

Research Paper

Then and now: Addressing young students' fine motor needs through a collaborative modelling teacher training intervention

Ingrid C. King

Background/aim: Young students' fine motor skills are an important predictor of their future academic success. Yet it is uncertain whether teachers have the means to identify and address students' fine motor needs. Occupational therapists working in schools have the knowledge and skills to train teachers, thereby improving outcomes for larger numbers of students. This is relevant given funding limitations and long waitlists for therapy service. To understand how to effectively train teachers, this study investigated whether a collaborative modelling teacher training intervention would impact positively at the time of implementation and five years later.

Methods: A two phase sequential mixed methods design was utilised. Changes in students' fine motor performance were measured using a one group pre-test post-test design. A five year follow-up interview was conducted to explore the teacher's perceptions. The classroom based training occurred over 20 weeks. Once each week, the therapist demonstrated activities with the students. These were repeated by the teaching staff. The fine motor programme ran with the entire class for eight weeks and then with a group of six students for the remaining 12 weeks. The fine motor programme was an early Fantastic Fingers™ version. The five year old New Zealand students were attending a school in a low income area.

Results: A significant difference was found in the group's fine motor performance following the teacher training intervention. The teacher continued to use the knowledge and activities after the training was completed.

Conclusion: Training teachers about fine motor skills using a collaborative modelling intervention appears to improve students' fine motor skills and is likely to benefit future student groups.

Ingrid C. King MSc (OT), Private Paediatric Occupational Therapist, QLD, Australia.

Email: ingrid@love2learnandgrow.com
www.myfantasticfingers.com
www.facebook.com/myfantasticfingers

KEY WORDS *collaboration, fine motor programme, occupational therapy, teacher education, school based practice.*

Introduction

Providing sufficient opportunities for four to six year olds to engage in fine motor tasks is important for their future academic success. Increasing evidence

from recent studies demonstrates that fine motor skills are a significant predictor of later academic achievement. Fine motor skills not gross motor, contributed significantly to the prediction of later academic achievement and were a better predictor of 2nd grade math and general achievement than receptive language (Pagani *et al.*, 2010). Fine motor skills, attention and general knowledge are much stronger overall predictors of academic success than early reading and math scores alone (Grissmer *et al.*, 2010). Fine motor ability to copy designs predicted higher scores on many subtests of academic achievement at the start of kindergarten as well as improvement from fall to spring (Cameron *et al.*, 2012). A study with over 3000 low income preschool children, average age of five years, showed that both fine motor writing and fine motor manipulative skills have significant effects on math and reading performance in 2nd grade (Dinehart & Manfra, 2013).

Based on neuroscience study findings, children are said to use fine motor skills in order to learn how to learn (Adolph, 2008). It is vital to provide opportunities to develop optimal fine motor skills for all students. Developmentally, the period between four to six years is significant for the maturation of fine motor manipulative skills (Case-Smith *et al.*, 1998). Examining children's fine motor skills in educational settings, determining their readiness for academic demands and providing fine motor intervention is relevant for teachers and occupational therapists (Dinehart & Manfra, 2013; Marr *et al.*, 2003).

A student's fine motor ability is important as a substantial part of their school day is spent on fine motor tasks. Three to five year olds spend an average of 37% of their in class time engaged in fine motor tasks and five to six year olds spend an average of 46% (Marr *et al.*, 2003). Older students spend 30% to 60% of their academic day on fine motor tasks (McHale & Cermak, 1992). Students with poor fine motor skills experience difficulty with colouring, drawing, scissor and ruler use, pasting, handwriting and keyboarding (Miller *et al.*, 2001). These difficulties can cause students to avoid activities in which fine motor skills are required and adversely affect their occupational performance as a student (Jackman & Stagnitti, 2007). The exact number of children with fine motor writing and manipulative difficulties is unknown. Estimates of students with handwriting dysfunction range from 10% to 30% (Feder & Majnemer, 2000) and those with impaired manual dexterity from 12% to 17% (L. Donaldson & P. Maurice, unpublished

manuscript, 1983; Ratcliffe, 2011). Figures increase when students who are 'developmentally vulnerable' in their fine motor skills, handedness and coordination are included (Australian Government, 2013).

Early identification and intervention for fine motor deficits is paramount as with age the impact of the skill deficit becomes greater as fine motor tasks become more complex (Ratcliffe, 2011). Unwarranted secondary issues including low self-esteem, academic and behavioural problems arise without effective intervention (Jackman & Stagnitti, 2007; Ratcliffe, 2011).

