03). Students' median of support needs in school activities had decreased from six needs at baseline to one need after the intervention. This decrease was found to be statistically significant (Z=14.54, p=<.001) with a large effect size, r=.59. At an individual student level, 84% of the students had improved their student–environment fit, of whom 22% had obtained a statistically significant improvement between measurement time points.

The overall proportion of students who said that they were satisfied with the support they had received in school activities had increased from 9% before the intervention to 39% after the ICT intervention. Looking specifically at the item Remember things, 4% stated that they were satisfied with their support at baseline. After the ICT intervention, as many as 69% of the students were satisfied with the support the ICT intervention had provided and they did not perceive a need for additional accommodations. However, the ICT intervention did not accommodate all the identified needs in school activities. The SSI ratings of 1 and 2, representing an unmet need for support, accounted for 12% of the total distribution of ratings after the ICT intervention, compared to 39% at baseline.

About 30% (n=43) of the sample had increased their school attendance between baseline and follow-up semester, and another 21% (n=31) had maintained the same level of school attendance as reported at baseline. In terms of grades, 54% (n=101) of the students had pass grades in all courses in English, Mathematics and Swedish.

The results of study III demonstrate that the students who benefitted most from the ICT intervention, i.e. those who achieved a statistically sig-

nificant improvement in student–environment fit, were those who at baseline had fewer than the median number of perceived accommodation needs in school activities (*Mdn* 6) and were without previous educational support and therefore had the lowest student–environment. Furthermore, students who had pass grades in English, Mathematics and Swedish had to a greater extent obtained a significant improvement in student–environment fit (χ^2(1, N=187)=8.4, *p*=.004). Together, these results indicate that the ICT intervention is primarily most beneficial for students with SEN whose difficulties in school activities are limited and who have relatively good educational achievement. Hence, it is less beneficial for the students who were identified in study II as perceiving the greatest need for support in school activities.

Productive occupations and perceived work ability one year after upper secondary school

The results of study IV show that almost two-thirds (63%, n=51) of the 81 former students with SEN were established in work (n=44) or enrolled in further studies (n=7) one year after upper secondary education. The largest proportion of the former students who were not established in work or further studies were currently seeking employment (n=12). When analysing differences between the groups, former students who were established in work or enrolled in further studies were more likely to have final pass grades from upper secondary education, χ^2(2, N=81)=7.5, *p*=.02. Furthermore, they had received time-assisting ICT to a lesser extent, χ^2(1, N=81)=7.1, *p*=.01, in the ICT intervention during upper secondary education.

The WRI interviews investigating perceived work ability included 13 former students with SEN who were established in work or further studies and seven who were not. Eleven of them were boys and nine were girls. In general, the rating of WRI items showed that the factors positively influenced the former students' perceived work ability. The items related to pursuing leisure-time interests and daily routines outside work were found to be the factors most likely to interfere, with a negative influence on the former students' perceived work ability (see Table 7).

Table 7. The ratings of WRI items of the 20 participants, sorted under the content areas and themes derived from the MOHO.

Theme	Content areas	Item	Interferes n(%)		Supports n(%)		
			1	2	3	4	NA*
Motivation	Personal causation	Assesses abilities and limitations	1 (5)	2 (10)	1 (5)	16 (80)	
		Expectation of job success	1 (6)	1 (6)		15 (88)	3
		Takes responsibility	2 (11)	1 (5)	3 (16)	13 (68)	1
	Values	Commitment to work			9 (45)	11 (55)	
		Work-related goals	1 (5)	3 (15)	3 (15)	13 (65)	
	Interests	Enjoys work	1 (6)		4 (25)	11 (69)	4
		Pursues interests	2 (11)	5 (28)	1 (5)	10 (56)	2
Daily routines	Roles	Appraises work expectations		1 (5)	3 (17)	14 (78)	2
		Influence of other roles		1 (6)		15 (94)	4
	Habits	Work habits		2 (12)	4 (25)	10 (63)	4
		Daily routines	3 (17)	1 (5)	2 (11)	12 (67)	2
		Adapts routine to minimise difficulties	1 (7)	2 (13)		12 (80)	5
Social environment	Environment	Perception of work setting	1 (8)	2 (17)	3 (25)	6 (50)	8
		Perception of family and peers		2 (11)	1 (6)	15 (83)	2
		Perception of boss	1 (9)	2 (18)	1 (9)	7 (64)	9
		Perception of co-workers		1 (8)	2 (15)	10 (77)	7

Note: *Not applicable (NA).

The qualitative findings concerning the former students perceived work ability is presented in relation to the three themes of motivation, daily routines and social environment, derived from the MOHO. In the text below, the codes from the analytical process are written in italics.

Motivation for work and further studies

Six codes were identified for the former students' motivational aspects for work and further studies, which influenced their perceived work ability.

