AJEC

The Australian Journal of Early Childhood (AJEC) is published quarterly and is sponsored by Early Childhood Australia. It features up-to-date articles designed to impart new information and encourage the critical exchange of ideas among practitioners in the early childhood field. The AJEC Committee invites contributions on all aspects of the education and care of young children. The journal is controlled by an editorial board and all submissions undergo a blind, peer-review process.

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IT’S AN HONOUR TO be invited to contribute an editorial to AJEC to mark 2008 as the year of Early Childhood Australia’s 70th birthday. As noted on another birthday by Manjula Waniganayake (2001), AJEC and its predecessor, the Australian Preschool Quarterly, have indeed been the ‘flagships’ of ECAs serial publications programs.

AJEC is a major demonstration of ECAs long standing commitment to scholarship in early childhood education and care. It is one of our organisation’s powerful advocacy tools, helping to promote best practice and debate to a wide audience of academics, researchers, practitioners, students and others, right across Australia and further afield.

At this time of celebration, ECA acknowledges with great appreciation the work of past and present AJEC (and APQ) expert editors and editorial committees, as well as the contributions of so many learned authors over the years. Without you AJEC, soon to be transformed into the Australasian Journal of Early Childhood, would not be the success that it is. Both ECA and AJEC readers are in your debt. We also thank the staff in ECAs National Office whose professional contribution is so very important to the smooth production and success of our journal.

As usual, this edition includes much to inform and provoke thought and discussion across a diverse range of topics. The first two articles describe projects aimed at reducing the difficulties often experienced by young Australian Indigenous children when they begin formal schooling, particularly in the areas of numeracy and literacy. We can learn from each.

Warren, Young and deVries report on the outcomes for two young Australian Indigenous children who attended a year of ‘Prep’ schooling despite being younger than the official ‘Prep’ entry age. While the cohort in this report is small, the issues are very big. The paper describes the larger Young Australian Indigenous students’ Literacy and Numeracy (YAILN) program of which the children were a part, discusses its pedagogical approach and theoretical underpinnings, reports the finding that the two children did enter their ‘formal’ Prep year with clear gains, and considers the roles of both teachers and older peers in the early learning of these children.

‘Bridging the Gap’, a home-book reading program with Indigenous Australian parents to support their young children in learning to read is described by Freeman and Bocher. Again, the careful design of the project and its ability to engage parents and children alike is instructive, as are the ‘spin-off’ benefits for the ongoing work of Aboriginal Education Assistants. The article reports quantitative results collected during the implementation of the program, with improvements in both children’s skills and in related areas such as home–school links.

The gross motor proficiency of five-year-old Hong Kong children and the efficacy of using a gross motor proficiency norm developed in one country with children in another country is the subject of Lam’s research. As part of her report Lam discusses numerous characteristics of life and early education in Hong Kong that could impact on different aspects of motor development. From her findings she recommends caution in using an instrument of this type that is valid in one country in another country, and urges further research in the area.

Bortoli and Brown studied the social attention skills of preschool children with an intellectual disability and children with a hearing loss. Their interesting report discusses and examines aspects of attention and its interaction with children’s social engagement, and considers differences in opportunities for social engagement, preferences for social engagement opportunities, and the effect of cognitive delay. The article also suggests related strategies for teachers.

The long-term effects of all-day kindergarten on children in the United States are the subject of the article by Chang and Singh. Using data from the Early Childhood Longitudinal Study, a nationally representative US data base, the authors analysed reading and maths scores, teacher activities in reading and maths, and children’s age, gender and socioeconomic status in three waves from the beginning of kindergarten to the end of first grade. The scale and method of this research are certainly interesting. We note that the average age of children in the youngest wave studied was five years and eight months, an age at which most Australian children are attending school ‘all-day’.

The final article of the edition comes from Smith who surveyed professional musicians about their childhood memories to understand the effects of instrumental music lessons at a young age on their lives. Smith’s report is interesting if highly selective. She does caution us about the danger of drawing conclusions only from the stories of very successful musicians, but does make concluding recommendations to parents and early childhood educators.

Margaret Young
Early Childhood Australia National President
Early Childhood Australia (ECA), a non-profit advocacy organisation for children from birth to eight, is seeking a new editor for the Australian Journal of Early Childhood (AJEC). The position will require you to be chair of the AJEC Committee, responsible for strategic oversight of the journal, and to sit on the ECA Publications Committee, which is responsible for directing ECA’s extensive publications program.

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The impact of early numeracy engagement on four-year-old Indigenous students

Elizabeth Warren
Janelle Young
Australian Catholic University

Eva deVries
Independent Schools Queensland

THIS PAPER REPORTS ON a component of a research project, Young Australian Indigenous students Literacy and Numeracy (YAILN), a longitudinal study investigating learning and teaching activities that support young Indigenous Australian students as they enter formal schooling. In Queensland, students are allowed to attend a non-compulsory year of schooling, Preparatory (Prep), if they reach the age of five years by the end of June in the year they enrol. In YAILN, one of the participating schools’ preparatory intake included Indigenous students who had not reached the required age for Prep. Numeracy understandings for two of these students were tracked during their pre-prep year. The pre- and post-test numeracy results and the interview conducted at the beginning of their ‘official’ preparatory year suggest that this extra year of schooling enhanced their knowledge of mathematics and has (a) put them on an even footing with students from more advantaged backgrounds as they enter Prep, and (b) given them a distinctive advantage over other Indigenous students who have not had equivalent experiences.

Introduction

YOUNG INDIGENOUS AUSTRALIAN students continue to experience difficulties at school, especially in the areas of literacy and numeracy. Results from the National Report on Schooling, National Benchmarks for reading, writing and numeracy in Years 3, 5 and 7 demonstrate a high percentage of Indigenous Australian children performing well below the benchmark (ACER, 2005; MCEETYA, 2008). The latest National Report on Schooling in Australia (MCEETYA, 2008) includes the following results for Indigenous students obtained from testing in 2006. Seventy-two per cent of Indigenous Queensland students are achieving at the benchmark for numeracy in Year 3. This is significantly below their achievement in both reading (88.5 per cent) and writing (89.7 per cent), and also significantly below the achievement of Indigenous students in five other states. Similar trends exist in the National Scores.

Unjustified blame has been laid upon Indigenous students in the past, and absenteeism, disadvantaged social background and culture have all been seen as contributing factors (Bourke & Rigby, 2000). This paradigm is seen as irresponsible (Cooper, Baturo, Warren, & Doig, 2004; Matthews, Howard & Perry, 2003; Sarra, 2003). Historically, most educational efforts have aimed to assimilate Indigenous students into Euro Australian society and are based on the ideology of cultural deprivation (Prochner, 2004). Our longitudinal research project, Young Australian Indigenous students’ Literacy and Numeracy (YAILN) draws on and adapts relevant mainstream research about young students’ numeracy learning, and endeavours to situate these findings in local settings where Indigenous cultural practices are recognised and respected. To date, there have been few published studies on the impact of early childhood education on Indigenous students (Prochner, 2004).

Theoretical underpinnings

Briefly, the research base and design principles that underpinned the development of the Numeracy aspect of YAILN were:

- Maths ability: All children are capable of learning mathematics. Children do not have to be made ready to learn as they freely engage with informal mathematics in everyday life (Greens, 1999).
Role of the teachers: Play is not enough to assist learning in the early years. Children learn through play but they need adult guidance to assist them to reach their full learning potential (e.g. Balfanz, Ginsburg & Greenes, 2003; Vygotsky, 1962). As compared with other cohorts of early years students, Indigenous students gain even less from attending play-based programs (Taylor, Thorpe & Bridgstock, 2006, cited in Fleer & Rabin, 2007).

Types of activities: Hands-on activity-based learning best helps young Indigenous students to engage with mathematics (Cooper, Baturo, Warren & Grant, 2006).

Role of oral language: A focus on the language of mathematics fosters important language acquisition and helps students to acquire meta-cognitive abilities. This focus is even more relevant for students whose first language is not English (Pappas, Ginsburg & Jiang, 2003). Yet pathways for oral language experiences tend to be restricted in early childhood settings (Kennedy, Ridgway & Surman, 2006).

Maths curriculum: Young students are capable of dealing with a comprehensive mathematics curriculum (Greenes, Ginsburg & Balfanz, 2004).

Indigenous students’ language: Aboriginal English reflects the culture and identity of Aboriginal people (Cronin & Diezmann, 2002) and discourses of Indigenous families often do not match that of the school (Cairney, 2003). Teachers need to create a bridge for young Indigenous students between Aboriginal English (AE) and Standard Australian English (SAE) as these students grapple with new language, new concepts and vocabulary presented for literacy and numeracy.

Value of ‘white’ mathematics: Parents of Indigenous students want their children to be bicultural and learn to live in both worlds (Partington, 1998). An understanding of ‘white’ mathematics is important for two reasons: (a) many traditional industries are now calling for personnel with advanced skills in mathematics (Mullis, Martin, Gonzalez & Chrostowski, 2004), and (b) mathematics is an empowering process acting as a tool to identify power differences among socioeconomic classes (Gustein, 2003).

YAILN is now in its second year. The students who participated in our first year were all from the preparatory classrooms, a non-compulsory year of schooling prior to Year 1 in Queensland. Prep classes are conducted five days a week and children stay all day. Participants must be aged five by 30 June in the year they start Prep. At the completion of the first year of YAILN our results indicated that, although Indigenous Australian students scored significantly lower on the numeracy pre-test, intervention focusing on (a) the language of mathematics, and (b) representations that support mathematical thinking in both directed teaching and play-based contexts helped these students to bridge the gaps in their learning (Warren, Young & deVries, 2008). The particular focus of this paper is to investigate the impact of engagement with YAILN on a small cohort of Indigenous students who had not reached the official age for entry to a Prep program.

One YAILN school, with a totally Indigenous population (School D), enrolled a small cohort of children in their Prep class who had not reached the age of five by 30 June, hence the term pre-preparatory students. The class consisted of up to 18 students, many of whom did not attend school on a regular basis. Of the 18 students, we managed to consistently track nine students over the school year; five were the correct age for Prep, two were Year 1-age students, and two were pre-prep students. The focus of this paper is the two pre-prep students (Widgy and Caddy) and was guided by the following research questions:

1. How does participation in the YAILN project affect understanding of number, patterning and oral language for pre-preparatory Indigenous students?

2. How do the mathematical understandings of Indigenous pre-preparatory students compare to Indigenous Prep students who had not previously engaged in numeracy activities?

Both Widgy and Caddy’s families were from low socio-economic backgrounds. The literature suggests that students from low socio-economic backgrounds begin school with many disadvantages. It seems that children who bring to school early mathematical knowledge are advantaged in terms of their mathematical progress through primary school (e.g. Aubrey, Dahl & Godfrey, 2006; Young-Loveridge, Peters & Carr, 1997). A consequence is that students with little mathematical knowledge at the beginning of formal schooling remain low achievers throughout their primary years and probably beyond. Denton and West (2002) showed that low income students usually come to preschool with the same basic readiness to learn as the more advantaged students. The difference lies in how they engage with advanced concepts and skills. Results from this study indicated that 63 per cent of students from high income families and 37 per cent of students from low income families had a strong understanding of the number sequence and could read two-digit numbers, identify the ordinal position of an object and solve simple word problems by the end of kindergarten. These differences were seen to reflect the mathematical knowledge each group brought to school and, in this instance, the educational gap remained by the end of the first year of schooling.
International studies suggest that allowing disadvantaged students and students with lower educated parents to attend school at an early age has a positive effect on their literacy and numeracy scores. Leuven, Lindahl, Oosterbeek and Webbink (2004), in a Dutch study involving data from more than 16,000 students reported that early learning makes subsequent learning easier. They found that increasing enrolment by one month increased the language and maths scores of students, from a low socio-economic background or ethnic minorities by 0.06 standard deviation, while early enrolment did not make a difference for non-disadvantaged students.

Method

In its first year, YAILN was a collaboration between researchers and teachers in five schools in North Queensland. The design of the project was a multi-tiered teaching experiment with the seven preparatory teachers participating in professional dialogue/learning with the researchers on four occasions throughout the school year. On each occasion, all of the teachers were released from their classrooms to participate in a day of professional learning. Subsequent to these days, the researchers visited all participating classrooms to continue professional dialogue and help teachers to trial activities and new resources. Discussions during these visits focused on both mathematics and literacy learning in the early years. From a mathematical perspective the focus of the dialogue was three fold: (a) the role of mathematics language in assisting young students to engage in mathematical thinking; (b) representations and activities that support mathematical learning in the early years with an emphasis on the language associated with these activities; and (c) how this learning underpins higher levels of mathematical understanding.

All the classroom activities were situated within the early childhood philosophy of activity-based learning with students encouraged to participate in a play-based and focused learning and teaching context. During discussions with their students, teachers promoted explicit mathematical language embedded within learning activities. They also encouraged students to talk about aspects of each activity and helped Indigenous students to distinguish between AE and SAE in their communications. Initially, the focus was not explicitly on number but on how various representations worked in a numberless world. For example, each classroom was given a large (5 x 5) floor grid and the activities involved students playing games while using their whole body. These activities gave students opportunities to talk about ‘What is beside you?’ ‘What is behind you?’, ‘What comes next?’ ‘How do you move to that position on the grid?’, ‘Which row is it in?’ and ‘Which column is it in?’ They were also encouraged to make patterns on the large floor grid. They ‘acted-out’ positional worlds in their home and school environment, recording these actions digitally, and, with their parents, writing sentences about their actions. In the later part of the year students then ‘mapped’ this language onto contexts involving numbers; for example, ‘What number is beside 9 or comes after 9?’, ‘What number is next?’, ‘What numbers are between 3 and 8?’, ‘How do you move from 9 to 11?’ Patterning activities also formed a key component of their initial engagement with mathematics. Figure 1 illustrates some typical mathematical activities that occurred at the commencement of the Prep year.

Data gathering techniques and procedures

Queensland is one of the largest states in Australia, and all schools in the study were a two-hour plane flight away from the researchers’ home town, so it was difficult to visit the school sites on a regular basis. Thus, the data tended to be gathered in one-week blocks, with the researchers visiting the sites five times during the year. Data-gathering had four components: pre- and post-tests, student portfolios, classroom observations, and teacher interviews. In total, 120 preparatory students participated in YAILN. All pre- and post-tests were conducted in a one-on-one assessment interview. Because of the intensity of the data collection—with each assessment interview taking up to one hour, 30 minutes for numeracy and 30 minutes for literacy—only 48 students participated in both the pre- and
post-numeracy tests. This purposely selected sample consisted of all the Indigenous students and a selection of students from other cultures, representative of a range of abilities. The pre-assessment interview (pre-test) occurred two months after the start of the school year. The pre- and post-tests and teacher interviews occurred in March and November. Insights into the first research question, **How does participation in the YAILN project affect understanding of number, patterning and oral language for pre-preparatory Indigenous students?**, were provided by the results of the tests administered in the pre- and post-assessment interview.

In order to answer the second research question, **How do the mathematical understandings of Indigenous pre-preparatory students compare to Indigenous Prep students who had not previously engaged in numeracy activities?**, a short interview was conducted with Jo, Widgy, Sussi and Fran at the beginning of the Prep year. Sussi and Fran were young Indigenous girls who had not attended a pre-preparatory year of school. All four students came from similar home backgrounds. The results of a pre-test interview conducted at the start of YAILN Preparatory year indicated that Indigenous students at School D had limited understanding of concepts about Western number systems on school entry (see Table 2), a trend confirmed by School D’s Prep teacher. Jo had attended the pre-preparatory year at School D, but enrolled midyear and hence did not complete the pre-test for numeracy. Unfortunately, Caddy was absent in the week the interviews occurred. The aim of the interviews was to gauge how Widgy’s and Jo’s understanding of mathematics compared with two students who had not attended a pre-preparatory year of school. This interview focused on their understanding of the number five and was conducted by the students’ Preparatory teacher, who was also Widgy’s and Jo’s pre-prep teacher.

### Pre- and post-tests results

The pre- and post-assessment interview consisted of three tests, one for number, one for patterning, and an oral language test. All the tests were developed by the researchers. The number test, School Entry Number Assessment (SENA), consisted of an interview with three main sections: number recognition, counting, and early addition and subtraction. This was based on the Mathematics component of School Entry Assessment (SEA), a tool designed by the New Zealand Government. Originally the context was a shop and assessments about students learning were made as students played a shopping game. SENA extended the types of questions asked, the way they were asked, and modified the context and materials for Australian Indigenous students. The context of a shop was replaced by objects that were considered to be in most of these Indigenous students’ homes; for example, leaves, clothes pegs, and hair clips. Before the interviews, the interviewer spent time interacting with the students in their classroom. Time was also allowed for the children to play with the objects before testing began. Students were encouraged to talk about their play, with the interviewer asking questions such as ‘Do you have this at home?’, ‘Do you know what we call this?’ All these actions were believed to help students to feel confident about answering the questions. The interview consisted of three main sections: number recognition, counting, and early addition and subtraction.

The Patterning test consisted of 11 questions. Students were asked to copy, continue and complete repeating patterns and to identify the repeating part in each. Research suggests that an understanding of these key concepts impacts on the application of numerical strategies in the later years of schooling (Papic, 2007). BOEHM, the third test, is a commercially produced standardised oral language test. In this test students were presented with three pictures. A typical question was ‘Point to the picture where the cake is in the middle of the tray’.

Figure 3 presents samples of typical questions from SENA and the Patterning test.

<table>
<thead>
<tr>
<th>SENA</th>
<th>Patterning test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show these cards</td>
<td>Can you copy this pattern for me?</td>
</tr>
<tr>
<td>Number recognition and counting</td>
<td>Can you continue this pattern for me?</td>
</tr>
</tbody>
</table>

The results of a pre- and post-test, an interview conducted with 48 students selected from five Prep school settings (average age 4 years and 11 months), indicated that, although the Indigenous Australian students (n=14) scored significantly lower on the pre-test, after one year of school there was no significant difference in their scores as compared with the whole cohort (Warren, Young and deVries, 2008). For both the Patterning test and Oral Language tests, while there was no significant difference in the pre-test results...
and the post-test results for Indigenous Australian students and non-Indigenous students, both groups exhibited significant improvement in both areas by the completion of the first year of the project.

The effect of participating in pre-prep for Widgy and Caddy

The total possible scores for the three tests were, SENA (28); Patterning (11) and Oral language (50). Table 1 presents the pre- and post-means and standard deviations for the whole sample of 48 students. Fourteen students were Indigenous and 34 students were from non-Indigenous backgrounds.

Table 1. Mean scores and standard deviations for all students (n=48)

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre-test scores</th>
<th>Post-test scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>SENA (28)</td>
<td>14.40</td>
<td>5.34</td>
</tr>
<tr>
<td>Patterning (11)</td>
<td>3.71</td>
<td>3.06</td>
</tr>
<tr>
<td>BOEHM (50)</td>
<td>27.80</td>
<td>7.74</td>
</tr>
</tbody>
</table>

A Wilcoxon Signed Rank Test was performed to ascertain if there were any significant differences between the students’ pre- and post-test scores for the three tests. The Wilcoxon Signed Rank Test revealed a significant difference between the students’ pre- and post-test scores for SENA (Z=5.82, p=.000), Patterning (Z=5.92, p=.000) and BOEHM (Z=5.91, p=.000). School D, the school that both Widgy and Caddy attend, is one of the participating schools in YAILN. Pre- and post-test scores for the three tests were obtained for nine of the students from the preparatory class at School D. Table 2 presents the mean scores and standard deviations for each test.

Table 2. Mean scores and standard deviations for School D (n=9)

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre-test scores</th>
<th>Post-test scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>SENA (28)</td>
<td>8.67</td>
<td>5.75</td>
</tr>
<tr>
<td>Patterning (11)</td>
<td>1.67</td>
<td>2.65</td>
</tr>
<tr>
<td>BOEHM (50)</td>
<td>22.0</td>
<td>4.85</td>
</tr>
</tbody>
</table>

The Wilcoxon Signed Rank Test revealed a significant difference between the students’ pre- and post-test scores for SENA (Z=2.67, p=.000), Patterning (Z=2.68, p=.000) and BOEHM (Z=2.55, p=.000). Table 3 presents the mean scores and standard deviations for Widgy and Caddy for the three tests.

Table 3. Pre- and post-test scores for Widgy and Caddy

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENA (28)</td>
<td>2</td>
<td>15</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Patterning (11)</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>BOEHM (50)</td>
<td>21</td>
<td>23</td>
<td>21</td>
<td>34</td>
</tr>
</tbody>
</table>

Widgy and Caddy’s pre- and post-test scores indicated a marked improvement in their understanding of number, patterning and oral language after their participation in a pre-prep program.

Widgy and Caddy’s scores, as compared with their cohort and the whole sample indicated that this improvement was similar to the trends exhibited in their cohort and the whole sample. While Widgy and Caddy’s post-scores for SENA were below the average scores of their cohort and the whole sample, both post-scores were within 1 standard deviation from the mean post-scores. Widgy was also below the mean score for the cohort and the whole sample for patterning and BOEHM, but she still exhibited significant improvement in both scores. Caddy’s post-patterning score was above the mean patterning score for his cohort and the mean score for the whole group. His post-BOEHM score was above the mean score for his cohort and just below the mean score for the whole group. These results would suggest that attending the pre-preparatory year of schooling did make a significant impact on both of these students’ understanding of number concepts, patterning and oral language.

It should be noted that Widgy and Caddy’s post-test scores were also above the mean scores for the whole sample pre-test scores. This suggests that they now have a very strong foundation on which to build their mathematical understanding as they formally participate in the Prep year of schooling. The section presents the data relating to the second research question: How do these understandings compare to Indigenous students who had not attended pre-prep?

Comparing students who attended pre-prep with students who did not attend

The interview consisted of five main components: One-to-one counting to five; conversation of five; Subitising to five; counting on and counting back from five and creating stories about five (e.g. two and three make five). The Preparatory guidelines for Queensland schools (QSA, 2006) indicate that students should know all about five by the end of Prep, hence the choice of the number five. Figure 2 presents a selection of activities used in this phase of the research.
The interviews were extremely short (approximately three minutes’ duration) and were conducted with four students; Jo and Widgy (both had attended pre-prep) and Sussi and Fran (neither had attended pre-prep). All four students are presently in the Prep year at School D. All interviews were video-taped. Table 4 presents a summary of the results for the four students.

Table 4. Results comparing pre-prep Indigenous students with Indigenous students who have not attended pre-prep.

