

Computer use in educational activities by students with ADHD

Vedrana Bolic, Helene Lidström, Nils Thelin, Anette Kjellberg and Helena Hemmingsson

Linköping University Post Print



N.B.: When citing this work, cite the original article.

Original Publication:

Vedrana Bolic, Helene Lidström, Nils Thelin, Anette Kjellberg and Helena Hemmingsson, Computer use in educational activities by students with ADHD, 2013, Scandinavian Journal of Occupational Therapy, (20), 5, 357-364.

<http://dx.doi.org/10.3109/11038128.2012.758777>

Copyright: Informa Healthcare

<http://informahealthcare.com/>

Postprint available at: Linköping University Electronic Press

<http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-86782>

Computer use in educational activities by students with ADHD

Authors:

Vedrana Bolic MScOT, PhD candidate^a

Helene Lidström MScOT, PhD^b

Nils Thelin^c

Anette Kjellberg MScOT, PhD^a

Helena Hemmingsson, PhD, Prof.^a

^a Department of Social and Welfare Studies, Faculty of Health Sciences, Linköping University, Sweden

^b Department of Social and Welfare Studies, Faculty of Health Sciences, Linköping University, Sweden, and Department of Public Health and Caring Sciences, Faculty of Medicine, Uppsala University, Sweden

^c Division of Psychiatry, University Hospital, Linköping, Sweden

Address for correspondence:

Vedrana Bolic
Linköping University
Faculty of Health Sciences
Department of Social and Welfare Studies
SE-601 74 Norrköping
Sweden
Telephone: + 46 11 363504
Fax: + 46 11 363189
E-mail: vedrana.bolic@liu.se

ABSTRACT

Aim: The aim of this study was to investigate computer use in educational activities by students with attention deficit hyperactivity disorder (ADHD) in comparison with that of students with physical disabilities and students from the general population. **Methods:** The design of the study was cross-sectional with group comparison. Students with ADHD (n=102) were pair-matched in terms of age and sex with students with physical disabilities and students from the general population (n=940) were used as a reference group. The result showed that less than half of the students with ADHD had access to a computer in the classroom. Students with ADHD reported significantly less frequent use of computers for almost all educational activities compared with students with physical disabilities and students from the general population. Students with ADHD reported low satisfaction with computer use in school. In addition, students with ADHD reported a desire to use computers more often and for more activities in school compared with students with physical disabilities. These results indicate that occupational therapists should place more emphasize on how to enable students with ADHD to use computers in educational activities in school.

Keywords: Information and communication technology (ICT), computer access, school-based practice, physical disabilities

INTRODUCTION

According to The Swedish National Board of Health and Welfare, the number of students with the diagnosis of attention deficit hyperactivity disorder (ADHD) has increased in recent years in schools in Sweden. The prevalence is estimated to be 3 to 6 percent of school-aged children, and boys are about three times more likely than girls to be diagnosed (1, 2). Students with ADHD display a higher risk, relative to the general population, of experiencing behavioural and educational difficulties in school that may have a negative impact on their educational performance; these difficulties frequently persist into adulthood (3-5).

Challenging behaviours include off-task and disruptive classroom behaviour, decreased work productivity, lack of study skills and difficulty with peer interaction (5, 6). Furthermore, there is considerable evidence that ADHD in students induces long-term negative consequences resulting in low grade-point averages (7) and a high school dropout rate (8, 9) compared with those of students without disabilities. Students with ADHD represent a significant proportion of students with disabilities who may struggle academically (5, 6); therefore, they may need an increased use of accommodations in a regular educational setting. According to the new Educational Act (10) in Sweden, support is to be provided by the school's healthcare facilities, which are responsible for monitoring the students' development and for protecting and improving the students' medical and psychosocial health and special educational needs. Support can also be provided by multiprofessional teams from habilitation centres (HCs), as in this study. HCs are responsible for providing medical, psychological, social or educational accommodations to individuals in their immediate environment, in order to develop modifications for participation in education and community life (11). Occupational therapists are part of these multiprofessional teams working at these centres. Given that adolescents with ADHD may struggle academically, more knowledge is needed about how to support students with ADHD in educational activities (5). One type of accommodation in school that holds