Most participants experienced a *compliance between their capacities and the demands* of activities, which made them experience self-control. They possessed abilities, or had developed strategies, to manage their occupational role. As an example, some former students said that they used ICT to conduct educational activities or to plan their everyday lives. In relation to their *thoughts about the future*, the former students were generally optimistic. Doubts about their ability to become established on the general labour market, due to perceived difficulties caused by disability, were also expressed by some and considered to reduce participants' motivation. The former students gave examples of their *efforts to reach desired ends*, such as complementing grades to obtain qualifications for higher education or finding an occupation related to their field of education. However, some participants did not express any initiatives to change their current situation even though they wanted to do something else in the future. Participants expressed the *importance to work* because it generated preferences in relation to their future plans. Motivational aspects also included earning a living to be economically independent and perceptions about productive occupations being meaningful because they contributed to current well-being. Most of the former students gave examples of what they liked about their productive occupation. They were *stimulated by work tasks,* found enjoyment in their interactions with people they encountered in their role and considered these experiences to contribute to self-development. Some participants expressed a *desire for change* in relation to their leisure time. They expressed concerns about limited time to pursue hobbies and for social activities with friends or family due to the time their productive occupation consumed when also handling their disability.

Daily routines influence on work and further studies

In this theme, six codes with influence on participants perceived work ability were identified. Overall, the former students were well aware of the expected behaviour associated with their occupational role, representing an *internalised work role*. Following examples represent descriptions of how participants should be in their productive role: "flexible", "dedicated" and "service-minded". Most of the former students perceived a satisfactory *balance between roles* and stated that they prioritised their productive role, which for most participants was easy because they did not engage in many other roles. In their productive role, participants experienced that they had efficient *occupational performance habits* that enabled them to perform in accordance with expectations. Their daily routines, both within and outside of their productive occupations, were experienced as functioning well and some participants *used support,* such as calendars, to plan their commitments. However, maintaining their occupational role required a lot of effort for some participants, which complicated the maintenance of functioning

daily routines outside their productive occupation and led to a situation where their *everyday habits were disrupted by work*. Some of the former students stated that their *disability impacted upon their habits*, which negatively affected both their productive and daily routines.

Social environment influence on work and further studies

Three codes constitute this theme. Most of the participants who worked perceived *support from their manager* and *from colleagues*. They gave examples of issues that the manager had addressed when the participants had experienced difficulties. Participants had confidence in their colleagues willingness to help if they needed support. Among those who described limited social support at work, the manager was considered to be unfair or that cooperation with certain colleagues was unsatisfactory. In relation to *family and/or friends*, all of the former students stated that they were a great source of support. They gave examples of support from family and friends in both the process of finding a productive occupation and in maintaining it.

DISCUSSION

General discussion

This thesis set out to increase the knowledge concerning participation in school activities in upper secondary education among students with SEN, an area that so far has received little attention in research. The findings of this thesis provide knowledge about restricted participation in school activities among students with SEN and certain school activities that the upper secondary school needs to prioritise to improve participation. Moreover, the thesis establishes that the SSI and ICT can be used for students with SEN in addressing environmental barriers to students' participation in school activities in upper secondary school. Additionally, participation in productive occupations and perceived work ability among the former students with SEN were investigated one year after their upper secondary education.

The following section will discuss some of the main findings, namely 1) restricted participation in school activities among students with SEN in upper secondary education, 2) the influence of ICT on participation in school activities in upper secondary education, and 3) participation in productive occupations after upper secondary education among students with SEN.

Restricted participation in school activities among students with SEN in upper secondary education

The findings indicated restricted participation in school activities among students with SEN due to their lack of needed support. Students perceived a need for support in several school activities in order to participate, and were rarely satisfied with the support that school had provided (studies II–III). Accordingly, the present findings confirmed earlier findings that students with SEN were overlooked in regards to receiving sufficient educational support in upper secondary school (Bolic Baric et al., 2016; Gibson & Kendall, 2010; Jacobs et al., 2020; Lundahl & Olofsson, 2014; Sikirica et al., 2015).

   The present thesis revealed that the need for support among the students with SEN was most prevalent in academic school activities: Remember things, Write, Do homework, Take exams and Read, in which the majority of students' support needs had not been acknowledged properly, as perceived by the students (studies I–III). Environmental barriers to participation in school activities have been reported before (e.g., Coster et al.,

2013; Şahin et al., 2020), but rarely focusing on the upper secondary school context or in relation to specific school activities. Why schools had not been able to provide an inclusive learning environment or sufficient individual support to this group of students with SEN this thesis does not reveal, but there was probably a combination of several interacting components. Potential explanations might involve available resources and their allocation, and teachers' limited time and knowledge of how to support students with SEN (De Vroey, Struyf & Petry, 2016; Niemi & Laaksonen, 2020; Pearce et al., 2010; Ramberg, 2013). School personnel could identify students with SEN, i.e. they were aware of students who they considered needed support to reach educational goals. Yet about one third of the students had received no previous educational support and the two thirds who stated they had access to educational support at inclusion still perceived a need for additional accommodations in school activities (studies II–III). This may be due to schools having limited funding for special educational services, forcing school personnel to prioritise between students (De Vroey et al., 2016; Pearce et al., 2010). The two thirds that had access to special educational support at inclusion could be those students with SEN that had the greatest need of support and who therefore had been prioritised, while the other students with SEN might be considered less at risk of not reaching educational goals. Nevertheless, neglecting support needs, even limited ones, may prevent these students reaching their full potential and may decrease their well-being and academic achievements (Warne, Snyder & Gillander Gådin, 2013). Another potential explanation for the limited access to support among the students with SEN may be that the majority of students in this thesis were studying within a vocational programme. Research conducted in a Swedish context has indicated that upper secondary school students with high socio-economic status (well-educated parents) have greater access to educational support (Ramberg, 2013), which aligns with the findings of Johansson (2017), that the frequency of support provided to students varies between educational programmes, in favour of students in preparatory programmes.

