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UCC
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Exploring the participation of children with Down Syndrome in Handwriting Without Tears® .

Abstract:

Background

Children with Down Syndrome typically experience difficulties with attention to task and lack motivation when learning to write. This article provides an evaluation of the HWT® method applied as an intervention to promote handwriting amongst children with Down Syndrome attending mainstream school in The Republic of Ireland.

Methods

In the absence of standardised measures, a purpose-designed group task participation scale and pre- and post-intervention teacher/parent questionnaire were developed by the first author and used to investigate the participation of 40 children with Down Syndrome in HWT® activities .

Results

Positive changes in participation in HWT® activities were recorded in group data and in teacher/parent report.

Conclusions

Hands-on multisensory learning approaches such as HWT® may encourage children with Down Syndrome to participate in activities that promote handwriting skills. Further research and the development of robust measures to evaluate handwriting intervention for this population of children is required.

Keywords

Handwriting Without Tears®, Children, Down Syndrome, participation, group intervention

Introduction

Handwriting is an important functional life skill and central to a child's ability to participate at school. The acquisition of handwriting presents challenges for children with Down Syndrome (DS) due to its complex nature involving; motor control, the integration of kinesthetic and visual information together with a range of cognitive abilities (Chu 1997, Riesman 1993). Occupational therapists play an important role assisting in the development of handwriting amongst children with special educational status. As numbers of children with Down Syndrome attending mainstream schools is increasing (de Graaf et al., 2013), greater understanding about interventions used routinely by occupational therapists to promote the development of handwriting is important to inform occupational therapy practice. Hand Writing Without Tears (HWT®) is an intervention used widely by occupational therapists to promote the development of handwriting (Olsen 2003). There is little research that has focused on the application of the HWT method applied to children with Down Syndrome. As an occupational therapist working with a population of children with Down Syndrome in The Republic of Ireland, the first author explored whether the programme, with its emphasis on a multisensory approach, was particularly suited for teaching prewriting/handwriting skills for children with Down Syndrome.

Background

Handwriting remains the greatest challenge for children with Down Syndrome attending mainstream school (Daunhauer et al, 2014**)**. Seventy percent of parents of children with Down Syndrome aged 5 to 13 years in one study reported their children were "very" or "somewhat" interested in learning to write (Trenholm & Mirenda, 2006**)**. From an occupational therapy perspective the identification of interventions that motivate a child to engage and participate are particularly important for this population of children (Fidler & Nadel, 2007). Difficulty with motivation, including poor attention to task, low levels of persistence at tasks and high levels of off-task behaviour have been reported for children with Down Syndrome; with overuse of social strategies to distract from tasks that are challenging (Kasari and Freeman, 2001; Fidler 2006; Fidler, 2005, Vlachou & Farrell, 2000). This personality-motivational orientation profile is considered particularly important when selecting appropriate educational or intervention techniques for children with Down Syndrome (Fidler & Nadel, 2007). Additionally, individuals with Down Syndrome have difficulties inhibiting irrelevant information, responding to changing demands during tasks and are continuously moving their attention, which impacts on their quality of learning (Dulaney & Tomporowski, 2000; Guazzo, 2007). As attention is needed to make decisions and select appropriate responses when involved in performing a handwriting task, the level of attention can affect the quality of handwriting (Feder & Majnemer, 2007).

Authors have recommended the use of 'errorless learning techniques' to increase the motivation to learn amongst children with Down Syndrome (Fidler, 2005). It is thought that the presentation of educational information using visual

materials could lead to more sustained attention in children with Down Syndrome (Trezise, Gray & Sheppard, 2008). One large scale United States study that investigated teacher/parent perspectives on inclusive practices for children with Down Syndrome (aged 4 to 20 years) reported the use of 'hands-on' materials and drill as best for instruction (Wolpert, 2001). Good practice educational guidelines for Down Syndrome have advocated for a syndrome–specific approach in choice of intervention, taking into account the developmental profile of children/adolescents with Down Syndrome (All party parliamentary group on Down Syndrome (APPGDS), 2012). Additionally attention to behavioral phenotype and developmental profile information in planning occupational therapy intervention for individuals with Down Syndrome has been advocated by those researching Down Syndrome and occupational therapy practice **(**Daunhauer & Fidler, 2011).