<table>
<thead>
<tr>
<th>Students</th>
<th>Understanding of five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended pre-preparatory year of schooling</td>
<td></td>
</tr>
<tr>
<td>Jo</td>
<td>Recognises all numbers to five without counting.</td>
</tr>
<tr>
<td></td>
<td>When two, three, four balls are hidden, recognises how many are left and how many have been taken away without counting.</td>
</tr>
<tr>
<td></td>
<td>Can create all the stories about five (e.g. zero and five, one and four, two and three).</td>
</tr>
<tr>
<td>Widgy</td>
<td>Can conserve all numbers to five.</td>
</tr>
<tr>
<td></td>
<td>Correctly counts different arrangements of the numbers to five.</td>
</tr>
<tr>
<td></td>
<td>Can subitise to five.</td>
</tr>
<tr>
<td></td>
<td>Can create some stories, but not all, about five.</td>
</tr>
<tr>
<td>Did not attend a pre-preparatory year of schooling</td>
<td></td>
</tr>
<tr>
<td>Sussi</td>
<td>Cannot correctly count different arrangements of five.</td>
</tr>
<tr>
<td></td>
<td>Can subitise one and two.</td>
</tr>
<tr>
<td></td>
<td>Can create two and three makes five.</td>
</tr>
<tr>
<td>Fran</td>
<td>Cannot consistently count to five.</td>
</tr>
</tbody>
</table>

There was a clear distinction between the two groups’ understanding of the number five. Jo was successful on all aspects of the interview. She could answer all questions about five, and throughout the interview did not use counting to aid her in her responses. Widgy initially had to count the number of objects the interviewer presented, but as the interview progressed, switched into discussions about five which did not require her to count the objects. Sussi could not consistently count to five. She had the numbers to three under control, but experienced difficulties with four and five. Fran could not consistently count to five. Both Jo and Widgy clearly understood the questions asked, especially the language of mathematics associated with the questions. The interview was conducted by the students’ Preparatory teacher, who was also Widgy and Jo’s pre-prep teacher.

Discussion and conclusions

Given that this paper shares the results of two Indigenous students who attended a pre-preparatory year, it is difficult to draw conclusions for the whole Indigenous community. For these two students the results clearly demonstrate that their attendance at school prior to the preparatory year assisted them in obtaining a better understanding of important Western mathematical concepts. The results also suggest that their understandings at the beginning of their Preparatory years are equivalent to the understandings held by many students from non-Indigenous backgrounds as they begin school.

The results begin to confirm the theoretical underpinnings of the YAILN project. The role of oral language in developing mathematical understanding especially for students whose first language is not English cannot be underestimated. As indicated by the results of the interview conducted at the beginning of the second year of the project, the students who had participated in pre-prep not only possessed a better understanding of numbers to five, but also the associated Western mathematical language used to access this understanding. Pappas et al. (2003) believe a focus on the language of mathematics fosters important language acquisition and helps students acquire meta-cognitive abilities. This research begins to confirm this finding.

For these Indigenous students, it appeared that direct teaching together with play-based opportunities were also important in learning mathematics at an early age. The results of the SENA component of the pre-test for number and the interview results for the two Indigenous students who had not attended pre-prep indicated that Indigenous students begin school with little knowledge about Western numbers. Most did not know the names of the numbers, nor could they meaningfully count to five. We are suggesting that this is not the type of knowledge that emerges solely from play-based situations. Adult guidance is needed (Greenes, 1999) and this is especially important for Indigenous students (Tayler et al., 2006).

Both of the Indigenous students reported in this paper are from a low socioeconomic background, and allowing these students to attend school early certainly had a positive effect on their early numeracy understandings (Leuven et al., 2004). Their pre-test results suggest that they brought to school a paucity of mathematical knowledge, especially knowledge related to understanding Western mathematics. Aubrey et al. (2006) claim that students with little Western mathematical knowledge at the beginning of formal schooling remain low achievers throughout their primary experience. The results of this research suggest that attendance in a pre-prep year of school may be an effective way to address this gap. Widgy and Caddy are now on an equal footing with other students as they begin their prep year. Both students remain part of our longitudinal study, Denton and West (2002) hypothesise...
that early learning makes subsequent learning easier, but this is yet to be fully tested. Our initial conversations with the Prep teacher and the distinctions between these students’ understanding of five as compared with students who had not attended a pre-prep year, suggest that the hypothesis may indeed be correct.

In alignment with our theoretical underpinnings we are suggesting that the ratio of pre-prep to Prep students should be low. Children can discover only so much through play. As the Prep students learn, they are in a position to assist pre-prep students to higher levels of understanding and helping pre-prep students to reach their learning potential (Balfanz et al., 2003). We propose that learning from older peers, along with explicit teacher-directed learning, all within a play-based environment, provide the most effective context for pre-prep Indigenous students for developing early numeracy understandings.

References


Bridging the gap: Improving literacy outcomes for Indigenous students

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THE MAIN AIM OF THE Bridging the Gap project was to encourage Indigenous families to use a home book-reading program to minimise the disadvantage often experienced by their children when learning to read. The project was implemented in Western Sydney by Aboriginal Education Assistants (AEAs) from the Indigenous Catholic Education Unit within the Catholic Schools Office, Parramatta Diocese, NSW, with 22 children and their families in Terms 2 and 3 of the school year. The program used shared-book reading to help the children become actively involved in the reading process. At post-test, the children’s mean reading age was higher than their mean chronological age, and there were increases in listening comprehension, phonemic awareness and receptive language. The project had a positive impact on the children’s self-esteem, interest in books, experiences with books at home, and home-school links. The project also had a positive impact on the role of the AEAs within the Indigenous Education Unit and their support of the literacy needs of Indigenous children in the first year at school.

Introduction

THERE IS EVIDENCE THAT children from socially and culturally diverse homes, including children from Indigenous backgrounds, are ‘at risk’ of difficulties in learning to read (Lonigan, 2004; Zubrick, 2006). These difficulties arise, in part, because teachers of early literacy often assume that children beginning school are familiar with books and have appropriate language skills. This assumption can cause problems for children who lack the experiences with written language and books that are prerequisites for literacy (Purcell-Gates, 1996) and for those whose first language is not Standard Australian English, including Indigenous children who speak English as a second language or dialect (Turnbull, 2002). This report describes a project that aimed to use a home book-reading program to ‘bridge the gap’ between the children’s experiences with books at home and reading instruction at school. The children were given books, and family members were shown how to read these books with the children. The program also provided an opportunity for effective links to be developed between Indigenous parents and school-based Aboriginal Education Assistants (AEAs).

In many classrooms, the instructional strategies used to develop literacy skills are not consistent with the educational, social and cultural needs of Indigenous children and their families (National Review of Education for Aboriginal and Torres Strait Islander People, 1995). For example, teachers often lack the competencies required to help Indigenous families develop the skills and confidence needed to support children when they are learning to read. When urged by teachers to read with their children, parents may feel anxious, bewildered and unsure how to translate the teacher’s suggestions into practice. Teachers misunderstand this uncertainty, unconsciously condemning Indigenous students to literacy failure from the point of school entry.

Introducing Indigenous families to book-reading techniques is one way to counteract both the perception and the reality of school failure. It can also contribute to developing positive relationships between teachers and Indigenous families by linking children’s literacy experiences at home with the goals and objectives of the school’s reading curriculum. Explicitly and systematically encouraging children to become actively involved in the reading process through interactive or shared-book reading (Al Otaiba, 2004) has been identified as the single most important activity in preparing children for success in literacy at school (Bryant & Wasik, 2004; Center, 2005; Lonigan, 2004). Shared book reading fosters children’s awareness of the connections between spoken words and print.
Attention is focused on the content or meaning of text (listening comprehension), learning about words (e.g. identical, long and short words), the sounds in words and letters (e.g. rhyme and alliteration), the alphabet, print, and the conventions of print (e.g. knowing the front from the back of a book) (Center, 2005). These strategies are particularly important for children whose families lack basic literacy skills, do not read books with their children, or lack the resources to buy or borrow books.

Programs for educationally disadvantaged children

Research has identified a strong positive link between early (emergent) and later literacy skills. This association is particularly significant for children from educationally disadvantaged homes who often lack the prerequisite skills needed for satisfactory progress in early literacy. Factors that contribute to children’s progress in learning to read include developing listening comprehension and deciphering print (Center, 2005). Listening comprehension can be fostered through reading text interactively. Here, the story is linked to children’s background knowledge, new vocabulary is discussed, and children are encouraged to predict what the story is about and later retell it. The skills needed to decipher print include understanding the concepts of ‘word’ and ‘sentence’ and recognising short, long and identical words, rhyme, alliteration, phonemes, and compound words (Center, 2005). Children at risk of delays in learning to read can be helped by encouraging literacy-related activities at home. Such activities can include teaching parents about literacy and increasing children’s exposure to books through shared reading. The use of alphabet books and games increases letter knowledge, creating links between reading experiences at home and at school (Lonigan, 2004, p. 67; see also Britto, Brooks-Gunn & Griffin, 2006; Burgess, Hecht & Lonigan, 2002; Lonigan, 2006; Mansell, Evans & Hamilton-Hulak, 2005; Purcell-Gates, 2004; Senechal, Lefevre, Thomas & Daley, 1998; Senechal, 2006).

Studies of early literacy confirm that the skills children need to succeed at school begin to develop well before school entry. A number of programs designed to help educationally at-risk children acquire prerequisite literacy skills during infancy and early childhood have been based on this finding. Head Start and Early Head Start, early intervention programs for infants, toddlers and preschoolers from low-income families that began in the United States in the 1960s as part of the ‘war on poverty’ (see Lazar & Darlington, 1982; Love et al., 2005; Zigler & Styfco, 2000), are examples of such programs. Similar programs include the Even Start Family Literacy Program (ESFL) (Alamprese, 2004; Fuligni & Brooks-Gunn, 2004; Wasik & Herrmann, 2004) and The Home Instruction Program for Preschool Youngsters (HIPPY) (Westheimer, 2003).

Examples of programs developed in Australia include the Mt. Druitt Early Childhood Project based on the Head Start model (Braithwaite, 1983; Healey, 1988) and, more recently, programs funded through the Australian Government’s Early Childhood–Invest to Grow initiative within the Stronger Families and Communities Strategy (FaCSIA, 2006). These programs provide a combination of school- or centre- and home-based services that aim to assist children and families in the years prior to school entry (birth to five years) or during the early school years. Their particular goal is to improve long-term outcomes for children who are educationally at risk.

Educational disadvantage and Indigenous people

It is generally accepted that indigenous people—including Aboriginal and Torres Strait Islander people in Australia, Maori in New Zealand and Inuit in Canada—are often educationally disadvantaged as a result of a complex array of factors. In Australia, this disadvantage is evident in results for Indigenous and non-Indigenous students reported in Overcoming Indigenous disadvantage, 2007 (SCRGSP, 2007, p. 31). These results show that the proportion of Indigenous students who did not achieve national benchmarks set for reading, writing and numeracy over the period 1999 to 2005 was consistently higher than for all students. In 2005, the proportion of Year 3 Indigenous students failing to achieve the benchmarks in reading was 22 per cent compared with 73 per cent for all students, 26 per cent compared with 72 per cent in writing, and 19 per cent compared with 5.9 per cent in numeracy. Equivalent figures for Year 5 were 37 per cent compared with 13 percent, 26 per cent compared with 7 per cent and 34 per cent compared with 9 per cent.

Among the factors identified as contributing to the success of projects concerned with overcoming the educational disadvantage of many Indigenous children (McRae et al., 2000), six are relevant for projects like Bridging the Gap:

1. The employment of Indigenous staff.
2. Access to an appropriate budget.
3. Development of positive partnerships between school and community.
4. Community trust in the Aboriginal Education Assistants, leading to increased community involvement in school events.
5. Parental enjoyment of the group sessions.
6. Children mixing with others and having fun doing new activities.
During the planning stage of the program described here, efforts were made to incorporate these factors into the design of the project.

**The Bridging the Gap project**

The aim of the Bridging the Gap project was to enhance the early literacy skills of Indigenous kindergarten children through a home shared-book reading program designed to:

- foster child–family interactions with books at home
- bridge the gap between children’s literacy experiences at home and the school’s reading curriculum.

The program also provided an opportunity for positive relationships to be developed between Indigenous parents and school staff.

The project was funded by a grant from the Australian Government Department of Education, Science and Training (DEST) Innovative Projects to Support Improved Literacy and Numeracy Outcomes of Educationally Disadvantaged Students. It was implemented in conjunction with Jarara, the Indigenous Catholic Education Unit within the Catholic Schools Office (CSO), Parramatta Diocese, NSW. The home book-reading program was designed by the Chief Investigator, a literacy specialist from Macquarie University, and implemented by four Aboriginal Education Assistants (AEAs) from Jarara.

**Method**

**Participants**

The experimental group comprised 19 Indigenous children and their families. Most of the children attended CSO schools in the Parramatta area and the others were at government schools but attended a homework centre operated by Jarara. The proposed design of the study included a matched non-participating control group to be located in kindergarten classes within the Parramatta region. However, there were not enough Indigenous children identified in the local schools to form this group. As an alternative, a non-equivalent contrast group was formed comprising 15 children in their second year at school. Several of these children had siblings in the experimental group, so there was some overlap between participating families.

**Assessment**

Both quantitative and qualitative procedures were used to evaluate the project. All the tests were administered individually to the children by the Chief Investigator or a research assistant.

Two standardised tests were used in the study: the *Peabody Picture Vocabulary Test-Revised* (PPVT-R) (Dunn & Dunn, 1995), a test of receptive language, and the *Waddington Diagnostic Reading Test* (WDRT) (Waddington, 1998), a test of reading comprehension. The PPVT-R was given at pre- and post-test. The WDRT was given only at the post-test on the grounds that a reading test could be distressing for children who were newly enrolled in school and had not yet received formal instruction in reading.

Non-standardised tests were used to assess the specific aspects of literacy targeted by the program. Listening comprehension was assessed using *Picture Book Sequencing* (12 items) based on Cain (1996), *Picture Book Structured Retell* (12 items) based on Wasik, Bond and Waclawiw (1995), and *Short Story Structured Retell* (14 items) based on Field and Walsh (1989). Other tests included *Phonemic Awareness* (24 items) from Tangel and Blachman (1995), and two tests adapted from Clay (1993): *Letter Identification* (26 items) and *Concepts About Print* (8 items).

Qualitative assessment included structured interviews with parents and children, conducted by the AEAs, and analysis of information collected as part of the intervention process.

**Materials**

At the start of the program, the AEAs gave each child a kit containing a tape-recorder, dice, tokens, a large storage box, stickers to decorate the box, pencils and *Stories are fun*, a booklet which set out guidelines for the reading and other activities to be completed over the intervention period. At each fortnightly visit over the 20 weeks of the project, the children were given a book (e.g., *Bangu the flying fox; Moonglue; Hello kangaroo*), audio-tape, game and associated activity. One of the books was a picture dictionary. The AEAs, with assistance from several parents, had selected 10 books from a collection of 25 on the basis of their appeal to Indigenous children and families. The AEAs also helped to design the games used in conjunction with each book.

Following discussion with the AEAs, a Tutor notebook was prepared that covered the procedures to be followed each fortnight with the families. The Tutor notebook included instructions on the specific book-reading skills to be taught to parents and a checklist that reminded the AEAs to explain any new book-reading procedures, review the new game and alphabet letters, and discuss any problems raised by the parents.

**Procedure**

Prior to the start of the school year, the Chief Investigator conducted a professional development program for the AEAs. The parent interview was role-played and the
specific book-reading strategies to be introduced to parents during the intervention were studied. These strategies included vocabulary extension; encouraging an interest in books, print and the alphabet; activating prior knowledge before story reading; listening to the story and asking questions during story reading; reviewing and retelling the story and applying it to their own experiences.

Resources needed for implementation of the project were ordered. Permission was obtained from the publishers to reproduce illustrations from two of the books. The AEA arranged for each of the story books to be read aloud and recorded on audio-tape by a member of the Indigenous community. Several Year 7 Indigenous students were asked to illustrate some of the books for the jigsaw puzzles and the Stories are fun booklets. A letter of informed consent was prepared, to be read and discussed with the parents during first contact. Approval to undertake the project and permission to conduct research in schools within the Diocese of Parramatta was obtained from the Ethics Review Committee (Human Research) at Macquarie University and the Director, Religious Education and Educational Services.

By the start of Term 2, 2001, all program materials (books, audio-tapes, games, etc.) had been assembled and parental informed consent forms signed. Interviews of parents in both the experimental and contrast groups and the pre-testing of the children were completed, and implementation of the program proceeded as planned. One AEA was responsible for 14 families, with the other AEs responsible for the remaining eight families. The program was delivered over a 20-week period in Terms 2 and 3. Where the AEs worked as educational assistants in the children's schools, the meetings with parents took place at the school, in the family home or at another location. Children attending the homework centre and their parents initially met as a group at the centre, but the centre closed after the first three meetings and the remaining meetings were held at the home of one of the parents.

At the first visit, the family was given the project kit and the first book together with the associated audio-tape and game. Children were encouraged to decorate the storage box and parents were shown how to help their child record how often they read the book and how much they liked using the smiley chart in the Stories are fun booklet. The routine for subsequent visits with families followed a similar format. The AEA brought a book, audio-tape and game, and modelled the selected book-reading strategy as outlined in the Tutor notebook. Any questions raised by the parents were discussed. Following completion of post-testing, each parent received a report on their child's progress and Jarara was notified about those children who might need extra help.

The excitement felt by everyone at the start of the program is evident in comments recorded following the first meeting with parents at the homework centre:

*The program started on 21 May. Children were very excited about the books and games. They enjoyed decorating their box with stickers. When children were leaving they took the box with the books and games and left the tape recorder for the mother—AEAs thought this was a good sign as they thought children would be more interested in the tape recorder. The parents were very apprehensive to start with as they thought they would have to read the books and were worried that this might be too difficult for them. In fact, two days after the distribution of the kits, two of the five parents telephoned the AEAs asking if they could get the next book immediately!*

Results

Both quantitative and qualitative information was collected during the implementation of the program. However, results reported here focus primarily on data derived from quantitative assessments of children in the experimental group.

Given the nature of the population being tested (i.e. children at risk of difficulties in learning to read), it would be expected that delays would be evident in language and reading scores, relative to age-equivalent scores, on the PPVT-R and WDRT. As expected, the mean age-equivalent on the PPVT-R at pre-test was 57.9 months compared with a mean chronological age of 64.2 months. At post-test, the mean age-equivalent on the PPVT-R was 65.8 months with a mean chronological age of 71 months (see Table 1). The average change between pre- and post-test in PPVT-R scores was 7.7 months. Expressed as a percentage of the children's mean chronological age at the time of the pre-test, their mean pre-test score on the PPVT-R was 90.5 per cent, and 92.3 per cent by the post-test. This suggests that over the intervention period there was a small reduction in the gap between mean age equivalent on the PPVT-R and chronological age. The mean WDRT age equivalent score for the children (the WDRT was administered at post-test only) was 76.2 months (mean chronological age of 71 months). The WDRT reading age of 14 of the children (75 per cent) was at or above their chronological age, with eight (42 per cent) six months or more above their chronological age, while five of the children (26 per cent) had a WDRT reading age up to five months below their chronological age.

Three sub-tests were used to assess listening comprehension: *Picture Book Structured Retell* (comprising 12 items), *Picture Book Structured Retell* (12 items) and *Story Book Structured Retell* (14 items). When scores
Table 1. Mean chronological age (months) at pre- and post-test, mean age-equivalent (months) PPVT-R pre- and post-test scores and WDRT post-test scores

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>Average change</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.A.(months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>64.2</td>
<td>3.7</td>
<td>58–69</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>71.3</td>
<td>3.7</td>
<td>65–76</td>
<td>+7.1</td>
</tr>
<tr>
<td>PPVT-R age equivalent (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>57.9</td>
<td>9.2</td>
<td>46–82</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>65.8</td>
<td>8.9</td>
<td>51–84</td>
<td>+7.7</td>
</tr>
<tr>
<td>WDRT age equivalent (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test*</td>
<td>n.a</td>
<td>n.a</td>
<td>n.a</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>76.2</td>
<td>6.8</td>
<td>65–96</td>
<td></td>
</tr>
</tbody>
</table>

*WDRT was not administered at pre-test

for these three tests were combined (38 items), the mean score for listening comprehension was 21.2 at pre-test and 29.9 at post-test. When expressed as the percentage of total possible scores, the mean percentage score was 61.7 at pre-test and 88.1 at post-test (see Table 2). Mean scores (expressed as a percentage of the total possible score) for the three individual tests used to assess listening comprehension were: Picture Book Sequencing, pre-test 61.7 per cent, post-test 88.1 per cent; Picture Book Structured Retell, pre-test 65 per cent, post-test 82.5 per cent; and Book Structured Retell, pre-test 53 per cent, post-test 77.5 per cent. In planning the assessment of listening comprehension, it was anticipated that these three tasks represented an increasing level of difficulty. The mean percentage scores cited here suggest that, as expected, the Story Book Structured Retell was the most difficult task for the children to complete.

At the time of the pre-test, the children achieved a mean percentage score on the test of phonemic awareness (24 items) of 73 per cent, rising to 92.5 per cent at the post-test. Eight of the children answered all items correctly. Clearly, by the end of the intervention period, almost all had mastered the phonemic awareness skills needed to identify different sounds within words. The children were less competent in letter identification. Their mean percentage score for the 26 items on this test was 55.8 per cent, rising to 83.5 per cent at the post-test. However, one child still recognised only four letters by the post-test. On the other hand, most of the children were familiar with the eight items on the concepts about print test prior to the intervention program; nine children answered all the items correctly at the pre-test and by the post-test, 18 could do the task with no errors.

Table 2. Pre- and post-test means, standard deviations (SD) and mean percentage scores for listening comprehension, phonemic awareness, letter identification and concepts about print

<table>
<thead>
<tr>
<th>Test</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Listening Comprehension</td>
<td>21.2</td>
<td>0.57</td>
</tr>
<tr>
<td>(38 items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture Book Sequencing</td>
<td>7.8</td>
<td>2.9</td>
</tr>
<tr>
<td>(12 items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture Book Structured Retell</td>
<td>6.4</td>
<td>2.0</td>
</tr>
<tr>
<td>(12 items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Story Structured Retell</td>
<td>7.0</td>
<td>2.3</td>
</tr>
<tr>
<td>(14 items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonemic Awareness</td>
<td>17.6</td>
<td>4.5</td>
</tr>
<tr>
<td>(24 items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter Identification</td>
<td>14.5</td>
<td>6.7</td>
</tr>
<tr>
<td>(26 items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concepts About Print</td>
<td>6.7</td>
<td>1.6</td>
</tr>
<tr>
<td>(8 items)</td>
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*Score expressed as a percentage of total possible score.

There was marked variability in the various test scores achieved by individual children. For example, one child’s age equivalent PPVT-R score increased by 27 months between pre- and post-test. Her score on listening comprehension also improved (she already scored well on phonemic awareness and letter identification). Another child’s age-equivalent PPVT-R score increased by 21 months, and three children’s scores increased by 12 to 15 months. Individual scores on the WDRT also varied widely. The highest score was gained by a child whose WDRT reading age (96 months) was 25 months above his chronological age. His PPVT-R score was 50 at pre-test, rising to 72 at post-test (chronological age 64 and 71 months respectively). His listening comprehension score (particularly picture book sequencing) increased over the intervention period, he made no errors on the test of phonemic awareness at either pre- or post-test, and he identified all but one of the letters of the alphabet correctly at post-test (15 letters at pre-test). Interestingly, this child’s teacher was not aware of his reading ability.
The reading age of one child was markedly lower than the rest of the group, and his age-equivalent pre- and post-test PPVT-R scores were below his chronological age. This boy had the lowest score on the letter identification task at both pre- and post-tests, but his performance on the other tests in the second assessment period was similar to that of the other children.

