Title: Participation in school-related activities that require hand use for children with and without developmental disabilities

Running Title: School participation for children

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Abstract

Background: Children with developmental disabilities (DD) may experience limited participation in school activities. Little is known about whether school participation of children with DD who attend special schools is impacted. This study specifically focused on physical engagement in school-related activities that require hand use for the comparison between this group of children with DD and typically developing children.

Methods: The sample consisted of 97 children with DD who attended special schools (mean age 8.2 ± 2.9 years; 60 boys and 37 girls) and 105 typically developing children who attended mainstream schools/kindergartens (mean age 8.6 ± 2.4 years; 48 boys and 57 girls). Parents completed the Children's Assessment of Participation with Hands, one of the domains of which captures participation in eight school-related activities involving hand use.

Results: Parents of children with DD reported that their children participated less, in terms of the number (χ^2=8.45–14.97, $p \leq 0.004$) and frequency (t=4.00–6.47, $p < 0.001$), in four activities than typically developing children. Parents of children with DD also reported that more assistance was needed for their children's participation in all activities (t=6.93–11.92, $p < 0.001$), and they wanted their children to participate in most activities more often and more independently (χ^2=18.46–59.34, $p < 0.001$).

Conclusions: Differences in participation in school-related activities requiring hand use between children with DD and typically developing children were revealed generally across all participation dimensions (does participate, frequency, independence, and desired change). This study provides information on the areas in which greater efforts are needed to support children's school participation.

Keywords: participation, school, hand use, children, developmental disabilities.

Introduction

Participation in school-related activities is crucial to children's learning and development (Simeonsson *et al.* 2001). Children with disabilities may experience restricted school participation due to the impact of their impairments and/or environmental barriers (Hemmingson & Borell 2002; Eriksson 2005; Coster *et al.* 2013). Studies have indicated that children with disabilities participated less and/or were involved less in specific school-related activities compared to children without disabilities (Simeonsson *et al.* 2001; Eriksson *et al.* 2007; Raghavendra *et al.* 2012; Coster *et al.* 2013; Peny-Dahlstrand *et al.* 2013). However, these studies have tended to focus on children with cerebral palsy, spina bifida, or various disabilities who attended mainstream schools. There is lack of knowledge about the participation in school-related activities of children with developmental disabilities (DD) attending special schools.

The present study extends existing knowledge about participation in school-related activities to children with DD who attend special schools. Special schools are designed to fit the complex educational needs of children with multiple disabilities (usually of a moderate or severe nature). They provide a supportive environment with special education teachers and high staff-student ratios. Although studies investigating school participation might partially include children with DD from special schools (Raghavendra *et al.* 2012; Coster *et al.* 2013), none have focused on this group nor investigated participation in school-related activities that specifically require the use of fine motor skills (referred to as the use of the hands in this study). According to McHale and Cermak (1992) and Marr *et al.* (2003), children spent 30–60% of their school time in activities involving hand use. Participation in hand-use activities is viewed as an indication of physical engagement; that is, *doing* in contrast to *observing* others' engagement (Chien *et al.* 2014; Kang *et al.* 2014). This study explored the extent to

which children with DD in special schools engaged in school-related activities requiring hand use, and compared their participation patterns with those of typically developing children.

Methods

Participants

This study involved a secondary analysis of data obtained from (*citation omitted*), which validated a newly developed Children's Assessment of Participation with Hands. In that study, 11 of 15 special schools within the (*area omitted*) provided permission for research, and 956 children with DD and their parents were invited for participation. A total of 97 parents of children with DD (10.1% response rate) provided written consent and returned the completed questionnaires. In addition, 105 parents of typically developing children were recruited from two kindergartens and one primary school within the same region. Inclusion criteria were that parents were able to read English and had children aged 2–12 years. Ethical approval for the study was granted by the (*institution omitted*) and the ethical review committee at (*institution omitted*).

Children with DD had the mean age of 8.2 years (*SD*=2.9 years), and 61.9% were boys. Their parents reported an average of 2.4 diagnoses/disabilities in their children (44.3% had an intellectual disability, 39.2% autism, 34.0% developmental delay, and 32.0% language/speech delay). The mean age of typically developing children was 8.6 years (*SD*=2.4 years), and 45.7% were boys.

