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**Children starting school
in Scotland**

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EXECUTIVE SUMMARY

Introduction

What is the range of cognitive development of children in Scotland when they start school? This report describes what children know and can do when starting school and records how much this varies according to gender, home background, pre-school experience and first language. The developmental stages of children starting school in Scotland are compared with children in England, Western Australia and New Zealand. The final part to the report investigates the question: is there an optimum age for starting school in Scotland?

The data for this report come from the Performance Indicators in Primary Schools (PIPS) Project, which is very widely used within Scotland. Children are assessed with the computerised PIPS On-entry Baseline Assessment when they first enter school. This assessment is currently used in a third of Authorities within Scotland, providing a widespread measure of cognitive development on-entry to school. The schools whose data were used for this report were shown to be representative of the whole of Scotland. This report concentrates on the cognitive part of the assessment where the data are known to be extremely reliable. The internal consistency measures are high and also when we compare the scores of children that are first assessed by the teacher with a re-assessment a few weeks later conducted by an independent researcher we get very similar answers. In fact, the re-test reliability has been estimated to be 0.98, which exceeds most assessments used in schools. The assessment also involves personal and social development and, at the end of the year, the teachers assess behaviour but these measures were not studied as part of the research.

What do children know and what can they do when they start school in Scotland?

The cognitive part of the PIPS On-entry Baseline Assessment includes early predictors of reading, phonological awareness, maths and vocabulary. The analysis of the scaled scores indicated, unsurprisingly perhaps, that there was enormous variation in the age of children starting school in Scotland. In the middle of the sample were children who could name a wide range of upper and lower case letters. They could repeat polysyllabic nonsense words, demonstrating a degree of phonological awareness. Typically, they could name all single digit numbers and work out informally presented sums such as $6 - 3$ and $3 + 2$. Their vocabulary was extensive and allowed them to identify objects such as a toadstool. However, there was considerable variation within the general pattern and this is described below.

At the lower end: Children at the lower end of this range could do very few of the activities described above. In fact, their early reading development simply stretched to being able to tell the difference between someone who is reading and someone who is writing. They could distinguish between the biggest and smallest in

a group, and the extent of their vocabulary enabled them to identify objects like carrots, a castle and a butterfly.

Exceptional starters: At the top end of the range were a small proportion of exceptional children able to read passages with difficult words in them like ‘everyone’ and ‘thought’ and to do formal sums such as $42 - 17$ or identify a three-digit number such as 396. Their vocabulary was extensive and they were typically able to identify objects such as a yacht and a microscope.

A much fuller description of the cognitive levels of children starting school is available in the full report.

Gender: We found that girls were slightly ahead of boys in early reading and phonics and vocabulary but not at all in maths. However, despite the differences between the mean scores of the two groups (which indicated a tiny advantage to girls in word-based assessments) the main feature of the data was the enormous variation within each group.

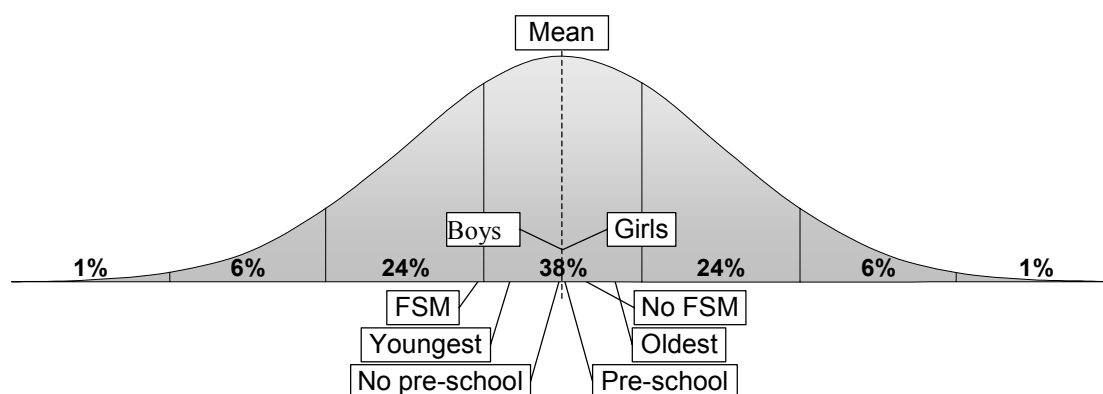
Homes: In terms of home background it has long been known that children from poorer backgrounds tend to do less well at school. This report used the measure of free school meals as an indicator of home background and the data clearly demonstrate that children from poorer backgrounds are falling behind their peers from more affluent neighbourhoods before they reach school. Their disadvantage is quite noticeable but does not indicate that their future is determined solely by affluence or background. There are certainly children from more deprived neighbourhoods who start off at a very high level and do extremely well later on, and vice versa. There are also children who forge ahead despite an unpromising start and the opposite can also happen.

Age: The average age when children started school was 5 years and 1 month but some children were as much as 6 months older than that and some 6 months younger. A year’s growth around the age of 5 has a marked impact on a child’s cognitive development and it is not surprising that we found this had a clear link to age.

Pre-school: Little connection was found between the amount of pre-school experience and children’s starting points at school. Perhaps this was because most children had spent a considerable period in a pre-school setting but that does not appear to be the full explanation. It may be that a study of children’s experience of pre-school could provide a better explanation.

The figure below gives an indication of the extent of the differences associated with gender, home background, etc.

Figure 1: Distribution of mathematics levels together with average scores for sub-groups



The figure demonstrates that there was no difference between girls and boys in their average starting points for mathematics but older children and those from more affluent homes (children who did not receive free school meals) had higher starting points. Although it is not shown on the chart, the amount of pre-school experience was positively related to the starting point in mathematics, but to a very small extent.

Important though age and home background were, they were small in comparison to the very large differences between pupils more generally. Similar results were found for vocabulary, reading and phonics. There was a very weak relationship found between the amount of pre-school experience and the PIPS scores at the start of Primary 1.