Factors associated with the lowest student–environment fit among students with SEN

The risk for experiencing restricted participation was associated with a high level of school absence, studying in a vocational programme and with neuropsychiatric disorders (study II). Students with any of these factors were those who perceived a need for support in school activities to the greatest extent. Accordingly, students with a high level of school absence, enrolled in vocational programmes or with a neuropsychiatric disorder might be in need of extensive support efforts to improve their participation in school activities.

Students with a high level of school absence experienced support needs to the greatest extent. Their absence might be the result of an unaccommodated school environment, since the MOHO recognises that individuals tend to choose and engage in activities that they consider are compatible with their perceived competence (de las Heras de Pablo, Fan et al., 2017). Low school attendance and a high drop-out rate among students with SEN in upper secondary school are reported in the literature and associations between these outcomes and students' access to educational support exist (Lundahl, Lindblad, Lovén, Mårald & Svedberg, 2017; Pijl, Frostad & Mjaavatn, 2014; Reid, 2008; Strom & Boster, 2007). Pijl et al. (2014) and Warne et al. (2013) have explained the relationship as related to students' decreased motivation to attend school when needed support is lacking and vice versa; when students felt supported by the school environment they were more motivated to attend school. In line with earlier research, the results demonstrated that students enrolled in vocational programmes or with a neuropsychiatric disorder had an increased risk of perceiving a high amount of support needs in school activities. Research has recognised that students who experience SEN tend to enrol in vocational programmes based on earlier difficulties in school and low educational expectations (Hakkarainen et al., 2016; Savolainen, Ahonen, Aro, Tolvanen & Holopainen, 2008), and neuropsychiatric disorders are commonly reported among students with SEN with accompanying difficulties, such as inattention and low concentration, usually having a negative impact on schooling (DuPaul et al., 2009; McCoy et al., 2012).

In regard to factors affecting perceived need for support, the students in study II more commonly had received accommodations that they considered enabled their participation in the academic school activity Do mathematics. Why were students satisfied with the support in this school activity? Was it because of the kind of support that they received or was it associated with the school activity? For future research, it would be interesting to investigate the factors associated with support that students perceived enabled their participation in school activities.

Academic school activities

The large proportion of students who needed accommodations in the academic school activities Remember things, Write, Do homework, Take exams and Read, and the schools' inability to successfully meet student's needs, suggest that these school activities need the most improvements to promote students' participation (studies I–III). The fact that over 50% of the students had not been provided with any support in the academic

school activities at inclusion (study II) is alarming since these school activities are encountered by students on a daily basis, throughout their schooling. Research has also recognised that reading ability (Hakkarainen et al., 2013) and the abilities to perform activities according to expectations, manage time and remember things (Simmeborn Fleischer et al., 2013) are related to students' academic success. The students' limited access to support in activities such as Read and Write, could be related to the teachers' assumption that students in upper secondary school have developed adequate skills and abilities in these school activities and that the need for support has therefore decreased as students advanced to upper secondary school (Pearce et al., 2010). However, the present findings clearly showed that this was not the case. Students with SEN in upper secondary education still perceived a need for support to participate in these school activities.

The proportion of students with unmet needs in academic school activities in the present thesis corresponded quite well with a study by Hemmingsson and Borell (2000), using the SSI for students with SEN in upper secondary education. In contrast, a smaller proportion of students with an unmet need for support in academic school activities were reported in studies primarily involving younger students with SEN (Egilson & Hemmingsson, 2009; Kocher Stalder et al., 2017). The complexity of supporting students in academic school activities in the upper secondary school might be influenced by the many different environments in which students perform these activities (Hemmingson & Borell, 2002; Pearce et al., 2010). The SSI item Write for example is performed in all environments where students are expected to produce written text, which in the upper secondary school includes various class rooms, the home environment, lectures and exams. This suggests that an accommodation to improve participation in academic school activities should ideally be portable to provide support in a variety of activities and environments, which also has been highlighted as an important factor among students with SEN (Pino & Mortari, 2014). Only 4-24% of the students were satisfied with the support they had in academic school activities (studies II–III), indicating that environmental aspects hindering students' participation were not addressed with the support from teacher assistants or special education teachers. Providing accommodations in a one-size-fits-all approach does not seem to be an effective way to improve students' participation in school activities, nor does it satisfy the students' need for support (studies II–III). The ineffectiveness of the support provided by special education teachers may be due to different priorities of the subject teacher and special education teacher, where subject knowledge is prioritised in upper secondary school, and limited time to plan and incorporate the support provided by the special education teacher (De Vroey et al., 2016). For support to be effective and increase participation in school activities, the student's involvement in

decisions regarding accommodations is important. Both in regards to what would be a suitable and useful accommodation in the particular school activity, and its possibility of being individualised based on students specific needs (Hakkarainen et al., 2013; Kramer et al., 2012; Simmeborn Fleischer et al., 2013).

Students' lack of support and their dissatisfaction with provided accommodations in school activities revealed in this thesis raise the question of whether schools have proper assessments to identify students' perceived need for support, and can thus meet these needs successfully and improve students' participation.