HWT® is a developmental and multi-sensory based inclusive handwriting curriculum. The instruction is designed to be visually attractive, to actively engage the child in fun activities, and uses a step-by-step approach to teaching letter formation, which can be considered to reduce errors (Olsen, 2003). A variety of multi-sensory 'hands-on' materials are used which enables repeated practice (e.g. making letters with wooden pieces, on magnetic boards). All these features can be considered important to addressing the developmental needs of children with Down Syndrome to facilitate engagement and optimize learning. Robust empirical studies regarding the effectiveness of HWT® with typically developing children are emerging (Roberts, Derkach-Ferguson, Siever & Rose, 2014).

However, research that has explored the application of HWT® with children with children who have additional needs is limited and studies have tended to be small and exploratory in nature (Owens, 2004).

Aim of the Study

This article presents findings from a doctoral study, undertaken by the first author, that explored prewriting/handwriting activities applying the HWT® method with a sample of school-aged children with Down Syndrome (Patton 2011).

The findings presented here address the question of whether children's participation in prewriting/handwriting changed following the application of the HWT® programme and includes the perspectives of the parents and teachers who delivered the programme at school and home as part of the study. (Participation is used widely in the occupational therapy literature to describe the active involvement in everyday occupations (Law 2002). For clarification, within the context of this article, use of the term, participation, refers to engagement of the child in handwriting activities included in the HWT® programme).

Methodology

Mixed methods were used in this descriptive evaluation of the application of the HWT® method with children with Down Syndrome. The context was a 'real life' community setting where the first author was employed as an Occupational Therapist with children with Down Syndrome, their parents and teachers. The HWT® program was delivered over a period of 8 months, from October to June 2006-2007. A collaborative approach was adopted whereby the first author trained parents and

teachers in the HWT® method. Parents and teachers then used the program at school and home, with support, provided from the first author over the period of the study. Children and parents also attended seven HWT® group intervention sessions (held fortnightly) with the first author.

Data was gathered from a structured observation of group HWT® sessions with the children using a purpose-designed HWT® task participation scale. To capture the views of parents and teachers, data was gathered from a teacher/parent questionnaire and from a post intervention focus groups as part of the evaluation. Data collection tools were designed specifically for the study in the absence of standardized measures. Methodological challenges of designing and conducting research with a heterogeneous group of children with Down Syndrome, with varied handwriting ability at the outset of the evaluation are discussed in the first author's PhD thesis (Patton 2011).

Ethics

Ethical approval for the study was obtained from Trinity College Dublin and Down Syndrome Ireland. Written consent was obtained from teachers and parents who consented on behalf of their child.

Participants

Forty six children with Down Syndrome attending mainstream schools in the three counties in the Republic of Ireland, along with their parents and teachers were recruited to the study using purposive sampling. Participants were contacted via a voluntary organization, Down Syndrome Ireland (DSI) who distributed information to

parents of children with Down Syndrome on their database. Inclusion criteria were; the children had Down Syndrome, were aged between 5 to 10 years 11 months at the start of the study and had handwriting difficulties based on parent/teacher report.

The findings presented here relate to 40 of the total 46 children recruited who were at beginning stages of learning to write; 28 children at a prewriting stage (level 1) and 12 children at a letter formation stage (level 2).

The sample consisted of 23 boys and 17 girls. Two children were in a special class in a mainstream school and 38 (95%) were in mainstream classes. The mean age of the sample was 7 years and the median age was 7 years 1 month. Children in the prewriting stage (level 1), ranged in age from 5 years 3 months to 10 years 9 months. There was wide variability in writing ability in relation to chronological age. Children at the letter formation stage (level 2, n=12) ranged in age from 6 years 6 months to 10 years 2 months.