promise for students with ADHD is the use of information and communication technology (ICT), such as computers and the Internet (12). Research on computer use for students with ADHD in school has focused on Computer Assisted Instruction (CAI) i.e. a computer-based instruction format, using multiple sensory modalities with immediate and frequent feedback and reinforcement. Computer use by students with ADHD can promote motivation for learning (13), active responding and attention (14) and prevent off-task behaviour during educational activities (5, 15, 16). It has been clearly suggested that computer use in school by students with ADHD can support oral reading fluency (17) and increase in periods of sustained reading and decrease in distractions (18). In addition, computer use may also support educational performance in mathematics achievement for students with ADHD, compared with written seatwork conditions, both in general educational settings (19) and special educational settings (20).

To date, research in occupational therapy on school participation has mainly focused on students with physical disabilities, not putting emphasis on the increasing number of students with psychosocial difficulties (e.g. ADHD) who may benefit from accommodations in educational settings. This, in turn, indicates that schools are more prepared to meet the needs of students with physical disabilities than those of students with psychosocial limitations (e.g. ADHD) (21, 22). An international study (22) has highlighted that there is a considerable risk that motor performance-related needs are the primary focus for provision of accommodations for adolescents with disabilities, indicating that students with ADHD may be overlooked regarding available accommodations compared with students with physical disabilities. Within the Swedish national school system, students with ADHD and students with physical disabilities participate in the same educational settings as other students and should have equal access to “modern learning tools” such as computers (10). Thus, this study will focus on

comparing access to, frequency of use and computer use in a variety of educational activities between students with ADHD, students with physical disabilities and students from the reference group. Earlier research (23, 24) suggests that students with physical disabilities have limited participation in a variety of educational computer activities compared to students from the general population. This in turn raises the question of whether the same shortcoming is experienced when it comes to computer use in school by students with ADHD. This study will also focus on the students' perception about computer use in educational settings and the students' level of satisfaction with computer use, as most studies fail to include measures of satisfaction, which is important for determining if students find interventions desirable in their daily activities (5). Accordingly, this study will focus on identifying factors associated with satisfaction with computer use in schools for students with ADHD. Thus, this study focuses on access to a computer in school and in a variety of locations, using computers for educational activities and the subjective experience of satisfaction with computer use in educational activities.

AIM

The aim of the current study was to investigate computer use in educational activities of students with attention deficit hyperactivity disorder.

The specific research questions were as follows:

- Are there differences in access to computers in school and location for computer use between students with ADHD and students with physical disabilities?

- Are there differences in the frequency of use and use of computers in a variety of educational activities between students with ADHD, students with physical disabilities and students without disabilities, who comprise a reference group?
- Are there differences in satisfaction with and perception of computer use in educational activities between students with ADHD and students with physical disabilities?
- Which factors associated with satisfaction with computer use in school can be identified for students with ADHD?

METHODS

The design of the present study was cross-sectional (25) with group comparisons being made between students with ADHD and students with physical disabilities, as well as students from the general population who are used as a reference group. The present study is part of a larger project investigating ICT use in school by students with various disabilities, compared to students from the general population. In 2007, HCs in both urban and rural areas in Central Sweden were invited to participate in the larger project. In total, 729 students with disabilities aged 10-18 years were identified from medical records, of which 254 participants had a primary diagnosis of ADHD and related disorders, such as disturbance of activity and attention, and dysfunction of attention, motor control and perception (DAMP). Data were collected using a questionnaire on ICT use in schools developed by Lidström (24) and colleagues. In order to enable comparison of computer use in school between students with disabilities and students from the general population, some of the questions in the questionnaire were replicated from a national survey “Information Technology in School”, conducted by the Swedish National Agency for Education (26). In addition, some questions

were specifically constructed for students with disabilities. Details concerning data collection procedure as well as results on computer use in school by students with physical disabilities have been presented previously (23-24, 27-28). Ethical approval for this study was granted by the regional ethics committee (2006/1101-31).