Using the SSI to identify students' need for support in school activities

The findings of this thesis establish the SSI as a valid assessment instrument, with a student-centred approach, that can be used in schools' work with special educational support to promote participation in school activities. As few assessment instruments exist in the school context, especially ones that address participation (Lidström & Munkholm, 2018), this finding may have implications for schools work with special educational support. In study I, support for the construct validity of the SSI for use among students with SEN in upper secondary education was found. By using the SSI, students' needs for support in school activities are identified, adequate information to plan individualised interventions is provided, and the effectiveness of implemented support in meeting the student's perceived needs in school activities can be evaluated. Hence, the SSI may be a valuable tool to identify and implement adequate accommodations in school activities to improve participation, which could contribute to increased quality in schools provision of special educational support (SOU, 2017). The SSI would also enable a desirable, person-centred process (De Vroey et al., 2016; Kramer et al., 2012; SOU, 2017) that gives the student influence over matters that concern her/him, which has been found to increase students' ownership and outcomes of learning (De Vroey et al., 2016).

As validation of assessment instruments is an ongoing process (Streiner, Norman & Cairney, 2015), the findings of study I also identified aspects that need to be addressed in further research, primarily focusing on the SSI rating categories that did not function as expected. All items in study I had disordered thresholds, involving the rating categories 2 (partial fit) and 3 (good fit). Hobart and Cano (2009) recognises three main reasons for disordered thresholds of items, namely: the assessor is not able to use the categories as intended; the categories do not capture the intended meaning of 'more and less' of the construct; or categories do not measure

the construct like other items. All these reasons impact on the reliability or validity of the items with disordered thresholds. In this particular case with the SSI, it was proposed that the disordering of thresholds could be due to assessors not using all rating categories (Andrich, De Jong & Sheridan, 1997; Hagquist & Andrich, 2004) since these students had rarely received educational support at inclusion (study I). However, since disordered thresholds were still present in study III, where the rating categories of 2 and 3 (involving received accommodations) were used, this explanation might not be the whole truth. Another complementary explanation may be that the rating categories do not capture the intended meaning of more and less of student–environment fit, impacting on the validity of items to inform decisions and outcomes (Hobart & Cano, 2009). Such a deviation needs to be explained qualitatively (Andrich, 2013) and could be because both SSI rating categories involve accommodations provided to the student, yet with different outcomes. A score of 2 implies that even though support has been provided, the student is still in need of support, which is more or less equivalent to a rating of 1. A score of 3, on the other hand, implies that the student is satisfied with the support s/he has been provided to participate in the school activity (Hemmingsson et al., 2014; Hemmingsson et al., 2020). Hence, these two categories are reliant on environmental circumstances such as whether a student has access to support and if that support is perceived as meeting her/his needs. Thus, the individual measure of student–environment fit is not generated solely based on the student's ability and the item difficulty, as proposed in the mathematical theory underlying Rasch analysis (Andrich et al., 2013) but is also dependent on whether support has been provided to the student. This may be why the items showed disordered thresholds also in study III. The proposed explanation for the disordered thresholds could impact on the unidimensionality of the SSI scale (Hobart & Cano, 2009); however, no indications of multidimensionality were found in the Rasch analyses in studies I and III. It can therefore be assumed that the SSI items all measure student–environment fit.

The current SSI rating categories are of great clinical value since they enable the SSI to be used both for identifying support needs among students and for evaluating the effect of implemented accommodations on meeting students' need for support. The scales value as a valid and reliable measurement of student–environment fit could however be improved. Given this knowledge, a post hoc combination of categories was performed in study III (Hobart & Cano, 2009) to use student–environment fit as an outcome measure. The above mentioned explanations of the disordering of thresholds need to be investigated further. Future studies could focus on developing the categorisation of the SSI rating scale. A clearer operational

definition of the rating categories that improves the distinction between them could potentially improve the validity and reliability of the scale.

The influence of ICT on participation in school activities in upper secondary education

The findings of study III imply that using ICT as support in school activities had a positive influence on participation as it decreased students' perceived need for support, which also may have contributed to students' increased school attendance. Analyses of pre and post measures of student–environment fit and students' need for support showed statistically significant differences with large effect sizes, implying the clinical relevance of the findings. To further investigate the clinical relevance of the change between measurement time points, an analysis of individual improvement in the outcome, i.e. student–environment fit, (Hobart et al., 2010) was conducted. The analysis revealed that 84% of the students had improved their measure of student–environment fit at follow-up, whereas 22% had obtained a statistically significant improvement. Considering the many needs for support in school activities that were reported among the students at baseline (*Mdn* 6), and that the median time for the ICT intervention was eight hours, the results indicated that accommodating students' need for support to improve their participation in school activities can be accomplished in a relatively short time. Furthermore, the data collection before and after the intervention was conducted within 4-6 months. The time between data collections may have given students an opportunity to incorporate the ICT as support in school activities and time to consider whether they perceived a need for additional accommodations. In light of these circumstances, one could argue that an individualised ICT intervention, with complementary services concerned with how to use the technology as support in school activities, might be a cost-effective, flexible intervention with an immediate, lasting and positive influence on participation in many school activities.