Approximately a third of the teaching staff were class teachers, with the remainder in a variety of learning support roles. Of note is that approximately half had been teaching for more than 20 years, and approximately one quarter had been teaching between 0-4 years. A smaller number of parents (n=6) and teachers (n=4) who expressed interest, took part in a post intervention focus with an independent facilitator.

Development of measures

In the absence of a standardised measure, an observation tool, the HWT® task participation scale, was designed by the first author that included items related to a child's engagement, interest, ability to stay on task and fine motor co-ordination. The

first author developed this specifically to measure participation in HWT® activities during the group intervention.

A pre- and post-intervention teacher/parent questionnaire was also developed to gain teacher and parent perspectives on their child's engagement and interest in HWT® prewriting/handwriting tasks at home and in school. For a summary of the stages in developing the teacher and parent questionnaire and the HWT® participation scale developmental, refer to figure 1.

[Insert Figure 1 here]

The HWT® task participation scale was developed from detailed analysis of the content of HWT® and understanding of observation techniques (Spitzer 2003). The principles of participant observation informed the development of a measure of participation behaviours of engagement, interest and staying on task in this group of children. The fist author observed two groups of children at the prewriting (level 1) and two groups of children at the letter formation stage of writing (level 2), at the start of the group sessions. Child behaviours displayed that were considered relevant to participation behaviours (engagement in group task, demonstrates interest in the task, and stays on task) were recorded and categorised. This tool was used as a guide to assist the first author in the objective scoring of the three participation behaviours. A three point Likert scale of: 'Most of the time', 'Some of the time', and 'None of the time' was used to score the participation behaviours on the performance of individual HWT® tasks. Prior to piloting, the task participation scale was reviewed by an occupational therapist with experience of working with children with Down Syndrome.

Refer to Table A for details.

Teacher/parent questionnaires

Teacher/parent perspectives were gathered in pre- and post-intervention questionnaire sections specifically designed by the first author, as no suitable questionnaire was found in the literature. The content of the questionnaire was developed following review of the Down Syndrome literature and analysis of the content and structure of HWT®. This information was combined with content analysis of field notes recorded during interactions with teachers and parents from initial meetings and telephone calls and from interactions throughout intervention. These interactions included face-to-face contact with parents and telephone or e mail contact with teachers. Closed questions, open questions and Likert scales were used with space provided for additional comments. **Refer to appendix B for sample questions.**

Teacher/Parent Focus Groups

Data was also gathered regarding parent and teachers views on the application of HWT® during two post-intervention focus groups. A semi-structured interview format was used, with questions being sent to parents/teachers beforehand. The theme of participation arose in these focus groups from discussion of the benefits of the application of HWT® and information pertaining to this is included here as it supports and informs other findings.

Piloting

The HWT® task participation scale was piloted during one group session with 3 children from level 1 and another with 3 children from level 2. An expert therapist observed the group sessions. The researcher and an expert therapist both scored the

participants using the group measure format. Percentage agreement on task behaviour indicators was 90% in both cases. Piloting for both the pre- and post-intervention questionnaires involved 2 teachers and 2 parents selected by purposive sampling. All questionnaires and focus group questions were reviewed by 2 academic staff members. Face, content and construct validity were addressed during the development process for the questionnaires by reviewing relevant literature, using themes from content analysis of field notes, seeking feedback on content from academic experts and teachers/parents during piloting and reflexive analysis in a research log kept by the first author throughout the period of the study (Finlay 2002).

Data Collection

Each group task was scored using the HWT® task participation scale immediately after group sessions by the first author who also administered the intervention. Time 1 was recorded on the first occasion of doing the activity and time 2 was after practice. Pre-intervention questionnaires were administered with 100% (n=40) response rate for both teachers and parents. Post-intervention teacher/parent questionnaires had 100% response rate for teachers (n=40) and 95% response rate for parents (n=38). Six parents and 4 teachers attended the post-intervention parent and teacher focus groups respectively.

Data Analysis

Descriptive statistics (frequencies and percentages) were used to analyze group data and teacher/parent questionnaires data. Content analysis was completed on field notes, teacher/parent questionnaire open questions and teacher/parent focus group transcripts. Themes identified were independently verified by the research supervisor.