Participants

In total, 132 out of the 254 questionnaires were returned by participants with ADHD, giving a response rate of 52%. For the present study children aged 10-11 (n=25) and those with the diagnosis of a developmental disorder of scholastic skills, unspecified (n=4), and Tourette's syndrome (n=1) were excluded, giving a total sample of 102 students (see Table I). The main reason for focusing on students aged 12-18 years were that middle school and high school implies new challenges such as multiple class rooms and teachers that may present an extra barrier to computer use in educational setting (29). Analysis of response bias regarding age and sex demonstrated no significant differences between the participants in the present study and non-respondents ($p>0.05$).

In order to enable comparison with students with physical disabilities, each individual in the ADHD group was pair-matched in terms of age and sex with students with physical disabilities. All except for 11 individuals were matched in relation to sex. In addition, in order to enable comparison of computer use in school between students with ADHD and students with physical disabilities, to students from the reference group, normative data were obtained from the national survey, from the Swedish National Agency for Education (26) mentioned above. The survey included 940 students from the general population, of whom 478 were boys and 462 girls. The age split was: 11 years (grade 5) (n = 292), 15 years (grade 9) (n =

340) and 17 years (level 2) (n = 308). The mean value for the tree groups is 14.5 years and the median is 15 years.

Questionnaire

For detailed information regarding the process of developing the questionnaire, see Lidstöm (24). The reliability of the questionnaire in terms of internal consistency for students with ADHD has been calculated, that is, a Cronbach alpha of $\alpha = 0.74$ was obtained.

The data for this study is based on 15 closed-ended questions (10 of these had between 4 and 12 statements). Overall the questions focused on computer use in school, including the use of a computer for a variety of educational activities, the frequency of computer use and satisfaction with computer use in school. For example, the question focusing on computer use in educational activities in school was as follows: “How often do you use a computer in educational activities for a) writing, b) searching for information on the Internet, c) making presentations, d) exercising skills (Doing practice exercises), e) e-mailing teachers and f) creating images/music/movies?” The participants graded their use on a multiple-choice five-point Likert scale, where 1 = never at all and 5 = often. The question concerning frequency of computer use read: “How often do you use a computer in school?” The participants graded their frequency of use on a 5-point Likert scale, where 1=never and 5=daily. Both of these questions were replicated from the survey “Information Technology in School” (26), enabling comparison with students from the general population. Satisfaction with computer use in school was formulated as: “How satisfied are you with your computer use in educational activities?” The participants graded their use on a five-point Likert scale, where 1 = not satisfied at all and 5 = very satisfied.

Statistical methods

Characteristics of the participants were dichotomized and differences between students with ADHD and students with physical disabilities were analysed using a chi-squared test with the statistically significant level set at $p < 0.05$ (25). For subsequent analysis, dichotomous variables were created for categorical parameters with more than two values. The chi-squared test with a level of significance of $p < 0.05$ was used to investigate differences between students with ADHD and physical disabilities. Missing values were low (< 5 participants) for each item, except for one item where there were missing values for 12 participants. The Kruskal–Wallis test was used to compare computer use in a variety of educational activities between students with ADHD, students with physical disabilities and students from the general population. In the analysis, $p < 0.05$ was considered significant (25). Binary logistic regression analyses were performed with the dichotomized dependent variable satisfaction with computer use in school for students with ADHD and a set of predictor variables such as students' characteristics, frequency of computer use and educational activities with a computer (e.g. writing, searching for information, e-mailing with teachers). Age and sex were used as covariates. The results are presented as odds ratios (ORs) with 95% confidence intervals (95% CIs) and p-values ($p < 0.05$). Statistical analyses were carried out using Statistica for Windows 8.0.