Interviews with experimental group parents conducted as part of the assessment process provided qualitative data on the impact of the program on children and families. Of particular interest are changes in the strategies the parents reported using over the intervention period when reading with their children. In the pre-test interview, almost half of the parents said they simply read the book, looked at the pictures, and asked questions about them. More than half (58 per cent) pointed to single words. Some encouraged the child to point to words or attempt to read them, and one suggested that the child ‘sound out’ words. One parent, whose child (discussed earlier) showed the largest change in pre- and post-test scores on the PPVT-R and scored highly on the WDRT, reported that she attempted to teach spelling when reading to her child: ‘If she brings a book home, [I] get her to spell ‘the’: ‘t-h-e’... I read, then spell the word while pointing.’ This child’s pre-test score on the listening comprehension tasks was below average and her post-test performance was average, but she made almost no errors on the phonemic awareness and letter identification tasks at both pre- and post-tests.

In the post-test interview, the parents described a more complex set of strategies for reading with their children. All but one made some reference to the title of the book, and several also looked at the cover and asked predictive questions. All now asked questions about what they had read, and one noted that the child also asked questions. More than half of the parents and a few of the children now pointed to words and letters as they read, while almost half of the children tried to read the book too, or repeated the parent’s words. The parents also now checked the child’s understanding of the story by asking questions, encouraging the child to retell what had happened or relate parts of the story to their own and the family’s experiences.

When parents in the contrast group interviews were asked to demonstrate how they read to a child, most began by looking at the title and the cover of the book before reading the text, looking at the pictures and talking about them. More than half pointed to words as they read, and a third asked questions. One parent (who also had a child in the experimental group) encouraged her child to repeat the words as she pointed to them. Only two parents talked to the child about the story’s topic.

The AEAs reported that participation in the project had been a great learning experience. They liked the inclusion of Koori stories in the books used in the program. All agreed that the storage box was good for keeping the books clean and organised, as well as giving the child a sense of ownership of the materials. The idea of using audio-tapes to support parent book-reading was good, though some commented that the books should be read by experienced readers with a pace that was not too quick and left enough time for the child to turn the page.

While the AEAs and parents liked the home visits (the AEAs felt it was ‘more personal’ to meet the parents at home), the group format that began in the homework centre also seemed to have been very effective. It gave parents an opportunity to share ideas and experiences about the program and watch others working with their children, while the children could watch others modelling appropriate behaviour for the different activities. A sense of camaraderie evolved among the homework centre parents, even though their children attended different schools. All found participation in group activities an unusual experience. Delivering the program to the small group of parents was efficient, with one AEA working with five families at the same time rather than one at a time. The group intervention model, together with the involvement of Indigenous staff and members of the children’s community, was consistent with the factors identified by McRae et al. (2000) as contributing to the progress of Indigenous children in the first years at school.

Discussion

Quantitative assessment of the children’s receptive language suggested a slight reduction in the gap between their age-equivalent test scores and chronological age over the intervention period, although there was wide variation in the scores of individual children. The receptive language skills of many of the children remained below the level expected for their chronological age.

Two interesting trends are evident in the children’s pre- and post-test listening comprehension scores:

1. Children who reported that they had lots of books at home achieved higher listening comprehension scores at the pre-test than children who said they did not have many books at home.

2. The greatest change in listening comprehension was achieved by children who did not have many books at home.

This pattern of change, where the most gains are seen among children who received the least stimulation prior to intervention, is frequently encountered in early childhood intervention programs. Participation in a program such as Bridging the Gap provides an opportunity for at-risk children to ‘catch up’ prior to
formal instruction in reading. The gains that can be achieved by environmentally advantaged children are often more limited.

By the end of the intervention, almost three-quarters of the children's WDRT reading ages were at or above their chronological age, although some children in the group continued to be at risk in literacy. Positive changes in non-standardised aspects of early literacy occurred in letter identification and listening comprehension, two areas in which the children scored poorly at pre-test.

The project had a number of important features. The focus was to help parents to implement shared reading of age-appropriate books as a means of linking children's literacy experiences at home with the school's early reading program. The books, games, audio-tapes and tape-recorder used in the program became the property of the children and their families. Qualitative assessment conducted within the study suggested that the books and other resources provided as part of the program were very important for both children and parents, particularly those parents who did not read or did not enjoy reading. The children's self-esteem was enhanced by their ownership of these resources. Parents were taught a range of shared-reading techniques that were previously unfamiliar to most of the group, some of whom were themselves weak or non-readers. The project provided an opportunity for positive ongoing interaction between the AEAs and the families of Indigenous students, both at school and (in some cases) at home. Previously, Indigenous parents often became involved with the AEAs only as a result of problems at school. Members of the local Indigenous community also participated in the project, selecting the books to be used in the program, illustrating some stories, and recording the stories on audio-tape.

**Conclusion**

Overall, results reported from implementation of the Bridging the Gap project suggest that the project had a positive impact on children's experiences with books at home; on child–parent interactions with books; on home–school links; and on the children's early literacy skills, their self-esteem, interest in books and attitude to school. It also had a positive impact on Jarara and the AEAs, particularly in the provision of support for Indigenous children's acquisition of literacy in the first year at school and beyond. The project provided a model which, with some modifications, could be implemented more widely by the AEAs to help young Indigenous children and their families in the early stages of learning to read.

Some specific findings from the project can be identified. For example, the resources used in similar programs should be developed in consultation with members of the children's family and community. Audio-tapes should be of high quality and recorded under carefully controlled conditions. Well-known identities, as well as family members, could be approached to record the stories on audio-tape, and the stories could include books published through Indigenous agencies.

Programs such as Bridging the Gap are particularly important for children from Indigenous backgrounds who often arrive at school lacking the knowledge and skills needed to progress satisfactorily. Alternative models that should be evaluated include a group format, which may be more cost-effective than intervention delivered individually. Other possible models include programs for four-year-olds provided either individually at home or in a group setting in the months prior to school entry.

The long-term impact of initiatives such as the project described here can be demonstrated only through continued monitoring of children's progress in literacy and related areas of the curriculum across the school years. Such studies can be difficult to implement because of a number of factors. For example, variables that can affect the progress of an intervention program include unintentional changes over time in the program being implemented, the cost of conducting longitudinal research, and inevitable delays in publishing results. Data reported from studies of the long-term outcome of programs such as Head Start (e.g. Love et al., 2005; Zigler & Styfco, 2000) demonstrate the difficulties associated with longitudinal research, but also the value of such research reports for those involved in the provision of intervention programs. These studies add to our accumulating knowledge and understanding of the strategies that are effective in supporting the progress of children who are at risk of failure in aspects of literacy within the regular school system.

Bridging the Gap has continued to operate in Western Sydney, funded by the Catholic Schools Office, Parramatta Diocese. In 2007, the AEAs participated in professional learning seminars, conducted by the Chief Investigator, on reading acquisition and how to teach children to read. They are now implementing individual intervention programs to at-risk Indigenous students (kindergarten to Year 6).

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Can norms developed in one country be applicable to children of another country?

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The primary aim of this study was to investigate whether a gross motor proficiency norm developed in one country could be applied to young children in another country. The secondary aim of the study was to assess the gross motor proficiency of Hong Kong preschoolers aged five years. The Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) (subtests 1 to 5) was used to test the gross motor proficiency of 242 children aged approximately five years (four years, six months–five years, five months). The gross motor proficiency of the young children was measured in terms of their performance on running speed and agility, balance, bilateral coordination, strength and upper-limb coordination (subtests 1 to 5 of BOTMP). The results indicated that Hong Kong children at five years were significantly better than the BOTMP norms in all test items except running speed and agility performance. Hence, norms developed in one country might not be applicable to children of other countries.

Introduction

Local research findings indicate that Hong Kong children are fatter and less fit than children in the previous decades (Fu, Nie & Tong, 2004a; Fu, Nie & Tong, 2004b; Ko et al., 2008; Lee, Cheung, Chung, Lau, Tam, 2007; Department of Health, 2006). According to Fu and associates (Fu et al., 2004a; Fu & Fung, 2004), the percentage of children with one or more coronary heart disease risk factors is quite high (46.3 per cent). According to the survey done by the Student Health Service of the Hong Kong Health Department (2006), the obesity rate of Hong Kong boys and girls increased from 12.7 per cent and 10.4 per cent in 1998 to 14.7 per cent and 12.4 per cent respectively in 2001. Findings reported by Ko et al. (2008) showed a further increase of the obesity rate to 15.9 per cent in Hong Kong adolescents. In response to these findings and the perceived decline in children’s activity levels, physical fitness programs and physical fitness testing for adults and youth have become popular in Hong Kong (Chinese University of Hong Kong, 1998; Ip, 1992; Lam, Ip & Lui, 1997; Lam, Ip, Lui & Koong, 2003). Nevertheless, tests and measurement instruments validated with overseas (usually North American or European) samples were often utilised, albeit after modification or local adaptation, for measuring the physical fitness and gross motor proficiency of Hong Kong school children.

According to Hands and Larkin (1998), using tests developed for one culture may be problematic when used in another country, because the test which is valid for one nation may not be valid for another. As there are hardly any norms for gross motor proficiency of Hong Kong preschoolers developed by validated tests (Lam, 2005; Lam et al., 2003), norms of Western countries are usually used as reference. However, Hands and Larkin (1998) question whether norms developed in Western countries are applicable internationally. This query is quite reasonable when considering children’s gross motor proficiency development, which is affected by many factors including biological and environmental factors (Bayley, 1935; Bayley & Jones, 1937; Clark, 1994; Cooley, Oakman, McNaughton & Ryska, 1997; Lam, 2005; Gallahue & Ozmun, 2002; Williams, 1983; Zachopoulou & Maki, 2005). Children in the Western countries are usually bigger than Asian children. Because of cultural differences, children in different nations may have different motoric habits (Lam, 2005); for example, Chinese use chopsticks while people in Western countries use a knife and fork for eating. Such habits could affect the fine motor skill development of young children, and thus contribute to the problem raised by Hands and Larkin (1998) in motor assessment.

In view of the above, development of local norms for Hong Kong children using validated instruments are
important. Local norms can inform the field of the current gross motor proficiency of Hong Kong preschoolers and perhaps indicate whether norms developed in one country are applicable to other countries with different cultural practices and values.

Thus, this present study aimed to:

1. Establish norms for the gross motor proficiency of Hong Kong children aged five years on the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP).

2. Compare the gross motor proficiency of five-year-old boys and girls living in Hong Kong on BOTMP.

3. Compare the test scores obtained by Hong Kong five-year-olds with the American test norms in order to investigate whether norms developed in one country are applicable to children of other countries.

**Method**

A total of 242 five-year-old children attending Hong Kong kindergartens were randomly selected for testing from a stratified sample of eight schools, in order to get an overview of the gross motor performance of Hong Kong preschool children. According to the BOTMP, ‘five years old’ is used to indicate children between four years, six months to five years, five months. In this study, the definition of ‘five years old’ in BOTMP was used to sample the children to be included. An invitation was sent to all local kindergartens to participate in the study. Eight kindergartens were randomly selected from volunteer schools and stratified according to geographical location; namely, Hong Kong Island, Kowloon, Eastern New Territories and Western New Territories. Two schools were randomly selected from each of the four geographical locations. There were 129 boys and 113 girls from the upper kindergarten classes.

For this study, the gross motor proficiency of Hong Kong preschoolers aged five years was measured by the subtests 1 to 5 of BOTMP, an international validated test instrument (Gallahue & Ozmun, 2002) that ‘assesses the motor functioning of children from 4+ to 14+ years of age’ (Brunininks, 1978, p.11). Children's gross motor proficiency, in terms of running speed and agility, balance, bilateral coordination and strength, which were categorised as gross motor skills by Bruininks (1978), was measured on subtests 1 to 4 of the BOTMP and upper limb coordination on subtest 5. Upper limb coordination, which was regarded by Bruininks (1978) as a mixture of gross and fine motor skill, is also one of the gross motor skills described by motor development experts (Clark, 1994; Dauer & Pangrazi, 1998; Gallahue & Ozmun, 2002; Graham, Holt & Parker, 1998). Further, these five subtests developed by Bruininks were found to be one coherent construct for young Hong Kong children, using exploratory factor analysis by Lam (2005). These five subtests were underpinned by a common dimension, which was labelled as ‘gross motor skills’ (Lam, 2005). The sum of the total point scores of the five subtest total scores was labelled as Gross Motor Proficiency Total Point Scores (GMTPS) to represent children’s gross motor proficiency in this study.

There were altogether 29 items in the gross motor skill subtests and gross and fine motor skills subtests. These two groups of subtest items are presented in Table 1. All test items within the subtests were scored on a Likert-type scale (ranging from 2 point to 15 point scale) starting from 0 (for details see Table 1). Higher scores represent more proficiency than lower scores.

The tests were administered by teachers of children in the eight participating schools. In order to enable the teachers to administer the tests more accurately and smoothly, the test manual was translated into Chinese for easy reference by teachers (Lam, 2005). Class teachers of participating children were trained to administer tests in a workshop before testing children. At the training session, the test instrument of BOTMP was explained by the researcher with the help of the video and test manuals (Chinese version) followed by demonstrations of how to measure the children with each test item. With reference to the subtests of BOTMP, five test stations were set up for practical session. After the practice, the testers tried out measuring and recording motor proficiency of children who participated in the pilot study, at all the stations. They were asked to report the scores to see if there was any deviation. If there was any, the tester would show how she measured and explain why she gave such a score, and the related issues were then discussed and clarified. The above arrangement for the training was aimed at providing tight control of the testers to strengthen the internal validity of the tests. When they were clear about the test instrument and understood how to administer the test, all the testers were requested to test another child for inter-rater reliability. An inter-rater reliability coefficient of 0.9998 was obtained, which indicated that the degree of inter-rater agreement was consistent and reliable.

As all the subjects were from kindergartens, any conclusions made from this study could not be seen as a representative of children from other school settings. However, the norm developed from this study could be regarded as an overview of the gross motor proficiency of Hong Kong preschoolers aged five tested by BOTMP. In order to investigate whether norms developed in one country are applicable to children of other countries, the Hong Kong data was compared with the American norm developed by Bruininks (1978).
In order to develop a norm from a validated test and obtain an overview of the Hong Kong preschoolers' gross motor proficiency, the BOTMP was used in this study. The means and standard deviations of the children’s total point scores of subtest 1 (running speed and agility), subtest 2 (balance), subtest 3 (bilateral coordination), subtest 4 (strength) and subtest 5 (upper-limb coordination and balance) scored in the BOTMP are presented in Table 2. The Gross Motor Total Point Score (GMTPS) for the whole sample (n=242) has a mean score of 45.92; standard deviation (SD) of 9.24, a maximum observed score of 76, a minimum observed score of 22, and a range (maximum–minimum) score of 54. The mean and standard deviation for Hong Kong preschoolers performing in each subtest are also shown in Table 2.

The GMTPS scores of male and female preschool children were compared using an independent t-test, and the results are provided in Table 2. There was no significant gender difference in either the GMTPS score, or any subtest scores except the Balance subtest. On this subtest (balance), girls (mean=21.28) scored significantly higher than boys (mean=18.57) (t-value=4.55, degrees of freedom=240, p<0.001).

Table 1. Subtest items from the Bruininks-Oseretsky Test of Motor Proficiency used for this study (adapted from Gallahue & Ozmun, 1995; with permission from Gallahue)

<table>
<thead>
<tr>
<th>Area Tested</th>
<th>Subtest</th>
<th>Item</th>
<th>Point score range*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross motor skills</td>
<td>1. Running Speed &amp; Agility</td>
<td>- Shuttle run (1 item)</td>
<td>0-15</td>
</tr>
<tr>
<td></td>
<td>2. Balance (8 items) - designed to measure static and dynamic balance abilities</td>
<td>- Static balance (3 items)</td>
<td>Test item 1: 0-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Dynamic balance (5 items)</td>
<td>Test item 2: 0-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test item 3: 0-7</td>
</tr>
<tr>
<td></td>
<td>3. Bilateral Coordination (8 items) - designed to measure simultaneous coordination of upper and lower limbs</td>
<td>- Foot and finger tapping (3 items)</td>
<td>Test Item 1 to 3: 0-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Jumping in place (4 items)</td>
<td>Test Item 4 to 5: 0-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test Item 6: 0-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test Item 7: 0-1</td>
</tr>
<tr>
<td></td>
<td>4. Strength (3 items) - designed to measure upper arm and shoulder girdle strength, abdominal strength, and leg strength</td>
<td>- Standing broad jump</td>
<td>Test Item 1: 0-16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Sit-ups</td>
<td>Test Item 2: 0-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Knee pushups (for boys under 8 and all girls)</td>
<td>Test Item 3: 0-16</td>
</tr>
<tr>
<td>Gross and fine motor skills</td>
<td>5. Upper Limb Coordination (9 items) - designed to measure gross and fine eye-hand coordination</td>
<td>- Ball bounce and catch (2 items)</td>
<td>Test Item 1 to 2: 0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Catching tossed ball (2 items)</td>
<td>Test Item 3 to 4: 0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Throwing a ball (1 item)</td>
<td>Test Item 5: 0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Touching swinging ball (1 items)</td>
<td>Test Item 6: 0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Precise upper limb movements (3 items)</td>
<td>Test Item 7 to 9: 0-1</td>
</tr>
</tbody>
</table>

* 1. All test items within the subtests were scored in a Likert-type scale starting from 0 (higher scores represent more proficiency than lower scores). 2. See the test manual for details of the scoring.

Results

Motor proficiency of the children aged five

In order to develop a norm from a validated test and obtain an overview of the Hong Kong preschoolers’ gross motor proficiency, the BOTMP was used in this study. The means and standard deviations of the children’s total point scores of subtest 1 (running speed and agility), subtest 2 (balance), subtest 3 (bilateral coordination), subtest 4 (strength) and subtest 5 (upper-limb coordination and balance) scored in the BOTMP are presented in Table 2. The Gross Motor Total Point Score (GMTPS) for the whole sample (n=242) has a mean score of 45.92; standard deviation (SD) of 9.24, a maximum observed score of 76, a minimum observed
Table 2. Gross motor proficiency of Hong Kong preschoolers aged five years

<table>
<thead>
<tr>
<th>Sub-test</th>
<th>Total (n=242)</th>
<th>Male (n=129)</th>
<th>Female (n=113)</th>
<th>df</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Motor Total Point Score (GMTPS) (Sum of 5 items)</td>
<td>45.92 (9.24)</td>
<td>45.44 (9.87)</td>
<td>46.47 (8.47)</td>
<td>240.00</td>
<td>0.87</td>
</tr>
<tr>
<td>Running Speed &amp; Agility</td>
<td>2.93 (1.89)</td>
<td>3.13 (1.92)</td>
<td>2.69 (1.84)</td>
<td>240.00</td>
<td>1.81</td>
</tr>
<tr>
<td>Balance</td>
<td>19.84 (4.81)</td>
<td>18.57 (4.93)</td>
<td>21.28 (4.24)</td>
<td>240.00</td>
<td>4.55*</td>
</tr>
<tr>
<td>Bilateral Coordination</td>
<td>7.27 (2.31)</td>
<td>7.19 (2.26)</td>
<td>7.36 (2.37)</td>
<td>240.00</td>
<td>0.57</td>
</tr>
<tr>
<td>Strength</td>
<td>8.34 (3.20)</td>
<td>8.73 (3.19)</td>
<td>7.99 (3.18)</td>
<td>240.00</td>
<td>1.80</td>
</tr>
<tr>
<td>Upper Limb Coordination</td>
<td>7.50 (3.08)</td>
<td>7.82 (3.12)</td>
<td>7.14 (3.01)</td>
<td>240.00</td>
<td>1.72</td>
</tr>
</tbody>
</table>

Comparison of Hong Kong preschoolers’ gross motor proficiency scores with the BOTMP norms (five years old)

The mean scores of the Hong Kong sample (n=242) and the BOTMP sample (n=68) on each subtest were compared using an independent t-test in order to find out whether any cross-cultural difference on gross motor proficiency of preschoolers existed.

The mean and standard deviation for each group and the t-value of each subtest item are shown in Table 3. The results show that Hong Kong children at five years (mean age=5 years, 1.30 months, SD=2.28) are significantly better than the BOTMP norm sample in Balance, Bilateral Coordination, Strength and Upper Limb Coordination subtests (see Table 3). By contrast, the Running and Agility Speed performance of Hong Kong children was significantly inferior to that of the BOTMP norm sample.

Table 3. A cross-cultural comparison of gross motor proficiency between Hong Kong samples and BOTMP samples aged five years.

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Mean Total Point Score</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>df</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running Speed &amp; Agility</td>
<td>2.93 1.89</td>
<td>4.30 2.20</td>
<td>2.20 308</td>
<td>-5.09*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balance</td>
<td>19.84 4.81</td>
<td>13.30 7.00</td>
<td>7.00 86#</td>
<td>7.24*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilateral Coordination</td>
<td>7.27 2.31</td>
<td>3.20 2.20</td>
<td>2.20 308</td>
<td>12.82*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength</td>
<td>8.34 3.20</td>
<td>6.00 3.60</td>
<td>3.60 308</td>
<td>5.18*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Limb Coordination</td>
<td>7.50 3.08</td>
<td>6.00 3.50</td>
<td>3.50 308</td>
<td>3.44*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Before using the t-test to calculate the t-values, the variance of the groups were tested. It was found that they were unequal in the Balance subtest. Thus, the formula for unequal sample sizes, unequal variance was used for calculation. The results of df=85.54

\[
D.F=\frac{s_1^2/n_1+s_2^2/n_2}{n_1+n_2-2} = \frac{s_1^2/n_1}{n_1-1}+\frac{s_2^2/n_2}{n_2-1}, \quad (Howell, 2001, p.214)
\]

and \( t \)-value=7.23905 were obtained in the Balance subtest.

Discussion

Gender difference in gross motor proficiency of Hong Kong preschoolers aged five years

When comparing the motor proficiency between Hong Kong boys and girls at the age of five years, no significant differences were found on any of the subtests except Balance, where the girls had significantly higher scores than the boys. As there were no test norms for boys and girls in BOTMP, there is no report of gender differences on subtest performance in the test manual. Subsequently, the norms for boys and girls developed in this study turn an important page for BOTMP and the field of test and measurement of gross motor proficiency of young children. These norms can be a reference used for future study.
When comparing these results with other research findings, girls were reported to be superior to boys at age five on the Balance test in studies by Al-Haroun (1988), Govatos (1966), Lam et al. (1997), Lam and Schiller (2002), Morris, Williams, Atwater and Wilmore (1982), and O’Brien (1999). However, these findings did not concur with those found by Malina (1968) and Plimpton and Regimbal (1992).

Even though the difference between boys and girls was not found to be statistically significant on other subtests, the mean scores indicated that boys’ scores at this age were superior to the girls’ scores on the subtest of Running Speed and Agility, Strength and Upper Limb Coordination. The Hong Kong results concur with those reported by Düger, Bumin, Uyanik, Aki and Kayihan (1999) and Raudsepp and Pääsuke (1995) that boys outperform girls significantly on throwing and muscular strength but no significant gender difference was found on running kinematics. Nevertheless, performance of boys scored lower than that of girls on Bilateral Coordination in the present study. These findings are in line with those of O’Brien (1999) and Lam and Schiller (2002) using the BOTMP instrument, although significant differences between boys and girls were not found in these items. Nevertheless, findings of this study did not concur with those found in the studies done by Al-Haroun (1988), Morris et al. (1982), and Plimpton and Regimbal (1992), who used other test instruments.