How do the starting points of children in Scotland compare with other countries?

The PIPS project collects a large amount of data from children in England, New Zealand and Western Australia as well as from Scotland. We know that the English and Scottish data are representative but we are not so sure about the representativeness of the Western Australian and New Zealand data. In order to make as fair a comparison as possible the analysis was restricted to children whose first language was English.

Firstly, the relative difficulties of all the items that were used in the baseline assessment in the different countries were compared. We did not have good enough data on the items in the phonics section to compare the different countries but we did for vocabulary, maths and early reading. We found remarkable agreement between the difficulties of the assessment items across the different countries. In general,

those items that were difficult in Western Australia were difficult in New Zealand; those that were easy in England were easy in Scotland and so on.

Next, the levels of development of pupils in Scotland were compared with pupils in other countries. Age for age, we found almost identical relationships between the different groups. In early mathematics we saw considerable similarities. However the mathematics development of older children starting school in Scotland, those aged 5 and a quarter to 5 and a half, appeared to be a little behind those in Western Australia of similar ages. For reading, the children in Scotland were generally a little behind those in other countries age for age except for those who were just 4 and a half years old. Those in New Zealand were considerably ahead and so the data were analysed further by breaking down the assessment into different parts. After taking age into account, pupils in Scotland could identify considerably fewer letters of the alphabet and had lower scores on the 'Concepts About Print' section of the assessment than pupils from other countries but the proportion of unusual children who were already reading sentences and doing other work was just the same as elsewhere. Similarly, the proportion of exceptional Scottish pupils who were able to tackle the more difficult mathematics items was the same as other countries. We do not offer an explanation for these findings, but we do call for urgent further investigations.

What is the optimum age for starting school?

In order to look for an optimal age for starting school we linked the PIPS On-entry data to later PIPS assessments of mathematics, reading, non-verbal ability and vocabulary administered when the children had reached Primary 3. These longitudinal data were available for pupils from one complete Scottish Authority. The Primary 3 PIPS assessment also included a measure of children's attitudes to maths, reading and school.

The age profile: The first point to come out of the analysis is that whilst we might expect the children in P3 to be of a single age, that is to say within half a year of the average age, there are clearly a small number of children who are old for the age group and also a small number who are young for the age group. It seems that some have been kept behind or pushed forward or sent to school a bit late or early.

Attainment linked to age: We looked at the age of the children against their achievement levels and found, not surprisingly, that in general the older the child the better their performance. As an exception to that generalisation we did find that some of the children who were old for P3 tended to be doing rather less well, corresponding to a view that they were deliberately kept back a year.

Optimum age? Overall, when we looked at the progress of the children starting from entry in the beginning of P1 to the end of P3 we found no evidence at all that there was an optimum age for starting school. Nor indeed did we find that the

younger children or the older children did unusually well in terms of progress made. We tried to examine the data in a variety of different ways and from different angles using multilevel models but failed to find any trend. We also found no connection between the age of the child and the attitude of the child in the year group. This left us in a position where we must conclude that there was no evidence for an optimum age for starting school in Scotland. Some might argue on the basis of this that we might send children to school when they are a little bit older but the evidence does not suggest this policy. This is because we were simply looking at the **relative** success of the children who were older or younger within that year group. It does not say that more years of schooling would not be good or harmful, it says that within a year group there is not an age advantage, that the younger children are not falling by the wayside compared to their older peers and so on.

In summary: The age of starting school is a contentious issue and this report has thrown some light on the matter, which does not suggest any need for a change in present arrangements. If Scotland were to consider changing its policy in this vital area, then we would recommend an evidenced based approach, with different pilot projects being introduced in a controlled fashion in different parts of Scotland. This would be a world first and could parallel the enormously important work from Tennessee on class size.

1 Introduction

This report focuses on two areas: the cognitive development of children starting school in Scotland and the impact of age of starting school on later attainment and progress. The first area is tackled by describing what children know and can do when they start school and how this is related to the age, sex, social background, special needs and first language of those children. The focus is on cognitive development and although we acknowledge the importance of personal, social and emotional development, this report does not deal with such measures other than attitude indicators in the second section.

The general pattern of what children know and can do when they start school in Scotland is then compared to three other countries. A good number of international studies, for example TIMSS, PISA and PIRLS, have looked at the attainment levels of pupils after several years of schooling but by looking at Scottish children starting school in comparison with children in other countries, this adds weight to the possibility of a more broadly based international study of children starting school and extends recently published work with specific reference to Scotland (Tymms et al; 2004 and in press).

Similarly, the age of transition to school from pre-school/home settings is an under-researched yet very important area. Although there is considerable interest in the age of children starting school and many articles and papers have been written on the subject (for example, Tizard and Hughes, 1986; Tymms, 1998), no broadly based quantitative studies have thrown light on the issue in Scotland.

In this report we use data from the Performance Indicators in Primary Schools (PIPS) On-entry Baseline Assessment (BLA) to consider the cognitive development of children starting school in Scotland and to compare the results with those from children from the other English-speaking countries. We also look at the age of children starting school in Scotland and relate this to their mathematics and reading achievement scores in P3. More specifically, the research analysis responds to these questions:

1. What do children know and what can they do when they start school in Scotland, and how does this profile vary by age, gender, home background, pre-school experience, first language and special needs?
2. Do children starting school in Scotland have the same age related development profile as children in England, Western Australia and New Zealand?
3. Is there evidence of an optimal age for starting school in Scotland?

2 Background

In Scotland 393 schools in 10 education authorities assess children using the PIPS On-entry BLA when they first enter Primary 1 and at the end of their first year of schooling. The PIPS On-entry BLA is one of several projects run from the Curriculum, Evaluation and Management (CEM) Centre at the University of Durham (CEM Centre, 2004; Fitz-Gibbon, 1996; Tymms and Coe, 2003), which aim to provide schools with data on the attainment, progress and attitudes of their pupils. Children are typically assessed using the PIPS On-entry BLA within their first six weeks of compulsory education at the start of Primary 1. The assessment, which is computer-delivered, is administered individually and the whole procedure takes approximately 20 minutes per child.