Member checking was completed on focus group data with all participants confirming themes identified.

Findings

Teacher/parent perspectives: Participation in prewriting/handwriting activities

Approximately half of the teachers identified staying on task/attention as one of the main difficulties for the children in relation to developing prewriting/handwriting skills pre-intervention. Twenty (50%, n=40) teachers and 26 (65%, n=40) parents either 'strongly agreed' or 'agreed' with the statement that the children were eager to try prewriting/handwriting activities pre-intervention. However, approximately 25% of parents and teachers either 'strongly agreed' or 'agreed' with the statement that the children refuse to try prewriting/handwriting activities pre-intervention. Indicating that engagement, interest in prewriting/handwriting tasks and staying on task were issues for children pre-intervention.

Post-intervention, 82% of parents (n=38) and 79% of teachers (n=39) reported that the child had more interest in prewriting/writing activities.. Approximately 75% of teachers (n=40) and parents (n=38) 'strongly agreed' or 'agreed' that the child showed more enjoyment of prewriting/writing activities post-intervention. Agreement between teacher/parent report did not occur in all cases which may indicate that these children performed differently in home and school environments and/or highlights the subjectivity of reporting perspectives.

Teacher/parent perspectives: Participation in HWT® activities

Over 90% of teachers and parents either 'strongly agreed' or 'agreed' that the child enjoyed the 'hands-on' activities in HWT®. Teacher/parent report of interest in

specific HWT® activities revealed more interest in 'hands-on' activities in comparison to paper and pencil activities for both children at the pre-writing stage and letter formation stage (Level 1 and 2**).** Similarly, both teachers and parents commented on the variety of manipulative materials in the method being important to maintaining and facilitating interest of the child. In particular, 15 teachers of children at the pre-writing stage (n=27) identified that HWT® 'hands-on' materials increased engagement in prewriting/writing activities. Parental comments in the post-intervention focus group outlined how involvement in the group facilitated engagement – impacting positively on child's confidence, self-esteem, enabling peer modelling and being motivational for the child.

Over 95% of teachers and parents reported how the child's mood and attention span had a significant impact on the amount of work that could be completed using HWT®. Other issues were tiredness and child illness. Child tiredness and illness identified in both questionnaire responses and focus groups as impacting on the amount that the child engaged in HWT®. **Refer to table 1 for supporting quotations.**

[Insert Table 1 here]

Group Intervention: Participation in HWT® activities

Between data collection times 1 and 2, an overall pattern of improvement in scores with more children scoring in the "most of the time category" is observed on all 3 criteria (Engagement, Interest and staying on task) and across all of the HWT® tasks - with the exception of drawing on the magnetic board and letters on slate tasks, where scores remained the same. The numbers of children scoring in the "none of the time" category is small across all tasks. Refer to tables 2 and 3 for details.

[Insert Tables 2 and 3 here]

Discussion

Pre-intervention teacher/parent report indicated that there were issues in the areas of interest, engagement in prewriting/handwriting activities and difficulties with staying on task. This corresponds with previous literature regarding difficulties with short attention span and poor motivation in children with DS (Dulaney & Tomporowski, 2000; Fidler, 2006; Fidler, 2005; Vlachou & Farrell, 2000). However, a majority of teachers/parents reported some positive change in interest in the children in prewriting/handwriting activities post-intervention. This suggests that the activities included in the program facilitated engagement and created a 'just right challenge' for the children involved in the study. Similarly, group data and parent/teacher reports suggest that they observed children's interest and engagement in handwriting activities increase with use of the HWT® program.

Increased levels of engagement were noted in 'hands-on' materials in comparison to paper and pencil tasks in group intervention. Similarly, teachers and parents reported that the 'hands-on' materials in HWT® were facilitators of engagement and interest in prewriting activities. These tentative findings are helpful given the unique learning challenges documented in the literature for children with DS and the complexity of developing handwriting skills (Fidler, 2006, APPGDS, 2012). They suggest that use of the HWT® as a teaching method can motivate children with Down Syndrome at the pre-writing and letter formation stages to engage in handwriting activities.