Research is required to determine whether teachers understand the value of fine motor skills and whether they have the means to assess and provide intervention for students with reduced fine motor abilities (Dinehart & Manfra, 2013). Half of New Zealand teachers surveyed were not able to identify students with significant fine motor impairments (L. Donaldson & P. Maurice, unpublished manuscript, 1983).

Australian teachers reported a lack of support for students with fine motor difficulties. Students are not eligible for funding for fine motor issues alone. Half of the teachers interviewed had little experience with occupational therapy and few were aware that occupational therapists are equipped to support students experiencing fine motor difficulties. Where participant teachers had experience with students receiving ongoing therapy intervention which also addressed fine motor issues, improvements in students' fine motor skills were reported (Jackman & Stagnitti, 2007).

Similar positive perceptions were reported from surveyed Canadian teachers (Fairbairn & Davidson, 1993). Occupational therapy was perceived to help eliminate problems that interfered with the students' ability to profit from instruction. These teachers perceived that therapists should spend less time on assessment and documentation and more time on classroom consultation, programme planning and implementation.

Therapists need to address what teachers consider important in order to form successful collaborative partnerships as collaborative practices in educational settings are essential for successful student outcomes (Boshoff *et al.*, 2013; Villeneuve & Shulha, 2012). Studies informing the optimisation of collaborative practices while addressing fine motor issues are relevant.

Internationally and within countries, a variety of occupational therapy service delivery models are used in the provision of school based services including direct interventions and consultation (Reid, Chiu, 2006). The consultation model is prone to implementation challenges with educators reporting that recommended strategies may not be delivered as envisioned by the therapist (Bayona *et al.*, 2006). As this model is traditionally

used for funded students, needs of other class members including students at-risk are seldom addressed. Limitations of the traditional consultation model along with long wait lists for therapy service, has led to the need to explore additional models of service delivery (Campbell *et al.*, 2012; Hutton, 2009).

Two studies on the efficacy of a whole class service delivery approach for improving four to six year olds' fine motor skills were located. Lust and Donica (2011) were reported to be the first to show that supplementing a preschool curriculum for low income children with an occupational therapy fine motor programme resulted in significant gains beyond that of typical Head Start programming (Lin, 2011). Ohi *et al.*'s study (2013) provides preliminary evidence that whole class fine motor and visual-motor intervention for five year old students results in significant improvements compared to students in classes who do not have this opportunity.

A coteaching model where occupational therapist and teachers jointly conducted a handwriting and writing programme for whole classes of grade one diverse learners was beneficial for all the students including those with poor handwriting. Teachers and therapists reported gaining new skills from the ongoing collaboration (Case-Smith *et al.*, 2012).

Given the importance of fine motor skills for future academic success, research is required on how to efficiently train teachers about fine motor skills and how effective this training will be on improving their students' fine motor skills (Dinehart & Manfra, 2013). Due to the numbers of students with fine motor needs, studies exploring collaborative interventions for groups and whole classes while simultaneously training teachers are necessary.

Within the collaborative framework, teachers' requests for instruction on fine motor interventions for groups and whole classes must be addressed (Wehrmann *et al.*, 2006). Feedback from fine motor training workshops for teachers conducted by occupational therapists showed that teachers value training that is practical and interactive (Chiu *et al.*, 2008). Surveyed teachers have requested demonstrations and modelling of occupational therapy programmes within the classroom, including those directed towards improving fine motor skills (Fairbairn & Davidson, 1993). As teachers value practical training with modelling of activities and strategies, it is prudent to explore a collaborative modelling classroom based intervention as a means for training teachers on how to improve students' fine motor performance.

Determining teachers' perceptions on the effectiveness of occupational therapy service provision to improve students' fine motor

performance is paramount. Teachers are more likely to continue to utilise suggested resources, implement strategies and continue with programmes if they perceive them to be effective (Reid *et al.*, 2006). A Canadian two phase study utilised quantitative and qualitative research to examine a school based consultation model for students with fine motor difficulties (Reid *et al.*, 2006; Wehrmann *et al.*, 2006). This research design is also required when evaluating a collaborative modelling fine motor teacher training intervention. Quantitative research methods are necessary to measure change in students' fine motor task performance. Qualitative methods are needed to explore the teachers' perspectives on the effectiveness of the training and collaborative process.