Instrument

The Children's Assessment of Participation with Hands (*citation omitted*), a parent-report questionnaire, was used to capture participation in activities requiring hand use across four life domains: self-care, recreation, education, and domestic life and community. The present study analysed the educational domain (including eight school-related items, see Table 1 for abbreviated descriptions). For each item, the parent was asked to report whether

the child participated in the activity in the past three months. If the items were not suitable for the child, a "not-applicable" option could be chosen. If the child did participate, the parent was asked how often the child participated (1=less than once a month to 5=everyday), how much assistance the child required (1=mostly assisted to 4=independent) and whether the parent wanted the child's participation to change (no or yes; if yes, there were four options of change: 'do more often', 'do less often', 'need less help' or 'enjoy more'). For each item, four types of scores were calculated to summarise the child's participation: does participate (based on the response of yes/no), frequency (based on rating scores), independence (based on rating scores), and desired change (based on the response of yes/no and the categories of desired change).

Development of the Children's Assessment of Participation with Hands involved a content review of existing children's participation measures and literature, expert review, and pilot testing (*citation omitted*). The construct validity (i.e., unidimensionality) of each of the four domains in this questionnaire has been established using Rasch measurement model, respectively (*citation omitted*). Its convergent validity has also been demonstrated by correlating with one similar participation measure (*citation omitted*). In addition, this questionnaire has acceptable test-retest reliability (intraclass correlation coefficients=0.69−0.96) in all domains except for the desired change dimension in the recreational domain (*citation omitted*).

Data Analysis

Comparison analyses between children with and without DD were performed for each item. These included a *chi*-squared test for categorical variables (does participate and desired change) and *t*-test for ordinal variables (frequency and independence). Bonferroni correction was applied to adjust *p* value to 0.0068 because of multiple comparisons. Effects sizes were

calculated for the ordinal variables, and a Cohen's *d* value of ≥0.80 is considered as a large group difference, 0.50–0.79 as medium, and 0.20–0.49 as small.

Results

The percentage of children reported as 'does participate' in four out of eight school-related activities requiring hand use was significantly lower for children with DD than typically developing children (see Table 1). The mean frequency of participation in five activities was also significantly lower for children with DD, and the group differences were medium to large (*d*=0.59–1.00). In addition, parents of children with DD reported significantly lower levels of independence for their child's participation in all activities (*d*=1.17–1.84) than parents of typically developing children. Parents of children with DD further reported significantly more desired change in their child's participation in all activities, and the types of desired change varied across the activities (see Table 2).

Discussion

The present study found that children with DD attending special schools had lower participation rate in school-related activities requiring hand use in comparison with typically developing children, implying limited physical engagement in those activities. This finding was generally consistent across all the four participation dimensions (does participate, frequency, independence, and desired change) and somewhat in agreement with previous studies on children with DD who attended mainstream schools (Eriksson *et al.* 2007; Raghavendra *et al.* 2012; Coster *et al.* 2013). Results highlight that children with DD attending special schools require continued support to engage in the full range of activities required at school.

Despite significant group differences identified in most school-related activities, it is encouraging that there are three activities in which children with and without DD participated to a similar extent, in terms of the number and frequency. These activities were: *operate*

computer in classroom learning activities, *do artwork,* and *participate in physical activity lessons*. Interestingly, these activities are not core academic activities but do, importantly, extend students' skills in creativity, physical fitness, and technology use (which is becoming increasingly required for academic learning). We noted that a high percentage of the parents of children with DD, however, wanted to see their children engaging in these activities more often. One reason could be that these three activities are of interest for children with DD and require less cognitive demands on children if suitable support is provided to enhance engagement. Also these activities may be more appropriate to the children's current developmental level and have been incorporated in the educational curriculum which they receive. Thus, the parents might consider that participating in these activities more often could be useful for their child's cognitive, motor, and social development, which in turn would help their child's participation in more complex school activities (such as handwriting) at a later age. For example, engaging in computer games requires a range of cognitive skills such as following instructions, memory, and problem solving; doing artwork requires fine motor skills and creativity; and engaging in physical activities with peers is beneficial for children's gross motor and social skill development. These collateral benefits may explain for the parents' desire for their children's more frequent participation in these activities, despite the fact that their participation frequency was comparable to that of typically developing children.