The content is based on those factors which previous research has shown to be the best predictors of later success or difficulty at school (for a review of the relevant literature, see Tymms and Middleton, 1995 and Tymms 1999b). These tend to reflect the general developmental level of a child rather than the outcome of any specific curriculum, particularly at the start of school. The style of presentation of the assessment has been designed to be attractive and appealing to children and teachers have repeatedly reported that children find the experience of completing the PIPS Baseline an enjoyable one.

The following areas are assessed:

- Writing – the child is asked to write his/her own name and the quality of writing is scored against examples.
- Vocabulary – the child is asked to identify objects embedded within a picture.
- Ideas about reading – assesses concepts about print.
- Repeating Words – the child hears a word and is asked to repeat it in this assessment of phonological awareness.
- Rhyming Words – the child selects a word to rhyme with a target word from a choice of three options in this assessment of phonological awareness.
- Letter identification – a fixed order of mixed upper and lower case letters.
- Word recognition and reading. This starts with word recognition and moves on to simple sentences that the child is asked to read aloud. The words within these sentences are common to most reading schemes. This is followed by a more difficult comprehension exercise which requires the child to read a passage and at certain points select one word from a choice of three that best fits that position in the sentence.
- Ideas about mathematics – assessment of understanding of words underlying mathematical concepts.
- Counting and Numerosity – the child is asked to count four objects. These disappear from the screen and then the child is asked how many objects they saw. This is repeated with seven objects.
- Sums – addition and subtraction problems presented without symbols.
- Shape identification.

- Digit identification – single, two-digits and three-digits.
- Maths problems – including sums with symbols.

The computer program presents the child with questions (aurally) and depending on the nature of the question, the child responds either by pointing to the answer from the choice of options on the screen or by saying the answer. The teacher controls the pace of the assessment and records the child's response on-screen. The program selects the next appropriate question. The way that the assessment works is illustrated by referring to the section relating to vocabulary. In this a child is shown a picture and asked to point to an item in the picture. The first picture is of a kitchen and for the first item the child is asked to identify the 'carrots'. The program continues with further, progressively more difficult, vocabulary items until finally it becomes too difficult for the child. At that point the program moves onto the next section. Each section operates independently but in a similar format of a sequence with stopping rules.

Because of the structure of the assessment it is extremely reliable. The test-retest reliability is 0.98. The internal reliabilities for the subscales analysed in this report are as follows:

	Number of Items	Chronbach's Alpha
Vocabulary	23	0.86
Phonics	17	0.86
Concepts about Print	10	0.76
Letter Identification	26	0.97
Word recognition and Sentences	20	0.93
Ideas about Maths	7	0.60
Counting and Numerosity	4	0.83
Simple Sums	8	0.83
Digit Identification	21	0.91
Shape Identification	5	0.62
Maths Problems	24	0.78
Reading¹		0.95
Mathematics²		0.93

¹ Includes writing, concepts about print, letter identification, word recognition and sentences.

² Includes ideas about maths, counting and numerosity, simple sums, digit identification, shape identification and maths problems.

The reliability of some of the sub-scales is quite low because there are so few items in the scale, however the ones that form the main focus of this report (vocabulary, reading, phonics and mathematics) are very high.

Feedback for schools from the initial assessment is in the form of charts and tables. It includes raw scores and standardised scores based on a representative sample of Scottish schools, stacked bar charts highlighting the relative strengths and weaknesses of individual children and box and whisker plots providing a picture of the distribution of standardised scores in each class.

The re-assessment of each child towards the end of the first year of schooling provides pupil-level information for Primary 1 teachers as they reflect on the achievements of their pupils and for Primary 2 teachers as they look to the future. Feedback from this second assessment includes a table of raw and standardised scores with measures of value added and attitudes, line charts showing progress in terms of improvement in each child's raw scores and scatter plots providing an alternative presentation of the attainment and value-added for a whole class.

The PIPS Baseline recognises the importance of and assesses personal, social and emotional development and also inattentive, hyperactive and impulsive behaviour at the end of the first year, although these are not analysed or discussed in this report.

Although intended for schools to enable them to monitor the relative progress of their pupils, the assessment details gathered at pupil-level in Scotland are also valuable for research purposes. Croxford (1999), for example, analysed PIPS data to report on inequality in the first year of schooling and Fraser *et al.* (2001) used PIPS data to evaluate the National Early Intervention Project. Croxford (2001) used PIPS data to monitor inequality and evaluate the early intervention programme in Aberdeen. Her analysis of the assessment carried out on entry to school showed that lower scores were generally found for younger children, for those coming from a relatively poor home background and for those who had English as a second language. Over a 3-year period she found evidence of a dramatic rise in average reading scores at the end of Primary 1, but no reduction in social inequality. In Aberdeen, data from PIPS assessments are available for Primary 1 and Primary 3 pupils dating back to 1997 and continues to be used to track changes in attainment in reading and mathematics, differences in attainment between boys and girls and the gap in attainment between disadvantaged and advantaged children.

There is now an international dimension to the PIPS project and parallel data from around 4000 schools in England, 500 schools in Western Australia and a further 80 in New Zealand have been gathered. As a result, a large and unique dataset relating to children starting school in several countries has been created. It is this dataset that is exploited for the purposes of this report.

Before exploring the PIPS data, however, it is important to determine the extent to which the education authorities using PIPS in Scotland were representative of Scotland as a whole. We consider this particular question in the next section.

3 Representativeness of PIPS data

The PIPS BLA was used in 10 out of 32 Scottish authorities in the academic year 2002-03. In order to draw conclusions based on the PIPS data it is necessary to determine whether these 10 authorities were representative of Scotland as a whole. To do this we analysed three different outcomes of assessments carried out in each of S4, S5 and S6 for each of the academic years 2000-01, 2001-02 and 2002-03, as set out in Table 1 (Summary of Outcomes Used to Determine Representativeness of Sample).