Follow-up interviews are important to establish whether initiatives begun in schools are sustained in the longer term (Hutton, 2009). In order to determine if a collaborative modelling fine motor teacher training intervention would continue to benefit new student groups, the teacher's perception was explored five years on from the end of the training.

The purpose of this two phase study was therefore:

- 1) To examine the effectiveness of a fine motor collaborative modelling teacher training intervention on the fine motor task performance of low income five year old students and whether there be a significant difference in their fine motor performance after the intervention;
- 2) To explore whether the collaborative modelling fine motor training intervention was effective from the teacher's perspective. Would the teacher continue to use the knowledge and activities acquired after a five year period of time had elapsed, and if so, why?

Methods

Design

This study used a two phase sequential mixed methods research design with data collected and analysed separately from two chronological periods (Teddle & Tashakkori, 2013). The second research question arose in part from the results of the quantitative data analysis in the first phase of the study. This led to further exploration using qualitative research methods for the five year follow-up.

Throughout the study, collaborative practice principles similar to those of Boshoff and Stewart's guided the methodology including the choice of evaluation measure, programme content, structuring and interviewing approach (Boshoff & Stewart, 2013). These principles centred on forming a committed team, identifying and working

on a joint problem with joint decision making and effectively communicating roles.

Participants

The study took place in New Zealand in a new entrant classroom at a low socio-economic decile 3 primary school beginning in 2007. After attending a fine motor workshop presented by the occupational therapist, a senior teacher of five year old students in their first year of school, requested assistance to improve her students' fine motor skills. Permission to conduct a training project within the school was obtained from the school principal. School policies governing participants' privacy, confidentiality and involvement were followed. All participants' anonymity was preserved. Early in the school year, the teacher's class of 19 students was evaluated by the therapist. None of the students had a diagnosis and none were receiving occupational therapy services. For the group phase the school employed a teacher assistant.

Procedures

Phase 1: whole class

Based on consultation with the teacher, it was decided that the fine motor evaluation would be classroom based and not overly time consuming. This was in keeping with values held by teachers in Fairbairn and Davidson's (1993) study. The students were assessed in pairs for approximately 25 minutes at a time at the back of the classroom.

Fine motor performance was evaluated on six fine motor tasks. These were: sequential thumb finger touching (touching the tip of the thumb to the tip of each finger in the same hand); channel drawing (while being timed, a pencil line was drawn inside a wavy track); in-hand manipulation (rolling a small play dough ball between the thumb, index and middle fingers); pre-writing pattern (copying a zigzag pattern); colouring-in (using a wax crayon to colour in small details of a picture); cutting with scissors (a circle and square were cut out along the bold lines). Finger touching and channel drawing were similar to those in the NEPSY (Korkman *et al.*, 1998). Colouring and cutting were like those in the Shore Handwriting Screen (Shore, 2003) which has been used as a pre-and post-test with modified scoring (Donica *et al.*, 2013).

Each task was scored according to set predefined written criteria. Performance was rated as good (3 points), fair (2 points) and poor (1 point). The pre-writing pattern task was scored on 3 criteria wrist position, forearm position and quality of pattern. A bonus point of 1 was awarded if the child consistently used the same dominant hand throughout. The maximum score was 25 points. Observations on task performance were recorded. Identical administration and scoring procedures were utilised with each student.

The students then participated in an eight week fine motor programme which ran for 40 minutes, three times a week. The programme of action songs and fine motor activities included ideas for increasing complexity and integration with early literacy and numeracy objectives. The activities covered: sensory awareness of hands and fingers; forearm and wrist position for writing activities; arm, hand and finger strength; in-hand manipulation; precision grip and dynamic finger movements for efficient pencil control; visual-motor integration including production of shapes, letters and numbers.

In the first session of each week the programme was run by the therapist modelling how to do each activity, with the class teacher observing and assisting. The therapist and teacher discussed the session. To aid intervention fidelity, ensuring adherence to the programme, comprehensive written guidelines were given to the teacher on how to administer, evaluate and record each completed activity. The teacher then repeated the demonstrated session twice, in the same week. The following week, the same activities were performed with the therapist present to advise on adaptations or modifications. The teacher carried out these activities twice more that week. New activities were presented each fortnight.

