Sustained Benefits of a Multi-skill Intervention for Preschool Children at Risk of Literacy Difficulties

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Asia Pacific Journal of Developmental Differences
Vol. 1, No. 1, January 2014, pp 62—77
DOI: 10.3850/S2345734114000064

www.das.org.sg/publications/research-journal/volume-1-no-1-january-2014

Children at mild risk for literacy difficulties (n=32, mean age 4.1 years) were identified using a multi-skill screening battery. The majority – the intervention group - had small group support (15 minute sessions twice weekly for 10 weeks), while the control group experienced the standard nursery group. The intervention comprised four 'streams' – language and phonics, memory (auditory and visual), gross motor skills (balance, imitation and catching) and fine motor skills (pegboard, tool use and fine pencil work). Both groups performed equivalently at pre-test. An immediate post-test showed mean standard score improvement for the intervention group (93.1 to 106.2), by contrast with controls (96.9 to 98.5). Mean effect sizes for the two groups were 0.88 and 0.23 respectively. Significantly greater improvements occurred for gross motor skill, memory, and phonology including rhyming, but not for fine motor skill, pre-literacy and speed which improved significantly in both groups. After 18 months, sustained improvements were found in memory, a key predictor of success in early learning, as well as in gross motor skill. The results suggest that a balanced, multi-skill intervention may be particularly effective for preschool children.

Keywords: Preschool screening, early intervention, learning difficulties, screening tests, longitudinal

INTRODUCTION

This paper addresses the key issue of whether or not screening and intervention is feasible and worthwhile for children at age 4, before they start formal education. There is now considerable evidence throughout the school years that the earlier literacy-related problems are identified, the more effective, and the more cost-effective, interventions are likely to be (National Reading Panel, 2000; Snow Burns and Griffin, 1998; Torgesen, 2001). Summarising a range of studies of support of children with severe literacy difficulties (Alexander, Anderson, Heilman, Voeller and Torgesen, 1991; Lovett, Lacarenza, Borden, Frijters, Steinbach and DePalma, 2000; Rashotte, McPhee & Torgesen (2001); Torgesen, Alexander, Wagner, Rashotte, Voeller, Conway and Rose, (2001, 2004); Truch, 1994; Wise, Ring & Olsen, 1999), Torgesen (2001) estimates that an hour's intervention at age 8 is likely to lead to a gain of 0.20 points in standard score on word identification and 0.30 points in phonemic decoding. He concludes that an intensive 70 hour intervention may be seen as 'normalising' the problems – accelerating the child back into the normal range of achievement. By contrast, interventions with older children tended to be 'stabilizing' rather than normalising the difficulties [Kavale, 1988], and led to very modest mean gains. We have provided a range of short term small group intervention studies for children aged 6 and above which proved highly successful (Nicolson and Fawcett, 1999). In the light of the 'stitch in time saves nine' nature of this relationship, we decided to investigate whether still earlier intervention – in the preschool period - is likely to lead to prove effective.

The skills with which a child enters school are highly predictive of future progress, (e.g. Vellutino & Scanlon, 2002; Whitehurst & Lonigan 2001; Denton & West 2002). Consequently, preschool has been identified as a key period (McCardle & Chhabra, 2004) to ensure that children enter school ready to learn to read. There is limited evidence available on the impact of intervention with preschool children, although explicit attempts to train up aspects of phonological awareness preschool lead to improved outcomes in literacy (Byrne, Fielding-Barnsley & Ashley, 2000). Evidence suggests that children 'at risk' of failure on phonological and orthographic skills can be 'inoculated' by intervention in kindergarten (Coyne, Kame'enui, Simmons and Harn, 2004; Outdeans, 2003; Schneider Roth and Ennemoser, 2000; Smit-Glaude, van Strein, Licht and Bakker, 2005). Studying economically at risk children in pre-kindergarten established that preschool children benefit from a program that emphasises social-emotional, motor and cognitive skills (Molfese, Modiglin, Beswick, Neaman, Berg, Berg and Molnar, 2006).