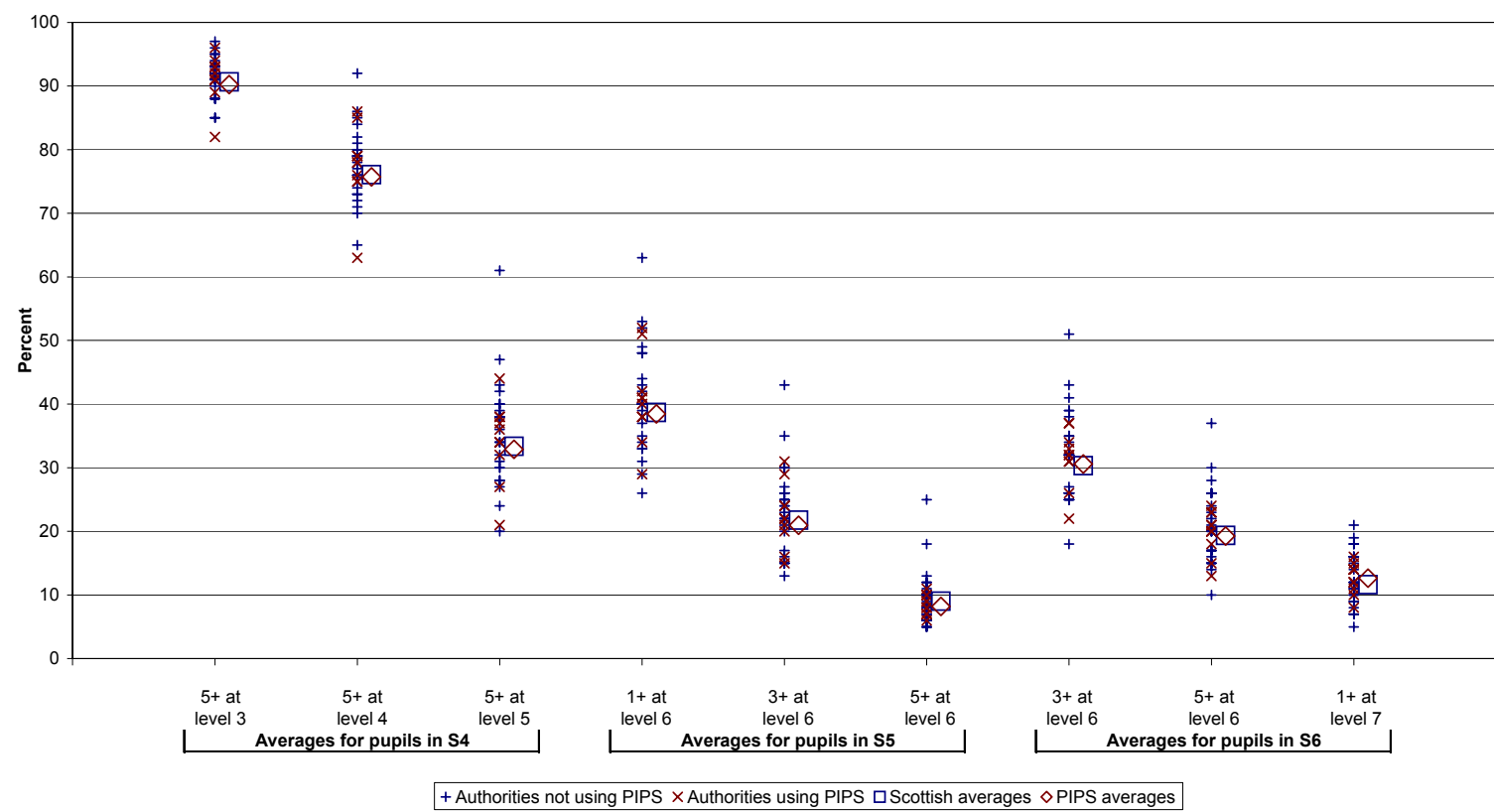
Table 1 Summary of Outcomes Used to Determine Representativeness of Sample

Year group	Outcomes considered
S4	Percent of S4 roll gaining 5 or more awards at level 3 or better
	Percent of S4 roll gaining 5 or more awards at level 4 or better
	Percent of S4 roll gaining 5 or more awards at level 5 or better
S5	Percent of S4 roll gaining 1 or more awards at level 6 or better in S5
	Percent of S4 roll gaining 3 or more awards at level 6 or better in S5
	Percent of S4 roll gaining 5 or more awards at level 6 or better in S5
S6	Percent of S4 roll gaining 3 or more awards at level 6 or better in S6
	Percent of S4 roll gaining 5 or more awards at level 6 or better in S6
	Percent of S4 roll gaining 1 or more awards at level 7 or better in S6

These figures, aggregated by authority, are available on-line from <http://www.scotland.gov.uk/stats/bulletins/00295-00.asp>.

The results were averaged amongst authorities using PIPS and amongst all authorities, weighted by the number of children on the S4 roll, and the averages compared. A summary of the scores is shown in Figure 1 (Representativeness of Sample) for data from the academic year 2002-03; the data from 2001-02 and 2000-01 show a similar picture.

Figure 1 Representativeness of Sample



The differences between the authorities using PIPS and authorities as a whole were small, less than 1% in all but one case, and typically 6% of the standard deviation of the averages for the individual authorities.

We can therefore be confident that the education authorities using PIPS in Scotland are representative of Scotland as a whole.

Having determined that this is the case, the remainder of this report is in three parts. The first (Section 4) looks at the cognitive development of children starting school in Scotland in 2002, where data were available on 8652 pupils. In Section 4 we identify the extent to which this profile varies by age, gender, home background, pre-school experience, first language and special educational needs.

In the second part (Section 5) we compare the starting points of children starting school in Scotland with three other countries. In Part 3 (Section 6) we use data on 1289 children from their start of schooling in the 2000 academic year and their matched results from testing in 2003, when they were in Primary 3, in an attempt to find evidence of an optimal age for starting school in Scotland.