The activity "*learn handwriting or complete handwriting homework at home*" had the greatest group difference in participation frequency between children with and without DD (d=1.00). A higher percentage of the parents of both children with and without DD also wanted change in their child's participation in this activity. This may imply that parents perceive handwriting as an important skill for their children to learn, suggesting a need for effective handwriting programs to enhance children's successful engagement in this activity.

Several approaches to improving children's handwriting performance have been reviewed by Feder and Majnemer (2007), and future studies are warranted to evaluate their effectiveness in children with DD.

As expected, children with DD required more assistance and their parents wanted more change to increase their independence in all the activities, compared to typically developing children. The largest group difference (d=1.84) was found in the activity "e*ngage in classroom learning activities*", which constitutes the major part of school participation (McHale & Cermak 1992; Marr *et al.* 2003). This is consistent with Eriksson *et al*.'s finding (2007) in which, however, it was observed that children who received more support from teachers/assistants participated less in class due to the lack of autonomy. Thus, the use of environmental and instructional strategies (e.g., using modified equipment, peer tutoring, or allowing more time for responses) may reduce children's reliance on adults and promote their more independent engagement in school activities.

The limitations of this study are the recruitment of the convenience sample of typically developing children and the exclusion of children with DD who attended mainstream schools. Future studies that recruit a representative sample of children with and without DD are warranted to confirm the study findings.

References

Chien, C. W., Rodger, S. & Copley, J. (2015) Development and psychometric evaluation of a new measure for children's participation in hand-use life situations. *Archives of Physical Medicine and Rehabilitation* **96**, 1045-1055.

Chien, C. W., Rodger, S., Copley, J. & Brown, T. (2017) An exploration of the relationship between two measures of children's participation. *Disability and Rehabilitation*, In Press. Available from: http://www.tandfonline.com/doi/abs/10.1080/09638288.2017.1300343 [Accessed 25 October 2017].

Chien, C. W., Rodger, S., Copley, J. & McLaren, C. (2014) Measures of participation outcomes related to hand use for 2- to 12-year-old children with disabilities: A systematic review. *Child: Care, Health and Development* **40**, 458-471.

Coster, W., Law, M., Bedell, G., Liljenquist, K., Kao, Y. C., Khetani, M. et al. (2013) School participation, supports and barriers of students with and without disabilities. *Child: Care, Health and Development* **39**, 535-43.

Eriksson, L. (2005) The relationship between school environment and participation for students with disabilities. *Pediatric Rehabilitation* **8**, 130-9.

Eriksson, L., Welander, J. & Granlund, M. (2007) Participation in everyday school activities for children with and without disabilities. *Journal of Developmental and Physical Disabilities* **19**, 485-502.

Feder, K. P. & Majnemer, A. (2007) Handwriting development, competency, and intervention. *Developmental Medicine and Child Neurology* **49**, 312-7.

Hemmingson, H. & Borell, L. (2002) Environmental barriers in mainstream schools. *Child: Care, Health and Development* **28**, 57-63.

Kang, L. J., Palisano, R. J., King, G. A. & Chiarello, L. A. (2014) A multidimensional model of optimal participation of children with physical disabilities. *Disability and Rehabilitation* **36**, 1735-41.

Marr, D., Cermak, S., Cohn, E. S. & Henderson, A. (2003) Fine motor activities in head start and kindergarten classrooms. *American Journal of Occupational Therapy* **57**, 550-7.

McHale, K. & Cermak, S. A. (1992) Fine motor activities in elementary school: Preliminary findings and provisional implications for children with fine motor problems. *American Journal of Occupational Therapy* **46**, 898-903.

Peny-Dahlstrand, M., Krumlinde-Sundholm, L. & Gosman-Hedstrom, G. (2013) Patterns of participation in school-related activities and settings in children with spina bifida. *Disability and Rehabilitation* **35**, 1821-7.

Raghavendra, P., Olsson, C., Sampson, J., McInerney, R. & Connell, T. (2012) School participation and social networks of children with complex communication needs, physical disabilities, and typically developing peers. *Augmentative and Alternative Communication* **28**, 33-43.

Simeonsson, R. J., Carlson, D., Huntington, G. S., McMillen, J. S. & Brent, J. L. (2001) Students with disabilities: A national survey of participation in school activities. *Disability and Rehabilitation* **23**, 49-63.