Phase 1: group

During the course of the eight weeks, it became apparent to the therapist and teacher that six students with low fine motor task performance scores, two girls and four boys, were struggling to perform many of the activities and were making slower progress. Observations included: difficulty concentrating in large group settings, impulsivity, low self-esteem, withdrawn passive behaviours, autistic-like traits, motor planning issues and delayed hand specialisation.

A teacher assistant was assigned to conduct a special group for these six students starting the following term. An individualised training session was conducted with the assistant as she was not present at the initial training workshop.

The same training and administration schedule was followed with the assistant and therapist. The class teacher attended fortnightly. The other sessions were administered during class time, decided by the teacher who supported the assistant while the groups ran to one side of the classroom. Every four weeks, the students' parents received a letter outlining what was being addressed with activity suggestions for home. The parents were invited to participate in the group to support their children. One parent attended some groups.

The six students repeated the eight week programme over a ten week period. Their fine

motor progress on the intervention activities was evaluated fortnightly according to predefined success criteria and documented following discussion amongst the therapist, teacher and assistant. A further two weeks of new activities were introduced before the end of the school year. The six students participated in 60 sessions over 20 weeks.

At the end of the intervention the six students were re-evaluated on the six fine motor tasks by the therapist. The scoring was re-viewed with the class teacher as part of the training process. Observations were made of the students' handwriting and writing comparing earlier and later story writing samples. The students' progress was discussed and recommendations were made to the teacher and principal.

The programme was then demonstrated to two other teachers along with the provision of the written training materials. The therapist's involvement came to an end and several months later, she relocated to a new geographical area.

Phase 2: follow-up interview with class teacher

Due to the collaborative nature of the study and as the author who was also the therapist and interviewer, had an existing relationship with the teacher, active interviewing techniques were utilised (Holstein and Gubrium, 1998). Active interviewing from Holstein and Gubrium's perspective is collaborative and grounded in intimacy. It optimises cooperative mutual disclosure in order to permit the respondent to deeply disclose information. The interviewer provides loose parameters for spontaneous yet structured production of information. The parameters were: classroom practice and issues relating to students' fine motor skills; the teacher's perceptions on the training process and intervention content; the nature of the partnership between teacher and therapist.

Data analysis

Phase 1

Data was analysed using SPSS Version 20.0. Descriptive statistics were computed for the whole class and the group of six students. Utilising the data from the six students' fine motor task performance scores before and after intervention, the paired sample *t*-test (two-tailed) was performed. The *p*-value was set at 0.05. Effect size was conducted using Cohen's *d* with the value of $d > 0.8$ regarded as a large effect size (Cumming, 2012; Cohen, 1988).

Phase 2

The teacher's participation in the follow-up interview five years later was voluntary and informed consent was given for the researcher to record the 40 minute telephonic interview. After the

audio-recording, the interview was transcribed verbatim.

Consistent with the exploratory nature of the study, a thematic analysis approach was used to gather insights about the data without imposing preconceived or existing categories or theories. The researcher conducted the thematic analysis by following Braun and Clark’s six phases of thematic analysis making modifications for a single interview transcript (Braun & Clark, 2006). The transcript was re-reviewed multiple times to find key messages and illustrative quotes. These were mapped into themes. The teacher was provided with a written copy whereby she could provide feedback on the trustworthiness of the themes. No changes were advised.

Results

Phase 1: whole class

For the 19 students with an average age of five years, 10 boys and 9 girls, the mean score on the six fine motor tasks was 16.53 with a standard deviation of 2.82. The minimum score was 12 and the highest score was 21 out of 25 points.

Phase 1: group

The conducted analysis using the paired samples *t*-test found that the fine motor training intervention significantly improved the six students’ fine motor task performance, $t(5) = 8.77, p < .001, d = 3.58$. This suggested that there was a large effect for improved fine motor task performance following intervention. Refer to Table 1 for the data on the groups’ performance prior to and after the fine motor training intervention.

Table 1: *Group’s change in fine motor task performance scores before and after training intervention - maximum score is 25 points (n = 6)*

Group Scores	Mean	Std. Deviation	Std. Error Mean
Prior to intervention	14.33	1.86	0.76
After intervention	18.67	1.51	0.62

Initially, the group met 31% of the success criteria for the intervention activities. This progressed to 76% by the end of the 20 weeks.

Observations from handwriting and writing samples before and after intervention included: more consistent letter sizing; smaller more evenly printed letters; straighter less wavy lines and increased written output. Overall the six students appeared to be more confident and engaged during fine motor tasks and were completing written work within the allocated time. Behavioural issues were

reduced e.g. one student was no longer poking holes in the paper during writing time; another stopped switching the pencil between hands.