Preschool intervention suffers from the obvious difficulty that it is not clear at the preschool stage which children are most likely to have literacy difficulties, and

consequently it may be necessary to provide an intervention for a greater proportion of the cohort than considered necessary with older children. For some years we have argued that a two stage approach to this problem is the most cost-effective, based on the development of an appropriate screening test with relatively wide scope, followed up by an intervention for those children screened as at risk. In earlier research, (Fawcett, Nicolson, Moss, Nicolson and Reason, 2001; Nicolson, Fawcett, Moss, Nicolson and Reason, 1999) we established that screening children in school at age 6 (using the Dyslexia Early Screening Test, Nicolson and Fawcett, 1996) followed by targeted short-term intervention can significantly assist most children at risk of reading failure. A 10 week intervention at age 6 led to an improvement of 3.8 standard score points in WORD (Rust, Golombok and Trickey 1993) reading standard score. This equates to 0.38 standard score units per hour instruction (around twice the improvement reported by Torgesen, 2001). Cost effectiveness was additionally quadrupled by using groups of 4 children. The fact that the support personnel were teachers rather than highly trained phonological support specialists lends further cost savings, leading to a cost-effectiveness perhaps 10 times those reported in the literature. It is important, however, to note that one is not 'comparing like with like' in this comparison. Although all low performing children in the screening were supported, their problems were by no means as entrenched as those considered by Torgesen.

The research reported here adapted the above approach to the preschool period. The methodology involved included formal, controlled, small group comparisons, together with the evaluation of a screening-support system. In brief, a skill-based screening test was administered (PREST, Fawcett, Nicolson and Lee, 2001), and an intervention package delivered to children who showed problems in pre-reading skills. Children were also given a test of receptive vocabulary (British Picture Vocabulary, BPVS – Dunn, Dunn, Whotton and Pintillie, 1982), as a rough measure of verbal IQ. The children's progress was followed from age 4yrs to 5yrs 8 months in all, and progress compared with a control group drawn from the same nursery who had received no intervention beyond normal nursery experience. This approach has similarities to Bailet, Rapper, Piasta and Murphy, 2009 who demonstrated significant improvements in emergent literacy in a major study of phonological intervention with 220 prekindergarten children identified as 'at risk' for reading failure based on their performance on screening tests between the ages of 4 and 5. Our study worked with even younger children aged just 4.1. There are both theoretical and applied justifications for using a multi-skill screening and intervention with children of this age range, to measure a broad range of aspects of 'readiness to learn' which can impact on progress in the early years,

Five main issues were addressed:

i. whether the screening and intervention process was feasible with children as young as 4 years;
ii. whether it proved effective and cost-effective;
iii. whether any improvements were sustained in the years post-intervention;
iv. to establish benchmarks for future research; and
v. to identify pointers for subsequent developments.

METHOD

Participants

Two cohorts of children were screened in two Sheffield nursery schools sharing the same academic program and environmental input. The schools were Broomhall Nursery (Nursery 1) and its annexe, Mushroom Lane nursery (Nursery 2). Both nurseries work to the same timetable, share planning meetings and follow the same rationale for the methods they adopted. The schools were selected for their existing links with the university and for their willingness to allow access to a nursery research worker taking children out to work in pairs in a small room.

These inner city nurseries cater for 120 children aged 3-5, they are funded by the local education authority so that parents do not pay fees, and draw from a mixed catchment area, including high rise flats and rented accommodation as well as private housing. Children are drawn from diverse ethnic backgrounds, with around 20% in total of Asian or African background, and 11% were entitled to free school meals. 22.5% had EAL (English as an alternative language), and 11% Special (educational) needs. None of the SEN or EAL participants were included in this study; they formed a separate group whose outcomes are not reported here. Both schools are well rated for their outcomes in terms of language and literacy, mathematics, and personal and social development, with children at school entry above the level expected for the average 5 year old.

Based on the screening, intervention was undertaken with 20 children screened as most 'at risk' based on the PREST test (Fawcett, Nicolson and Lee, 2001). A control group of 12 children was also identified, matched for initial scores with the intervention group (3 of the control group were not available at post-test because they had moved away from the area, and so only 9 controls are included in the analyses). Mean data for the intervention and control groups

respectively were as follows: Age: mean 4.06, range 3.9 to 4.3, sd 0.01; control mean 4.22, range 4.1 to 4.3, sd 0.05. British Picture Vocabulary scores: mean 102.1, range 80-127, sd 13.67; control mean 103.6, range 82-127, sd 14/62. Gender balance: intervention 12M 8F; control 4M, 5F.