These inconsistent findings on preschoolers’ gross motor proficiency may be caused by the fact that different researchers used different test instruments or different test procedures which influenced the performance outcomes, and consequently the findings in different studies may not be comparable. Nevertheless, when comparing the findings of the Hong Kong study with those administrated by similar procedures and BOTMP (Düger et al., 1999; Lam & Schiller, 2002; O’Brien, 1999), consistent findings were found on gender differences at the age of five years. However, in relation to the claim made by Hands and Larkin (1998) about the validity of the test, the results of comparing Hong Kong norms with US norms (test norms) in this study revealed that the norm developed in one country may not be applicable to children from other countries with different cultures.

The norm of gross motor proficiency of Hong Kong preschoolers aged five years using BOTMP

This study was motivated by the need for a local norm to measure the gross motor proficiency of children in Hong Kong. Traditionally, norms developed overseas were used to gauge the gross motor performance of young children for local purposes. This raises the question, can norms developed overseas be applied to local participants? This contributes to the core of this paper. In order to address this question, means of the subtest scores for Hong Kong male and female children were developed based on a sample of this study. The local norm was compared with the test norm established by BOTMP. Since there were no test norms developed for girls and boys, the comparison of the Hong Kong gender norms with BOTMP gender norms was not possible. Thus, for the discussion of the gender differences in children’s gross motor proficiency in the present study, the findings of Düger et al. (1999) and O’Brien (1999) which were also obtained using the BOTMP with similar testing procedures to the present study, were used for somehow addressing the two issues identified from the literature, cross-cultural comparisons and gender difference.

The results of this study show that Hong Kong children at five years are significantly better than the BOTMP norm sample in Balance, Bilateral Coordination, Strength and Upper Limb Coordination subtests (see Table 3). However, the Running and Agility Speed performance of Hong Kong children was significantly inferior to that of the BOTMP norm sample. The findings of the present study were consistent with that of the Hong Kong pilot study (Lam & Schiller, 2002).

When considering the acquisition of Running Speed and Agility, skills which require space and constant practice, and looking at the limited space and time allocation for children’s motor activities in Hong Kong, this finding was not surprising. Moreover, Chinese teachers pay great attention to the children’s safety. As running around in limited space is usually associated with risk, danger and accidents, conscientious teachers usually stop children from running. Discouragement of such behaviour and consequently insufficient ‘opportunities for practice’ or ‘encouragement’ (Gallahue, 1996; Gallahue & Cleland, 2003) of these skills may explain the results of the preschoolers’ Running Speed and Agility in this study.

According to Gallahue and Cleland (2003), providing sufficient ‘opportunities’, including sufficient facilities, equipment and time for practising motor skills, is crucial for children’s learning and refinement of such skills. Rink (1998, p. 28) also emphasised that ‘practice of motor skills is essential for developing and refining the motor program and reducing the variability’. The results of this study indicated that it would assist children’s skill development if Hong Kong teachers could provide appropriate facilities, ample equipment and sufficient practise time to increase the opportunities for practising motor skills, to facilitate children’s agility, running speed and overall motor learning. Hong Kong teachers could also encourage children to participate in physical activities more often, and give positive feedback to children on their motor skill performance in order to encourage them to try new skills and refine their motor
skills to become effective, efficient movers and enjoy movement and their mastery of it (Gallahue, 1996).

This study found that mean scores in the other subtests—Balance, Bilateral Coordination, Strength and Upper Limb Coordination—were superior to the American norm. The Hong Kong children's performance on Balance and Bilateral Coordination were significantly (p<0.001, see Table 3) better than the test norm at the age of five. The present results were similar to the findings obtained in an earlier pilot study (Lam & Schiller, 2002) showing that Hong Kong children were in advance of the norm indicated in BOTMP in Balance and Bilateral Coordination. The mean scores obtained by the Hong Kong sample in Strength and Upper Limb Coordination were also significantly (p<0.001, see Table 3) better than the BOTMP norm.

These findings may also be the result of limited space in Hong Kong. Most families (with four persons) in Hong Kong live in high-rise apartments of approximately 400 to 500 square feet (including two bedrooms). Children would naturally be trained by adults to develop balance in order to avoid knocking over furniture or bumping into obstacles in confined spaces at home during their growing process. Additionally, balance benches, beams and folding tunnels which occupy less space than other large movement apparatuses are usually found in kindergartens (Lam, 1999) to provide motor activities for young children. Activities such as walking or crawling on benches and floor lines or through folding tunnels stimulate bilateral movement, and these types of motor activities may provide more practice opportunities in Balance and Bilateral Coordination for young children.

Many Chinese children are trained to use chopsticks at home at the age of two years, and to write at age two or three years, so some of them may excel in these fine motor skills by the time they are four or five years old. Such fine motor skills might have helped the children in this study to obtain higher scores in the test item, which required simultaneous drawing of a stroke and a cross by using both hands within the subtest Bilateral Coordination. Thus, the total point scores for Bilateral Coordination obtained by the Hong Kong sample are better than the BOTMP norm. It is important to note also that the American norm was established some years ago, whereas the Hong Kong study is relatively recent. Motor development of children can be affected by various factors, such as diet, lifestyle, exercise and facilities for physical activities. American children's motor proficiency in the 1970s may not be the same as today's. As well as the dated nature of the test norm, genetic differences between Chinese children and American children on body build and physical abilities may provide another explanation for the differences between the scores of the Hong Kong children and the test norms. Thus, the results of this study could be a reference for cross-cultural comparison.

Based on Gallahue's advice (Gallahue, 1996; Gallahue & Ozmun, 1998, 2002) in relation to 'opportunities for practice' and 'encouragement', Hong Kong children may show more lower body strength than upper body strength because they have more opportunities to practise lower body skills, and these skills are encouraged. As well, genetic difference in body build between Chinese children and American children may contribute to these results. A study conducted by the Chinese University of Hong Kong (1985) on the physical fitness of teenage children (aged 12 to 16 years) in Hong Kong revealed that Hong Kong children were strong in lower body (leg and abdominal strength) in terms of standing long jump and sit-ups, but comparatively weak in the upper body and limbs. There are only three test items in the BOTMP Strength subtest: standing long jump, sit-up and push-up. If the above findings on Hong Kong youth are also true of Hong Kong preschool children, the test items favour Hong Kong preschool children because two out of the three items in BOTMP are measuring lower body strength. Thus, the results of this study were not surprising. Furthermore, the points system used for scoring the standing long jump, derived from the American sample, may need to be reviewed for its sensitivity because most of the Hong Kong preschoolers were able to achieve a high score for Strength when they had made a good jump. In order to reveal strength in performance more objectively, an additional test item on the upper body could be added to the Strength subtest of BOTMP to increase the sensitivity of this subtest.

Because of limited space in kindergartens, teachers usually emphasise the accuracy of throwing and catching objects to avoid accidents during object manipulation activities. Limited space and equipment confine children to manipulating an object within a small area or to practise in pairs, and this training might contribute to high scores in test items 1 and 3 within the Upper Limb Coordination subtest, both of which require accuracy. The chopsticks training of young Chinese might also help the Hong Kong preschoolers to obtain better scores in items 8 and 9 within the Upper Limb Coordination subtest. These could be the possible reasons contributing to the better scores obtained by the Hong Kong sample in the Upper Limb Coordination subtest.

The findings are consistent with those obtained in the pilot study (Lam & Schiller, 2002), which revealed that norms developed in one country may not be applicable to children from other countries with different cultures. As the samples in the pilot study and the samples for the main study were measured by BOTMP with similar ‘testing procedures’ (Al-Haroun, 1988, p. 14), the findings should be regarded as comparable to BOTMP, which was a validated test. This study has provided supporting evidence that the American sample was
better than the Hong Kong sample on Running Speed and Agility, while the Hong Kong sample was better than the norm of BOTMP on Balance, Bilateral Coordination, Strength and Upper Limb Coordination. Since the testing procedures of this study are the same as those for the BOTMP American norm (n=68), and the samples (n=242, at pretest) of the present study are from kindergartens from different local districts, the findings of this study could be regarded as a Hong Kong norm for five-year-old preschoolers’ gross motor proficiency using BOTMP. Nevertheless, it was found from this study that the scores of the Hong Kong children are very different from the test norms. This suggests that test norms developed in other countries should never be used to assess Hong Kong children without first checking the applicability of the test. Apart from this, a wide range of standard deviation of mean scores was also observed. These results could be explained by the fact that motor development rate of children at this age may vary from individual to individual, and their motor skills may not be developed at the same pace. A similar observation was also found in the BOTMP norm (see Table 3) which indicated a bigger range in the standard deviation of mean scores than did the Hong Kong results, and supported the view in the literature that young children’s motor proficiency does not develop at the same rate.

Conclusion

The objectives of this study were to investigate whether norms developed in one country were applicable to children of other countries, to establish norms for the gross motor proficiency of Hong Kong preschoolers aged five years, and to compare the motor proficiency of five-year-old boys and girls in Hong Kong. The findings of this study revealed that norms developed in one country might not be applicable to children of other countries where culture and race are important factors. The performance of Hong Kong preschoolers aged five years (Mean age=5 years, 1.30 months) tested on running speed and agility was inferior to the American norm developed using BOTMP, whereas Hong Kong children’s performances on balance, bilateral coordination, strength and upper-limb coordination were significantly better than the American norm at the age of five years. There was no significant gender difference in the areas of running speed and agility, bilateral coordination, strength and upper limb coordination for Hong Kong preschoolers, but Hong Kong girls performed significantly better than Hong Kong boys on balance.

The Hong Kong norms developed in this study are the first of their kind in Asia. These new norms enable comparison of gross motor proficiency data of young children across two countries/regions utilising the same instrument (BOTMP; Bruininks, 1978), thus addressing the issue of non-comparability raised in the literature by researchers such as Al-Haroun (1988, p. 14). The norms, especially the gender norms developed in this study, can be used in future cross-cultural studies using BOTMP (Bruininks, 1978) as a reference. However, this study lends weight to the argument by Hands and Larkin (1998) that there is a danger in applying norms developed in one country to children of countries with different cultures, as the norms might not be directly transferable, as demonstrated by this study.

Further research is recommended in view of the scarcity of research into the gross motor proficiency of young children. The following are recommended for further study:

1. Although BOTMP is a validated test, a cautious approach should be applied to check the validity of an instrument when newly applied to a culture, in order to obtain more valid comparable data. An instrument valid for one country might not be valid for another.

2. If BOTMP (Bruininks, 1978) is used in future studies, there is a need to review its sensitivity on the Strength subtest. In order to increase its sensitivity, more test items on upper body strength (which currently has only one item) should be added. A test with more targeted items tends to be more reliable than one with fewer items.

Author’s Note

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The social attention skills of preschool children with an intellectual disability and children with a hearing loss

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Thirty preschool children (10 with typical development, 10 with an intellectual disability and 10 with a hearing impairment) were videotaped during play. Data was collected for each participant group, covering the number, length and nature of social engagement opportunities (SEOs) and the children's attentional states during SEOs.

The typically developing group had SEOs of longer duration than did the children with an intellectual disability, although not significantly longer than those of the group with a hearing impairment. The children with intellectual disability were more frequently disengaged during SEOs. The typically developing group's SEOs were more visual and interactive than those of the other two groups. The typically developing group was more attentive than the group with a hearing impairment, and was more likely to display aware–alert and sustained attention than were the two disability groups. For higher-order attentional states, the typically developing group was more likely to achieve focused and divided attention than was the hearing impaired group, which was more likely to exhibit these states than was the group with an intellectual disability.

Introduction

Addressing social skills in early childhood is regarded as a critical domain in the preschool curriculum (Blair, Denham, Kochanoff & Whipple, 2004). Most typically developing children naturally acquire and use sophisticated social skills (Kohler, Anthony, Steigher & Hoyson, 2001). These children are able to apply and adapt these skills during play and other interactive situations (Pierce-Jordan & Lifter, 2005). Children with disabilities, however, have difficulty in several areas which can be observed in their interactions (Sheridan, Hugelmann & Maughan, 1999), such as their reduced ability to initiate and maintain social interaction with peers (Sigman & Ruskin, 1999), to establish joint attention and eye gaze (Charman, Swettenham, Baron-Cohen, Cox, Baird & Drew, 1997), and to respond to their peers (Kohler, Strain & Shearer, 1992). Learning to independently manage social skills is critical for all children (Blair et al., 2004) but even more important for the child with a disability attending an inclusive preschool (Pierce-Jordan & Lifter, 2005).

Proponents of inclusion believe that one of its core benefits is the social integration of children with disabilities (Foreman, 2005; Mastropieri & Scruggs, 2000; Stainback & Stainback, 1997). It is also held that inclusion will equip children with the skills to extend their interactions within their local neighbourhood (Stainback & Stainback, 1997). This is often the primary motive for parents of children with a disability in sending their child to an inclusive preschool (Sloper & Tyler, 1992). In this setting, children with and without disabilities can use peer observation (Bandura, 1997) and peer interaction to learn about and practise these skills. While the philosophy of inclusion is laudable, in reality social engagement for children with disabilities appears to remain a difficulty. A major problem is the child’s maintenance of social exchange (Guralnick, 1992), thus missing out on further opportunities for social interaction. It is therefore important to identify strategies that will help facilitate their interaction with typically developing peers (Ivory & McCollum, 1999).

Entry into an established activity with other children requires the child to display strategy generation, negotiating and communicating intent. While some children with disabilities, such as those with hearing loss, have been found to show interest in the immediate social environment, their entry into interaction continues to challenge them (Brown, Remine, Prescott & Rickards, 2000). In general, children with disabilities are more likely to hover around the periphery and observe established activity (Brown et al., 2000).

Children with intellectual disability have been reported as having difficulty in engaging with peers (Furman &
Walden, 1990; Guralnick, 1990; Guralnick & Groom, 1987; Guralnick & Weinhouse, 1984). As a result, their peers make adjustments to their communication. For instance, the peer group has been found to use less complex language; more directives, clarifications and repetitions; and more non-verbal communication (Guralnick & Groom, 1987). Successful entry into and maintenance of social interaction requires mastery of a medley of skills, including social problem-solving, knowledge of script, strategic behaviour, communication competence and management of attention (Antia, 1985; Brown et al., 2000; Dorsch & Keane, 1994; Dykeman, 1998; Levy-Shiff & Hoffman, 1985; Rose-Krasnor, 1985).

The effects of reduced skills in social problem-solving, script knowledge and strategy use have been illustrated in studies investigating social interactions of children with disabilities in inclusive settings. For instance, these children have often been shown to be the recipient rather than the initiator of social contact (Evans, Salisbury, Palombera, Berryman & Hollowood, 1992) and their initiation attempts are more likely to be refused (Vandell & George, 1981). Children with hearing loss in particular have been found to have fewer interactions with peers and, when interactions do occur, they are often shorter in duration and less complex (Antia 1994; Antia & Kreimeyer, 1996; Higginbotham & Baker, 1981; Vandell & George, 1981).

If a child’s ability to process the social information of an activity is impaired it may lead to impulsive and inappropriate responses to social offers, thus affecting the child’s acceptance by peers. Children with disabilities are less popular with their peers and are frequently rejected (Stone & La Greca, 1990; Vaughn, Elbaum & Schum, 1996) and have fewer friends than their non-disabled peers (Guralnick, Connor, Hammond, Gottman & Kinnish, 1995; Guralnick & Groom, 1987). They may be more socially isolated in the inclusive setting (Faught, Ballerweg, Crow & van den Pol, 1983), find it difficult to form reciprocal friendships (Guralnick, 1990), and may seek interaction with adults more frequently (Lederberg, Ryan & Robbins, 1986).

Establishing and maintaining interaction in the preschool requires all children to keep up with scripted routines and to be alert to changes in that script. As the script of an activity evolves, changes are conveyed within the peer group both verbally and non-verbally, so the child’s communicative ability (Black & Hazen, 1990) and attention are fundamental skills which involve the use of higher-order processing (Guralnick, 1992). Children with intellectual disability and those with hearing loss are likely to have deficits in both communication and attention that will affect higher-order processing and impact on their degree of social engagement.

Several researchers consider the management of attention to be a key factor separating children with and without disabilities (Douglas, 1980; Keogh & Margolis, 1976) and have noted differences between these groups in terms of capacity, how information is processed, vigilance and intelligence (Shiffrin & Schneider, 1997).

Attention and social information processing are closely related concepts (Antia, 1985; Dorsch & Keane, 1994). Studies of children with challenging behaviour have shown them to be less attentive to, and less accurate in, interpreting social cues (Dodge, Murphy & Buchsbaum, 1984; Dodge & Tomlin, 1987), to produce fewer competent responses (Dodge, Petit, McClaskey & Brown, 1986; Renshaw & Asher, 1982) and to be more likely to anticipate an outcome by using aggressive behaviour (Cirino & Beck, 1990).

It has been proposed that attention may depend on the ability to integrate multimodal sensory information (Quittner, Smith, Osberger, Mitchell & Katz, 1994). The competing stimuli of the preschool setting, however, may affect this ability in some children.

While attentional states may not always be observable (Warner-Rogers, Taylor & Sandberg, 2000), some studies have used overt behaviors, such as sustained watching, facial expression and activity level, as indices of attention (Choi & Anderson, 1991; Ruff & Rothbart, 1996).

Studies investigating attention from a social perspective have been limited to joint attention within parent–child interactions (Kasari, Freeman, Mundy, & Sigman, 1995; Landry & Chapieski, 1989; Waxman & Spencer, 1997) and indicate that the child’s capacity to manage joint attention with the parent emerges in the first year of life (Quittner, Leibach & Marceil, 2004). These early experiences with the caregiver are considered to be the cornerstone for building future cognitive, linguistic and social skills.

Studies of the joint attention skills of children with Down syndrome and children with hearing loss show that both groups experience difficulties in regulating joint attention. For instance, children with Down syndrome prefer to attend to a face rather than an object and have difficulty managing shifts of attention between objects and people (Kasari, Mundy, Yirmiya & Sigman, 1990; Landry & Chapieski, 1989; Ruskin, Kasari, Mundy & Sigman, 1994). In many infants with hearing loss the development of joint attention is affected by the child’s sensory deficit and their communication delay, and the adult is required to increase the level of scaffolding required to establish and maintain attention (Brown & Remine, 2004). According to Quittner et al., (1994, 2004) hearing children with typical development learn to focus their visual attention selectively while simultaneously monitoring their environment through audition. The strong reliance on visual monitoring in the case of children with Down syndrome and children with hearing loss is a medley of skills, including social problem-solving, knowledge of script, strategic behaviour, communication competence and management of attention (Antia, 1985; Brown et al., 2000; Dorsch & Keane, 1994; Dykeman, 1998; Levy-Shiff & Hoffman, 1985; Rose-Krasnor, 1985).
hearing loss may mean that these children miss out on important social cues.

The preschool is a dynamic environment in which the rules, script and dialogue of the activity are constantly changing. In order to maintain social engagement a child needs to be vigilant. Studies of attentional vigilance in children with Down syndrome have yielded mixed results, from reduced ability to maintain vigilance (Krakow & Kopp, 1982, 1983), to a reported ability to sustain and manage their attention within the presence of competing stimuli (Ruskin et al., 1994). In children with hearing loss, performance on joint attention tasks has been found to be better for children fitted with a cochlear implant than for children using hearing aids (Smith, Quittner, Osberger & Miyamoto, 1998).

The concept of social functioning has changed from a global concept referring to the overall adequacy of a person's social performance (Kratochwill & French, 1984) to a multidimensional construct composed of several interacting components (Brown, Bortoli, Remine & Basyariatul, 2007). This study adopts this multidimensional view of social functioning.

The purpose of the study was to investigate the types of social engagement opportunities for children with intellectual disability and children with hearing loss, and to compare them with those of their typically developing peers. Three major questions were addressed:

1. Are opportunities for social engagement the same for children with intellectual disability and children with hearing loss when compared to hearing children with typical development?

2. Are there differences in the types of social engagement opportunities for the three groups of children?

3. How effective are the three groups of children in managing their attention during social engagement opportunities?

### Method

#### Participants and educational placements

Thirty preschool children (10 with hearing loss [HI], 10 with intellectual disability [ID] and 10 typically developing children [T]) aged between four and five years participated in the study. All children in the HI group had a severe–profound hearing loss, and details of their unaided Pure Tone Averages (PTAs) are given in Table 1. All participants in the ID group had Down syndrome. The degree of intellectual disability was not available during data collection. The participant groups were matched as closely as possible for gender, age, parents’ occupation and birth order in the family.

<table>
<thead>
<tr>
<th>Participant</th>
<th>PTA (in dB HTL)</th>
<th>Hearing Device</th>
<th>Age of Diagnosis (in months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>96</td>
<td>HA²</td>
<td>13</td>
</tr>
<tr>
<td>HI 2</td>
<td>101</td>
<td>CI³</td>
<td>7</td>
</tr>
<tr>
<td>HI 3</td>
<td>85</td>
<td>HA</td>
<td>18</td>
</tr>
<tr>
<td>HI 4</td>
<td>100</td>
<td>HA</td>
<td>10</td>
</tr>
<tr>
<td>HI 5</td>
<td>95</td>
<td>HA</td>
<td>18</td>
</tr>
<tr>
<td>HI 6</td>
<td>120</td>
<td>CI</td>
<td>9</td>
</tr>
<tr>
<td>HI 7</td>
<td>84</td>
<td>HA</td>
<td>16</td>
</tr>
<tr>
<td>HI 8</td>
<td>107</td>
<td>CI and HA</td>
<td>3 weeks</td>
</tr>
<tr>
<td>HI 9</td>
<td>100</td>
<td>HA</td>
<td>8</td>
</tr>
<tr>
<td>HI 10</td>
<td>96</td>
<td>HA</td>
<td>18</td>
</tr>
</tbody>
</table>

¹ PTA = Unaided pure tone average (hearing threshold level)  
² HA = Hearing aid  
³ CI = Cochlear implant  
HI = Hearing impaired

The 10 participants from the HI group were recruited from two preschool programs, nine of them from an integrated program specialising in intervention for children with a hearing loss. One participant (HI 10) was recruited through a parent advisory service that offered support to parents and children, as well as curriculum support to the child's preschool teacher. The children from the ID group were recruited through a specialised early intervention program for families of children with Down syndrome. All children in the ID group were filmed in their local preschool program. The 10 participants from the T group were recruited from two day care centres that were accredited to implement a kindergarten program within their facility.