Involvement—perceived need for support

The results of study III showed that by using ICT in school activities the student–environment fit increased among the students with SEN, as a result of students' decreased need for support in school activities. From an occupational perspective (Kielhofner, 2008; Taylor, 2017), in line with the ICF (WHO, 2001), these findings indicate that ICT usage in school activities can provide improved opportunities for participation and learning among students with SEN. The decrease in students' median number of school activities in which they perceived a need for support, six at baseline and one at follow-up, indicated that the ICT can be used to accommodate

students' support needs in a variety of school activities (study III). Thus, the findings indicated that ICT is a flexible accommodation that may be individualised based on the students' needs (Lidström & Hemmingsson, 2014; McKnight, 2016). The flexibility of the ICT in catering for students' need for support in a variety of school activities may be of particular value in the upper secondary school, where subject teachers' opportunities to respond to the many different needs for support among students in different classes have been recognised as limited (De Vroey et al., 2016). However, other key factors in the present study may have had a crucial impact on the positive outcomes of the ICT intervention. The ICT intervention was individualised based on students' view of support needs in school activities and preferences for how to cater for them, and services from occupational therapists or special education teacher and technicians were provided. These are all aspects that have been raised in research as important to enable effective educational support to students (Hakkarainen et al., 2013; Kramer et al., 2012; Lidström & Hemmingsson, 2014; Perelmutter et al., 2017; Simmeborn Fleischer et al., 2013).

Students' grades in the core subjects of English, Mathematics and Swedish were also used as an outcome measure of the involvement dimension of participation and 50% of the students obtained pass grades in all courses of included subjects they enrolled in (study III). Grades were considered to offer an objective measure of involvement, i.e. pass grades are a certificate of reaching educational goals. However, it proved to be a challenge to use grades as a measure of involvement since the national programmes include different numbers of courses in these subjects, with progressively increased difficulty. Nevertheless, it enabled analyses that identified students with pass grades as those who obtained a significant improvement in student–environment fit to the greatest extent, suggesting that the present ICT intervention as support in school activities might be most beneficial for students with relatively good attainment and limited support needs. Or it may indicate that students with pass grades had better digital competence (Hatlevik, Guðmundsdóttir & Loi, 2015) and could make better use of the ICT as support in school activities. However, it is quite safe to assume that students today generally possess good digital competence (Internetstiftelsen, 2019). Even though digital competence was not measured in this thesis, services provided to students, which included training and strategies for how to use the ICT as support in school activities, addressed this issue.

School attendance
The findings of study III indicated that the ICT intervention might have had a positive influence on students' school attendance as 30% of the students increased their attendance and another 21% remained at the same

level of attendance. The improved school attendance might be because the ICT intervention met students' perceived need for support in school activities. To address students' subjective experience of their opportunities to participate and succeed in school has been raised as an important factor in relation to proactive measures for increased school attendance. In their Response to Intervention model to promote school attendance, Kearney and Graczyk (2014) suggest that students showing a risk for absenteeism should receive targeted accommodations to reduce their perceived barriers to attending school. Generally, students' school attendance decreases throughout their upper secondary education (Attwood & Croll, 2006; SNAE, 2014) and the present findings could indicate a trend break, which needs to be investigated further. In future research, the present ICT interventions' impact on school attendance should ideally be addressed in studies with a longitudinal design, and with more than two data collection time points (Ployhart & Vandenberg, 2010).

ICT as support in managing the school day

Based on the remarkable large proportion (89%) of students who perceived a need for support in Remember things, and the low proportion of students that had accommodations sufficiently addressing it at inclusion (study II), special attention will be given to this school activity in the following section. As described in the SSI, Remember things included the students opportunities to remember school assignments, managing time in relation to the schedule and performance of activities, as well as preparing for school activities and bringing the right equipment to class (Hemmingsson et al., 2014; Hemmingsson et al., 2020). Hence, it was related to carrying out daily routines, included in the activity and participation component of the ICF (WHO, 2001). Research has recognised organisational demands as challenging for upper secondary school students in general (Lundahl & Olofsson, 2014) and for students with SEN in particular (Egilson & Hemmingsson, 2009; Jacobs et al., 2020; Kocher Stalder et al., 2017) and along with the findings presented in this thesis, the need for upper secondary schools to consider improving students' opportunities to handle these demands is clear.

Before the ICT intervention in study III, 4% of the students considered the support that school had provided to cater for their perceived need in the item Remember things to be adequate, and at follow-up that proportion had increased to 69%. It is recognised that ICT can be used to support maintaining information, remembering and planning, and to initiate task execution by reminders (Brandt, Jensen, Søberg, Andersen & Sund, 2020; Frank Lopresti, Mihailidis & Kirsch, 2004). Given the findings of study III, using ICT to support students with SEN in managing the school day and

organisational demands of school activities is promising and may improve students' opportunities to participate in school activities.

Participation in productive occupations after upper secondary education among students with SEN

The results of study IV revealed that almost two-thirds (63%, n=51) of the 81 former students with SEN were either working or enrolled in further studies one year after upper secondary education. This proportion corresponds well with the national average of establishment in productive occupations among former upper secondary school students one year after graduation (60%) (SNAE, 2019a). That the present proportion of former students with SEN that was established in productive occupations corresponded with the national average may be considered positive, since students with SEN are commonly reported to be established in work or further studies to a lesser extent than their former peers without SEN (Engdahl & Forslund, 2015; Hakkarainen et al., 2016; Myklebust & Båtevik, 2014). However, as proposed by SNAE (2019a), the 'establishment status' among former students may be more valid three years after graduation, which warrants future studies to follow the participation in work or further studies among former students with SEN over longer periods.