RESULTS

Characteristics of the participants

The characteristics of the students with ADHD and students with physical disabilities are presented in Table I. The majority of the students in the two groups were boys. The mean age for the groups of students was 14 years (SD=1.7; range 12-18; median=14). Chi-squared test

showed that students with ADHD attend classes with fewer than 16 students to a higher extent than students with physical disabilities ($p<0.05$). Students with physical disabilities walked with a walking aid or used a wheelchair to a higher extent than students with ADHD ($p<0.05$).

In addition, 14 students with ADHD reported using a walking aid or a wheelchair indicating that these students may have motor difficulties in addition to their ADHD diagnosis.

> Insert Table I about here <

Access to and location for computer use in educational activities

The chi-squared test showed no significant differences concerning access to computers in school between students with ADHD and students with physical disabilities. However, fewer students with ADHD (14% vs. 27%) were provided with their own computer in school compared with students with physical disabilities ($p<0.05$). No differences in location for computer use were recorded between the two groups of students: students with ADHD and students with physical disabilities used them in a variety of locations, such as the classroom (42% vs. 43%), computer room (49% vs. 52%) and library (21% vs. 22%) ($p>0.05$).

Educational activities with a computer and frequency of computer use

A comparison of computer use in a variety of educational activities, as presented in Table II, between students with ADHD, students with physical disabilities and the reference group demonstrated that students with ADHD had limited participation in four out of seven educational activities, compared with both students with physical disabilities and students from the general population ($p<0.05$).

As far as the frequency of computer use in school is concerned, daily computer use was similar for students with ADHD (9%) and students from the general population (13%) ($p>0.05$), whereas for students with physical disabilities it was higher (21%) ($p<0.05$).

Satisfaction with and perception of computer use in educational activities

A chi-squared test concerning comparison between students with ADHD and students with physical disabilities concerning satisfaction with computer use revealed no significant differences between the two groups. Among students with ADHD, 55% reported being very or fairly satisfied with their computer use in school, compared to with 67% of students with physical disabilities. A chi-squared test on students' perceptions of amount of computer use in school revealed that a higher proportion of students with ADHD (66%) wanted to use a computer more often in school compared with students with physical disabilities (47%) ($p<0.05$) and for more activities in school (63%) compared with students with physical disabilities (47%) ($p<0.05$). Although not significantly different, students in both groups, those with ADHD (40%) and those with physical disabilities (29%) reported that that their classmates used the computer more often in school than they did ($p>0.05$).

Factors associated with satisfaction with computer use in educational activities among students with ADHD

From the results of the multiple binary logistic regression analysis, as shown in Table III, three variables remained significantly associated with being satisfied with computer use in educational activities among students with ADHD: having access to a computer in school (OR

9.6, $p=0.01$), using a computer for writing (OR 3.3, $p=0.01$) and using a computer for searching for information on the Internet (OR 2.9, $p=0.01$).

> Insert Table III about here <

DISCUSSION

The aim of this study was to investigate the computer use in educational activities of students with ADHD in comparison with that of students with physical disabilities, as well as students from a reference group. Students with ADHD reported significantly lower use of a computer for almost all educational activities compared with students with physical disabilities and students without disabilities. The findings indicate that students with ADHD may be overlooked with regard to computer use in school. Computer use in school provides a novel alternative to traditional instruction that may capture the attention of students with ADHD. In addition, computer use can also lead to significant improvement in active engagement time, on-task behaviour, improvement in attention (5,14-16) and educational performance in reading (17-18) and maths (19-20), thus making these findings critical for students with ADHD.

The findings in the present study indicate a low level of satisfaction with computer use in school among students with ADHD and students with physical disabilities, with only half of the students with ADHD reporting being very or fairly satisfied with it. In addition, the results indicate that being able to use a computer for writing and for searching for information on the Internet was associated with a threefold higher likelihood of being satisfied with computer use. This indicates that there may be a connection between using a computer's full potential

for a wide range of educational activities and being satisfied with computer use in school. Earlier research revealed that a high frequently use of computers in school was an important factor for participation in educational computer activities of students with physical disabilities (23).