Table 1 Participation patterns of school-related activities of children with and without developmental disabilities

Activities	Does participate, *n* (%)		Frequency, mean±*SD*			Independence, mean±*SD*			Desired change, *n* (%)	
	With DD	Without DD	With DD	Without DD	*d*	With DD	Without DD	*d*	With DD	Without DD
Learn handwriting or complete handwriting homework at home	54 (74.0)	92 (94.8)*	2.81±1.91	4.37±1.23*	1.00	1.87±1.04	3.28±0.95*	1.42	51 (98.1)	23 (25.8)*
Get school items and pack school bag at home	56 (65.9)	88 (87.1)*	2.8±2.22	4.02±1.75*	0.62	2.41±0.98	3.44±0.79*	1.17	36 (69.2)	22 (25.6)*
Engage in classroom learning activities	62 (80.5)	96 (98.0)*	3.71±1.96	4.77±0.80*	0.77	1.98±1.05	3.61±0.72*	1.84	44 (77.2)	16 (17.8)*
Operate computer in classroom learning activities	77 (93.0)	97 (98.0)	3.84±1.28	4.17±0.99	0.30	2.16±1.07	3.58±0.69*	1.61	49 (68.1)	13 (13.8)*
Do artwork	89 (98.9)	98 (97.0)	3.85±0.87	3.70±1.10	0.15	2.04±1.05	3.59±0.69*	1.78	61 (72.6)	22 (22.7)*
Participate in physical activity lessons	76 (91.6)	97 (98.0)	3.44±1.29	3.69±1.07	0.21	2.21±0.99	3.45±0.93*	1.30	53 (73.6)	21 (22.6)*
Play game or on playground equipment during recess	77 (87.5)	102 (98.1)*	3.87±1.65	4.63±0.89*	0.59	2.51±1.08	3.84±0.46*	1.73	45 (64.3)	6 (6.1)*
Manage self-care	76 (90.5)	99 (99.0)	4.25±1.47	4.87±0.56*	0.61	2.36±0.97	3.73±0.64*	1.70	51 (69.9)	10 (10.5)*

Note: Does participate is calculated based on the number of children who participated in the activity; Frequency is calculated based on the average of the ratings among all children; Independence is calculated based on the average of the ratings among the children who participated in the activity; and Desired change is calculated based on the number of parents who desired for change in the activity.

DD=developmental disabilities; *n*=number of children; *SD*=standard deviation; *d*=effect size.
* *p* value < 0.0068 (Bonferroni adjustment of the significant level was applied)

Table 2 Types of desired change in participation in school-related activities for children with or without developmental disabilities

Activities	Do more often, *n* (%)		Do less often, *n* (%)		Need less help, *n* (%)		Enjoy more, *n* (%)	
	With DD	Without DD	With DD	Without DD	With DD	Without DD	With DD	Without DD
Learn handwriting or complete handwriting homework at home	33 (63.5)	14 (15.7)*	0 (0.0)	0 (0.0)	21 (40.4)	10 (11.2)*	16 (30.8)	7 (7.9)*
Get school items and pack school bag at home	15 (28.8)	15 (17.4)	1 (1.9)	0 (0.0)	22 (42.3)	8 (9.3)*	6 (11.5)	3 (3.5)
Engage in classroom learning activities	22 (38.6)	10 (11.1)*	0 (0.0)	0 (0.0)	28 (49.1)	5 (5.6)*	8 (14.0)	4 (4.4)
Operate computer in classroom learning activities	23 (31.9)	9 (9.6)*	2 (2.8)	1 (1.1)	26 (36.1)	5 (5.3)*	10 (13.9)	3 (3.2)
Do artwork	35 (41.7)	14 (14.6)*	0 (0.0)	1 (1.0)	30 (35.7)	5 (5.2)*	16 (19.0)	7 (7.3)
Participate in physical activity lessons	25 (34.7)	12 (12.9)*	0 (0.0)	0 (0.0)	25 (34.7)	6 (6.5)*	16 (22.2)	8 (8.6)
Play game or on playground equipment during recess	22 (31.4)	3 (3.0)*	1 (1.4)	0 (0.0)	22 (31.4)	2 (2.0)*	18 (25.7)	3 (3.0)*
Manage self-care	21 (28.8)	3 (3.2)*	1 (1.4)	0 (0.0)	34 (46.6)	7 (7.4)*	7 (9.6)	1 (1.1)

Note: DD=developmental disabilities; *n*=number of children.
* p value < 0.0068 (Bonferroni adjustment of the significant level was applied)