The finding that pass grades were more common in the group of former students with SEN that were established in work or further studies is in line with earlier research, e.g. Mazzotti et al. (2016), recognising the predictive power of grades in successful establishment on the labour market and in further studies. It further highlights the importance of supporting students with SEN during upper secondary education to help them achieve the goals of education, as graduation has been identified as one of the most important factors for students with SEN in relation to long-term employment (Båtevik, 2019).

Despite students' past experiences of restricted participation and need for support in school activities during upper secondary education, the qualitative findings showed that, in general, the former students with SEN believed in their work ability, and were optimistic and motivated in relation to productive occupations. However, some participants also said that they struggled to maintain their daily routines while performing their productive role (study IV). The former students with SEN in the present study had received an ICT intervention during upper secondary education, which may have contributed to increased self-advocacy and belief in their work ability. In relation to work, self-advocacy has been identified as a factor associated with employment after upper secondary education among students with SEN (Wehman et al., 2015) and belief in one's work ability and positive expectations in relation to future work have been found to be predictive of

work attainment among sick-listed persons (Ekbladh et al., 2010). The former students with SEN also stated that they perceived support from their social environment, primarily from friends and family both in relation to finding and obtaining a productive occupation after leaving upper secondary education (study IV). In the study by Wehman et al. (2015), parental support was also associated with employment after education among student with SEN. Given this, the qualitative findings of study IV revealed factors in favour for a successful entry to the labour market or enrolment in further studies among these students.

Methodological considerations

Given that the studies comprising this thesis are primarily based on quantitative data, the generalisability of the findings must be discussed. Quantitative methods allow statistical analyses of data for the purpose of describing, investigating and comparing characteristics and outcomes (Field, 2016; Polit & Beck, 2016), in this case within a large sample of students with SEN with the aim of generalising findings to similar populations. In the following section some general considerations will be presented concerning the overall design of the thesis and included studies. Some remarks on the trustworthiness of the findings of study IV will also be made.

External validity

External validity concerns the generalisability of findings, i.e. the extent to which the present results hold true for other populations and settings (Field, 2016; Polit & Beck, 2016). The population of interest in this thesis was students with SEN in upper secondary school, which, based on existing literature, is a heterogeneous group of students whose need for support is considered to arise from their interaction with the specific environment of school activities. Applying broad inclusion criteria, based on students' inability to achieve educational goals, and noticeable difficulties with planning, problem-solving, conducting and/or finishing tasks and/or a high level of school absence rather than, for example, being restricted to students having a medical diagnosis, was considered to enable a sample representative of the population in order to generalise findings. The long sampling period (a duration of several years) and the multiple settings of data collection (five different municipalities) could also reduce the risk of bias due to time-related fluctuations and might allow variations in the sample to enhance the representativeness, which may be affected by the consecutive sampling method based on criteria (Polit & Beck, 2016). With respect to the characteristics of the sample, for example the overrepresentation of boys and students in vocational programmes which corresponds with other studies involving students with SEN (e.g., Hakkarainen et al., 2016; Smeets

& Roeleveld, 2016), together with the relatively large sample size, which reduces sampling errors (Polit & Beck, 2016), it is considered likely that the sample is representative of the population and that the findings may be generalised.

However, a limitation of the present thesis is the lack of information about non-responders, due to the use of secondary data. The sampling was performed in the SIAT projects and no record of eligible participants who declined participation in the projects exists, nor does information on potential participants that may have been missed or di-prioritised by the school personnel. An analysis of non-respondents was therefore not possible and no information about the response rate can be presented. This may be a cause of bias since non-respondents may be students with more or less need for support in school activities, less interest in using ICT, or higher school absence than those who participated. The findings need to be interpreted with this limitation in mind. For example, students with the most participation restrictions might have been missed in the inclusion of participants in the SIAT projects because of their non-attendance at school. Keeping in mind the association between school absence and the high extent of perceived need for support in school activities revealed in study II, the present sample might give a more positive picture than the reality.

Finally, some remarks should be made on the attrition of participants in study IV, which is not uncommon in longitudinal studies but could cause bias regarding the representativeness of the sample (Polit & Beck, 2016). Encouragingly, no differences in demographics were present between the sample in study IV and the participants in study III, indicating that the drop-out of 60% had not caused bias. Counteracting measures were taken to address attrition by using reminders and offering participants the option to answer the questionnaire by telephone or as a web-based questionnaire. However, a lesson learnt from this data collection process is that contact information provided years earlier may not be adequate. This may be especially true when youths are involved, since they are likely to change their e-mail addresses and telephone numbers when they for example change mobile phone operator, leave their parental home or start studying. Thus, for future research involving youths, this study recommends considering collecting personal identity numbers to provide better opportunities to ensure valid contact information.

Statistical conclusion validity

The statistical conclusion validity concerns the extent to which presented findings are correct, and relates to the data used for statistical analyses and aspects such as statistical power, the reliability of measures and intervention fidelity (Polit & Beck, 2016). Statistical power refers to the ability to detect relationships among the variables under study, and the large sample

sizes in studies I–III, with 509, 484 and 300 participants respectively, are considered to have strengthened the statistical conclusion validity and to have decreased the risk of Type II error, i.e. acceptance of the null hypothesis when it is false (Field, 2016; Polit & Beck, 2016). However, the results of group comparisons among former students with SEN that were or were not established in work or further studies (study IV), where the sample consisted of 81 former students with SEN, should be interpreted with more caution in relation to Type II error.