#### Developmental screening

One week prior to data collection, all participants were assessed for their levels of communication, social competence, daily living skills and motor skills, using the Vineland Adaptive Behaviour Scale (VABS). The VABS developmental checklist was completed by the child’s kindergarten teacher. Table 2 shows the mean age equivalence scores in months for communication and socialisation for each of the groups. The results of this assessment showed that the typical group was indeed functioning in the typical range and that the mean scores for the two groups with disability reflected their respective developmental delay.
Table 2. Age equivalence in months for ABC, communication and socialisation

<table>
<thead>
<tr>
<th>Participant</th>
<th>Chronological age (in months)</th>
<th>Adaptive behaviour composite (ABC)</th>
<th>Communication</th>
<th>Socialisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T.1</td>
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<td>65</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>T.2</td>
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<td>60</td>
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<td>44</td>
</tr>
<tr>
<td>T.3</td>
<td>62</td>
<td>64</td>
<td>63</td>
<td>53</td>
</tr>
<tr>
<td>T.4</td>
<td>62</td>
<td>61</td>
<td>66</td>
<td>48</td>
</tr>
<tr>
<td>T.5</td>
<td>51</td>
<td>60</td>
<td>52</td>
<td>50</td>
</tr>
<tr>
<td>T.6</td>
<td>63</td>
<td>59</td>
<td>66</td>
<td>50</td>
</tr>
<tr>
<td>T.7</td>
<td>64</td>
<td>64</td>
<td>67</td>
<td>51</td>
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<td>T.8</td>
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<td>T.9</td>
<td>56</td>
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<td>T.10</td>
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</tr>
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<td>below 12</td>
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<td>ID.2</td>
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<td>20</td>
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<td>14</td>
</tr>
<tr>
<td>ID.3</td>
<td>51</td>
<td>17</td>
<td>below 12</td>
<td>12</td>
</tr>
<tr>
<td>ID.4</td>
<td>61</td>
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<td>below 12</td>
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<tr>
<td>ID.5</td>
<td>58</td>
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<td>22</td>
<td>27</td>
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<td>ID.6</td>
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<td>15</td>
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<td>below 12</td>
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<td>ID.7</td>
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<td>ID.10</td>
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<td>HI.3</td>
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<td>HI.4</td>
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<td>HI.9</td>
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<tr>
<td>HI.10</td>
<td>50</td>
<td>37</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

T = Typical development  
ID = Intellectual disability  
HI = Hearing impairment

Data collection

All children were videotaped during free play in the preschool on three occasions. The half-hour sessions were filmed weekly over a three-week period, yielding 90 minutes of videotaped data per participant. The middle 20 minutes of the videotaped segment were coded, providing 60 minutes of raw data per participant. The videotapes were time-coded second-by-second.

Coding

There were three levels of coding: social engagement opportunities (SEOs), type of social engagement opportunities, and attentional states. At the first level, social engagement opportunities were identified by marking on a transcript the second at which each SEO commenced and ended. An SEO was defined as an opportunity for proximal and visual engagement with a partner from which interaction might follow. An SEO was judged as having ended when a participant moved more than two metres away from the activity, an adult moved between the participants, or a barrier was placed between them.

At the second level, the type of SEOs was coded, the transcripts being segmented into 10-second intervals. Four categories of SEOs were identified: disengaged, proximal, visual and interactive. *Disengaged* was defined as the child showing no evidence of interest in activities with peers despite being within two metres of a peer; *proximal* as the child engaging in parallel play and being within two metres of a peer but not watching or interacting; *visual* as the child showing visual engagement with peers and/or events around them; *interactive* as the participant engaging in communication either verbally or non-verbally. For example, if a child was painting at an easel next to another child, but there was no visual or interactive engagement, this would be coded as *proximal*. If the child watched another peer painting at the next easel, it would be coded as *visual*. If the children discussed their painting it would be coded as *interactive*.

The third level measured the child’s attention state during SEOs. Five states of attention were identified: inattentive, aware–alert, sustained, focused and divided. Coding of the five states of attention was conducted for presence or absence in each interval. The *inattentive* state was defined as having difficulty remaining focused on the task or ignoring other children in a communal activity; *aware–alert* as the participant being observed voluntarily turning their head, or moving their body in response to sounds, people and/or the activity without abandoning the task at hand. To be in the *sustained* state of attention the participant maintained their visual or auditory attention to episodes of social interaction for at least three seconds (Anderson, Choi & Lorch, 1987) despite the presence of competing stimuli (Dykeman,
The focused state was defined as the participant being able to change from one task to another by showing increased interest in another social activity (Tipper, Bourque, Anderson & Brehaut, 1989). The divided state was defined as the participant displaying a balance of engagement between their current social activity and events happening around them.

The three levels of coding are illustrated in Figure 1.

**Figure 1. Coding levels**

**Social Environment**

**Level 3 - Social attention states**
- Inattentive
- Aware–alert
- Sustained
- Focused
- Divided

**Level 2 - Types of social engagement opportunities**
- Disengaged
- Proximal
- Visual
- Interactive

**Level 1 - Social Engagement Opportunities**

**Intercoder agreement**

Intercoder agreement was estimated using the Kappa statistic (K) on 25 per cent of the data. Three coders were used: Coder 1 was a PhD student, Coder 2 was the first-named author, and Coder 3 was an experienced special education teacher.

**Data analysis**

The data was analysed for the three participant groups using an analysis of variance (ANOVA). In order to determine significant differences between participant groups, post hoc comparisons were applied using Tukey’s method. Only probability values of less than .05 are reported.

**Results**

The first set of analyses compared the number and length of SEOs for the three participant groups. The number of SEOs was determined by counting the SEOs in each session using the second-by-second transcript. The length of each SEO was considered to be an estimate of the child’s ability to maintain an opportunity for social engagement and so the number of seconds per SEO was calculated. These were then summed for each participant for all sessions. There was no statistically significant group effect for the number of SEOs.

For length of SEO, the ANOVA showed that there was a statistically significant group effect (F=5.337 (2, 27), p<.05). The pair-wise comparisons of the participant groups showed that, for SEO lengths, there was a statistically significant difference between the T group and the ID group (p<.05). The mean lengths of SEOs and their standard deviations for the three participant groups are shown in Table 3.

**Table 3. Group means and standard deviations for length of SEOs**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>3251</td>
<td>379.3</td>
</tr>
<tr>
<td>ID</td>
<td>2395</td>
<td>618.8</td>
</tr>
<tr>
<td>HI</td>
<td>2775</td>
<td>711.4</td>
</tr>
</tbody>
</table>

¹ Groups significantly different at p<.05

T = Typical development
ID = Intellectual disability
HI = Hearing impairment

The second set of analyses compared the type of SEOs of the three participant groups. The mean scores for each type of SEO and their standard deviations for the three groups are shown in Table 4. For the disengaged category, results showed that there was a statistically significant group effect (F=12.410 (2, 27), p<.001). Pair-wise comparisons of the participant groups for the disengaged category showed statistically significant differences between the T and ID groups, (p<.001) and between the ID and HI groups, (p<.05). There was no significant difference for the proximal category. For the visual category, results indicated a statistically significant group effect (F=10.972 (2, 27), p<0.001). Pair-wise comparisons for the visual category showed that there were statistically significant differences between the T and ID groups, (p<.001) and between the T and HI groups, (p<.05). Comparisons for the interactive category showed a statistically significant group effect (F=31.192 (2, 27), p<.001). Pair-wise comparisons for the interactive category showed statistically significant differences between the T and ID groups (p<.001) and between the T and HI groups (p<.001).

The final set of analyses investigated the participants’ states of attention during SEOs. For the inattentive state, results showed a statistically significant group effect (F=6.906 (2, 27), p<.05). Pair-wise comparisons for the inattentive state showed a statistically significant difference only between the T and HI groups (p<.05). For the aware–alert state there was a statistically significant
The ability to engage socially and to maintain interaction with a peer are critical tasks facing all children in the inclusive setting, rendering the preschool a socially challenging environment. In the initial screening stage of the study, the typically developing children were found to be functioning at age-appropriate levels for all developmental domains. The ID group was delayed in all areas, and the HI group’s age-equivalent scores were also below their chronological ages, the exception being the motor domain.

The first question raised by this study related to whether the opportunities for social engagement would be the same for all three groups. Despite the challenges faced by the ID and HI groups there was evidence to show that they were able to take up opportunities for social engagement. Surprisingly, on this measure no statistically significant differences between the three participant groups emerged. However, while the ID group showed evidence of the ability to establish SEOs, the ID group was less able than the T group to sustain them. The problems in maintaining engagement for the ID group may stem from their cognitive and linguistic delay, but the lack of a significant effect for the HI group suggests it is the cognitive component that is contributing to this difficulty.

The second question focused on the type of SEOs accessed by the three groups. The typical group presented as children who remained engaged, monitored their peers and the surrounding activities visually, and were interactive. The ID group presented as more disengaged than both the

**Table 5. Group means and standard deviations for the states of attention**

<table>
<thead>
<tr>
<th>Attention states</th>
<th>Group</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inattentive</td>
<td>T</td>
<td>23.7</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>29.5</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>37.8</td>
<td>9.1</td>
</tr>
<tr>
<td>Aware–Alert</td>
<td>T</td>
<td>31.8</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>20.7</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>18.9</td>
<td>6.7</td>
</tr>
<tr>
<td>Sustained</td>
<td>T</td>
<td>40.6</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>22.3</td>
<td>10.8</td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>30.1</td>
<td>5.6</td>
</tr>
<tr>
<td>Focused</td>
<td>T</td>
<td>26.8</td>
<td>7.3</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>4.5</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>11.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Divided</td>
<td>T</td>
<td>18.5</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>.74</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>HI</td>
<td>11.1</td>
<td>7.6</td>
</tr>
</tbody>
</table>

1 Groups significantly different at p<.05  
2 Groups significantly different at p<.001  
T = Typical development  
ID = Intellectual disability  
HI = Hearing impairment
T and HI groups and less likely than these two groups to monitor social activity visually. In terms of interaction the T group was more likely to engage in sustained interaction with peers than were the two disability groups. Despite these differences there was evidence that all three groups used a proximal strategy at times to provide opportunities for social engagement. Similarly, all three groups used visual engagement. These were the preferred strategies for the two disability groups. It would appear that these two groups accessed SEOs through watching and playing alongside their peers; that is, in parallel play.

The final question was concerned with the attentional states of the three participant groups during social engagement. The analyses showed clear differences between the typical group and the two groups with disabilities. Interestingly, the HI group was the most inattentive group. For the aware—alert and sustained states, the T group scored significantly higher than the other two groups. For the focused state, differences emerged between all three groups; for the divided state differences were found between the ID group and the other two groups.

In summarising the three levels of coding, the results show that children in the HI group were able to maintain themselves in SEOs to a level commensurate with the T group. This appeared to be a result of their use of proximal and visual strategies. However, the high score for inattention may be misleading, since these participants may have been using a visual scanning strategy to compensate for their poorer auditory acuity. This may also explain the lower score for sustained attention and focused attention when compared to the T group. Interestingly, this group also achieved the divided attentional state. Collectively these findings suggest that their attentional behaviour is self-regulated rather than distractible.

In contrast, children in the ID group were less able than the T group to maintain SEOs but, like the HI group, they used visual and proximal strategies to do this. While they appeared to be no more inattentive than the other two groups, they were less likely than the T group to show evidence of all higher order attentional states. The differences between the ID and HI groups were at the focused and divided states. This would suggest that the cognitive delay of the ID group was more likely to engage in sustained interaction without comprising stimulation would assist both groups to establish and maintain their focus; increased opportunities for children to engage in proximal and face-to-face exchanges can be capitalised on; close observation of the child during opportunities for social engagement, using the model outlined in this study, will enable teachers to identify characteristic patterns of behaviour and attention that will help in formulating realistic goals and effective interventions.

Acknowledgements

The authors wish to thank the parents, children and teachers who participated in this study. Thanks also go to the Advisory Council for Children with Impaired Hearing who awarded the Elisabeth Murdoch Scholarship to the first-named author.

References


Caring for the super of remarkable childcare professionals everywhere

While you’re busy taking care of others, HESTA is busy taking care of you.
Is all-day kindergarten better for children’s academic performance?
Evidence from the early childhood longitudinal study

Mido Chang
Kusum Singh
School of Education, Virginia Tech

THE GOAL OF THIS STUDY was to explore the long-term effects of all-day kindergarten programs on children’s academic performance. The study used three waves of data from a nationally representative database from the United States, the Early Childhood Longitudinal Study (ECLS), with the first wave at the beginning of kindergarten and the third wave at the end of the first grade. The average age of the children at the first wave was five years and eight months; at the third wave seven years and three months. The study further examined if these effects vary as a result of teacher curricular activities relating to reading and mathematics. The study conducted three-level longitudinal multilevel analyses using three measures of reading and maths IRT scores, sets of teacher activities in reading and maths, children’s age, gender and socioeconomic status. The results indicated that all-day kindergarten children began with significantly higher scores and showed faster growth rates in both reading and math compared with half-day kindergarten children. Importantly, all-day kindergarten teachers had significantly higher frequencies of reading and mathematics activities than did half-day kindergarten teachers. These results suggest an important implication for the potential benefits of all-day programs in the US.

Introduction

ALTHOUGH KINDERGARTENS in the United States have a history of more than 150 years, defining the most beneficial kindergarten program is an issue still to be settled. In early traditional kindergarten, the most beneficial program was identified as one that allowed a child to make a smooth transition from home to school. All that children needed to do in traditional kindergarten was to play and adjust themselves to a social setting (Nelson, 2000). These days, kindergartens in the United States emphasise academic achievement and school readiness, which had been the goal of the first grade curriculum in the past. American kindergarten children are expected to pay attention to highly structured and segmented academic instruction such as reading, writing, mathematics and science lessons (Clark, 2001). While there are debates among policy-makers and scholars over the benefits of full-day versus half-day kindergarten programs and the developmental goals of these programs, the large numbers of American kindergartens try to comply with the learning standards set by the state governments. Those guidelines delineate the general expectations for what young children should know and be able to do before they enter first grade (Cryan, Sheehan, Wiechel & Bandy-Hedden, 1992; Elicker & Mathur, 1997). Moreover, the issue of high accountability of schools and the growing demands of a push for an ‘early start’ add to the importance of kindergarten children’s academic performance (Vecchiotti, 2003).

Along with the curricula of kindergarten programs, the length of kindergarten has also been an important policy issue in the United States. The number of all-day kindergartens in the US has substantially increased: a typical all-day kindergarten program runs five–six hours per day and five days per week, while a half-day runs two–three hours per day and three–five days per week. In 1999, 56 per cent of all kindergartens programs were all-day programs. Many kindergartens have switched from half-day to all-day programs in recent years, and many more are likely to do so (Elkind, 2001; Fusaro, 1997; Weast, 2001). The changing educational demands on young students explains the rapid growth of all-day kindergartens. Social reasons, such as a growing need for child care, have also provided an impetus for the growth of all-day kindergartens. Many more mothers are in the labour force, and all-day kindergarten is a safe and preferred alternative to other forms of child care (Boardman & Kelly, 2004). Educational policy-makers have also argued in favour of all-day kindergarten for
low-income minority children (Magnusona, Ruhmb & Waldfogelc, 2007; Zvoch, Reynolds & Parker, 2008).

There are many important policy issues embedded in the debate over the pros and cons of the all-day program. The shift from a half-day to a full-day kindergarten program can be extremely expensive. The change to an all-day program requires a substantial increase in the kindergarten budget for teachers’ salaries and additional classrooms and other resources. Not only are the all-day programs more expensive, they also require more human resources, and make increased educational demands on young children. So it is important to critically examine the benefits of all-day versus half-day programs, and to gather data-based evidence on the effects, both short-term and long-term, of all-day programs on children’s academic achievement.

Although there is growing literature on the effects of all-day kindergarten and children’s cognitive development, much of that work consists of policy briefs and concept papers. Proponents of all-day kindergarten claim, however, that those programs are beneficial and worth funding (Vecchiotti, 2003; Weast, 2001). Some studies have supported the benefits of all-day kindergarten for special groups of children and their families. For example, research shows that single-parent and dual-employment families prefer the convenience of all-day kindergartens (Clark & Kirk, 2000; Elkind, 2001), and the academic achievement of children who are at risk is higher for those in all-day kindergarten than for those in half-day kindergarten (Elicker & Mathur, 1997; Fusaro, 1997).

The effects of all-day kindergarten on student achievement have not been established on the basis of empirical evidence using a nationally representative large-scale database. Few studies have compared the two program types and their effects on children. Studies on the long-term effects of all-day kindergarten that track the cognitive growth in early grades are even fewer. Because of insufficient longitudinal research on the efficacy of all-day kindergarten on academic achievement, there is limited evidence on the long-term benefits of all-day kindergarten for most children. Many quantitative studies have shown inconsistent findings, because of small samples, cross-sectional data and less reliable outcome measures.

The present study attempts to overcome some of the limitations of earlier research and presents longitudinal growth models of children’s academic achievement in reading and mathematics, examining differences between all-day and half-day kindergarten programs. Valid longitudinal research requires a well-designed study that includes the use of appropriate data and methods. The database should offer three or more repeated observations, and each observation should be measured on a comparable scale (Hox, 2002). The database of the Early Childhood Longitudinal Study—Kindergarten Cohort (ECLS-K) from the National Center for Education Statistics (NCES, 2001, 2002) is particularly suitable, because the database contains six waves in each subject area enabling a longitudinal analysis, and a large sample for a multilevel analysis. Taking advantage of these benefits, we conducted three-level longitudinal multilevel analyses examining the long-term effects of an all-day program on academic achievement in the kindergarten year, as well as measuring student academic growth to the first grade. The age range of the children for the study was from five years and eight months (kindergarten) to seven years and three months (first grade).

**Literature review**

Kindergarten program type is an important educational context, one closely linked with children’s academic achievement (McLean, Haas & Butler, 1994). The studies of all-day versus half-day kindergarten in the US have shown inconsistent findings. While some studies have identified benefits of all-day programs, others showed either no difference or negative effects. For example, some comparative studies of kindergarten program types have demonstrated that all-day programs bring children advantages in such academic domains as oral-language development, literacy skills, mathematical reasoning and concepts, and problem-solving (Chmelynski, 1998; Clark, 2001; Cryan, Sheehan, Wiechel & Bandy-Hedden, 1992; da Costa & Bell, 2000, 2001; Elicker & Mathur, 1997; Hough & Bryde, 1996; Johnson, 1993; Viadero, 2002; Walston & West, 2004; West, Denton & Reaney, 2000). Hough and Bryde (1996) conducted a quasi-experimental study comparing six all-day kindergartens with half-day kindergartens similar in location, school size, student norm-referenced data, and socioeconomic status (SES). They found that all-day children outperformed half-day children in the majority of the language, arts and mathematics skills, and the norm-referenced achievement test.

In general, all-day kindergarten has been found to have positive long-term effects. The programs are more beneficial than half-day programs when it comes to enhancing children’s readiness for primary school education. For instance, all-day kindergarten children are better prepared for first grade and are less likely to be held back in a grade (Cryan et al., 1992; Elicker & Mathur, 1997; Gullo, 2000; Johnson, 1993; Ohio State Department of Education, 1992; Ohio State Legislative Office of Education Oversight, 1997; Zvoch et al., 2008). Elicker and Mathur (1997) observed 12 all-day and half-day kindergartens for two years in a middle-class midwestern American community and found that children in the all-day program demonstrated greater progress and higher levels of first grade readiness than did children in the half-day program. A study by the Ohio
State Department of Education (1992) showed that all-day pupils performed better than half-day pupils until they reached the second grade. Gullo (2000) compared second-graders’ academic outcomes and found that all-day kindergarten children scored significantly higher in maths and reading on the Iowa Test of Basic Skills, as compared with half-day kindergarten children. Cryan et al. (1992) also presented evidence positively linking participation in an all-day kindergarten to test performance, at least through the first grade. A study by the Ohio State Legislative Office of Education Oversight (1997) reported that all-day children had better retention rates, fewer remedial reading program placements, and higher standardised test scores than did half-day children—although the difference in test results disappeared by the end of the second grade.

Positive outcomes for all-day programs are generally attributed to the additional hours spent in kindergarten, which provide for greater continuity of day-to-day activities and a developmentally appropriate curriculum that includes activity centres, projects, field trips, and free play (Cryan et al., 1992; Rothenberg, 1995; Towers, 1991). The additional time also allows teachers to observe the children and become more familiar with their developmental needs. Teachers can later use this information to develop an individualised instructional plan. In an all-day kindergarten children spend more time engaged in child-initiated, independent, flexible, in-depth and creative activities that lead them to gain more confidence in their abilities and build better relationships with classmates and teachers (Elicker & Mathur, 1997; Nelson, 2000; Vecchiotti, 2003). Moreover, all-day kindergarten schedules tend to be more relaxed, have more repetition of the same content, offer more remedial instruction, and put greater emphasis on literacy and numeracy than their half-day counterparts do (da Costa & Bell, 2001; Denton, West & Walston, 2003; Johnson, 1993).

On the other hand, critics of all-day kindergartens have warned that some aspects of such centres are harmful to young children. For example, using the data collected from the third grade children who were previously enrolled in either all-day or half-day kindergarten, Saam and Nowak (2005) found that the children in all-day kindergarten did not show better performance on language, art and maths scores than those in half-day kindergarten, nor did all-day kindergarten children from low SES background receive any benefit. Holmes and McConnell (1990) chose 10 half-day and 10 all-day kindergartens at random and compared six measures of the California Achievement Tests. Their results indicated no significant differences between the two groups in visual recognition, sound recognition, vocabulary and language expression. Although they noted significant differences in comprehension and mathematics concepts and applications, they reasoned that the differences were because of gender. Natale (2001) also argued that excessively long hours of schooling can be particularly burdensome for children, and heavy academic schedules can suppress their creativity and natural inquisitiveness. Good (1996) reported on problems for teachers of all-day kindergartens. Many teachers found it difficult to deal with short attention spans and they ended up spending more time on review, and had difficulty providing continuity and keeping groups together. They also felt that the day was too long for some children as well as for some teachers. A half-day program may be more suitable for children who need more time at home with their parents, or who need more time to rest in the afternoon. Parents of children who attended half-day programs reported that their children were less tired and happier in kindergarten, had more time to spend with the family, and the transition to school was easier. Elkind (2001) found that the widespread attendance at all-day kindergarten has led first grade teachers to raise their expectations for the skills required to enter first grade, and this has led to many children being held back in kindergarten classes.

It is evident that research findings are inconsistent and the debate on the advantages and disadvantages of all-day versus half-day kindergarten is far from settled. There is clearly need for more research on the outcomes of kindergarten program type, using large-scale national data and advanced statistical procedures.

**Method**

**Data and weights**

This study used the ECLS-K database to examine the longitudinal growth of children's academic achievement. The ECLS-K was designed to provide assessment of the various developmental aspects of children from the onset of their formal schooling, through their progress during the elementary school years. It also provides data on the quality of kindergarten programs and elementary schools, and thus it allows educational researchers to study children's developmental experiences in the early school contexts. This study used three waves of data to examine if the effects of all-day kindergarten program last until the end of first grade. The choice of three waves was mainly because of the available weight for longitudinal data analysis and sample sizes. The three waves of data used for this study represent: (a) a baseline measure, the first term of kindergarten, 1998; (b) an initial follow-up, the second term of kindergarten, 1999; (c) a second follow-up, the first term of first grade, 2000. Using these three waves of data, the study had two practical benefits. First, the study was based on a valid representation of the national population of children, using a longitudinal weight for the student level (C124CW0) which had high non-zero weights.
(87 per cent). Second, the application of the weight avoided the problems caused by over-representation of the Asian group in the ECLS-K dataset.