4 What do children know and what can they do when they start school in Scotland?

4.1 The Cognitive Profile Of Children Starting School In Scotland

Rasch scaling was used to estimate the relative difficulties of the items for the entire PIPS On-entry Baseline assessment and for each section separately (for an explanation of Rasch scaling see Bond and Fox, 2001). The interval scale enables direct comparisons between items and sections to be made. Figure 2 gives a general overview of the stages of development of children on entry to school. Figure 3 gives a more detailed comparison of the reading and phonological awareness, mathematics and vocabulary sections.

Figure 2 Developmental descriptors of children starting school in Scotland.

Each box describes activities which have been selected so that a typical child in the group can do about half of the tasks described. They can generally manage the items described in the box below but not above.

Top 1% of children	These unusual children can read passages with relatively difficult words such as 'your', 'leave', 'everyone' and 'thought'. They can do formally presented calculations such as $42 - 17$, identify 3-digit numbers and can work out subtraction problems such as 'What is 3 fewer than 7?'
6% of children	Children in this group can typically read simple sentences composed of high-frequency words. They can work out addition problems such as 'What is 2 more than 6?' Their vocabulary extends to being able to identify items such as 'cosmetics' embedded within a picture.
24% of children	These children can recognise high-frequency words such as 'dog' and 'house' when presented in a multiple-choice format. They can name 2-digit numbers and recognise objects such as a microscope and a yacht when presented within a picture.
Middle 38% of children	This middle group of children can name a wide range of upper and lower case letters and they can repeat polysyllabic nonsense words, demonstrating a degree of phonological awareness. They can name all single digits and work out informally presented problems involving calculations such as $6 - 3$ and $3 + 2$. Their vocabulary allows them to identify objects such as a saxophone and a toadstool.
24% of children	These children can name approximately 5 letters of the alphabet and identify pairs of rhyming words when presented in multiple-choice format. They can count up to 7 objects and then recall the quantity counted. They can identify objects such as a padlock and a violin.
6% of children	This group of children know the difference between writing and pictures and can repeat simple words such as 'mantle' and 'stop'. Their mathematical development includes being able to identify shapes such as a triangle and a circle and they understand the concepts of 'tallest' and 'most'. They can count up to 7 objects but can't say how many there were afterwards. Their vocabulary enables them to identify objects such as a pan and a pigeon.
Lowest 1% of children	These children can tell the difference between reading and writing activities. Their understanding of mathematical concepts extends as far as being able to tell the biggest and smallest objects from a group of three. They can identify objects such as carrots, castle and butterfly.

Figure 3 Descriptors of children starting school in specific cognitive areas

	READING & PHONOLOGICAL AWARENESS	MATHEMATICS	VOCABULARY	DIFFICULT ITEMS
Exceptionally High Scores (1% of children)	Read passages with difficult words such as 'your', 'leave', 'everyone', 'thought'.	Carry out formally presented calculations such as $42 - 17$. Identify 3-digit numbers. Do problems such as 'What is 3 fewer than 7?'		
High Scores (6% of children)	Read simple sentences with high-frequency words such as 'The dog has a red ball'.	Work out addition problems such as 'What is 2 more than 6?'	Identify objects such as 'Cosmetics'.	
Above Average (24% of children)	Recognise high-frequency words such as 'dog', 'house', 'flower', 'car', presented in a multiple-choice format.	Identify 2-digit numbers. Select half of 6 objects.	Identify objects such as 'Microscope' and 'Yacht'.	
Average (38% of children)	Name a wide range of upper and lower case letters. Repeat polysyllabic nonsense words such as 'Frigglejang' and 'Denalty'.	Name single digit numbers. Work out informally presented problems involving calculations such as '6-3' and '3+2'.	Identify objects such as 'Saxophone' and 'Toadstool'.	
Below Average (24% of children)	Name a few letters. Detect rhyming words.	Count up to 7 objects and then state how many there were. Name a few digits.	Identify objects such as 'Cherries', 'Padlock' and 'Violin'.	
Low Scores (6% of children)	Know the difference between writing and pictures. Repeat simple words such as 'Mantle'.	Identify a triangle and circle. Understand mathematical concepts of 'Tallest' and 'Most'. Count up to 4 objects and then recall the quantity counted.	Identify objects such as 'Pan' and 'Pigeon'.	
Exceptionally Low Scores (1% of children)	Know the difference between someone who is reading and someone who is writing.	Understand mathematical concepts of 'Biggest' and 'Smallest'.	Identify objects such as 'Carrots', 'Castle' and 'Butterfly'.	EASY ITEMS

4.2 How Does The Cognitive Profile Vary?

How then does this cognitive profile vary? Data on age, gender, home background, pre school experience, first language and special educational needs are collected at the time of the PIPS BLA and the analysis below shows how the cognitive profile varies in relation to these variables.

4.2.1 Sex

Table 2 (Sex) indicates the advantage to girls over boys in standard deviation units (Effect Sizes³) for the four areas being considered.

Table 2 Sex

Area	Advantage to girls	SD boys	SD girls
Vocabulary	0.06**	1.00	0.97**
Phonics	0.15**	0.97	0.97
Reading	0.21**	1.00	0.99
Mathematics	0.00	1.05	0.95**

** p<.01

In general, the girls started school in Scotland a little ahead of the boys, although in mathematics they were exactly on a par. The greatest difference between boys and girls was in the reading section where there was an advantage of about a fifth of a standard deviation. There was a similar but slightly smaller advantage in phonics and in the vocabulary there was just 0.06 of a standard deviation, which was statistically significant but educationally not important. It is worth pointing out also that the spread of scores for the girls was significantly less both for vocabulary and for mathematics, although not for phonics or for reading. The implications of the standard deviations differences are that the girls form a more homogeneous group than the boys. Extreme scoring groups, the very highest and the very lowest, will have a greater preponderance of boys amongst them. There will be fewer girls with special needs in both of those categories.