The statistical analyses conducted in the different studies were based on the current data and aim of the study. Since the SSI generates ordinal data and the questionnaires collected mainly categorical data, this was considered when choosing the statistical approach. Primarily descriptive statistics, group comparisons and non-parametric analyses were used, with the exception being study III where the interval measure of student–environment fit allowed for the use of parametric methods (Field, 2016). In study II, a logistic regression was used to investigate student characteristics associated with a high level of support needs in school activities. As socio-economic factors are associated with SEN (Banks & McCoy, 2011; Smeets & Roeleveld, 2016), incorporating such factors in the analysis may have increased the explanatory power, which rose to 19%. Information related to socio-economic status was collected within questionnaires I and II, but the internal drop-out in these questions was considered too large to include this information in the logistic regression analysis which did not incorporate cases with missing independent variables (Field, 2016). Another contributing factor to the relatively low explanatory power could be the use of cross-sectional data, which tend to generate low coefficients (Eisenhauer, 2009).

Support for the construct validity of the SSI, found in study I, suggests that the data for analyses in studies II–III was valid to use to meet the aims of the studies. Furthermore, students' individual measure of student–environment fit before and after the intervention was converted into interval level to enable a reliable evaluation of the difference between time points in study III and to overcome the potential bias due to the disordered thresholds of the SSI scale. Also, in study IV a psychometrically sound assessment instrument, the WRI (Ekbladh & Haglund, 2012), was used to generate valid data on perceived work ability among the former students with SEN. Both these assessment instruments have a theoretical foundation in the MOHO (Kielhofner, 2008; Taylor, 2017). In this thesis, the use of the MOHO offered a theoretical explanation of how participation in school activities and perceived work ability among the students with SEN was influenced by their interaction with physical and social environmental factors, acknowledging the students' subjective experiences of environmental barriers.

The validity and reliability of the questionnaires used in the thesis has not been evaluated. The information collected via the questionnaires was used in a descriptive way and primarily constituted student demographics, information about received ICT, and support in school activities and their current occupation, suggesting that evaluating the questionnaires psychometric properties are not relevant as they are not used as outcome measurements (Streiner et al., 2015). However, the questionnaires used in this objective still need to be valid and reliable in regard to the formulation of questions, which must be clear and simple to understand to generate valid information (Polit & Beck, 2016). This was accounted for by the involvement of HL, one of the supervisors, in the SIAT projects where she acted as a method-supporter to ensure reliable information was obtained from the questionnaires. Furthermore, questionnaire III used in study IV was developed by the three supervisors, all PhDs.

Fidelity of the ICT intervention

Since the ICT intervention was considered as complex (MRC, 2019) and was implemented in the SIAT projects some remarks on the interpretation of the findings and fidelity of the intervention in study III are appropriate. Study III had a quasi-experimental, one-group pretest-posttest design. This design did not allow statements on the effectiveness of the ICT intervention as there was no control group (Polit & Beck, 2016), which is a limitation of the present study. However, evaluating interventions with non-experimental designs is sometimes the most feasible approach even though estimates of casual effect are limited (MRC, 2019), as in this case where a large-scale intervention had already been implemented. The large effect sizes and the evaluation of students' individual measures of student–environment fit (Cohen, 1988; Hobart et al., 2010), together with the theoretical explanation of the outcomes, indicate the clinical relevance of the ICT intervention.

The one-group pretest-posttest design cannot control external factors or other changes that may have occurred between the measurement time points (Polit & Beck, 2016). Furthermore, the lack of blinding among the assessors could have caused an overestimation of the ICT interventions' effect (Balk et al., 2002). However, questions in questionnaire II ensured students' use of ICT and professionals in the SIAT projects had a reconciliation with the student after a few weeks to ensure the ICT provided adequate support in school activities. The risk of bias caused by assessors overestimating the effect of the intervention was accounted for by the Rasch analysis, which provided stable and reliable interval measures of student–environment fit at baseline and follow-up. Furthermore, the rating of SSI items was based on students' perception of support needs and whether they had

been met properly, which may have reduced the risk of overestimation among assessors.

As noted earlier, no fidelity criteria or measurements were applied in the SIAT projects. However, several important fidelity aspects were considered (Gearing et al., 2011), including professionals' experiences with ICT, their education concerning the content and delivery of the ICT intervention, and training in the administration and use of the assessment instrument (SSI). In addition, the summary of the ICT intervention, presented in Table 3 in the method section of the thesis, indicated that all students had been provided with the two main components of the ICT intervention, namely the ICT device and/or software and services from professionals, suggesting that the fidelity of the intervention was acceptable.

Mixed methods approach

Consensus regarding quality measures of mixed methods has not yet been reached, but addressing the quantitative and qualitative approaches separately is not considered enough (Halcomb, 2019). In study IV, a mixed methods approach was chosen to contextualise information (Creswell et al., 2011), and to take a quantitative perspective on participation in productive occupations among former students with SEN one year after their upper secondary education, and to include the individuals' experiences of environmental factors that facilitated or hindered their participation. As such, the use of both quantitative and qualitative data had a clear connection to the aim of the study, as stressed by Bryman (2014). The intention was to combine the strengths of the different approaches to answer the research question (Creswell et al., 2011); however, the low proportion of students who participated in the WRI interviews and the unit of analysis, might have limited the possibility to fully exploit this advantage.