According to Shaw and Lewis (16), students with ADHD may be particularly motivated to use a computer in educational activities as it allows them to work at their own pace, or perhaps because the computer does not rely on handwritten skills and enables them to manipulate their own work by deleting and using spelling and grammar checks. Students with ADHD reported using a computer for writing less than students with physical disabilities. This is not a surprising result since students with physical disabilities are provided with a computer as an assistive technology device for handwriting difficulties (30). Nevertheless, recent research suggests that handwriting difficulties, in terms of speed and legibility, are not uncommon in children and students with ADHD (31), indicating that some students with ADHD may also benefit from assistive technology devices.

Notably, only half of the students with ADHD and physical disabilities reported having access to computers in the classroom and one third of the students reported that their classmates used the computer more often than they did in school, indicating limited opportunity to use the computer in the classroom. More effort aimed at increasing accessibility to computers in the classroom is needed to enable students with ADHD to use computers in school. Furthermore, approximately one-third of students with ADHD used a computer to search for information on the Internet compared with half of the students with physical disabilities and two-thirds of the students without disabilities. The Internet offers a forum for knowledge gathering,

communication and entertainment and represents a new arena for designing the learning environment in schools in relation to individual needs. In this sense, these findings may reflect the increasing need to use the Internet for different online activities, an essential condition for everyday life in 21st century society. There is no reason to believe that students with ADHD should be less motivated and stimulated to use computers in educational settings than students with physical disabilities and students without disabilities. This, in turn, raises issues about the environmental barriers to computer use in schools for these students.

Previous research on computer use for students with ADHD has identified environmental barriers that have a negative impact on computer use in educational activities. These include availability of computers and appropriate software and lack of support and adequate computer training for teachers (32). The less frequent use of computers in school by students with ADHD and physical disabilities may be a result of their limited access to computers and the Internet in the classroom. Moreover, if there is only one computer available in a classroom, students often have to share this computer. It is reasonable to consider that students with ADHD might not have easy accessibility to the one computer that is shared by the whole class, as a result of a lack of self-esteem due to past experiences of being socially excluded by their classmates (33, 34).

The results in the present study show that half of the students with ADHD attended classes with fewer than 16 students. Moreover, it is less common for students with ADHD to be frequent computer users, indicating that attending small classes does not necessarily increase students' opportunities to use computers in school. **This coincides with an earlier study** (23) that indicated that an important factor for computer use in educational activities by students with physical disabilities was attending mainstream school, in classes with more than 16 students. More research on this topic needs to be undertaken before the associations between

attending small classes and participation in computer activities in school of students with ADHD are more clearly understood.

Together, these findings indicate that the limited use of computers for educational activities and low level of access to computers in the classrooms for students with ADHD may result in decreased opportunities to develop the digital skills required for everyday life in a rapidly changing society. Being able to use computers for educational activities have all been linked to more favourable educational performance for students with ADHD in multiple areas of performance such as mathematics (19-20), science (16), oral reading fluency (17) and writing. Thus, from an occupational therapy perspective, it is important that occupational therapists develop strategies for computer use in educational settings and to promote students with ADHD to use computers in school, in order to develop conditions for computer use on equal terms. This study recognizes that the needs of students with ADHD are not fully acknowledged in Sweden and thus require further attention from habitation centres and the educational system. Furthermore, cooperation between occupational therapists, students and other important stakeholders, such as parents and representatives of the educational system, may benefit the students' opportunities to use a computer in school.

Methodological considerations

The students in the present study are enrolled in habilitation centres and may therefore not represent the general population of students with ADHD receiving support from the general education system. It is important to bear in mind that the need for support varies among students with ADHD, from requiring long-term support to occasionally being in need of help from a healthcare centre. One limitation of the present study is associated with the response

rate (52%). This might reflect the fact that students and their families with a special interest in computer use in school responded to the questionnaire, which could limit the generalizability of the study.