Nursery 1 was asked to identify all children of the appropriate age, parental permission was sought for participation in the study, and children were screened using the Preschool Screening Test (Fawcett, Nicolson and Lee, 2001). This test (PREST) was based on a simplified version of the DEST that is suitable for 4.5 plus (Fawcett, Nicolson and Lee, 2001) and was developed for children aged 3.5 upwards in school.

The test takes around 30 minutes to administer and produces a profile of strengths and weaknesses in comparison with age referenced norms. Ten children from cohort 1 were selected for intervention on the basis of risk scores of 0.4 or greater, given the prototype intervention over a 10-week period, and their performance was checked again. Having established the feasibility of the approach, in the second phase, Nursery 1 contributed the control group, and a second cohort was screened for intervention in Nursery 2. The control group included the children in Nursery I in the age group 3:9-4:3 to match the intervention group.

DESIGN

Performance of the intervention and control groups on the screening test was measured both before and after the 10-week training period. The critical variable was the amount of improvement for the experimental group and the control group from pre-test to post-test. The control group received standard nursery school experience, which involved no structured support. The differential improvement of the experimental group would give an indication of the effectiveness of the intervention. In addition, a further 'delayed screening test' was undertaken when the children reached the age of 5:8 using the DEST (Nicolson and Fawcett, 1996) in order to assess the extent to which any improvements were maintained in the absence of further interventions.

The training regime was designed for children working in groups of two in two/three weekly sessions of around 15 minutes, over 10 weeks, with the interventions taking place within the normal nursery session. Nursery attendance was two hours daily (10 hours per week). The intervention group and the control group therefore shared 90-95% of the nursery environment, with the remaining time allocated to the intervention activities for the intervention group and general, professionally administered, nursery activities for the controls. In terms

of criteria (McCardle and Chabra, 2004) the design is more rigorous than a 'quasi experimental' design, in which the control group have no intervention, but less rigorous than a 'clinical' design, in which alternative interventions are pitted against each other. In our view, it represents a reasonable compromise in that it provides an appropriate estimate of what gains might be made within an established educational system by targeted short-term interventions.

a) Screening

Screening and intervention were delivered by a nursery nurse, with no specialist training but with an interest in special needs. Screening was carried out using the Preschool Screening Test (Fawcett, Nicolson and Lee, 2001). The PREST was developed by combining simplified components of the Dyslexia Early Screening Test (Nicolson &Fawcett, 1996), a screening test for children from 4.5 to 6.5 years, with some components from the Middleton-in-Teasdale Screening Test (MIST, Lee, 2004), a comprehensive but time-consuming battery.

Ten two- or three-minute tests were used from PREST, eight of which were based on DEST: two tests of pre-literacy [digit naming, in which the digits 4, 3, 5, 7, 6 are shown and the number read correctly is recorded], and letter naming (c a t s r and first letter of child's name); two tests of phonological awareness [rhyming in which children are asked to identify the rhyme in a nursery rhyme, and pick out the odd one from sets of three pictures, and phonemic discrimination, in which pairs of phonemically confusable (or identical) words are spoken by the tester, and the child has to say whether they are the same or different]; speed of processing (the Rapid Automatised Naming test in which the child has to say the names of a set of 20 pictures of common objects as fast as possible]; Memory (verbal memory including a standard digit span test, and spatial memory via the 'Corsi frog' test in which the child has to remember which 'lily pads' a frog jumps to]; fine motor skills [bead threading speed and scissor use, and shape copying accuracy] and gross motor tasks (heel-to-toe balance and catching and hopping) from the DEST/MIST were adapted to include simple balancing tasks, and a Romberg test (standing on both feet with one foot in front of the other) appropriate for children of this age group. The tests therefore cover literacy, cognitive and motor domains together with visual, auditory and kinaesthetic modalities.

b) Assessment

Participants were assessed using the PREST at age 4:0 (pre-intervention) and again at 4:4 (post-intervention). For the follow-up at 5:0 and 5:8 they were assessed using the Dyslexia Early Screening Test. The PREST is a simpler version

of the DEST for a younger age group, the DEST has commonalities with the PREST and so the data are comparable. The DEST comprises 11 sub-tests in five areas (literacy skills, phonological awareness, verbal memory, motor skill and balance, and auditory processing).