The deductive content analysis was performed with guidance taken from Graneheim and Lundman (2004) and Graneheim et al. (2017), which was considered helpful since it offered hands-on strategies for how to conduct the analysis and to improve the trustworthiness of findings. The trustworthiness of the findings might have been strengthened since both boys and girls who were and were not established in work or further studies participated in the WRI interviews, involving the credibility of the findings. As noted earlier, the credibility could possibly have been strengthened with richer data (Graneheim et al., 2017). Furthermore, the sub-sample was representative of the larger sample of study IV. Additionally, dependability (Graneheim et al., 2017) was addressed by an ongoing discussion in the analysis process between the author of this thesis and one of the supervisors (EE) to ensure compliance between the data and the chosen theoretical foundation, the MOHO (Taylor, 2017).

CONCLUSIONS

The findings of this thesis have provided new knowledge concerning the participation in school activities among upper secondary school students with SEN. Students with SEN perceived a need for support in several school activities and had rarely received support that they were satisfied with to participate in school activities. Participation restrictions were most prevalent in academic school activities: Remember things, Write, Do homework, Take exams and Read. In these school activities, the majority of the students had not received any support.

Students with a high level of school absence, enrolled in vocational programmes or with a neuropsychiatric disorder experienced the most support needs in school activities. Accordingly, upper secondary schools should pay attention to the opportunities for participation in school activities among students with these characteristics.

The findings revealed support for the construct validity of the SSI to measure student–environment fit among students with SEN in upper secondary education. Thus, the SSI can be used to provide valid information in the process of identifying the need for support in school activities and evaluating the impact of implemented accommodations.

The individualised ICT intervention provided better opportunities for students with SEN to participate in school activities. Students' need for support decreased and their student–environment fit increased after the intervention. Students perceived that the ICT satisfactorily met their need for support in school activities. Using ICT as support in school activities may also improve school attendance. The ICT intervention proved to be most beneficial for students who experienced few (≤6) support needs in school activities, who had not previously received support in school activities and who had pass grades.

One year after their upper secondary education, the proportion of the former students with SEN corresponded with the national average of establishment in work or further studies. The importance of pass grades for establishment in work and further studies was supported. Furthermore, in general the former students with SEN believed in their work ability

IMPLICATIONS

The findings of this thesis have implications for professionals within the student health unit and personnel in Swedish upper secondary education in regard to promoting participation and learning among students with SEN. Knowledge provided by the included studies may also be of value to decision-makers to further develop the quality of the service providence of special educational support and to guide schools proactive measures on an organisational level to increase the inclusive state of upper secondary education.

Pass grades are important for successful entry into productive occupations after upper secondary school among students with SEN. Therefore, it is of the outmost importance to support their participation in school activities. School personnel and professionals within student health units, as well as decision-makers on a national level must bear this in mind when making decisions affecting students' access to support.

High school absence could be considered an indicator of participation restrictions due to an unsupportive school environment. The school situation of students with high school absence should be investigated since a supportive school environment can increase students' attendance. This knowledge may be used to guide national efforts to address school absence as well as the work with individual students within student health units.

Professionals in student health units should investigate the opportunities for participation in academic school activities among students with SEN in upper secondary education. In this process, professionals can use the SSI as a valuable tool that provides valid information on which accommodations can be planned and evaluated. The implementation of ICT as support in these school activities can be one way to improve students' opportunities to participate. When implementing ICT, several stakeholders and complimentary expertise should ideally be involved, such as students, teachers, occupational therapists, special education teachers and technicians.

FUTURE RESEARCH

This thesis has generated new questions and suggestions for future research:

The findings of study III indicated that most students improved their participation in school activities using ICT as support. However, the ICT intervention was most beneficial for students with limited support needs, and not as beneficial for students who were reported to experience most need for support in study II. How best to promote participation in school activities among students with the most support needs could be an area for future research. In addition to ICT, an intervention should probably involve other aspects of the students' personal and educational situation and additional professional competence.

Study III provided new knowledge about the positive influence of ICT on participation in school activities among students with SEN. However, the one-group, pretest-posttest design did not provide evidence of the effectiveness of the ICT intervention, nor does it allow conclusions to be drawn about students' participation in productive occupations after upper secondary education. Studies with stronger designs are still needed. Furthermore, a longitudinal design, including a data collection more than one year after upper secondary education, would be preferable to investigate the impact of provided support on participation in productive occupations and societal life among former students with SEN.

Study III indicated that support in school activities could increase students' school attendance. This is an important finding and a promising area for future studies, which ought to apply a longitudinal approach. To promote school attendance is an important task for the school as graduation from upper secondary education is one of the most important factors in relation to youths' future opportunities in adult life and with implications for their health.

In some school activities, such as in Do mathematics, students more commonly perceived that the school had provided support and accommodations that enabled their full participation. What characterised the support

provided to students in mathematics and teacher's knowledge and experience thereof might guide the development of more effective support efforts in upper secondary education and could be an area for future study.

Development of the rating scale of the SSI is another suggestion for future research. The disordered thresholds need further scrutinising and as noted earlier, by developing operational definitions of the different rating categories an improved distinction between them may be accomplished.

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Papers

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