³ The metric “effect size” is chosen because of its increasing use in educational research, its applicability across studies and the potential for its use in meta analyses. It can also be readily linked to Figures 1 and 2. It would be possible to express differences in months and the link is made in Table 4, but as can be seen the variation in the relationship between age and outcome could mislead the unwary reader.

4.2.2 Home Background

Table 3 Home background

Area	Advantage to those without free meals	SD with FSM	SD no FSM
Vocabulary	0.62**	0.99	0.97
Phonics	0.45**	1.01	0.96
Reading	0.69**	0.97	0.98
Mathematics	0.68**	1.04	0.99

** p<.01

Home background has long been established as being an important variable when looking at children's performance at school, especially when no earlier cognitive measure is available. There are a variety of ways of looking at home background and later on in this report we use post codes linked to deprivation indices, but a straightforward and widely used measure is the entitlement to free school meals which gives a dichotomous outcome. Quite clearly in each of the 4 variables there were highly significant differences between the average scores of pupils from the groups with and without free school meals. This was most noticeable for reading and vocabulary where the difference amounted to nearly 7/10 of a standard deviation and almost as much in phonics and rather less in mathematics. It might be that it was rather less in phonics because the phonics measure was less reliable. The overall general pattern averages out at about 7/10 of a standard deviation.

4.2.3 Pre-school Experience

Table 4 Pre-school experience

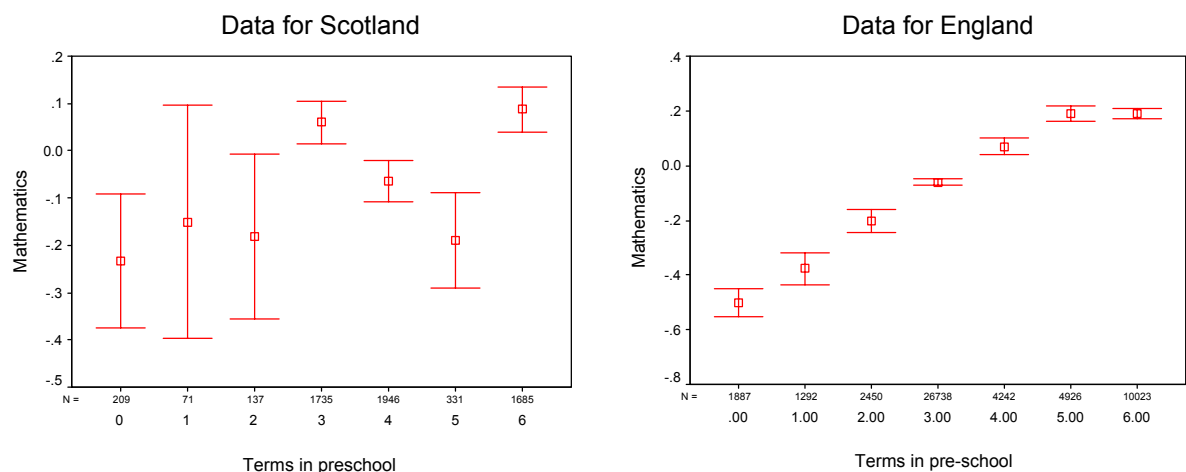
Area	Advantage for each term	Result from England
Vocabulary	0.01	0.10**
Phonics	0.01	0.07**
Reading	0.01	0.10**
Mathematics	0.03**	0.11**

** p<.01

Very little connection was found between the amount of pre-school that pupils had experienced and their scores on the baseline assessment. The amount of pre-school experience recorded varied from no full-time terms to 6 and it was expected that a strong relationship would be found. On analysis, only a minimal link was found for mathematics (0.03 of a standard deviation unit per term). For a child attending pre-school for six terms the advantage would be 0.18 standard deviation units, which is not of great educational importance. By contrast in England a very clear and uniform relationship was found in the same year group amounting to figures that were typically around 0.1 standard deviation units per term. Figures 4 and 5

below show a very strong and clear relationship between mathematics and the amount of pre-school in England but not for Scotland. The values on the Y-axis of Figures 4 and 5 are mean scores with error bars denoting the 95% confidence interval. The datasets were smaller for Scotland and so one might expect to find a weaker pattern because of the errors on the measurement and it might also be that, because the children were older in Scotland, proportionately fewer pupils had experienced only one or two terms in pre-school. But to find such a weak relationship effect is a little odd and at this stage no clear explanation is apparent.

Figures 4 & 5 Maths and terms in pre-school



4.2.4 Special Educational Needs

Not enough data were recorded to be able to comment.

4.2.5 Age

Table 5 (Age) compares the difference between the youngest children (four and a half years old) and the oldest children (five and a half years old) starting school in Scotland and England (age four and five respectively) for each area of the PIPS BLA. The differences are expressed as Effect Sizes.

Table 5 Age

Area	Scotland Gain per year	England Gain per year
Vocabulary	0.41**	0.66**
Phonics	0.34**	0.68**
Reading	0.56**	0.85**
Mathematics	0.66**	0.98**