Phase 2: follow-up interview with class teacher

Four main themes emerged from the analysis of the interview transcript: fine motor need then and now; collaboration, programme content and training for success. A description of each theme is provided along with quotes reflecting the teacher’s perspective.

Fine motor need then and now

After the workshop, the teacher identified ‘a big need’ for fine motor development in her class and extending to other year levels. She saw this need as ongoing from one year to the next and explained that she wanted to do something about it. Therefore it was important to her that the principal also ‘saw the need’ and was behind her efforts. The following quotes illustrate her viewpoint:

‘I’m quite passionate about that (the need for good fine motor skills), if you’re wanting them to ... write a sentence or their name but if they can’t do some of those fine motor skill things ... they get too tired.’

‘The need for schools is big...I’ve got lots of children who can’t write their name... priority learners ... are the low achieving... if the kid can’t do something what are you doing to teach that kid?’

‘If you think “what is the really important need?” That’s the need you need to address in class rather than thinking, “oh, we haven’t got the time.”’

Collaboration for success

The teacher indicated that the collaboration between herself and the therapist was ‘enormous’ and ‘building up of the relationship’ was essential.

‘You became a friend as well... your involvement went on and on.’

Her classroom was ‘de-privatised’ and ‘open’. Being ‘flexible’ was very important when collaborating. This included the data collection process and scheduling of sessions.

‘You know in all schools you need to have data... we collected data. It wasn’t onerous.’

‘We came to an agreement that was going to work for ... the children, for you, for me for good outcomes.’

‘We met at other times to review things.’

Collaboration with the principal was important. He provided funding for the teacher assistant and requested feedback and data before and after intervention. The teacher explained that he is ‘very hot in this... that it’s based on research.’

In addition to the school staff, parents needed to be ‘on board’. Over and above their

permission for their children to participate, the 'partnership between home and school' was important to the teacher. The parent letters were vital for 'communication' between home and school.

Programme content for success

The teacher commented on two aspects of the fine motor programme content. Firstly, a number of the activities were designed by the therapist to compliment what she was already using:

'...like the Caterpillar Song... you made up a tune and the actions. It wasn't an extra thing. It was taking something (a handwriting programme) that I was interested in in any case but adding music to it... I still sing that all the time... music is important for all children.'

On using in-hand manipulation to place counters on an alphabet chart e.g. on 'a' for apple:

'That's not an extra activity. That's taking something that we do in class and giving a reason behind why it's important to do.'

The programme was perceived to be 'really nice and simple' to do and 'fun' for the children and teacher. It contained lots of variety with 'inside activities, outside activities, things to do together.'

Training for success

The teacher thought the practical workshop activities and illustrated handouts were 'excellent'. She emphasised the need for training to be 'hands-on' and indicated that she, like many others is a 'visual person that needs to be shown and then I've got it.'

The training was 'so practical' rather being given a 'list' of activities or self-study.

'I was part of it and you taught me well, whereas other things in development books haven't stuck with me... We have got strengths as teachers, but we haven't got your OT background.' With reference to the therapist returning each week to demonstrate activities, the teacher said:

'That was really good because for teachers you do need to have somebody coming back to model it... I would say "when Johnny does this with his fingers, what are they really meant to be doing?" It was hands-on ... it wasn't a theory thing. It was practice. Modelling is a very important thing to do.'

In discussing why the fine motor programme did not discontinue like some of the other class programmes, the teacher reported the following:

'If you do the activities ... it sticks in your brain... and you know why ... then it was very easy when you left. It just didn't die a natural death... we believed in developing and because there are a lot of needs at our school for fine motor skills, in the end through our training me and then training the others, we were able to have it ongoing.'

'When we could see how successful (it was) and the results from my class then we shared it (with other class teachers).'

Discussion

This study explored the effectiveness of collaborative modelling as a method of teacher training to address the fine motor needs of larger populations of students at risk, specifically five year old New Zealand students from low income backgrounds. Based on the existing model of school based consultative occupational therapy service delivery in New Zealand, these students would either not be eligible for funding or would have limited access to therapy and may have faced long wait times due to occupational therapist shortages and high caseloads. This scenario is common in other countries. It is therefore not surprising that there are calls for the development of new models for providing occupational therapy services in schools (Campbell *et al.*, 2012; Villeneuve & Shulha, 2012).