The findings lend support to the view that multi-sensory, visually appealing, 'hands-on' materials and the step-by–step approach of HWT® were features of the program that children enjoyed. Lending support to earlier findings where teachers and parents reported the use of 'hands-on' materials as one of the best teaching methods for children with DS (Wolpert, 2001). The findings also concur with a study where teachers reported that the materials and methods used in HWT® were important to creating and maintaining first grade student's interest and engagement (Benson, Salls & Perry, 2010). Parents reported that the group intervention had a positive influence on the child's confidence, increasing motivation and enabling peer modeling to occur. The delivery of the program as a group intervention has been identified by others as important, contributing to positive outcomes in relation to motivation and social participation (Camden et al., 2012).

The barriers to engagement in HWT®, reported by both teachers and parents, highlight factors that need to be taken into account by therapists during intervention with this population. Child illness as a barrier to participation is perhaps unsurprising as health issues are prevalent in individuals with Down Syndrome (Bull, 2011**).** The reported difficulties with mood and attention span concur with the reported difficulties for this population in persevering at tasks and avoidant behavior (Kasari & Freeman, 2001; Fidler, 2006; Fidler, 2005; Guazzo, 2007; Vlachou & Farrell, 2000). A 'cascading effect' caused by difficulties with cognitively avoidant behaviour and avoidance of challenging tasks has been suggested to exacerbate difficulties with motor skills in individuals with Down Syndrome (Daunhaeur & Fidler, 2011).

The HWT® task participation scale, developed by the first author for this study was designed to capture change in engagement and interest of children with Down Syndrome with the HWT® activities. This may provide a useful starting point for other Occupational Therapists using the program with children with Down Syndrome.

There is a need for further research concerning interventions that can assist the development of handwriting amongst children with Down Syndrome. Future development of measures for this population of children are required and these might include teacher/parent perspectives on the meaningfulness of the handwriting activities in the HWT® program for children with Down Syndrome. A major difficulty in this study was ascertaining fidelity to the HWT® program when the children were using the program at home and school and therefore measures that include the systematic observation by teachers and parents in natural contexts could result in a more ecologically valid measurement. This may allow the comparison of the child's participation in learning approaches such as HWT® across different environments including home and school. Additionally, this approach would facilitate advancements in occupational therapy practice to include a more occupational focus in handwriting intervention as recently advocated (Gerde, Foster & Skibbe, 2013).

Limitations

There are many limitations in this doctoral study and the findings are not generalizable being context specific, relating to a small number of children with Down Syndrome in the Republic of Ireland. Researcher bias is recognised as significant issue, as the first author acted both as researcher and Occupational Therapist. While this was an unavoidable aspect of a real life evaluation, steps were

taken to counter bias where possible, this included triangulation of the findings from the various data collection methods used in the study, including; the HWT task participation scale and teacher and parent reports gathered from the questionnaires and focus groups. The focus groups were conducted by other members of academic staff to minimize the effect of researcher bias and facilitate expression of opinion by participants. Questionnaires were coded and posted to parents for completion to reduce the direct contact with the researcher/therapist during completion. These measures may have assisted the expression of honest opinions about the value of the program by participants. Finally, the first author maintained a personal log throughout the duration of the study enabling reflection on her own clinical reasoning and decision making during the evaluation, an important aspect aiding the personal development of the first author and rigor in research enquiry (Finlay 2002).

Conclusion

Handwriting can be considered a functional skill which enables participation in school activities in children, and independent life in adults, with Down Syndrome. The need to emphasize functional skills that enable improved participation in age-appropriate activities has been advocated as important in interventions for children with Down Syndrome (Rihtman et al., 2010). Additionally, studies of adults with Down Syndrome indicate that success in later independent functioning in daily living and employment is linked to those that received school experiences aimed at teaching specific skills (Hanson, 2003).