The study also considered the effects of schools that have different kinds of kindergarten programs. However, the study paid attention to the school effects only during the kindergarten year in an effort to avoid a confounding effect caused by children who moved schools from kindergarten to first grade. In this study we also deleted those cases that contained all missing values on the three waves of the dependent variable, because longitudinal multilevel analysis is flexible enough to use available cases and does not require complete case data. The data used for the study totalled 17,350 children and 1,015 kindergartens.

**Analytical tools**

For the present study, we used independent samples t-tests and longitudinal multilevel analysis (often called Hierarchical Linear Model [HLM]) as our major analytical tools. While we compared the average frequencies of teacher activities in half-day and all-day kindergarten programs using independent samples t-tests, we examined the long-term effects of all-day kindergarten associated with teacher activities in reading and maths activities.

The statistical and conceptual strengths of using multilevel analysis with nested data have been demonstrated by researchers such as Raudenbush and Bryk (2002) and Kreft and de Leeuw (1998). A major benefit of multilevel analysis is that it helps researchers to explore various contextual effects. Multilevel analysis is also highly flexible in longitudinal analysis, in the sense that it does not require equal spacing or an equal number of observations (Heck & Thomas, 2000; Hox, 2002; Kreft & de Leeuw, 1998; Lee, 2000; Raudenbush & Bryk, 2002). Using the major benefits of a longitudinal multilevel analysis, we explored the long-term effects of kindergarten programs and their curricular activities on children's academic performance.

**Model description and variables**

This study used three-level multilevel longitudinal models, in which we examined the effects of an all-day kindergarten at the school level, which interacts with children's individual contextual effects of reading and maths activities in kindergarten class, children's age, SES and gender, along with the longitudinal growth of children's academic performance.

**Level 1 (Growth level):** The first level model involved the growth of academic achievement, which was specified by using the *Time* variable. Each student's growth in terms of academic achievement was measured in two subject areas, reading and mathematics. The age of children at each assessment time point was given in months, serving two important roles: first, it was used to control for the effects of measurement errors caused by different assessment time points for various schools and groups; second, it was used to control for the effect of the student's age. The average age of children at the first wave was 68 months (the youngest was 53 months, the oldest 79 months). At the third wave the average age was 87 months (the youngest was 72 months, the oldest 96 months).

In each subject area, an Item Response Theory (IRT) scale score was used as a dependent variable. An IRT scale score is an estimated ability index rather than the sum of the correct answers. It is derived from an item-characteristic curve which shows how the probability of a correct answer relates to the difficulty of a test item and an examinee's ability. One of the benefits of an IRT score is that the information about an examinee's ability and the item characteristics (i.e. item difficulty and discrimination) can be separated. Thus it ensures that the scores at different time points are measured on a comparable scale, which is an important condition for a longitudinal dataset. Moreover, the IRT scale score is expected to have some advantages over the other scores in respect to analysing change, since it accounts for guessing and dependent omissions.

**Level 2 (Individual level):** We specified two separate models for reading and maths subject areas. The level 2 model for reading included the effects of the student's socioeconomic status (SES), age in months at the first term of kindergarten (Age), gender (Gender), and a composite teacher reading activity (Read) while the level-2 model for maths had the variables of SES, Age, Gender, and a maths teacher composite activity (Math).

The study used the composite SES continuous variable created by ECLS-K using parents' education, income and occupation. The Age variable was measured in months at the first assessment time in kindergarten. The student's gender (Gender) was coded 0 for male and 1 for female. The composite variable for teacher reading activities was created using 21 items, and the composite variable for teacher maths activities was created using 16 items. Those original teacher activity items were measured by frequencies (1=Never, 2=Once a month or less, 3=Two or three times a month, 4=Once or twice a week, 5=Three or four times a week, and 6=Daily). The detailed description of activities and reliability statistics (coefficient alpha) are presented in Table 1.
Table 1. Descriptions of Classroom Reading and Maths Activities and Reliability Index

<table>
<thead>
<tr>
<th>Reading activities (Coefficient alpha = 0.767)</th>
<th>Maths activities (Coefficient alpha = 0.756)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on letter names</td>
<td>Count out loud</td>
</tr>
<tr>
<td>Writing alphabet</td>
<td>Geometric manipulatives</td>
</tr>
<tr>
<td>New vocabulary</td>
<td>Counting manipulatives</td>
</tr>
<tr>
<td>Dictate stories</td>
<td>Maths-related games</td>
</tr>
<tr>
<td>Work on phonics</td>
<td>Use calculator</td>
</tr>
<tr>
<td>Story/See print</td>
<td>Music to learn maths</td>
</tr>
<tr>
<td>Story/Don’t see print</td>
<td>Movement to learn maths</td>
</tr>
<tr>
<td>Retell stories</td>
<td>Use measuring instruments</td>
</tr>
<tr>
<td>Read aloud</td>
<td>Explain/solve maths</td>
</tr>
<tr>
<td>Basal reading texts</td>
<td>Calendar-related activities</td>
</tr>
<tr>
<td>Read silently</td>
<td>Do maths worksheets</td>
</tr>
<tr>
<td>Work books/sheets</td>
<td>Use maths textbooks</td>
</tr>
<tr>
<td>Write from dictation</td>
<td>Do maths on chalkboard</td>
</tr>
<tr>
<td>Write with invented spellings</td>
<td>Solve maths with partner</td>
</tr>
<tr>
<td>Choose books to read</td>
<td>Solve real-life maths</td>
</tr>
<tr>
<td>Write stories/Report</td>
<td>Mixed-group maths work</td>
</tr>
<tr>
<td>Work related to book</td>
<td></td>
</tr>
<tr>
<td>Publish own writing</td>
<td></td>
</tr>
<tr>
<td>Perform play/skits</td>
<td></td>
</tr>
<tr>
<td>Write in journal</td>
<td></td>
</tr>
<tr>
<td>Storytellers</td>
<td></td>
</tr>
</tbody>
</table>

Level 3 (School level): The kindergarten program type was specified at level 3 after treating them to centre on the mean to avoid statistical stability of analyses. The ECLS dataset contained three types of kindergarten programs: morning, afternoon and all-day kindergarten. In this study, we identified both morning and afternoon kindergarten as half-day programs and compared them with all-day programs by assigning dummy codes of 0 and 1. The new variable was named Allday.

We specified the random components only with the intercept and the slope because the other random components were not significant. The intercept and the slope coefficients were assumed to vary across individuals at level 3.

Results

Teacher classroom activities in all-day and half-day kindergartens

Before we performed major analyses, we conducted descriptive analyses and present the results in Table 2.

Table 2. Descriptive statistics of Reading IRT Scores, Maths IRT Scores, SES, Age and Gender

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading First term of kindergarten</td>
<td>23.226</td>
<td>8.789</td>
</tr>
<tr>
<td>Reading IRT Score Second term of kindergarten</td>
<td>33.293</td>
<td>10.996</td>
</tr>
<tr>
<td>Reading First term of first grade</td>
<td>55.712</td>
<td>13.867</td>
</tr>
<tr>
<td>Maths First term of kindergarten</td>
<td>19.814</td>
<td>7.253</td>
</tr>
<tr>
<td>Maths IRT Score Second term of kindergarten</td>
<td>27.848</td>
<td>8.760</td>
</tr>
<tr>
<td>Maths First term of first grade</td>
<td>43.314</td>
<td>9.218</td>
</tr>
<tr>
<td>SES</td>
<td>0.005</td>
<td>0.803</td>
</tr>
<tr>
<td>Age in months at the first term of kindergarten</td>
<td>68.408</td>
<td>4.345</td>
</tr>
<tr>
<td>Gender Male</td>
<td>4806 (44.3%)</td>
<td>6045 (55.7%)</td>
</tr>
<tr>
<td>Gender Female</td>
<td>4471 (43.1%)</td>
<td>5899 (56.9%)</td>
</tr>
</tbody>
</table>

In the first analysis we compared the frequencies of teacher class activities in half-day and all-day classes by employing an independent samples t-test. The results showed the teachers of all-day kindergarten had significantly higher frequencies of classroom activities than did the teachers of half-day kindergarten, in both reading and maths areas (t=33.90, p<0.01; t=32.14, p<0.01, respectively).

Results of longitudinal analysis

Reading scores: The results of analysis using reading scores indicated that the children who attended all-day kindergarten showed higher levels of achievement in both initial scores and growth rates than did those who attended half-day kindergarten. As shown in Table 4, the intercept for the variable Allday, 15.90, is
statistically significant \( (p<0.01) \), indicating that all-day children’s reading scores were 15.90 points higher than those of half-day children during the first term of their kindergarten year. The coefficient for the growth rate of \textit{AllDay} \( (1.87, p<0.01) \) was also significant, indicating that all-day children raised their reading scores 1.87 points faster than did half-day children.

We also paid attention to the effects of teacher reading activities on children’s performances in kindergarten classrooms. We observed a significant positive effect of teacher reading activities for both all-day and half-day kindergarten children \( (\text{coefficient}=1.11, p<0.01) \). In other words, when kindergarten teachers increased reading activities, children in both all-day and half-day kindergarten demonstrated high performance, although we did not observe a significantly different effect for all-day kindergarten.

We noted the significant effects of three other demographic variables: the SES effect on the reading performance of children was significant in both all-day and half-day kindergarten \( (\text{coefficient}=3.99, p<0.05) \), with high SES children having higher performance than low SES children; the gender effect was also significant \( (\text{coefficient}=2.32, p<0.01) \), with girls having higher reading scores than boys in both all-day and half-day kindergarten; and age had a positive effect during kindergarten \( (\text{coefficient}=1.33, p<0.01) \), but showed a negative growth rate \( (\text{coefficient}=-0.23, p<0.01) \). That is, older children showed higher reading scores in kindergarten, but they tended to increase their scores more slowly than did younger children.

Maths scores: The results of the study showed that the effect of all-day kindergarten on the maths performance of children was similar to that on the reading performance. All-day kindergarten children scored 9.71 points higher in maths performance at the beginning of the kindergarten year, and increased 1.26 points faster compared with their half-day counterparts.

Contrary to our expectation, the teacher activities in maths classes showed no significant effect on children’s maths performance. When we analysed teacher activities in mathematics, teachers in all-day kindergarten presented significantly more activities related to mathematics.

The effects of SES, gender and age on maths performance showed similar patterns to those we

### Table 3. Mean differences of teacher activities in half-day and all-day kindergartens

<table>
<thead>
<tr>
<th>Activity</th>
<th>Half-day</th>
<th>All-day</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Reading activities</td>
<td>8295</td>
<td>3.92</td>
<td>.555</td>
</tr>
<tr>
<td>Maths activities</td>
<td>8225</td>
<td>3.52</td>
<td>.583</td>
</tr>
</tbody>
</table>

Note: * \( p<0.05 \), ** \( p<0.01 \)

### Table 4. Estimates of Reading and Maths IRT Scores from HLM Analyses

<table>
<thead>
<tr>
<th></th>
<th>Reading Score</th>
<th>Math Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
</tr>
<tr>
<td>Intercept</td>
<td>-72.65**</td>
<td>1.84</td>
</tr>
<tr>
<td>All-Day</td>
<td>15.90**</td>
<td>2.44</td>
</tr>
<tr>
<td>SES</td>
<td>3.99**</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>0.19</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>-0.25</td>
<td>0.29</td>
</tr>
<tr>
<td>Reading Activity</td>
<td>1.11**</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>-0.14</td>
<td>0.33</td>
</tr>
<tr>
<td>Growth Rate</td>
<td>4.44**</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>1.87**</td>
<td>0.31</td>
</tr>
<tr>
<td>Age</td>
<td>1.33**</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>-0.23**</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note: * \( p<0.05 \), ** \( p<0.01 \)
noted with children’s reading performance: higher SES children (coefficient=3.52, p<0.01) and female children (coefficient=0.32, p<0.01) had higher performance; and older children showed higher performance in kindergarten (coefficient=0.89, p<0.01), but displayed a low growth rate (coefficient=-0.15, p<0.01).

Conclusion and discussion

In this study we examined the long-term effect of all-day kindergarten on children's academic performance in reading and mathematics. The most important finding of this study was the positive significant effect of all-day kindergarten. All-day kindergarten children began with significantly higher scores and higher growth rates in both reading and mathematics compared with their half-day counterparts. Not only did the all-day children begin with significantly higher scores in both maths and reading but they also maintained a higher level of achievement than did half-day students until first grade. Therefore the study results suggest an important implication for potential benefits of all-day programs. The findings confirm that attending an all-day kindergarten facilitates the early achievement of children who are preparing for the transition to formal schooling, and in this sense the results are consistent with those obtained in previous studies (Chmelynski, 1998; da Costa & Bell, 2000; Fusaro, 1997; Wang & Johnstone, 1999).

Another finding of our study is that teachers of all-day kindergarten offered more activities relating to reading and mathematics. Our results confirmed the previous research findings (Cryan et al., 1992; da Costa & Bell, 2001). The teachers in all-day kindergarten were, on average, able to spend the additional hours on more subject-related activities. In promoting reading skills, all-day teachers had more time for letters, vocabulary, stories, journal-writing and plays. In teaching mathematics, all-day teachers had more time for manipulatives, music/movement for maths, measuring instruments, calendars, maths textbooks and group activities. The study found that the more frequent reading activities in all-day kindergarten were directly related to students’ high reading performance. However, the more frequent maths activities were not associated with high maths scores.

In reporting these findings, it is important to acknowledge some limitations of the study. Although this study found positive effects of all-day kindergarten on the performance of children from kindergarten to the first grade, it is difficult to fully isolate the effects of kindergarten program type without controlling for other social and school factors. Because this study is not an experimental study in which random assignment makes it possible to estimate causal–effect relationships, the direct causal–effect link between the kindergarten program and student achievement levels should not be inferred. It is important to note that there may be many other social and non-academic advantages of all-day kindergarten not considered in this study. We believe that more studies are needed, focusing on the ethnic, cultural and home backgrounds of children when considering the effect of kindergarten program type. Future studies would provide more comprehensive results if such factors as location (urban versus rural), average income level and minority ratio were also taken into account. Most importantly, quality of all-day kindergarten programs should be considered in future studies. The quality of the extended hours, the use of developmentally-appropriate curriculum, and the interaction between teachers and children should be investigated when comparing half-day and all-day programs. For example, it is important to compare the effects of children's play with the effects of curricular activities in kindergarten. Having enough time to play is critically important for young children's optimal growth, learning and development (Isenberg & Quisenberry, 2002; Jalongo, 2003). When child-initiated and teacher-supported play serves as the primary context in the early school setting as kindergarten, children's learning is expected to be developmentally appropriate (Hanline, 1997).

In summary, this study contributes to a better understanding of all-day kindergarten by providing a broad picture of the outcomes. The practical implications include a clarification of prior research results and the establishment of a firmer foundation on which educational policymakers can base their decisions about all-day kindergarten programs.

References


Measuring what students entering school know and can do: PIPS Australia 2006–2007

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Irene Styles
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This paper reports analysis of 2006–2007 on-entry assessment data from the Performance Indicators in Primary Schools Baseline Assessment (PIPS-BLA) of random samples of students in England, Scotland, New Zealand and Australia. The analysis aimed, first, to investigate the validity and reliability of that instrument across countries and sexes; and, second, to investigate what students know and can do the year before they start formal schooling. Data was analysed using the Rasch measurement model and interactive software (RUMM2020). Results indicated that three scales, Reading, Vocabulary and Mathematics, represent (with the exception of very few items) single variables which have the same meaning across all four countries and both sexes. The three scales may also be combined and regarded as a single measure at a higher level of scale. Developmental trends for children starting school were similar for all four countries.

Introduction

The first years of formal schooling are recognised as being the most important in terms of student development (Arthur, Beecher, Dockett, Farmer & Death, 2005; Louden et al., 2005; Rouse & Fantuzzo, 2006). Providing appropriate programs that cater for the needs of students when they enter school is therefore a key concern for those responsible for education at system, school and classroom levels. However, identifying what students know and can do as they enter school presents challenges for system personnel, school leaders and teachers. On the one hand, classroom teachers have long experience of dealing with students entering school, and they are accustomed to the demands of this age group. On the other hand, accountability pressures on schools and systems of national assessment programs to ensure that all students are adequately catered for have heightened awareness that the variability of what students come to school knowing and being able to do may be underestimated. Furthermore, resistance to national assessment programs experienced by some teachers of middle primary secondary years (Wildy, 2003, 2004) is, in some jurisdictions, heightened in the early childhood years.

Possible sensitivity about assessment in the early years is linked to a number of issues, including formal versus informal assessment, objective vs subjective assessment, and the use of local vs imported assessments. Teachers distinguish between informal and formal assessment: the former is part of their everyday practice; the latter is sometimes viewed as being externally imposed to provide information for making judgements about their program effectiveness. Distinction can be made about relatively subjective and relatively objective assessments: the former are based on the teachers’ professional knowledge and experience; the latter are made independently of the teacher. Further, there is sometimes a preference for locally developed assessments over those developed elsewhere because of the relevance of items to local students.

This paper examines one formal, objective assessment program—Performance Indicators in Primary Schools (PIPS) Baseline Assessment (BLA)—used internationally and increasingly in Australia to find out what students entering school know and can do. PIPS-BLA (Tymms, 1999) is one of a suite of assessments developed by the Curriculum Evaluation Management (CEM) Centre of Durham University (www.cemcentre.org). PIPS-BLA was introduced to educational authorities and individual schools across Australia in 2001 by Helen Wildy. The PIPS Australia website contains relevant information and can be accessed at www.education.murdoch.edu.au/pips.
The paper has two sections: the first focuses on the assessment instrument and its properties; the second presents outcomes of the application of the assessment instrument in England, Scotland, New Zealand and Australia.

**PIPS Baseline Assessment**

The PIPS-BLA is a computer-adaptive interactive assessment administered to students within the first few weeks of their starting the year prior to Year 1 in primary school. The assessment is administered a second time towards the end of that year. (Note that the somewhat cumbersome terminology ‘the year prior to Year 1’ is used throughout this paper and also throughout all PIPS Australia documents. Australian states and territories use a variety of terms to refer to this year: for example, ‘Pre-Primary’, is used in Western Australia.)

The assessment consists of four measures: Reading, Mathematics, Vocabulary and Phonological Awareness. Together these predict level of success at school in the early years (Tymms, 1999) and more recent evidence shows good predictive validity up to the end of primary education (Tymms, Merrell, Henderson, Albone & Jones, 2007). The four scales comprise four sets of items:

**Reading**
- Ideas about print.
- Letter identification (fixed order of upper and lower case letters).
- Word recognition and reading (words that occur with high frequency in most reading schemes).

**Mathematics**
- Ideas about mathematics.
- Counting and numerosity (student asked to count number of objects and repeat the number when picture has disappeared from the screen).
- Sums (addition and subtraction problems without the use of symbols).
- Shape identification.
- Digit identification (one, two and three digits).
- Maths problems (including sums with symbols).

**Vocabulary**
- Identification of named objects within a series of pictures.

**Phonological awareness**
- Repeating words (student hears a word and is asked to repeat it).
- Rhyming words (student chooses a word from three options, to rhyme with the target word).

Items are presented on computer to each student individually in expected order of increasing difficulty within a picture and, in some cases, across a set of pictures, and any particular scale is deemed completed when the student responds with incorrect answers to either three consecutive items or four items in a screen. At both the start and end of the year, students attempt new items until the difficulty of the items exceeds their ability to complete them correctly. However, at the end of the year students enter the assessment at the point slightly behind the point that they reached earlier in the year.

Schools are provided with feedback, showing raw and standardised scores for Reading, Mathematics and Phonological Awareness, as well as representations of the data as Box and Whisker plots, composite bar charts showing achievement, and line graphs and scatterplots showing progress.

Studies have shown the four scales to be internally reliable with Cronbach’s alphas of 0.95, 0.93 0.86 and 0.86 for Reading, Mathematics, Vocabulary and Phonological Awareness, respectively (Merrell & Tymms, 2007). More importantly, Reading and Mathematics have similarly high test–retest reliabilities. Vocabulary is a little lower (0.74) and Phonological Awareness is lower still (0.52). Because of several issues concerning the Phonological Awareness scale in terms of its reliability and purpose, the analyses reported here focus on only three of the four scales, Reading, Mathematics and Vocabulary. This decision is similar to that taken by Merrell and Tymms (2007).

**Research questions**

For this paper we identified three questions, similar to the questions posed by Merrell and Tymms (2007) and Tymms, Merrell and Jones (2004) in their study of similar data from 2002–2003 analysed by different software. The first relates to the assessment instrument and the second two relate to applications of the instrument:

- Do the three scales represent the same constructs for each of the four countries: England, Scotland, New Zealand and Australia? If the answer is yes, scores from the four countries may be compared. However, if the answer is no, the variables would represent different constructs, and the scores should not be compared.
- What is the cognitive performance of students starting the year prior to Year 1 in the four countries and particularly in Australia?
- Do students starting the year prior to Year 1 in England, Scotland, New Zealand and Australia have the same age-related performance?

We randomly selected samples of 1000 students from 2006–2007 start of year data sets from each of England,
Scotland, New Zealand and Australia. Since use of PIPS- BLA is not universal in each country, samples do not represent all students in each country. Students in England and Scotland begin the school year in August/September; students in Australia and New Zealand begin their school year in February.

The data was analysed using the Rasch measurement model for dichotomous data (Andrich, 1988, 1989; Rasch, 1960/80; Wright, 1999). The Rasch model is used to establish the internal consistency and reliability of scales in a wide range of disciplines in the social science and medical fields. This analysis allows items to be ordered from easiest to most difficult, where items above zero are relatively more difficult than items below zero. The unit of measurement is the logit. The first step in the analysis was to address the question of whether each scale may be accepted as constituting a single variable. The second step was to establish whether the items measure the same construct in each country. For the second step we used the Differential Item Functioning (DIF) facility available in the computer software used for the analysis, RUMM2020 (Andrich, Sheridan & Luo, 2005). A major advantage of the software is the interactive nature of its presentation, which is consistent with the need to consider multiple indicators of the fit of the data to the Rasch model. No one statistic is necessary or sufficient to establish the quality of the variable being scrutinised. The software provides a range of indices at different levels of diagnosis of the psychometric properties of the scales and the persons assessed. Using these, it is possible to examine the characteristics of sets of items as well as individual items, and groups of people as well as individuals (Andrich et al., 2005).

For some purposes, more useful information may be provided from a summary of performance on all three scales, rather than on each scale separately. Hence, the question of whether the combined sets of items may also be considered to constitute a single variable at that (higher-order) level of scale was addressed by combining all items from all four countries and re-analysing the data, again using the RUMM software. These analyses are described in turn and the results reported in the next sections.

**Analysis and results**

**Psychometric properties of the PIPS-BLA**

**Question 1:** Do the three scales represent the same constructs for each of the four countries: England, Scotland, New Zealand and Australia?

Using data combined from all four countries, each of the three scales for Vocabulary, Reading and Mathematics were run separately and the fit of each set of items to the Rasch model was evaluated using five criteria (two statistical tests of fit to the model, graphical fit to the model, targeting of the items to the persons, and, last, the reliability). It is the picture formed from the combination of these criteria that is evaluated (Andrich, 1988; Andrich & Styles, 2004). If an item is shown not to fit the model, then the item may be omitted because it is not measuring the same variable as the rest of the items. However, account is also taken of other considerations, as we illustrate below.