Alternative models (Case-Smith *et al.*, 2012; Lust & Donica, 2011) have successfully provided fine motor intervention for larger numbers of struggling and at-risk students. Traditionally, these students would have no or restricted access to therapy services.

In this study, nearly one third of the class had difficulty performing fine motor tasks. An incidence of 17% was reported from a New Zealand study with nine to ten year olds some 24 years earlier (L. Donaldson & P. Maurice, unpublished manuscript, 1983). Socio-economic factors may have contributed as children from low income backgrounds score lower on fine motor tasks than children from higher income families (Bowman & Wallace, 1990; West *et al.*, 2000).

The initial workshop served to alert the teacher to her students' fine motor needs. She became very motivated to work together to facilitate change. Therapists have a crucial role in assisting teachers to understand their students' fine motor needs. Workshops with practical activities appear to be an effective springboard from which to launch teacher training interventions. Chiu *et al.* (2008) likewise found that teachers value workshops that address fine motor problems using practical and interactive training.

Similar to the teachers of students with fine motor difficulties in Wehrmann *et al.*'s study (2006), this teacher proposed that the therapist teach her occupational therapy strategies and programmes for use with her class. As Campbell *et al.* (2012) found, when therapy intervention applies to many students, teacher implementation is more likely.

In this study, the occupational therapist used a collaborative modelling approach to train the teacher to conduct a fine motor programme for

her entire class for eight weeks. A further 12 weeks of training followed with the teacher and assistant and was run with a group of six students. The large effect size for improved fine motor task performance following intervention suggests that training teaching staff using collaborative modelling is beneficial when addressing the fine motor needs of groups of five year old children.

Positive findings were reported by Case-Smith *et al.* (2012) from a 12 week handwriting and writing programme cotaught by therapist and teachers. The coteaching model was advocated as it provides a structure for ongoing collaboration between therapist and teacher. The literature reports that successful educational outcomes are positively influenced by collaborative efforts. Strong working relationships and integration by the therapist into the school environment are essential if the therapist is to understand and support the teacher whose primary responsibility is to deliver the curriculum.

In this study, according to the teacher, the building of relationship between herself and the therapist was vital. Working in the classroom enabled the therapist to become part of the school team and more knowledgeable about the curriculum. Previously, teachers have identified training needs for therapists in understanding the classroom, curriculum and need to plan programmes within the framework of curriculum policies (Fairbairn & Davidson, 1993).

Teachers have recommended that in order to improve students' fine motor skills, therapists should provide them with fine motor activities that coincide with the curriculum and are suitable for groups of students (Jackman & Stagnitti, 2007). Where the therapist used activities in the intervention programme that integrated with the curriculum, these specific activities were utilised by the teacher five years on.

The enormous degree of collaboration was made possible through the therapist's regular ongoing involvement and ability for both members to be flexible around data collection and session scheduling. Therapists need greater flexibility to work with students in class in order to demonstrate strategies for teachers (Campbell *et al.*, 2012). Educators have identified the itinerant nature of therapists' servicing as a barrier to collaborative practices. Similarly therapists have found scheduling sufficient time with the teacher challenging (Villeneuve & Shulha, 2012).

In this study the therapist was in the classroom on a regular basis which gave the teaching staff opportunities to ask for clarification. This would not have occurred if a list of activities were provided. Without clarification and modelling, activity lists potentially lead to less optimal implementation (Hutton, 2009). Consistent and responsive services were provided (Campbell *et al.*, 2012) and were essential for the relationship building and successful student outcomes. Additionally, as the therapist led sessions with the whole class and group, the teaching staff had the opportunity to observe her practice. The teacher indicated that this modelling equipped her to be able to remember why and how to perform the activities. This enabled her to confidently continue with the fine motor programme after the therapist left. Teachers have reported that modelling is the best way to learn (Hutton, 2009).

et al., 2012) and were essential for the relationship building and successful student outcomes. Additionally, as the therapist led sessions with the whole class and group, the teaching staff had the opportunity to observe her practice. The teacher indicated that this modelling equipped her to be able to remember why and how to perform the activities. This enabled her to confidently continue with the fine motor programme after the therapist left. Teachers have reported that modelling is the best way to learn (Hutton, 2009).