CONCLUSIONS

The results in the present study indicate that students with ADHD report limited computer use in several educational activities in school compared with students with physical disabilities and **students without disabilities**. These results reveal that there are barriers in using the computer in school on equal terms with students with physical disabilities and students from the general population. From an equality perspective, it is essential to enable students with ADHD to use computers in educational activities. Focusing on promoting computer use in educational activities in the classroom for students with ADHD is an emerging issue in occupational therapy. The findings in this study demonstrate a desire to use a computer more often and for more activities in school, indicating that engagement in educational activities involving a computer is meaningful to students. Since research on computer use in educational activities of students with ADHD is scarce, further studies are warranted in this emerging field of occupational therapy.

REFERENCES

1. Ljusberg AL. Pupils in remedial classes. (Dissertation). Department of Child and Youth Studies, Stockholm University; 2009.
2. Socialstyrelsen. Kort om ADHD hos barn och vuxna - en sammanfattning av Socialstyrelsens kunskapsöversikt. (Brief on ADHD in children and adults: a summary and a literature review. Stockholm: Socialstyrelsen; 2004.
3. DuPaul G J. School-Based Interventions for Students with Attention Deficit Hyperactivity Disorder: Current Status and Future Directions. *School Psychol Rev.* 2007; 36(2): 183–94.
4. Leo IM, Feldman HM. Academic and Educational Outcome of Children with ADHD. *J Pediatr Psychol.* 2007;32(6):643-54.
5. Raggi VL, Chronis AM. Interventions to address the academic impairment of children and students with ADHD. *Clin Child Fam Psychol Rev.* 2006;9:85-111.

6. Pelham WE, Fabiano GA. Evidence-based psychosocial treatments for attention-deficit/hyperactivity disorder. *J Clin Child Adolesc Psychol.* 2008; 37:184-194.
7. Ek U, Westerlund J, Fernell E. Academic performance of students with ADHD and other behavioural and learning problems —a population-based longitudinal study. *Acta Pædiatrica.* 2010;100:402–6.
8. Trampush JW, Miller CJ, Newcorn JH, Halperin JF. The Impact of Childhood ADHD on Dropping Out of High School in Urban Students/Young Adults. *J Atten Disord.* 2009;13(2):127-36.
9. Cobb B, Sample PL, Alwell M, Johns NR. Cognitive-Behavioral Interventions, Dropout, and Youth with Disabilities. *Rem Spec Edu.* 2006;27(5):259-75.
10. SFS. 2010:800. Skollagen. (The Education Act). In Swedish. Stockholm: Utbildningsdepartementet; 2010.
11. Socialstyrelsen termbank. Available from: <http://app.socialstyrelsen.se/termbank/ViewTerm.aspx?TermID=4143>http://www.nlm.nih.gov/cgi/mesh/2008/MB_cgi?mode=&index=16408&view=concept MeSH Unique ID: D017418.
12. Mull CA, Sitlington PL. The role of technology in the transition to postsecondary education of students with learning disabilities: a review of the literature. *J Spec Educ.* 2003;37: 26–32.
13. Jitendra AK, DuPaul GJ, Someki F, Tresco KE. Enhancing Academic Achievement for Children with Attention- Deficit Hyperactivity Disorder: Evidence from School-Based Research. *Dev Disabil Res Rev.* 2008;14:325-30.
14. Rabiner DL, Murray DW, Skinner AT, Malone PS. A Randomised Trial of Two Promising Computer-Based Interventions for Students with Attention Difficulties. *J Abnorm Child Psychol.* 2010;38:131-42.
15. DuPaul GJ, Weyandt LL. School-based Intervention for Children with Attention Deficit Hyperactivity Disorder: Effects on academic, social and behavioural functioning. *Int J Disabil Dev Educ.* 2006;53(2):161-76.
16. Shaw R, Lewis V. The impact of computer-mediated and traditional academic task presentation on the performance and behaviour of children with ADHD. *J Res Spec Educ Needs.* 2005;5(2):47–54.
17. Clarfield J, Stoner G. Research brief: the effects of computerized reading instruction on the academic performance of students identified with ADHD. *School Psych Rev.* 2005;34:246–54.
18. Hecker L, Elkind J, Elkind K, Katz L. Benefits of Assistive Reading Software for Students with Attention Disorders. *Ann Dyslexia.* 2002;52:243-72.
19. Mautone JA, DuPaul G J, Jitendra AK. The effects of computer-assisted instruction on the mathematics performance and classroom behavior of children with ADHD. *J Atten Disord.* 2005;9:301–12.
20. Ota KR, DuPaul GJ. Task engagement and mathematics performance in children with attention deficit hyperactivity disorder: Effects of supplemental computer instruction. *Sch Psychol Q.* 2002;17:242–57.
21. Bedell GM, Khetani MA, Cousins MA, Coster WJ, Law MC. Parent perspectives to inform development of measures of children’s participation and environment. *Arch Phys Med Rehabil.* 2011;92:765-73.
22. Egilson S, Hemmingsson H. School participation of pupils with physical and psychosocial limitations: A comparison. *Br J Occup Ther.* 2009;72;4:144-52.
23. Lidström H, Granlund, M, Hemmingsson, H. Use of ICT in school: a comparison between students with and without physical disabilities. *Eur J Spec Needs Educ.* 2012; 27(1):21-34.