The analyses indicated that, overall, the fit of each of the three sets of items (the three scales) to the Rasch model was acceptable. Note that, in the Rasch model, both over-discriminating and under-discriminating items are regarded as indicating problems of fit of items to the model (Andrich, 1988). The performance of an item is represented using the Item Characteristic Curve (ICC). An item showing under-discrimination is presented in Figure 1. The ICC compares the actual response patterns (dots) with the expected response pattern (curves) for the item. The horizontal axis shows the range of respondents’ total scores (transformed into logits) divided into step intervals, with each dot corresponding to the mean total score for the persons in a particular step interval; the vertical axis shows the probability of responding correctly given a particular total score.

Figure 1 shows the under-discriminating, though relatively easy, item from the Mathematics set (*Which container has the least water*) with little variation between actual values across the person’s total scores. This would not necessarily be a reason to omit the item; such items may be useful in setting students at ease, motivating them to continue, and enabling a degree of success for less able students.

The worst-fitting items in each scale are listed in Table 1, together with each scale’s reliability statistic—the Person Separation Index (PSI) (the equivalent of Cronbach’s alpha).

The procedure followed was to check all the criteria mentioned above and to eliminate items that do not fit the model one at a time until the reliability coefficient (Person Separation Index) decreased rather than increased. An increase in the PSI would indicate that the item that had just been eliminated had been acting against the rest of the items in the set; a decrease would indicate the item had been contributing usefully to the scale. The fit of the
then worst-fitting item was again checked graphically and a decision made as to whether it should remain in the final set. This procedure resulted in the elimination of one item from the Reading scale (Write name); three from the Mathematics scale (Least water, Shortest person, Hexagon); and none from the Vocabulary scale.

The reliability coefficients for all three scales are high, though not quite as high as those reported by Merrell and Tymms (2007) for the 2002–03 samples. The lowest reliability we found was that for the Vocabulary scale. The Vocabulary scale’s coefficient may not be as high as the coefficients for Reading and Mathematics scales because of the uneven spread of item difficulties relative to students. Ideally, items would be evenly spread across the spread of persons (that is, items and persons would be well-targeted to each other). However, patterns in the distribution of persons and items shown in Figure 2 indicate that persons at the high end of the scale are not targeted well—there are only two items at their level. This scale would benefit from the inclusion of items designed to fill in the gaps in the spread of items (around -1 logit, corresponding to the words knife, pan; and 0 to 0.5 logits corresponding to the words windmill, violin), and from 3 logits upwards corresponding to the words at least as difficult as microscope, yacht.

The distributions for the remaining scales, Reading and Mathematics, are shown in Figure 3 and Figure 4, respectively. Figure 3 indicates that more difficult items for Reading should be developed if students are to be tracked across time. At present, the most able students are not being measured as reliably as the rest of the cohort. The same is true for some of the least able students—there are no items targeted at their locations on the continuum. This would account for the slightly lower PSI for Reading compared with Mathematics. Figure 5 shows that Mathematics is the most difficult set of items for this cohort of students—it is well-targeted except for a small group of the least able students.

Having established that the three scales are measuring a similar variable (that they have similar construct validity, and that the measures are reliable), the Item Characteristic Curve of each item in each measure was checked to ascertain whether it showed Differential Item Functioning (DIF) according to country or sex. This procedure indicates whether, given the same total score on the measure, students from different countries (or different sexes) have a similar likelihood of scoring the same as each other on each item. Total scores are divided into a chosen number of step-intervals from lowest to highest scores, and expected and actual mean scores for each country (or sex) on each item are compared for each total score group. If the item has the same meaning across the groups, then the actual scores for each group would follow the expected curve. An example of the graphical representation of the DIF by country for one item (Vocab Wasp) is shown in Figure 5, where all groups of students in Scotland and England

### Table 1. Items showing number of items in each scale, worst-fit items, and Person Separation Indices (PSI) for each of three scales

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total number of items</th>
<th>Content of item</th>
<th>Level of item difficulty (std error)</th>
<th>Type of misfit</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>49</td>
<td>Write name</td>
<td>0.06 (0.02)</td>
<td>Low discrim</td>
<td>0.90</td>
</tr>
<tr>
<td>Mathematics</td>
<td>66</td>
<td>Least water</td>
<td>-1.87 (0.04)</td>
<td>Low discrim</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shortest</td>
<td>-2.92 (0.05)</td>
<td>Low discrim</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hexagon</td>
<td>-0.76 (0.04)</td>
<td>Low discrim</td>
<td></td>
</tr>
<tr>
<td>Vocabulary</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
found the item easier than did all groups of students in New Zealand and Australia.

Table 2 shows the occurrence of DIF items according to Country.

One may speculate about reasons for the DIF. Perhaps Wasp and Toadstool are terms more commonly used in the United Kingdom, whereas Yacht might be more familiar to antipodean students. However, we cannot suggest the reasons for DIF of the two Reading items c and Fullstop.

In a traditional approach to measurement, omitting items is the standard way of dealing with such differences, leading to reduction in both the reliability and validity of the measures. However, using the principles inherent in the Rasch model and, specifically, the item-split facility in the RUMM202 program, it is possible to separate DIF items into two or more items on the basis of whichever factor (country or sex, in this analysis) is showing DIF. This new procedure has been developed by Andrich and Hagquist (2004).

In the case of the Reading scale, item IAR53 Fullstop was split into two items— IAR53NZ (for the New Zealand sample) and IAR53Aust/Eng/Scot (for the Australia, England and Scotland samples). Each of the other Reading and Vocabulary items which showed DIF was similarly split into two items. The analyses were then rerun with the ‘new’ items in place of the DIF items. Items fitted the model satisfactorily and no further significant DIF was evident. For Vocabulary, the reliability (PSI) increased from 0.80 to 0.81, and for Reading, PSI remained at 0.90. In this way, the DIF is overcome without omitting items, the

---

**Table 2. Items showing DIF according to country**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Item showing DIF</th>
<th>Direction of DIF</th>
<th>Item location before splitting*</th>
<th>Item locations after splitting*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Letters c</td>
<td>Scot and Eng show higher scores than NZ and Aust across all person total score groups</td>
<td>-1.32 Eng/Scot = -1.97 NZ/Aust = -0.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ideas of print Fullstop</td>
<td>NZ shows higher scores than Aust and both show higher scores than Eng and Scot across all total score groups</td>
<td>1.35 Eng/Scot = 2.09 NZ/Aust = 0.84</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>No items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Vocab Wasp</td>
<td>Eng and Scot show higher scores than Aust and NZ across all total score groups</td>
<td>0.45 Eng/Scot = -1.15 NZ/Aust = 0.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vocab Toadstool</td>
<td>Eng and Scot show higher scores than Aust and NZ</td>
<td>2.42 Eng/Scot = 1.67 NZ/Aust = 2.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vocab Yacht</td>
<td>NZ and Aust show higher scores than Eng and Scot from the middle to the top end of the total score groups</td>
<td>3.62 Eng/Scot = 3.92 NZ/Aust = 2.89</td>
<td></td>
</tr>
</tbody>
</table>

*Note that these analyses will have different origins and hence the locations are relative to the 0 logit origins in separate analyses for each scale and for each split and non-split analysis within each scale. The differences in the relative item locations for the split items can, however, be compared directly since they come from the same analysis.

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Figure 4. Distribution of persons and items on the Mathematics scale

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Figure 5. Graph of Item Characteristic Curve (expected and actual scores) across the range of total scores for Vocab Wasp for each of four countries
reliability is maintained and even increased a little for one scale, and, in addition, more valid measures for students in the country categories or, in one scale, Sex categories, have been obtained (Andrich & Hagquist, 2004).

Having examined each item in each scale for DIF according to country, we then examined each item in each scale for DIF according to sex. Only one item was found to exhibit DIF and this is shown in Figure 6.

Table 3 shows the occurrence of DIF due to sex differences. Again, it is noted that DIF indicates the existence of higher scores being likely for students of one or other sex even though these students have the same total score on a particular measure.

The conclusion is that performance on these scales by country or by sex can be compared directly because the scales have been shown to have the same meaning (with the exception of a very few items) across all countries and both sexes. It has been demonstrated that the PIPS-BLA has similar construct validity for each of the four countries whose samples of data were used for this study. Our analysis indicates that PIPS-BLA is internationally applicable and not biased towards or against either sex.

We have shown that the three scales, separately, can be regarded as measuring the same constructs across all four countries. Hence, we are now able to combine all the data from all three scales and all four countries to establish whether the entire set of items can be considered a single variable for that level of scale. We can also establish the difficulties of the items relative to one another and relative to the distribution of the students’ scores on all items.

Overall, the items fitted the model adequately and the combined scale’s reliability coefficient (PSI) was 0.95. The items indicating the most misfit to the model are shown in Table 4. Note that one would expect five per cent of the items (in this case, five or six items) to misfit by chance alone. Eliminating one of these items at a time (in order of worst fit to the model) and inspecting the resultant

### Table 3. Items showing DIF according to sex

<table>
<thead>
<tr>
<th>Measure</th>
<th>DIF according to sex</th>
<th>Direction of DIF</th>
<th>Location before splitting</th>
<th>Locations after splitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Vocab, Jewellery</td>
<td>Girls have higher scores than boys across the whole range of total scores (N=1582 Total sample ~4000)</td>
<td>2.37</td>
<td>Girls = 1.50 Boys = 2.60</td>
</tr>
</tbody>
</table>

Table 4. Items showing misfit to the model and Person Separation Index for three scales combined

<table>
<thead>
<tr>
<th>Total number of items</th>
<th>Items showing misfit</th>
<th>Type of misfit</th>
<th>Item location (logits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>138</td>
<td>Least water*</td>
<td>Low Discrimination</td>
<td>-0.85</td>
</tr>
<tr>
<td></td>
<td>Wasp*</td>
<td>Low Discrimination</td>
<td>-0.75</td>
</tr>
<tr>
<td></td>
<td>Pigeon*</td>
<td>Low Discrimination</td>
<td>-0.57</td>
</tr>
<tr>
<td></td>
<td>Padlock*</td>
<td>Low Discrimination</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Write name</td>
<td>Low Discrimination</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Cat</td>
<td>Low Discrimination</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>High Discrimination</td>
<td>-2.20</td>
</tr>
<tr>
<td></td>
<td>House</td>
<td>High Discrimination</td>
<td>1.22</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Low Discrimination</td>
<td>-2.41</td>
</tr>
</tbody>
</table>

*items omitted from analysis

### Table 5. Means (standard deviations), F statistics and probability levels for the three scales, separately and combined, by sex (n[boys]=2041; N[girls]=1900: df=1.4)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Means (Std Dev) (in logits)</th>
<th>F statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Girls: 0.24 (1.79) Boys: -0.06 (1.78)</td>
<td>29.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Girls: -0.79 (1.69) Boys: -0.82 (1.94)</td>
<td>0.30</td>
<td>0.59</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Girls: 1.46 (1.66) Boys: 1.21 (1.79)</td>
<td>20.20</td>
<td>0.00</td>
</tr>
<tr>
<td>Combined scales</td>
<td>Girls: 0.33 (1.34) Boys: 0.14 (1.41)</td>
<td>18.40</td>
<td>0.00</td>
</tr>
</tbody>
</table>
tests of fit, ICCs and the PSI, four items were omitted because, taken as a whole, evidence indicated they were acting against the combined Reading, Mathematics and Vocabulary variable. After elimination, the PSI remained at 0.95. At this stage, the remaining items were accepted as forming a single variable at this level of scale.

We have established that the PIPS-BLA is as appropriate an assessment instrument for students in Australia as it is for students in England, Scotland and New Zealand. Further, we have shown that the items form a valid and reliable measure of the cognitive performance of students entering school in all four countries. We now proceed to the second part of the analysis to examine two applications of the instrument: first, to show what students entering primary school know and can do; and, second, to establish whether there are differences in the development of students in each country related to the age they start school.

**Applying the PIPS-BLA**

Question 2: What is the cognitive performance of students starting the year prior to Year 1 in the four countries and particularly in Australia?

Figure 7 shows the distribution of the students (four countries combined) relative to the distribution of the items. (Items and persons are scaled on the same continuum and locations on this continuum are given in logits.)

The mean for the entire sample was 0.23 logits with a standard deviation of 1.38. This indicates that the average-performing student is likely to have a 50 per cent chance of success with items located at that mean location on the scale, to have an increasingly greater chance of being successful on items located below that mean, and to having increasingly less chance of being successful with items located above that mean. The items are well-targeted to the persons, with the exception of a few low-scoring students at whom no items are targeted (and thus they have not been measured as reliably as others in the sample). Importantly, the items that comprise the three scales (Reading, Mathematics and Vocabulary) are generally well spread across the range of item locations. There is, however, a slight clustering of Reading and Vocabulary items at the easier end of the continuum and a distinct clustering of Mathematics items at the more difficult end of the continuum. This is consistent with our analysis of the scales which generated Figures 2, 3 and 4, which indicated Mathematics comprised the most difficult ones, relative to the persons tested.

The difference between mean scores for girls and boys was statistically significant at less than a probability level of 0.01, with the girls’ mean score (and standard deviation) being 0.33 (1.34) and the boys’ mean score being 0.14 (1.41). Differences in mean scores for girls and boys on each of the three scales analysed separately, and on the combined scales, are presented in Table 5. Note that
These locations are relative to different sets of items with different 0 logit origins and thus the means for each of the variables cannot be compared directly.

Girls performed significantly better than boys, although differences were small, on Reading and Vocabulary. The mean difference on Mathematics was not significant. Girls showed less variability than boys on Mathematics and Vocabulary, but not on Reading where the variability was similar for both sexes. Other researchers have reported the tendency for boys to show more variability than girls do on a range of developmental measures (Andrich & Styles, 1994; Deary, Thorpe, Starr & Whalley, 2003; Hedges & Newell, 1995; Kagan & Moss, 1962; Maccoby, 1974).

We now focus on the Australian sample to report analyses for all items combined, and examine the types of items at different locations on the continuum. Following the procedures described above, one item (Vocab Pigeon) was eliminated from the analyses of the combined items, after which the fit of items to the model (using all the criteria mentioned earlier in the paper) was satisfactory with a PSI of 0.95. The mean score (standard deviation) on all items was 0.57 logits (1.34). This indicates that the average student in our sample of Australian students starting the year prior to Year 1 has about a 50 per cent chance of being successful on such items as recognition of the letter u, knowing where the start of a story is, being able to identify half of a number of objects, and being able to identify a padlock.

For the Australian data, the mean for boys was 0.48 logits (1.35) and for girls 0.65 logits (1.32), (F=4.19 [1,996], p=0.04), mirroring the result for all four countries except that the difference was significant at only a 0.05 level of probability.

As with the whole sample, Figure 8 indicates there are a few low-scoring students who are not targeted as well as the majority of the students. The next representation, Figure 9, shows the same distribution as shown in Figure 8 drawn on a vertical scale with a selection of items located at various points along the continuum.

So far we have described the cognitive performance on the three scales of students starting the year prior to Year 1 in England, Scotland, New Zealand and Australia. We have shown what these students are likely to know and be able to do in terms of items on the PIPS-BLA, that girls slightly outperform boys in Reading and Vocabulary, and that girls perform as well as boys in Mathematics. In particular we have shown what the Australian sample of students know and can do. Now we move to the third research question concerning age-related performance of students in each of the four countries.

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**Figure 10. Mean Reading scores for nine age groups and four countries.**

**Figure 11. Mean Mathematics scores for nine age groups and four countries.**

**Figure 12. Mean Vocabulary scores for nine age groups and four countries.**
Question 3: Do students starting the year prior to Year 1 in England, Scotland, New Zealand and Australia have the same age-related performance?

The four countries have different ages for students starting school. The mean scores for each age group by country were plotted for each of the three scales. The graphs in Figures 10, 11, and 12 show the developmental patterns across nine age groups for England, Scotland, New Zealand and Australia for Reading, Mathematics and Vocabulary, respectively. Means for age groups with very small numbers of students were removed from our analysis as they are not reliable indicators of the likely mean scores for those groups. These groups would include students who have begun school earlier than most of their peers in a particular country, and also students who are repeating a year or starting school later than most of their peers. Country by age group interactions were significant at p<0.05 for all three variables, hence age group and country statistical differences are not reported here.

Note the wide variation in entry age for Australian students: some start as young as 4.5 years and others start as old as 6.0 years. While the Australian students are not the youngest on entry in the four countries in this study, they certainly include the oldest students of the four countries, reflecting the wide variation in starting ages between states and territories.

In general, the age-related development of our sample of students from all four countries is very similar and follows the trends found by Merrell and Tymms (2007) when they examined 2002–2003 data from the same four countries. However, we note some anomalies. The first of these is in Reading where New Zealand students perform relatively higher than their similarly-aged peers in the other three countries. However, the performance of these same students on Vocabulary appears to decrease slightly with starting age in comparison with their peers in the other countries. Scotland shows relatively higher performance in Vocabulary than similarly aged students in the other three countries, but their performance in Reading seems to be lower than that of students in other countries in age groups across 5 to 5.5 years.

Further investigation is needed to make sense of the downward sloping Vocabulary scores for the New Zealand sample. We are also curious about the unexpectedly high Scotland scores. In Merrell and Tymms’ (2007) analyses for earlier data, the difference between Scotland and the other countries on Vocabulary was relatively smaller than it appears in our analysis.

Three points emerge from these representations. First, performance is age-sensitive for students who are approaching the start of their formal schooling. Without the influence of formal schooling, students’ cognitive performance improves as they grow. At this stage of their lives older students know more and can do more difficult tasks than younger students, even by a matter of a few months. Second, within the cohort of students who are approaching the beginning of formal schooling, even without the classroom experience, there is a wide range of cognitive performance. Students vary quite dramatically in what they know and can do, even before their formal schooling starts. Third, what students know and can do is able to be measured by the PIPS-BLA regardless of the age students enter the year prior to the start of formal schooling.

Conclusions

There is no doubt that the PIPS-BLA is a robust instrument. Our use of the Rasch measurement model showed that the three scales, Reading, Mathematics and Vocabulary, can be viewed as comprising a single variable at one level of scale. We might call this variable Readiness for school, a term commonly used in the literature (for example, La Paro & Pianta, 2000). We examined the ways the items functioned across the four samples from England, Scotland, New Zealand and Australia, and between sexes. From this analysis, we found that a very small number (6) of the total 138 items worked in different ways. We could explain why four of these (Wasp, Toadstool, Yacht, Jewellery) worked differently but were mystified why others, such as recognising a fullstop or the letter c, were less difficult in England and Scotland than in New Zealand and Australia. However, we do not recommend removing these differently functioning items because the model and the computer software we used (RUMM2020) allowed each differently functioning item to be replaced by new split items, thereby maintaining or even improving the reliability and validity of the measure of student performance.

In our analysis of the combined scales across the data from all four countries, we also examined the extent to which the items fit the model. We found nine items that either under-discriminated or over-discriminated. Four of these were removed from subsequent analyses because, based on several pieces of evidence, they acted against the variable Readiness for school. However, at this stage, we do not suggest that any of these items be removed or changed permanently. Consideration to drop items would involve practical matters such as whether we would want to shorten the assessment, or whether there were other items at the same level of difficulty. Our next task is to replicate these analyses to investigate the robustness within the Australian data, between states and territories. Such analyses may reveal other items that might not fit the model or that might operate differently across states and territories and these would need to be considered in any decision to remove items from the PIPS-BLA.

Notwithstanding these findings, we conclude that the psychometric properties of the instrument are sound. Our analyses incorporating the changes show that the items form a valid and reliable measure of cognitive performance.
at the start of the year prior to Year 1 for our samples of students from England, Scotland, New Zealand and Australia.

Having established the robustness of the PIPS-BLA we described its use for finding out what students at this stage of development know and can do, and how this age-related knowledge and skill varies between the four countries and between boys and girls. Our findings here show similar trends to those of Merrell and Tymms using similar data five years ago. Significantly, for an Australian audience, the performance of our students at each age is similar to the performance of students in the other three countries, except for the students from Scotland who outperformed all students on Vocabulary. We noted, too, that girls outperformed boys in Reading and Vocabulary and were on a par with boys for Mathematics. Subsequent analyses will be conducted to examine age-related performance differences across Australian states and territories and for subgroups of students in these jurisdictions. We will continue our analyses using two new data sets. We will examine the Western Australian PIPS-BLA data from 2004 for which we have matched performance data on Reading and Numeracy scores from the Western Australian Literacy and Numeracy Assessment (WALNA) for the same students in Year 3 in 2007.

Acknowledgements

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We also acknowledge the contribution of Professor David Andrich of The University of Western Australia.

References


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Learning a music instrument in early childhood: What can we learn from professional musicians’ childhood memories?

Wyverne Smith
Murray School of Education, Charles Sturt University

PROFESSIONAL EARLY CHILDHOOD educators are often asked for advice about whether or when a young child should learn to play a music instrument. Many educators who do not have a background in music education may not be confident in providing such advice. A range of overseas research has supported learning a music instrument in the early childhood years, noting the importance of parental support. This research project investigated the effects, especially emotional, on children’s lives of adding instrumental music lessons to their general education, using the strategy of surveying professional musicians about their childhood experiences. Of the 46 professionals surveyed, all but two reported that the addition of music lessons to their general education had improved their enjoyment of childhood. Implications for early childhood professionals and teacher educators are also considered.

Background

EARLY CHILDHOOD EDUCATION is often the site for conflicting views on the importance of early learning. On the one hand, there are suggestions that children need to start learning specialised skills early, in order to attain mastery status in later years. On the other hand, there are recommendations that young children not be introduced to formal instruction in the early years, as so much of their learning is play-based (Elkind, 1982). As a teacher of piano to young children, my own experience reflects positively on the active involvement of young children in learning to play an instrument. However, it is also the case that both parents and children have noted that this experience can produce stress. To consider the potential stress involved and to reflect on the role of family and teachers, this study investigated the experiences of people who had successfully learned to play a music instrument during their early childhood years.

In the past 10 years, there has been a considerable amount of research related to children’s learning to play a music instrument. Previous research has investigated areas such as the benefits of learning a music instrument (Rauscher et al., 1997; Schellenberg, 2004), the age of starting to play a music instrument (Jorgensen, 2001), and the involvement of parents in the process (Creech & Hallam, 2003; Davidson, Howe, & Sloboda, 1995; McPherson & Davidson, 2002). Also researched were the reasons parents enrolled their children in music lessons (Yun Dai & Schader, 2001) and the connection between practice and success (McPherson, 2001; McPherson & Renwick, 2001). However, little has been written on the impact of learning a music instrument on early childhood (defined as birth–eight years) experiences.

This project sought data from professional musicians about their childhood experiences of learning an instrument, particularly relating to parental involvement, and their perceptions about whether or not practising an instrument hindered their enjoyment of childhood. In the telling of their stories, other details of their music life were discussed, such as the age they began lessons, the instruments they played, the reasons for the choice of instrument and teacher, and the number of family members who played instruments. In addition, the musicians were asked about their memories of their early years at school and the role their teachers had in their music learning.