The sub-tests are as follows. Digit names tests knowledge of digits 1-9, Letter names tests knowledge of t, s, d, e, w, o, b, q, n, y. Rhyme tests both for understanding of rhyme and of first letter sounds; Rapid naming involves the time taken to speak the names of pictures on a page full of common objects; Discrimination is the score on saying whether word pairs such as 'fuse' and 'views' are identical. Digit span tests verbal memory for sequences of digits. Beads is the number of beads threaded in 30 s; Postural stability reflects the degree of movement when pushed gently in the back; Shape copying tests the accuracy of copying simple geometrical shapes. Sound order tests the ability to determine which of two sounds played shortly after each other was first. The overall DEST score is essentially the average of the scores on the individual sub-tests.

c) The intervention

The intervention was developed by the first two authors based on a whole school intervention (Middleton Rescue Package, MIRP, Lee, 2004), modified and extended for small group work. It is important to highlight the fact that four year old children are still in a phase of rapid development of a range of cognitive and motor skills. Consequently, although in assembling the intervention battery we were placing strong emphasis on language based skills, we aimed to cover the full range of the nursery school curriculum, including skills that may also underpin motor and cognitive development. Furthermore, in order to be successful, it was important to engage the attention and co-operation of young children with no experience of formal schooling, and very short attention span.

Intervention took place in groups of two, for around 15 minutes. All children had at least 2 sessions weekly. The 13 children with moderate risk scores on PREST had two sessions of language support, and one of motor skill per week with the remainder having only two sessions per week. In each session three skills were presented to maintain variety and interest, and maximise learning. The intervention researcher adapted the program to the needs of the children, spending longer on games which the children clearly enjoyed.

At each stage care was taken to provide the right mixture of familiarity and challenge, so that children were exposed to new skills. Skills trained by both language and motor intervention explicitly included a range of concentration and listening skills. The aim of the intervention was therefore to introduce a more

explicit teaching element, and to encourage all children to take part, while maintaining the element of fun which is crucial for success at any age. Above all, instant reinforcement and feedback was provided.

Rationale for the training methods adopted

The link between language difficulties and learning disabilities is well established (see the report of the National Reading Panel). The rationale for motor skills intervention was based on a whole school intervention package developed by the second author and his colleagues (the Middleton-in-Teesdale Intervention and Rescue Programme, 2001), that had proved particularly effective in previous school-based outcome evaluations.

We focused here on a combination of language and motor skills appropriate for learners in the early stages of development. Although both gross and fine motor skills were included, the training was set up in such a way that all children had more language than motor skill input, with a ratio of around 70:30 language to motor, and all motor skills intervention included aspects of language. In other words, an integrated program of skills was devised and delivered as a generic program to the children in the intervention group.

Activities included**:**

i) Language and Phonological Activities. Tasks included segmentation, phoneme identity and blending using their own name, finding initial sounds, rhyming, ear training, sequencing, tongue twisters linked to letter sounds

ii) Cognitive and Memory Activities: tasks included auditory and visual memory, prepositions with small plastic coloured bears, memory games, opposites, miming, copying patterns, associating geometric shapes on different properties including shape, size, colour and thickness.

Iii) Gross Motor Activities. Balancing on the wobble board (a wooden board balancing on runners, which can be adjusted to make it more or less difficult to balance), playing 'Simon says' (a game where the child follows the spoken directions only if they are preceded by the phrase 'Simon says') and trying to catch bean bags or throw them at skittles.

iv) Fine Motor Activities included colouring in, peg board, sewing, hammering, sequencing, and Graphisme (filling in a picture with dots).