24. Lidström H. ICT and Participation in School and Outside of School Activities for Children and Students with Physical Disabilities. (Dissertation). Karolinska Institutet, Stockholm; 2011.
25. Polit DF, Beck CT. Nursing research. Generating and Assessing Evidence for Nursing Research. (Eighth ed.). Lippincott Williams and Wilkins; 2008.
26. Skolverket. Sammanfattning av enkätstudie: IT och skola 2005 (Conclusion of the survey: IT at school 2005). Stockholm: Skolverket; 2005.
27. Lidström H, Ahlsten G, Hemmingsson H. The influence of ICT on the activity patterns of children with physical disabilities outside of school. *Child Care Health Dev.* 2011;37(3):313-
28. Lidström H, Aimqvist L, Hemmingsson H. Computer-based assistive technology device for use by children with physical disabilities: a cross-sectional study. *Disabil Rehabil Assist Technol.* 2012;7(4):287–93.
29. Hemmingsson H, Bedell L. Environmental barriers in mainstream school. *Child Care Health Dev.* 2002;28(1):57-63.
30. Preminger F, Weiss PL, Weintraub N. Predicting occupational performance: Handwriting versus keyboarding. *Am J Occup Ther.* 2004;58:193-01.
31. Brossard-Racine M, Majnemer A, Shevell M, Snider L, Belenger SA. Handwritten capacity in children newly diagnosed with Attention Deficit Hyperactivity Disorder. *Res Dev Disabil.* 2011;32:2927-34.
32. Xu C, Reid R, Steckelberg A. technology Applications for Children with ADHD: Assessing the Empirical Support. *Educ Treat Child.* 2002;25(2):224-48.
33. Mikami AY. The Importance of Friendship for Youth with Attention-Deficit/Hyperactivity Disorder. *Clin Child Fam Psychol Rev.* 2010;13:181–98.
34. Mrug S, Molina BS, Hoza B, Gerdes AC, Hinshaw SP, Hechtman L, Eugene AL. Peer Rejection and Friendships in Children with Attention-Deficit/Hyperactivity Disorder: Contributions to Long-Term Outcomes. *J Abnorm Child Psychol.* 2012; Epub 2012 14 Feb.

LEGENDS OF TABLES

Table I. Characteristics of students with ADHD and students with physical disabilities.