Study Limitations

Limitations in sample size, absence of a control group and study design with evaluation not blinded at the time of scoring, make it difficult to generalise the findings to services in schools in other areas. The evaluation may have been strengthened by additional measures to assess changes in the students' occupational and later academic performance.

Conclusion

The teacher in this collaborative modelling fine motor training intervention reported positive benefits for herself professionally and for her students. The five year follow-up interview revealed that she continues to use the acquired knowledge and activities from the fine motor programme with new groups of students. Earlier identification and intervention may assist to reduce adverse behavioural, emotional and academic consequences of poor fine motor skills. This model of therapy service provision with weekly involvement from the therapist over five months appears to be justified given the enduring outcomes. While two thirds of the group sessions for the students with fine motor difficulties were conducted exclusively by teaching staff, a significant difference and large effect size were obtained. This study provides preliminary evidence for the effectiveness of collaborative modelling teacher training intervention to improve fine motor skills for groups of five year old students from low income backgrounds.

Acknowledgements

The author would like to thank the educators, parents and students who participated in this study. The author also thanks Stuart Lee for his assistance with the statistical data analysis.

Further Information

The fine motor programme used in this study has been subsequently adapted. *Songs and Games for Fantastic Fingers™* consists of a book with CD and instructional DVD. These are available from the website www.myfantasticfingers.com

References

- Adolph, K. E. (2008). Learning to move. *Current Directions in Psychological Science*, 17 (3), 213–218.
- Australian Government. (2013). *A snapshot of early childhood development in Australia 2012: AEDI national report*. Retrieved from [http://www.rch.org.au/uploadedFiles/Main/Content/aedi/Report_NationalReport_2012_1304\[1\]\(1\).pdf](http://www.rch.org.au/uploadedFiles/Main/Content/aedi/Report_NationalReport_2012_13041.pdf)
- Bayona, C.L., McDougall, J., Tucker, M.A., Nichols, M. & Mandich, A. (2006). School-based occupational therapy for children with fine motor difficulties: Evaluating functional outcomes and fidelity of services. *Physical and Occupational Therapy in Paediatrics*, 26 (3), 89-110.
- Boshoff, K. & Stewart, H. (2013). Key principles for confronting the challenges of collaboration in educational settings. *Australian Journal of Occupational Therapy*, 60 (2), 144-147.
- Bowman, O. J. & Wallace, B. A. (1990). The effects of socioeconomic status on hand size and strength, vestibular function, visuo-motor integration and praxis in preschool children. *American Journal of Occupational Therapy*, 44 (7), 610–621.
- Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2), 77-101.
- Cameron, C.E., Brock, L.L., Murrah, W.M., Bell, L. H., Worzalla, S. L. & Grissmer D. et al. (2012). Fine motor skills and executive function both contribute to kindergarten achievement. *Child Development*, 83 (4), 1229-1244.
- Campbell, W.N., Missiuna, C.A., Rivard, L.M. & Pollock, N.A. (2012). “Support for everyone”: Experiences of occupational therapists delivering a new model of school-based service. *Canadian Journal of Occupational Therapy*, 79 (1), 51-59.
- Case-Smith, J., Heaphy, T., Marr, D., Galvin, B., Koch, V., Good Ellis, M et al. (1998). Fine motor and functional performance outcomes in preschool children. *American Journal of Occupational Therapy*, 52 (10), 788-796.
- Case-Smith, J., Holland, T., Lane, A. & White, S. (2012). Effect of a co-teaching handwriting program for first graders: One-group pre-test–post-test design. *American Journal of Occupational Therapy*, 66 (4), 396-405.
- Chiu, T., Heidebrecht, M., Wehrmann, S., Sinclair, G. & Reid, D. (2008) Improving teacher awareness of fine motor problems and occupational therapy: Education workshops for pre-service teachers, general teachers and special education teachers in Canada. *International Journal of Special Education*, 23 (3), 30-38. Retrieved from <http://files.eric.ed.gov/fulltext/EJ833680.pdf>
- Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cumming, G. (2012). *Understanding the new statistics: Effect sizes, confidence intervals and meta-analysis* (pp. 21-51). New York, NY: Taylor & Francis Group.
- Dinehart, L. & Manfra, L. (2013). Associations between low-income children’s fine motor skills in preschool and academic performance in second grade. *Early Education and Development*, 24 (2), 138-161.
- Donica, D., Goins, A. & Wagner, I. (2013). Effectiveness of handwriting readiness programs on postural control, hand control and letter and number formation in Head Start classrooms. *Journal of Occupational Therapy, Schools and Early Intervention*, 6 (2), 81-93.
- Fairbairn, M. & Davidson, I. (1993). Teachers’ perceptions of the role and effectiveness of occupational therapists in schools. *Canadian Journal of Occupational Therapy*, 60 (4), 185-191.
- Feder, K. P. & Majnemer, A. (2007). Handwriting development, competency and intervention. *Developmental Medicine and Child Neurology*, 49 (4), 312-317
- Grissmer, D., Grimm, K. J., Aiyer, S. M., Murrah, W. M. & Steele, J. S. (2010). Fine motor skills and early comprehension of the world: Two new school readiness indicators. *Developmental Psychology*, 46 (5), 1008-1017.
- Hutton, E. (2009). Occupational therapy in mainstream primary schools: An evaluation of a pilot project. *British Journal of Occupational Therapy*, 72 (7), 308-313.
- Holstein, J.A. & Gubrium, J.F. (1998). Active interviewing. In: D. Silverman (Ed.), *Qualitative research theory, method and practice* (pp. 113-129). London: Sage Publications Ltd.
- Jackman, M. & Stagnitti, K. (2007). Fine motor difficulties: The need for advocating for the role of occupational therapy in schools. *Australian Journal of Occupational Therapy*, 54 (3), 168-173.
- Korkman, M., Kirk, U. & Kemp, S. (1998). *NEPSY a developmental neuropsychological assessment manual*. San Antonio, TX: Psychological Corporation.
- Lin, S.H. (2011). Research update: Handwriting readiness. *OT Practice*, 16 (2), p33. Retrieved from http://www.nxtbook.com/nxtbooks/aota/otpractice_0116issue21_v2/index.php?startid=6#/24