Table 1. Mean performance of the intervention group and controls on subtests of the PREST pre and post intervention, together with performance of the intervention group at a follow-up at age 18 months later. (Standard deviations are in parentheses)

	Pre-literacy	Speed	Phonology		Memory		Fine Motor Skill		Gross Motor Skill	
	Digits & letters	Rapid Naming	Phon Disc	Rhyme	Digit Span	Corsi frog	Beads & Cutting	Shape Copying	Balance	Catch & jump
Intervention Pre	101.35 (15.44)	101.00 (15.05)	97.83 (19.57)	97.24 (14.89)	94.57 (11.48)	92.64 (12.69)	104.33 (14.57)	87.62 (11.87)	87.50 (14.31)	67.11 (21.77)
Intervention Post	109.69 (13.28)	107.63 (9.47)	108.98 (18.76)	119.50 (16.86)	108.75 (13.26)	104.23 (9.73)	110.86 (10.12)	97.76 (9.51)	103.91 (14.41)	91.07 (18.35)
Effect Size	0.60	0.47	0.61	1.57	1.34	0.87	0.47	0.82	1.02	1.01
Control Pre	98.75 (16.83)	100.09 (16.69)	99.21 (10.69)	97.00 (13.69)	98.13 (10.64)	93.79 (18.18)	113.80 (10.60)	91.93 (10.11)	101.30 (18.19)	74.69 (33.60)
Control Post	105.65 (10.23)	105.82 (11.68)	103.16 (15.29)	96.17 (13.23)	97.29 (8.70)	92.27 (16.51)	111.60 (11.22)	93.93 (12.88)	97.68 (18.48)	81.25 (23.49)
Effect Size	0.49	0.47	0.29	-0.06	-0.08	-0.11	-0.16	0.16	-0.23	0.29
Intervention Follow-up	100.46 (10.72)	98.87 (9.39)	104.04 (17.75)	107.06 (7.44)	114.23 (14.30)		105.36 (26.12)	112.84 (7.66)	100.88 (11.22)	
Control Follow-up	105.89 (3.41)	91.65 (26.16)	106.04 (9.62)	108.24 (7.07)	107.94 (14.13)		101.90 (20.90)	110.21 (4.85)	85.03 (19.07)	

In later weeks, children were encouraged to pit themselves against a stop-watch or an egg timer, not only to emphasise the need to work quickly, but also to assist concentration.

It is important to note that, following the intervention, it was considered that five children continued to have difficulties. These were then given support for a further four weeks. This intervention was delivered to children individually, targeted at their areas of particular difficulty. It is also important to note that the interventions delivered are not commercially available, and represent a generic approach that can be modified as required to suit the teacher/participants.

DATA ANALYSIS

The 'raw' scores on the PREST sub-tests at pre-training and post-training were converted into age-adjusted standard scores using the conversion data available in the normative sample. In order to highlight the different skill domains, the separate sub-tests were also combined to give scores on six skill domains: pre-literacy, phonology, memory, speed, fine motor skill and gross motor skill. Following a multivariate analysis of variance of the pre- and post-training scores for the two groups, individual two factor analyses of variance were undertaken on the separate sub-tests, with the aim of identifying for which skills the intervention group improved significantly more than the control group (revealed by a significant interaction between group and time-of-test). In order to provide quantitative estimates of the amount of improvement, changes in standard score were calculated. In addition, effect sizes of the improvements were calculated for each group by dividing the group change in standard score by the standard deviation of the cohort on the initial test (Cohen, 1977). Corresponding standard score analyses were undertaken at the 5:8 follow-up using the DEST data.

RESULTS

The means and standard deviations of the standard scores for both groups at pre- and post-training test, together with the corresponding effect sizes, are reported in table 1 below, and illustrated in figure 1.

If we consider first the control group, it may be seen that they have made some progress overall. Their mean standard score improved from 96.9 to 98.5 (mean effect size 0.23). There was a clear 7 point improvement in digit and letter knowledge, but other scores showed variable changes. By contrast, the intervention group showed improvements across the board, with a mean