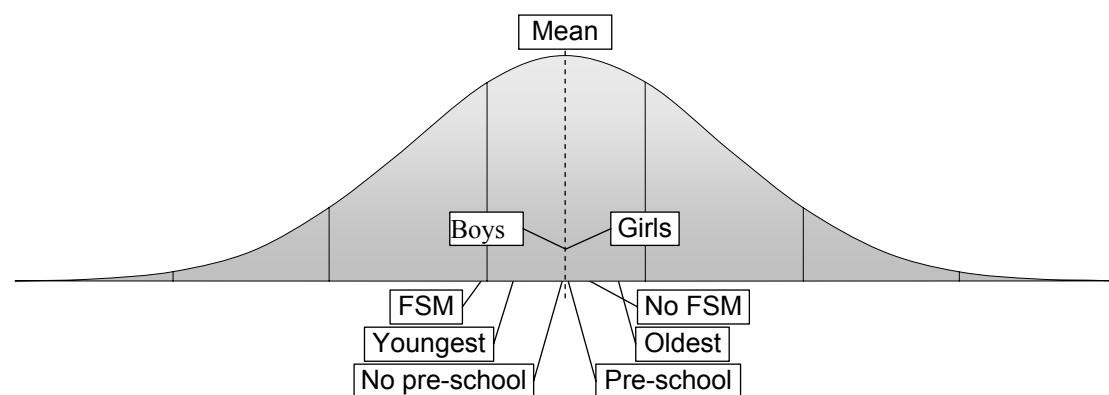
Clearly the age of children is of considerable importance in their cognitive development. To quantify the relationship between age and measured attainment, regression analyses were carried out to estimate the difference that a year makes. That is essentially the difference between youngest and the oldest children starting school in Scotland. Comparing four-and-a-half year-olds to five-and-a-half year-olds, the difference amounts to about half a standard deviation unit. The difference was slightly higher for mathematics, rising to two thirds of a standard deviation, and a little less for phonics and vocabulary. Generally, the pattern can be translated into a figure of about 0.05 per month. There was a stronger relationship in England. That is to be expected, at least to some extent, since the mean age of children starting school was lower than in Scotland and age is a more important factor for younger children than older.

4.2.6 Summary: What children know and can do when they start school in Scotland

In the first part of this research the PIPS on-entry baseline assessment was used to describe what children know and can do when they start school in Scotland. This was presented in charts derived from Rasch analyses. It showed a very large range of cognitive development. In the top 1% were fluent readers and individuals who were very adept at working with numbers and had extensive vocabularies. They could read passages which include words such as “everyone” and do problems such as “what is 3 fewer than 7?”. In the lowest 1% were children whose progress towards literacy had reached the stage of recognising the activities of reading and writing without themselves having skills in those activities. They knew mathematically relevant words such as biggest and smallest but had difficulty counting just a few objects.

The age, sex and home backgrounds of the children showed systematic links to the developmental levels and the chart below summarises the results for mathematics.

Figure 6 Summary chart for mathematics



There was no difference between girls and boys in their average starting points for mathematics but older children and those from more affluent homes had higher starting points. Although it is not shown on the chart, the amount of pre-school experience was positively related to the starting point in mathematics, but to a very small extent.

Important though age and home background were, they were small in comparison to the very large differences between pupils more generally. Similar results were found for vocabulary, reading and phonics.

A very weak relationship was found between the amount of pre-school experience and the PIPS scores at the start of Primary 1.

5 Do children starting school in Scotland have the same age related development profile as children in England, Western Australia and New Zealand?

5.1 Comparison Of The Starting Point Of Children With Three Other Countries

In this section the starting points of Scottish children are compared with those from England, New Zealand and Western Australia. The study was restricted to children whose first language was English, which gave the sample sizes indicated in Table 6 (Samples of children from 2003 whose first language was English).

Table 6 Samples of children in 2003 whose first language was English

Data source	Numbers
Scotland	8,652
England	65,258
Western Australia	10,630
New Zealand	5,870

The data from England and Scotland have been shown to be representative of their countries but the Western Australia and New Zealand samples were not guaranteed to be representative of those countries as a whole. The schools in those two countries joined the project in much the same way as in England and Scotland and one might expect that they would be representative, but this has yet to be demonstrated.

Before starting the comparative analyses we used Rasch analyses to scale the items in the four sub-tests independently within each country. We then compared the relative difficulties of the items for children in Scotland with other countries. The purpose was to identify any items in the assessments that functioned differently in the four countries. The results showed very few differences. The strongest agreements were in mathematics, where the correlations of the difficulties of the items in the four countries were all 0.99. This is so high that no further preliminary action was needed before making comparisons.

The difficulties of the reading items were also strongly related but not quite so strongly. The correlations are shown in Tables 7, 8 and 9.

Table 7 Correlation between difficulties of 56 reading items⁴

	WA	NZ	England
NZ	.99**		
England	.97**	.96**	
Scotland	.96**	.94**	.99**

** Correlation is significant at the 0.01 level (2-tailed).

The lowest correlation was for the items difficulties between Scotland and New Zealand but the figure (0.94) was felt to be sufficiently high to allow further analysis to proceed.

A similar analysis for the vocabulary items showed that two words were particularly difficult in the antipodes compared with the UK. They were pigeon and wasp and therefore these were excluded from further analysis. The correlations, excluding these items, are shown in Table 8.

Table 8 Correlation between difficulties of 17 vocabulary items⁵

	WA	NZ	England
NZ	.96**		
England	.97**	.96**	
Scotland	.95**	.96**	.99**

** Correlation is significant at the 0.01 level (2-tailed).

As with the reading correlations it was felt that the lowest figure (0.95) was sufficiently high to proceed with further analysis.

The phonics section was less satisfactory as the correlations in Table 9 show.

Table 9 Correlation between difficulties of 17 phonics items⁶

	WA	NZ	England
NZ	.98**		
England	.96**	.98**	
Scotland	.91**	.91**	.95**

** Correlation is significant at the 0.01 level (2-tailed).

The correlations between the item difficulties for Scotland and the other countries might appear to be high for social science work but figures of 0.91 leave something to be desired as a basis for comparing countries and the correlations with Scottish data were the lowest in the table. Further, when the difficulties of specific

⁴ A few infrequently tackled items with large errors were omitted.

⁵ A few infrequently tackled items with large errors were omitted.

⁶ A few infrequently tackled items with large errors were omitted.

items were compared it was not possible to pick out just one or two items as being problematic with a view to dropping them from the analysis. The point of this analysis was to ascertain if any items seemed to be culturally biased and relatively more easy or difficult for children in a particular country. The items in the phonics section gave different outcomes for pupils in Scotland compared with pupils in England and New Zealand and as a result it was thought to be inappropriate to proceed with comparison of phonological awareness.