Handwriting is a complex perceptual-motor skill, requiring much practice, typically taking many years to master. The findings indicate that the application of HWT® may have a positive impact on active involvement in prewriting/handwriting

tasks of children with Down Syndrome. In particular, the 'hands-on' multisensory materials in HWT® appeared to be key to facilitating participation or active involvement of the children with DS in specific prewriting/writing activities. This research consolidates learning approaches that suit children with Down Syndrome, facilitating their participation and engagement, which is essential to learning.

Given the complex needs of children with Down Syndrome in relation to participation on prewriting/handwriting activities, further investigation of participation more broadly as an occupation developing in home and school environments is required in future research and practice. In conclusion, the findings raise interesting questions regarding the interaction between the developmental profile of children with DS and intervention to facilitate participation in prewriting/handwriting activities.

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Appendix A:

Table A:
Indicators of HWT® task participation developed from participant observation

Task performance indicator	Positive performance indicators		Negative performance indicators	
Engagement in group task: Shows a good level of participation	Sitting in chair, facing instructor		Fidgets, gets up off chair	
	Takes turns		Turns body away from group	
	Shares materials		Refuses to participate in task	
	Looking at instructor		Not looking at instructor	
	Looking at materials when performing tasks		Not looking at materials when performing task	
Demonstrates interest in task: Shows curiosity and attention to task	Verbalising about the task, e.g. B is for …		Glazed expression, staring into space	
	Smiling/ laughing		Rushes through task, not taking care	
	Looks for instructor to help them		Talks about other things as distracting tactic	
	Shows work to instructor or other members of group		Pulls at items, gets distracted by these items	
Stays on task: Continues with task to completion	With verbal instructions repeated once		Verbal &/ physical prompts have to be repeated 2 or more times	
	With physical demonstration repeated once		Has to be refocused on task a number of times	
	Is focused on task		Watches others in group rather than staying on task	

Table B: Task Participation Scale

Indicator 1: Engagement: Child demonstrates engagement in task
Scale:
1 = Does not engage
2 = Engages somewhat
3 = Engages fully

Indicator 2: Interest : Child shows curiosity and interest in task
Scale:
1 = Child does not demonstrate interest
2 = Child demonstrates interest some of the time
3 = Child demonstrates interest most of the time

Indicator 3: Staying on task: Child continues with task to completion
Scale:
1 = Child does not stay on task
2 = Child stays on task some of the time
3 = Child stays on task most of the time

Appendix B:
Sample questions From Post-intervention parent questionnaire

Note: The same questions were included in teacher questionnaire

Section 4: Your child and their interest in prewriting/handwriting

Q.7. For each of the following statements, please tick the answer which best describes your child.

a. My child enjoys using the hands on materials in the programme.
Strongly Agree □ Agree □ Uncertain □ Disagree □ Strongly disagree □

b. My child shows more enjoyment of prewriting/ writing activities since starting the programme.
Strongly Agree □ Agree □ Uncertain □ Disagree □ Strongly disagree □

c. My childs' mood at the time of the session has a significant impact on work completed using the programme.
Strongly Agree □ Agree □ Uncertain □ Disagree □ Strongly disagree □

d. My childs' attention span at the time of the session has a significant impact on work completed using the programme.
Strongly Agree □ Agree □ Uncertain □ Disagree □ Strongly disagree □

Q.8. Has there been a change in interest overall in prewriting/writing activities since the introduction of the programme? Please tick as appropriate.

a. My child shows more interest □
b. My child shows no change in interest □
c. My child shows less interest □

Q.9.a. What was the level of interest shown by the child in the tasks involved in the programme?
Please tick the appropriate box (If not applicable, tick the end box).

Task	Very interested	Interested	Somewhat interested	Not at all interested	Not applicable
i. Action songs					
ii. Making Mat man					
iii. Building with Wooden pieces & mat					
iv. Making letters with capital letter cards					
v. Making letters using magnetic board & Stamps and/or yellow toggle					
vi. Forming letters using chalkboard					
vii. Forming letters in boxes					
viii. Writing using grey block paper					
ix. Writing in workbook					
x. Writing using double lined notebook/paper					

b. Please use the following lines for any comments regarding your child's interest in prewriting/ handwriting activities included in the programme.

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