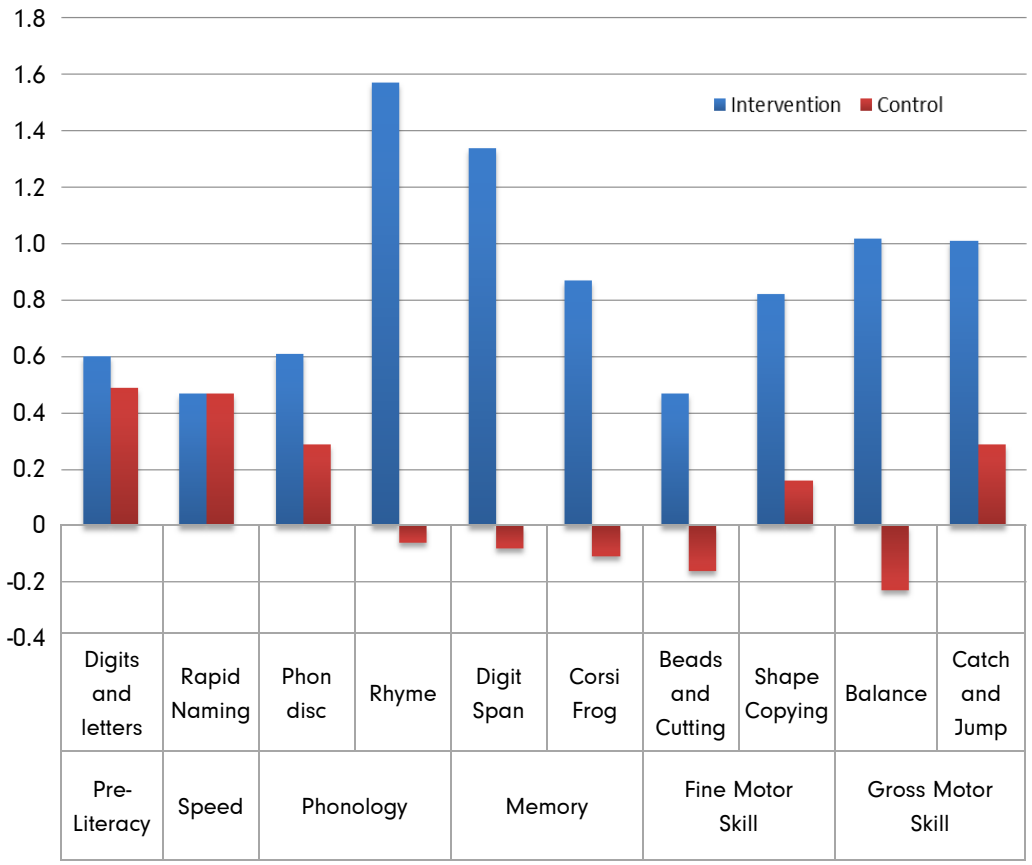

Figure 1. Effect sizes for improvement pre/post for intervention and controls. An effect size of 0.2 is small, 0.5 is medium, and 0.8 or more is large (Cohen). It may be seen that some skills improve in both groups, but others seem to deteriorate in the control group without explicit support.

improvement from 93.1 to 106.2 - with a minimum increase of 6.6 points and notable increases (10 points or more) in all but Rapid Naming, Beads & cutting and digits & letters. The mean effect size was 0.88.

In terms of inferential statistics, the multivariate analysis on the six skill domains indicated that significant interaction effects (using Wilks' lambda) occurred for: phonology, memory and gross motor skills. [$F=5.83$, $p<.05$, $F=18.63$, $p<.001$; $F=4.57$, $p<.05$] but not for pre-literacy, speed or fine motor skill [highest $F=1.95$, NS]. Significant effects of time-of-test were found for pre-literacy, phonology, speed, fine motor skill and gross motor skill [$F=6.32$, $p<.05$; $F=7.56$, $p<.05$; $F=5.44$, $p<.05$; $F=7.78$. $p<.05$; $F=4.37$, $p<.05$ respectively] but not for memory [$F=1.52$].

The above analyses reflect group differences rather than individual differences. It was therefore of particular interest to assess the pattern of changes at the individual level. We categorised each individual score on a sub-test as 'at risk' if it fell one standard deviation or more below the mean (a standard score of 85 or less). Any individual with 30% or more of their PREST scores ≤85 was categorised 'at risk' overall. Overall risk incidence fell from 65% to 5% for the intervention group, and from 42% to 33% for the control group.