Table II. Computer use in seven educational activities among students with ADHD, students with physical disabilities and students from the reference group.

Table III. Variables associated with satisfaction with computer use in educational activities among students with ADHD

Table I. Characteristics of students with ADHD and students with physical disabilities.

	Students with ADHD (n = 102) N (%)	Students with physical disabilities (n = 102) N (%)
Sex		
Boys/Girls	81 (79.4)/ 21 (20.6)	75 (73.5)/ 27 (26.5)
Age		
12 -15/16-18	78 (76.5)/ 24 (23.5)	78 (76.5)/ 24 (23.5)
Age, years (mean/SD)	14.2±1.7	14.2±1.7
Diagnosis		
Attention deficit hyperactivity disorder (ADHD) and related disorders	82 (80.4)	
Dysfunction of attention, motor control and perception (DAMP) and related disorders	20 (19.4)	
Cerebral palsy and related disorders		44 (43.1)
Spina bifida		7 (6.9)
Neuromuscular disorder		11 (10.8)
Other diagnosis		40 (39.2)
Residential area		
Urban/Rural	43 (42.2)/ 58 (56.9)	43 (42.2)/ 59 (57.8)
School		
Mainstream school/Special school	86 (84.3)/16 (15.7)	86 (84.3)/ 16 (15.7)
Class size		
≤ 16 students	49 (48.0)	29 (28.4)*
Not writing with a regular pen¹	11 (10.8)	13 (12.7)
Alternative access solutions and specific software²	30 (29.4)	48 (33.8)
Mobility		
Walks with a walking aid or using a wheelchair ³	14 (13.7)	28 (27.5)*

Receives help from assistants in school	11 (10.7)	19 (18.6)
--	-----------	-----------

¹Includes those stating that they have never or seldom used a regular pencil for writing

²Includes those using an alternative access solution, such as an alternative keyboard and mouse (e.g. Alphasmart, joystick, roller ball), and specific software, such as speech synthesis and special programs.

³Of these 14, 2 students used a wheelchair.

Table II. Computer use in seven educational activities among students with ADHD, students with physical disabilities and students from the reference group.

	Students with ADHD (n=102)	Students with physical disabilities (n=102)	Reference group (n=940)	Kruskal–Wallis test ¹ Significant differences between groups 1, 2 and 3
	N (%)	N (%)	N (%)	
Educational activities with a computer²				
Writing	43 (41.2)	58 (56.9)	— ^a	1-2
Exercise skills	10 (9.8)	15 (14.7)	73 (7.8)	NS
Search for information	34 (33.3)	51 (50.0)	555 (59.0)	1-2, 1-3
Make presentations	11 (10.8)	22 (21.6)	349 (37.1)	1-2, 2-3, 1-3
E-mailing with teachers	2 (2.0)	11 (10.8)	136 (14.5)	1-2, 1-3
Create images/ music/movies	5 (4.9)	13 (12.7)	174 (18.5)	1-3
Cooperate with students in other schools	3 (2.9)	3 (2.9)	88 (9.4)	NS

¹ An analysis using Kruskal- Wallis test with a p-value of $p < 0.05$.

² The students graded to what extent they used a computer in educational activities using a 5-point scale, where 1 = not frequently and 5 = frequently. This table presents the results of score 4 and 5 on the scale.

^a No reference data are available.

Table III. Variables associated with satisfaction with computer use in educational activities among students with ADHD.

	OR	(95% CI)	p-value
Access to a computer in school	9.6	2.0-46.1	0.00
Educational activities with a computer:			
Writing	3.3	1.4-7.8	0.01
Exercise skills	1.8	0.4-7.4	0.40
Search for information on the Internet	2.9	1.2-7.2	0.01
Make presentations	3.2	0.6-15.8	0.13
Create images/music/movies	2.2	0.2-22.0	0.48
Cooperate with students in other schools	1.4	0.1-16.5	0.76

CI= confidence interval; OR= odds ratio