- Lust, C.A. & Donica, D.K. (2011). Effectiveness of a handwriting readiness program in Head Start: A two-group controlled trial. *American Journal of Occupational Therapy*, 65 (5), 560-568.
- Marr, D., Cermak, S.A., Cohn, E.S. & Henderson A. (2003). Fine motor activities in Head Start and kindergarten classrooms. *American Journal of Occupational Therapy*, 57 (5), 550-557.
- 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 (10), 898-903.
- Miller, L.T., Missiuna, C.A., Macnab, J.J., Malloy-Miller, T. & Polatajko, H.J. Clinical description of children with developmental coordination disorder (2001). *Canadian Journal of Occupational Therapy*, 68 (1), 5-15.
- Ohl, A.M., Graze, H., Weber, K., Kenny, S., Salvatore, C. & Wagreich, S. (2013). Effectiveness of a 10-week tier-1 response to intervention program in improving fine motor and visual-motor skills in general education kindergarten students. *American Journal of Occupational Therapy*, 67 (5), 507-514.
- Pagani, L. S., Fitzpatrick, C., Archambault, I. & Janosz, M. (2010). School readiness and later achievement: A French Canadian replication and extension. *Developmental Psychology*, 46 (5), 984-994.
- Ratcliffe, I., Franzsen, D. & Bischof, F. (2011). Development of a scissor skills programme for Grade 0 children in South Africa: A pilot study. *South African Journal of Occupational Therapy*, 41 (2), 24-32.
- Reid, D., Chiu, T., Sinclair, S., Wehrmann, S. & Naseer, Z. (2006). Outcomes of an occupational therapy school-based consultation service for students with fine motor difficulties. *Canadian Journal of Occupational Therapy* 73 (4), 215-224.
- Shore, L. (2003). *Shore handwriting screen for early handwriting development: Examiner's manual*. USA: Harcourt Assessment Inc.
- Teddle, C., & Tashakkori, A. (2013). Mixed methods research: Contemporary issues in an emerging field. In: N.K. Denzin & Y.S. Lincoln (Eds.), *Strategies of qualitative inquiry* (4th ed., pp. 135-167). Los Angeles, CA: Sage Publications Inc.
- Villeneuve, M.A. & Shulha, L.M. (2012). Learning together for effective collaboration in school-based occupational therapy practice. *Canadian Journal of Occupational Therapy* 79 (5), 293-302.
- Wehrmann, S., Chiu, T., Reid, D. & Sinclair, G. (2006). Evaluation of occupational therapy school-based consultation service for students with fine motor difficulties. *Canadian Journal of Occupational Therapy* 73 (4), 225-235.