Benefits of learning to play an instrument

There is an abundance of information about the positive benefits of music lessons for children. For example, in
their study known as the Mozart effect (Rauscher, Shaw & Ky, 1993, cited in Rauscher, 2003), the researchers claimed that music had a positive effect on the brain. Schellenberg (2004, p. 320) also concluded that ‘music listening and music lessons can lead to short-term and long-term cognitive benefits’. The strongest benefits were reported to come from music instruction rather than listening to music (Rauscher & Hinton, 2006).

Teachers and researchers make strong claims for the benefits of learning a music instrument. One Suzuki violin teacher and teacher trainer at Oberlin Conservatory of Music, US noted that in her experience:

> most children who study music deeply eventually become more confident, more sensitive individuals and they are usually better listeners. Often, they are leaders in other areas, and they almost universally do well in other subjects at school (Costa-Giomi, Price, Rauscher, Schmidt, Shackford & Sims, 1999, p. 31).

Stewart (2007, p. 1) cautioned that music students often come from privileged homes where parents are ‘actively involved in their children’s education’. Stewart (2007) notes that music tuition has value outside of music itself but reminded us that ‘music’s intrinsic values are second to none. We teach a language that begins where all other languages end. Music has the ability to express every nuanced emotion of the human experience’ (p. 4). Costa-Giomi et al. (1999, p. 32) conclude that ‘It’s clear that music study at any age can increase the quality of life, and those who teach it are handing present and future generations a gift whose value is only beginning to be understood.’

A range of research and experiences suggests that it is appropriate for children to begin music lessons at an early age. It is well-known that many famous composers/musicians began lessons as young children, Mozart and Mendelssohn to name two. Jorgensen (2001) concluded from his research on a group of Norwegian conservatorium students that those who had obtained the highest grades had started learning the instrument earliest. Consequently his advice to parents was ‘if you have ambitions for a professional career for your child ... start as early as possible ... If you simply want your child to have a rich life and desire to take care of and nurture their expressive potential, they will also benefit by an early start’ (p. 238).

Jorgensen also suggested that it takes up to 10 years to develop expertise (Jorgenson, 2001, p. 235). Adolescents have difficulty coping with extra-curricular learning because of the many stresses in their lives (Sprenger, 2005), so an early start helps develop considerable competence before adolescence.

McPherson and Davidson state that, in relation to private instrumental tuition, ‘within reason, the adage “earlier the better” is probably appropriate as a general guide to when children should start learning an instrument’ (McPherson & Davidson, 2006, p. 331). They describe (pp. 346-347) age-related learning principles that include learning to play by rote as distinct from learning to read the music; rich, varied experiences within the lesson; inventing their own notation; and learning to play songs they can already sing.

The Suzuki Method promotes learning by rote and the delay of music literacy, but creativity is not regarded as important at an early age ‘when there is nothing with which to be creative’ (Beegle, 1999, p. 74). Suzuki teachers believe that children need to learn some music skills in order to be creative. Other methods use a ‘pre-reading’ step which promotes music literacy in the early years. Bastien, an American piano teacher and publisher, wrote that ‘the student who has been exposed to a period of pre-reading ... will be more likely to comprehend the complexities of the staff when it is presented’ (Bastien, 1977, p.155). This method uses large music notes that go up and down on the page according to the melody but are not placed on lines and spaces. Children are also encouraged from the beginning to create their own songs. Many current tutorial books now use the Bastien pre-reading method. Most children’s tutorial books begin by using songs that children can already sing. The Kodály (Forrai, 1988) music method teaches music literacy and creativity through singing and games from a very early age.

Some instruments are more suitable for young children because of the size of the instrument and the technique required. Jorgensen (2001) indicates that piano, violin and recorder seem to be the most popular instruments for young children to learn. Their choices could be related to the child or parents’ perception of how easy the instruments are to play (McPherson & Davidson, 2002). Descant recorders are small, cheap and easily acquired. Violins are made in fractional sizes, as small as one-sixteenth of the full size. McPherson and Davidson (2006) also suggest that children have a view of themselves being successful on a particular instrument. Pianos are a well-known instrument, and the electronic keyboard popularised by modern singers is a less expensive and easily obtained option.

While studying the learning styles of pre-school violin students, Calissendorff (2006, p. 86) reported that the children said ‘playing had to be fun ... If it is easy, you don’t get tired’. Rife, Schnek, Lauby, and Lapidus (2001, p. 5) also found in their study of 568 young music students that they had to ‘have a good time at music lessons’. Calissendorff (2006, p. 93) has also indicated that the children needed to ‘like their teacher and to receive encouragement from their parents’. So, learning an instrument while still very young is widely promoted, but must be done in ways that are suitable for children.
The roles of family and early childhood teachers

Family

There is evidence that the success of young children's music lessons depends on parental involvement (Creech & Hallam, 2003). While the amount of practice is important, ‘the amount of time spent by parents in supervising home practice is even a better predictor of successful achievement in the initial stages of development’ (Brokaw, 1982, cited in Creech & Hallam, 2003, p. 32). In addition, Sloboda (1991) and Sosniak (1985, cited in Creech & Hallam, 2003, p. 32) state that the support and encouragement of parents who lacked formal knowledge was also acknowledged as helpful. Furthermore, Davidson, Howe and Sloboda (1995, cited in Creech & Hallam, 2003, p. 32) wrote that ‘without the positive involvement of parents in the process, the highest levels of achievement are likely to remain unattainable’.

However, there are several other factors to consider concerning family involvement that may determine success. The first is a mutual understanding between teacher and parent of the role that each plays in the instruction and supervision of music tuition with the young student. Second, parental contribution should complement the teacher’s encouragement and guidance. Parents need to understand the teacher’s instructions as well as allowing their child some independence (Pitt & Davidson, 2000). Other factors include the parents’ confidence in their role and their child’s ability to learn an instrument, the parents’ persistence and resilience, and agreement between the two parents about goals (Creech & Hallam, 2003).

When Yun Dai and Schader (2001) explored the reasons parents supported their child’s music training, they reported that the main reason given by the majority of parents (especially professional parents) was the belief that music lessons benefited their child personally, rather than because they believed the children should develop musical talent.

Music teachers

While parents have the added responsibility of selecting a suitable music teacher, the most important contribution instrumental teachers can make is to provide enjoyable lessons for children. Children who like their teacher and the music they are given to learn are more likely to continue music lessons (Rife et al., 2001).

A knowledge of how children learn is also important in an instrumental teacher, and this is not always the case when a performing musician decides to teach. According to McPherson (2005, p. 30), the chosen teacher needs to have ‘an understanding of what is going on in children’s minds when they perform.’

The teacher needs to encourage reflection by ‘asking students to explain how they are doing a task’ (p. 31).

Music concepts, like any other concepts, can be difficult to grasp. Teachers need to listen to children in order to understand their thinking strategies and, if necessary, be able to guide them to clearer understanding. McPherson (2005, pp. 31-32) reported that in his three-year longitudinal study of 7-9 year-olds learning a music instrument, the children who progressed effortlessly were those ‘who applied musically appropriate mental practice strategies early in their learning’. Barry and Hallam (2002, cited in McPherson, 2005, p. 28) stated ‘beginners are not always aware of where they are going wrong’. They need help to connect what they hear to what their fingers are doing, to isolate the problem and fix it.

McPherson (2005, p. 28) suggested that teachers need to help children to develop an ‘armoury of task-appropriate strategies’ that may be used during parent-supervised music practice. The strategies suggested fell into two categories: ‘organisational’, that included keeping a practice diary and practising difficult parts before enjoyment, and ‘improvement’—practising with persistence to improve and knowing how to correct their own mistakes (McPherson, 2005, p. 19).

Early childhood teachers.

Early childhood teachers have three roles in encouraging children to play a music instrument. First, they need to be able to advise parents of suitable extra-curricular lessons, of which music is only one of the many available. Olson and Hyson (2005, p. 67) stated ‘we should do a better job communicating our role as reliable, credible sources of information and support’.

Second, teachers in early childhood settings need to provide a holistic music environment and a developmentally appropriate music program for children. Wright (1991, p.158) suggested that each early childhood centre should have a wide variety of music instruments, including piano, guitar, banjo, violins and trumpet, and a range of multicultural percussion instruments. Wright (1991, pp. 141-142) put these instruments in a context of exploration and enjoyment for a ‘child-centred approach’ and suggested that children explore sound in a variety of ways, including:

1. Manipulating objects
2. Imitating sounds, discriminating between sounds
3. Classifying sounds
4. Sequencing sounds
5. Improvising with instruments

Family

Music teachers

Early childhood teachers.

Australian Journal of Early Childhood
Encouragement of musical creativity is the third role of early childhood teachers. 'If children's efforts are encouraged, they may continue to create their own music beyond the age when they usually become self-conscious and stop doing so' (MENC Adviser, 2006, p. 65). Kenney (2007, p. 31) stressed the importance of children being permitted to explore sound and to compose, with their efforts recorded by adults. Kenney supported the MENC Adviser's call for the urgency of giving children opportunities for creativity when she said, 'Maybe the reason Western culture thinks that only a few gifted people can become composers is that we lose most of our composers before they turn eight' (p. 31). Barrett (2005) has also researched widely in the area of music creativity in early childhood, exploring ways that children compose and record their composition with invented notation. Upitis (2000, p.16) suggested that just as language is learned by immersion in a rich language environment, so too is music. She adds that this rich music environment 'would include adult musicians who could model and encourage playfulness with music'.

Research by Artan and Balat (2003) reported that, when children aged between four and six years were asked 'What is music?', they replied, 'Playing a music instrument.' Since it could be presumed that the most common musical activity for young children at home, in the car and at school would be listening to CDs or singing, this response is surprising. Furthermore, they cited Bjorkvold's argument that 'musical instruments are fundamental for children: if they cannot find the real musical instrument, they create their own' (Bjorkvold, 1992, cited in Artan & Balat, 2003, p. 360).

Early childhood teachers may be well-placed to provide all the creative opportunities already discussed. These opportunities and others may provide the foundations for sound music education experiences and motivate children to develop more advanced skills. However, according to Andress (n.d., cited in Ponick, 1999, p. 32), teacher education courses need to 'empower these teachers and care-providers to present quality music experiences to their charges'.

It is acknowledged that there are two sides to the story of music in peoples' lives—the stories of those who reached a confident stage in their music skills and the stories of those who gave up prematurely. Finding those who were 'lost' would be an interesting and worthwhile second step to more enlightenment about the place of instrumental music in children's lives. However, this project is the first step, seeking knowledge through the experiences of competent musicians.

Method

Selection of participants

This research project used a combination of quantitative and qualitative methods, studying a non-random sample. There were 46 participants in all. Thirty-nine of them were members of an international orchestra, based in Malaysia. This orchestra provided convenient access to musicians from a variety of nationalities—with 13 nationalities represented in the group. Four participants were from an Australian symphony orchestra, and three were teachers from a music conservatorium in regional New South Wales.

Written questionnaires, designed by the author, were based on aspects of early learning such as reasons for choice of instrument and teacher, attitudes to lessons and practice, and parental support. The questionnaires were trialled with an Australian member of the Malaysian orchestra and that member's colleagues (Japanese, French/Canadian and Hungarian) for relevance and understanding by people whose first language was not English. The questionnaires were then distributed to more than 120 musicians, of whom 46 (24 males and 22 females) responded. In addition, five of these 46 were interviewed in person. The survey questions relied on the memories of participants. ‘Memory work’ has been questioned as being unreliable as a research methodology (Ceci & Loftus, 1994, p. 362). However, Crawford, Kippax, Onyx, Gault and Benton (1992, p. 37) see its worth as enabling people to reflect and analyse their personal history. Norquay (1990) sees the importance of memory work in education because examining the memories can help to make changes in the way we support children's learning.

Many of the questions were 'tick the box' style or numbering, but space was also given for participants to add more if they wished. Calculations were made from the short answers to examine the commonalities and differences. As the participants were extremely busy, it was essential that the task was not onerous but that the opportunity was given for those who wished to elaborate. Informal interviews were held with each of the five volunteers from the Malaysian group at a coffee shop in close proximity to the orchestra's concert hall, and took between 20 and 30 minutes. The author designed the questions and conducted the interviews, individually addressing each participant's survey answers. Each participant talked enthusiastically about their childhood experiences.

With the decline in the number of orchestras in Australia and overseas and the intense competition for positions in the remaining orchestras, it is likely that only the more talented, persistent and confident musicians gain full-time orchestral positions (Bennett, 2005). It was hoped that the stories of these musicians might give some
insight into the early music experiences for children. The survey data focused on their memories of music and instrumental lessons in early childhood, including details of when they began lessons, the part their parents and teachers played in the music education and their feelings about practice.

Results

Thirty-three of the 46 musicians who responded began studying music when they were under nine years of age (Table 1). The average starting age was seven years four months, with the youngest being two years old. It is interesting to note that four of the youngest starters were Japanese who were taught by the Suzuki method and that six of the 11 under-five-years starters were taught by family members—five by their mother and one by an aunt. These family members were also professional music teachers. Twenty (43 per cent) participants started playing music before the age of seven. This is consistent with Jorgensen’s (2001) findings that successful musicians had started formal music lessons when they were young.

Of the 72 per cent (33) of participants who began instrumental lessons under the age of nine, only two now play their first instrument as career musicians. Their career instrument was more often the second or third they had studied. Piano and violin were the most popular first instruments. Nine musicians changed instruments twice before finding the one that suited them. One participant found success on his fourth instrument. He wrote that the clarinet ‘was going nowhere for me. As soon as I tried the trombone, everything worked well’.

Twenty musicians began on their first instrument because of availability, whereas they chose their next instrument because they ‘liked the sound’ or because of hero worship of a teacher or soloist. The cliché ‘the instrument chose me’ was used by more than one participant in surveys and interviews in an attempt to explain the unexplainable. The idea that certain instruments go with certain temperaments, suggested by Ben-Tovim and Boyd (1985), also seemed to be borne out in the stories of some participants. One participant changed from trumpet to tuba. He said that he liked the supportive role of the tuba rather than the trumpet, which he described as ‘everything out there ... always courageous’. Another wrote that ‘the school added timpani/percussion to the instrument menu at just the right time’. He had not excelled at either of the two instruments he had tried but the timpani suited his personality. One conclusion to be drawn from this is that it is important to consider a change of instrument if children retain their interest in music but seem to be not progressing with a particular instrument.

Schools played a valuable part in some participants’ lives. Thirteen mentioned school instrumental programs as the starting point for their lessons. Three of these were from Queensland primary schools, which are well-known for their extensive instrumental music program (Department of Education, Training and the Arts, 2008). The others were from eight different countries (Japan, the Netherlands, Ecuador, Romania, United Kingdom, Sweden, Canada and Hungary). In Australia, The

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National Review of School Music Education (Department of Education, Science and Training, 2005) recommended that schools should offer instrumental tuition to meet the needs of children (p. 20). This review showed promise for a much improved music education for all children, although de Vries (n.d.) lamented that the review did not mention music in early childhood. The Music Council of Australia and The Australian Society of Music Education have since begun a campaign to urge the various government bodies to act on the recommendations made in the review (Music Council of Australia, 2006).

Most (41) of the musicians wrote or spoke about the music they remember hearing as children (Table 2). Six of the participants grew up in church communities, of which one wrote ‘the kids and grown-ups were singing all the time’. A large number of participants (89 per cent) reported the sound of recorded music (CDs, radio and tapes) in the home. One musician said, ‘Classic FM radio was on all the time. I got to know standard classical repertoire without knowing I was absorbing it.’ Many had direct experiences of live classical music, including attending concerts or listening to parents and/or sibling(s) playing a music instrument. Only nine per cent (four) wrote they had no relatives who played instruments. The implication from this finding is that it is beneficial to immerse children in a rich music environment from an early age.

Several participants had memories (Table 2) of preschool teachers who were musically very creative and inspiring, but only nine attended specific pre-school music classes such as Kodály, Orff or Yamaha. Three of the nine grew up in Hungary, where the Kodály system originated. One Japanese musician completed a Yamaha class. Three attended Kodály classes in Australia, the United States and Japan. One Australian attended Yamaha classes. Preschool music classes are promoted in Australia today, but at the time the musicians were ‘pre-schoolers’ these classes may not have existed in their country of residence. These classes have always been expensive in Australia and therefore limited to those who can afford them.

All participants who began lessons early had parents who were closely involved in the lessons and practice (Table 3). Almost half of the participants (48 per cent), reported that it was their parent/s who initiated music lessons and chose their first instrument. Some participants were taught initially by a parent, and only one reported an unhappy relationship. Very few said their parents were not involved at all, except to pay for and drive them to lessons. Although two said their parents’ input was negative, they now, as adults, say they are grateful.

To an early childhood professional, initiating music lessons for children and the consequent organisation of daily practice might sound limiting of children’s choices. However, parents usually make considered serious choices for their young children. For example, parents choose to have their children taught to swim. If possible, they also select a kindergarten that has similar values or religion to their own. Parents also help their children with other routines such as cleaning teeth and even a bedtime story, both regarded as positive habits for children. Music lessons and practice can be just another decision, based on whether it is considered they will benefit a particular child.

While some researchers (Creech & Hallam, 2003) have looked closely at the ways parents have been involved in their children’s learning, this research project focused on the participants’ feelings about learning to play a music instrument in early childhood.

Although many participants reported that at times, and especially in the very early years (under eight), they did not like to practise, most did not think this discipline had affected their childhood in a negative way. Some of the comments were:

Male (30-40 years): Practising was a burden of sorts. But I’d have to say that, once I found a tutor that I loved, that gave me all the inspiration and motivation I needed.

Male (40-50 years): I would describe my childhood in highly positive terms.
Male (20-30 years): I think my childhood was pretty happy. I didn’t particularly enjoy practising, but it didn’t make me miserable.

Female (20-30 years): I would describe my childhood as happy. I loved my violin teacher.

Female (20-30 years): I had a very happy childhood surrounded by music.

Female (30-40 years): When I was a kid I just loved playing the violin. It was fun.

Half of the participants were ‘told to practise’ by parents, with one participant writing ‘at times “told” was far too mild a word’. Sixty-nine per cent of participants (32) actually liked to practise, although many used provisos such as ‘sometimes’ and ‘on a particular instrument but not another’. An important aim of this research was to explore the emotional effects of being made to practise. In two cases, the relationship with a parent seemed to be put at risk. The first, where the parent supervising was also the teacher, was described by the participant: ‘practice was unbearable ... my sister and I were quite fed up’. Because her parent was also the teacher, her daily practice was always a lesson. Nevertheless, during the interview, this participant said she now feels she owes her mother a lot because playing in the orchestra is a real joy. The second felt trapped into practice. ‘My father said, “If you really want, you can stop,” but I knew that if I did I would make him sad. I loved him so much that I couldn’t give up ... My parents should have discussed it with me.’

However, most participants (44) reported positive benefits. Some stated that music benefits the brain, echoing the conclusions of Rauscher (Costa-Giomi et al., 1999; Rauscher, 2003). Others talked about the improved quality of their life, as claimed by Shockford (n.d., cited in Costa-Giomi et al., 1999) who said, ‘It adds richness to your soul’.

Most (44) also reported that they liked their teacher. For some, their exceptional teachers provided the motivation to continue learning the instrument. Comments included: ‘He was funny and the lesson was fun ... it helped me to love music’; ‘Fantastic teacher! We are still in touch’; ‘The sweetest lady, an excellent teacher with gentle guidance and positive reinforcement’. Four reported that they had teachers they disliked, and as a result their parents soon found a new teacher. One participant did not like her teacher, who was the only teacher of that instrument in the town. She said her mother had asked her to try for a year, and that if she was still not happy she could give up. This participant said she was glad her mother had made her keep going because later, when another teacher was found, her instrument became her love and career.

The five participants who were also personally interviewed were asked whether they thought instrumental music lessons should be offered to all children, or only to those who seem talented. (Many of these musicians are parents themselves as well as being music instrument teachers.) The answers were very definite: ‘All children can learn and enjoy making music.’ All said parents should understand that for the first couple of years it is hard work, and that children need help and encouragement to keep up their practice. They noted that, on their own, most children do not have the maturity to be self-motivated and self-directed. The two participants (surveyed and interviewed) who had an ‘unhappy’ experience with learning to play an instrument in childhood said they would have their own children taught, but they would be careful about their children’s wellbeing. In particular, there would be family communication about the process.

The average age for participants in the questionnaire for deciding that music would be their career was 18, with only two stating that from early years it was ‘assumed’. This suggests that for the most part the parents’ and/or child’s purpose in beginning music lessons was something other than a career.

**Summary**

The majority of these professional musicians began their music lessons as young children, and their parents were closely involved with that learning process. They had memorable, close relationships with their music teachers. Although the musicians had spent considerable time practising their instrument during early childhood, often with a parent supervising, most described their childhood in positive terms. They added that the opportunities afforded them as they progressed, to interact with other young musicians in ensembles such as school bands, youth orchestras and music camps, gave them extra enjoyment. The two participants who had negative recollections about some aspect of their childhood regretted the lack of honest, open family communication about the music learning process. No participant felt that their hard work had not been fruitful; rather that, regardless of career, music had enriched their life.

**Further research**

In this research, only ‘successful’ musicians have been surveyed. How can we know about the people whose childhood experiences of the discipline of music study were so negative that they gave up or, as Austin, Renwick and McPherson (2006, p. 222) suggest, about the people who gave up because of their fixed belief that they do not have music ability? There is a need to research those who commenced learning a music instrument but gave up. Researching their memories of their experiences with instrumental music lessons might provide more insight.
into the wisdom of when and how to add instrumental music lessons to children’s education.

Implications

For parents
1. Immerse your child in a rich music environment at home.
2. Begin instrumental music instruction early.
3. Choose a teacher that young children like and one who makes music fun.
4. Ensure that a developmentally appropriate method of instrumental instruction is being used.
5. Show interest in the child’s progress and provide encouragement and enthusiasm.
6. If possible, join in the child’s music practice in a supportive manner.

For early childhood teachers
Based on research by Artan and Balat (2003), Kenney (2007), Upitas (2000) and Wright (1991), it would seem that early childhood teachers need to:
1. Provide a music-rich environment (a variety of music instruments) that will inspire music play.
2. Give children opportunities to sing and dance creatively.
3. Seek authentic current information about the suitability of other lessons offered to young children.
4. Display music symbols and pictures of instruments in the learning environment.
5. Encourage children to use symbols to record their compositions.
7. Make music ‘fun’.
8. Play an instrument yourself or invite a parent, grandparent or orchestral member to share their talent.
9. Take children to appropriate concerts or invite the concert to the centre.

Implications for early childhood teacher education
Teachers who understand the language of music are well-placed to sow the seeds of music literacy in children. During pre-service teacher education, students need to have opportunities to hear a range of music and explore a variety of instruments. Creative and exploratory experiences in their courses will open them to the many enriching music experiences children can have. Without themselves gaining a basic level of music literacy, as well as the experiences outlined above, new teachers will find it hard to lay the foundations for children’s music development. Teachers without music literacy can provide children with basic music experiences which can be enjoyable and worthwhile, but, as the National Review of Music Education (2005) stated, ‘many Australian students miss out on effective music education because of the lack of equity of access; lack of quality of provision; and the poor status of music in many schools.’

References


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