FOLLOW-UP TESTS AT 5:8 YEARS

As noted above, the groups were followed up roughly 18 months after the end of the intervention in order to establish whether the improvement in performance was sustained after the intervention finished, or, as is most common in such cases, whether they slipped back toward their original performance levels. The standard score data are shown in the bottom lines of Table 1 (with 18 of the intervention group and 9 of the controls). It may be seen that in general the mean standard scores were indeed sustained. There were drops of over 5 points in pre-literacy and in rhyme (but that is not surprising in that there are ceiling effects on these tests at 5:8, in that it is impossible to score over 110). There was also a drop in rapid naming. Otherwise scores remained the roughly same or improved. The minimum standard score was 98.87, easily within the normal band. None of the 18 individuals was at risk, with only one individual having more than one at risk score out of the 9 measures.

In general the control group also made satisfactory progress over the period. The most notable differences from the intervention group derive from the low mean scores for rapid naming and for balance, which arise from poor scores from 7 individuals within the group (2 for rapid naming and 5 for balance). Two of the 9 had at risk scores on 2 of the 9 tasks, with 6 of the remainder having one at risk score.

Interestingly, the intervention group continued to show an advantage in memory in comparison with controls, based on standard scores 7 points higher overall. Despite being significantly poorer than controls at pre-test on digit span, the effect size for the intervention group was 1.37 compared with the control effect size of -0.08. Memory is notoriously difficult to improve, and the research was careful not to teach the test, encouraging instead a series of listening skills, and memory games such as "I went to market and I bought' which builds up an alphabetical sequence which each child must correctly repeat, while adding the next letter in the alphabet. These games are suitable for use by parents as well as preschool teachers to enhance auditory memory development.

OVERALL DISCUSSION

Five key issues were noted in the introduction. We consider them in turn.

(i) Feasibility of the screening and intervention process

Clearly this minimal requirement was satisfactorily met. It should be stressed that this was by no means a foregone conclusion, in that a very abbreviated intervention program had to be developed suitable for working in 15-minute periods two to three times per week. The participants enjoyed both the screening and the intervention, as did the intervention researcher!

(ii) Effectiveness

The maximum time in the intervention was 45 minutes for 10 weeks – 7.5 hours. From a child's perspective therefore 7.5 hours' intervention led to a mean increase of 12.1 standard score points, or 1.6 standard score points per hour intervention. Given that the children were seen in pairs, one can double this figure to obtain the cost-effectiveness, namely 3.2 standard score points per hour. These are extraordinarily strong findings, suggesting that it would be entirely feasible to screen and support many times as many children at age 4 than if one waits for the problems to become entrenched by age 8. A stitch in time truly saves 9 in this case.

(iii) Maintenance of improved performance

The 18 month follow-up suggested that none of the intervention group had any problems at 5.8 years. There appears to be some evidence of a diminution in processing speed, but otherwise all the skills appear to have been maintained.

(iv) Benchmarking of interventions at age 4

One of the major contributions of the National Reading Panel (2000) was to 'benchmark' interventions, so that it should be possible to predict the expected improvement for different types of interventions. The Panel expressed their findings in terms of effect sizes of gains for phonological awareness, single word reading accuracy and fluency and comprehension. Torgesen (2001) produced the further important refinement in terms of cost effectiveness (that is, effect per hour of instruction) as introduced by Nicolson et al., (1999). To our knowledge, there are no corresponding benchmarks – in terms of effect sizes or standard score improvements, for 4 year old children, and indeed we are not aware of any benchmarks at any age for skills such as memory, speed, fine and gross motor skills. Consequently, even though these data are based on a very small

sample of children we hope that they will provide a start in this important endeavour.

(v) Directions for further research.

One of the most intriguing issues raised by this research is that, based on one of the author's (Lee) decade of first hand experience of the value of including gross and motor skill practice within a balanced intervention program, we made our intervention very much broader (and shallower) than those normally advocated. This study in itself can yield little direct evidence relating to the differential value of including interventions for skills at best indirectly related to literacy.

Nonetheless, there is consistent evidence within the literature that broadening an intervention to include say fluency as well as reading leads to consequent advantage (Berninger, Abbott, Vermeulen and Fulton, 2006; Fawcett, Moss, Nicolson, Reason and Nicolson, 2001; Hatcher, Goetz, Gibbs and Smith, 2006; Nicolson, Fawcett, Moss, Nicolson and Reason, 1999; Nicolson 2001; Wolf, Miller & Donnelly, 2000). It would clearly be an important research priority to replicate the present study with larger numbers of participants and with differing types of intervention so as to explore these issues systematically.

One further issue is the degree to which it is valuable to make skills explicit. One of the goals of the intervention was to be explicit at all times, not only articulating what the target performance was, but also whether the child was achieving it. It seems that the standard nursery curriculum (at least in the UK) simply exposes a child to a range of experiences. We conclude, with Molfese and colleagues (2006) that it is important that material is delivered explicitly for children at risk of failure, because they are less well equipped to extract implicit information.

A final intriguing issue is why it was that the intervention group showed gains 'across the board'. It is probable that this reflects the breadth of the multi-skill intervention, but it is also possible that there were gains in meta-skills that underlie improved school performance. In particular, based on anecdotal records maintained for each child, we noted that the intervention group learned to listen, to do what the researcher/nursery nurse asked, and to seek appropriate feedback on their performance. In other words, they were learning how to learn! (Fawcett, Nicolson, & Lee, 2004)

This is a key requirement for success in the early years at school. Some evidence for this view derives from further measurements that we have not reported here owing to the lack of suitable norms, because these subtests were not included in the published PREST. There were striking improvements for the intervention group

in repetition memory (the ability to repeat a sequence of words). 100% of the intervention group improved, 75% achieving near perfect scores by contrast with scores of zero at pre-test, whereas performance of the controls remained unchanged.

The study reported here fits in particularly well with current moves in policy in the UK, towards a broader curriculum in the early years. It has been particularly relevant in Wales in terms of the new Foundation phase that emphasises the need for outdoor play before formal literacy teaching is introduced. It is an approach that seems to be simple, effective and cost-effective, and further studies are now in progress using this approach. 35 schools in South Wales have now adopted this model with 5 year olds, with considerable success (Jones and Fawcett, 2013), and a new intervention package based on this is now available (Hands on Literacy, 2012).

IMPLICATIONS FOR THE ASIAN PACIFIC REGION

Children here start school later, and there is an expectation that their literacy skills will be well developed by the time they start formal schooling, with a variable range of support available for children in preschool. A similar approach could be particularly useful in the preschool period in countries where children start school later, thus ensuring that all children can fully benefit from instruction by the time school starts. Most children at risk of dyslexia need specific and explicit support individually or in small groups in order to make the progress expected of them and keep pace with their peers on school entry. The skills outlined here must be in place before any more formal literacy learning can take place. These are the principles behind moves towards preschool support for children at risk for dyslexia on early screening tests as advocated by the Dyslexia association of Singapore.

LIMITATIONS OF THE STUDY

It should be acknowledged that this was only a small-scale study, that it reflects real world limitations in subject attrition, notably in the control group, that we have no information on any support provided from home, and intervention was delivered by only one person, who had no specialised training in intervention of any type. If these findings could be replicated in larger studies, it seems that screening and intervention might prove a key factor in prevention of learning difficulties, at least for a substantial proportion of young children in the lead up to school entry.

CONCLUSIONS

The results of this study suggest that a multi-skill 10 week intervention delivered to four year old children in nursery in two to three sessions of 15 minutes weekly can be successful in improving the pre-reading skills of children in comparison with a control group receiving only normal nursery schooling. Even those children resistant to remediation improved their skills following a further more targeted intervention over a four week period. We consider that this research has significant implications for educational policy and practice, in the UK and beyond.

Guidelines for cost-effective nursery screening and intervention emerging from this study include the administration of short age-normed screening tests designed for this age group, followed by explicit small group teaching of language and motor skills over a short time frame, with further individual targeted intervention for children who do not accelerate. This leads to the possibility of 'inoculating' children against failure, combining the advantages of early teaching with the sheltered environment of the nursery. This should have significant 'knock on' effects, allowing a more rapid pace of teaching in the early school years and reduced incidence of reading failure, leading to beneficial effects throughout the educational system, and, in due course, society.

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ACKNOWLEDGMENTS

The research reported here was supported by a grant from the Nuffield Foundation. We acknowledge gratefully the committed performance of Michelle Tovey who undertook the interventions. We are particularly grateful to the teachers, parents and children in the Broomhall and Mushroom Lane nursery schools, Sheffield, UK for their unstinting support in the project.

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