For each of the three other sub-tests (mathematics, reading and vocabulary) the datasets for Western Australia, New Zealand, England and Scotland were combined and the Rasch scales were created. The children were then put into eleven age categories corresponding to increments of 3 months each. The lowest had a mean age of 4.2 years and the highest of 6.6 years. The average scaled scores and 95% Confidence Intervals were then plotted against age to produce Figures 7, 8 and 9 below. The first thing to notice from the figures is the difference in the age of children starting school in different countries. The pupils in England tend to be the youngest although there is some overlap with Scotland and New Zealand. The New Zealand sample is quite interesting in that all children start school immediately after their fifth birthday. The three charts show generally very similar patterns indicating that the cognitive growth patterns of children whose first language is English is similar in Scotland when compared with England, Western Australia and New Zealand. But, despite the general pattern, there were differences and these are examined in more detail below.

The vocabulary scores rise steadily with age. When the error bars (95% Confidence Intervals) are taken into account the Scottish data in blue are seen to be very much in line with the data from the other three countries, which are also in line with one another. There is suggestion that the vocabulary scores of the younger children are higher than similar children from England but this is a small effect. It amounts to an Effect Size of 0.2 or about three and a half months of development.

Figure 7

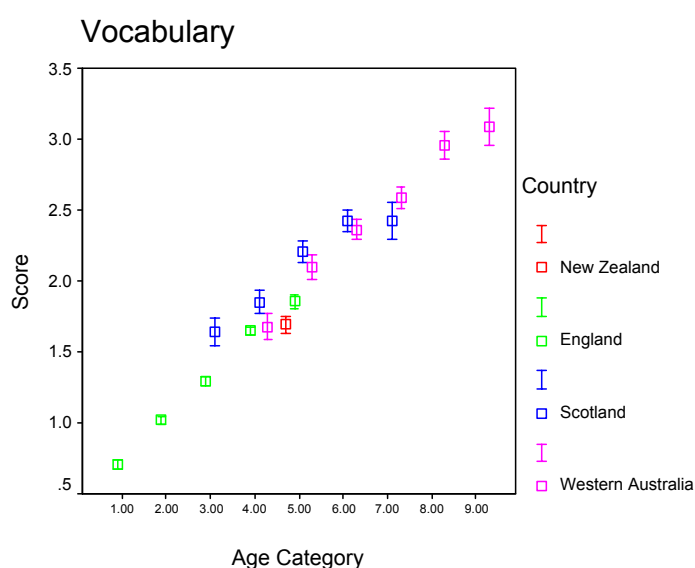
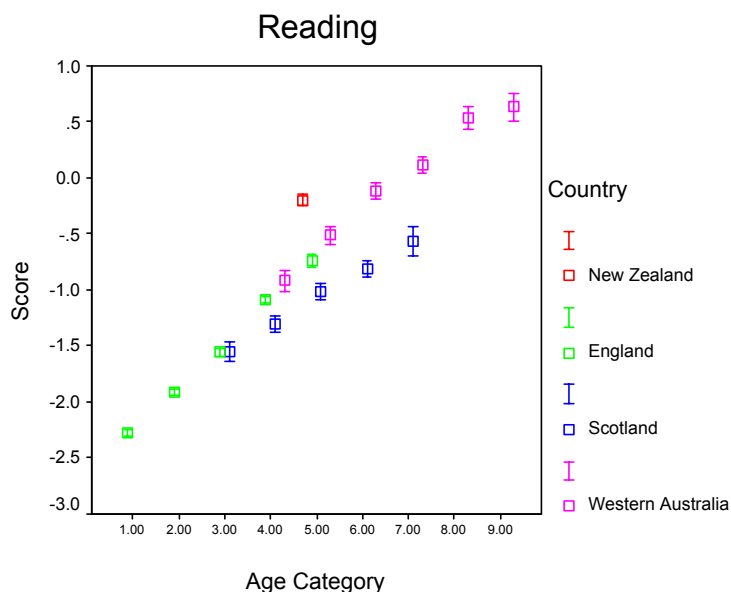
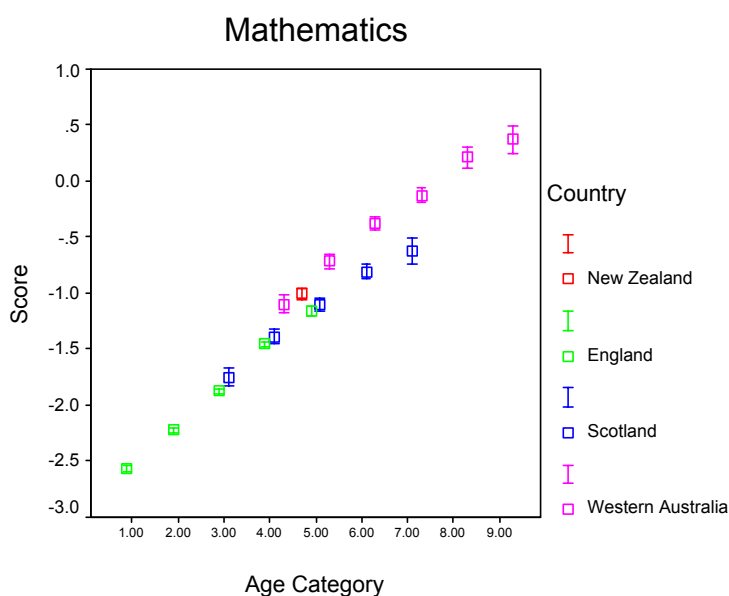


Figure 8



The reading chart shows some clear differences from the vocabulary chart. The Scottish data now fall increasingly behind the data from the three other countries as the age increases. The English and Western Australian results form an unbroken continuum and the New Zealand scores are higher. The younger children are in line with the scores of children of the same age in England but for the oldest children there is a discrepancy of 0.38 standard deviation units (Effect Size) or about just over five months of development compared with similarly aged children in Western Australia.

Figure 9



The pattern for mathematics is very similar to the pattern for reading. The English and Western Australian data appear to form a continuum and the Scottish data show increasing discrepancies from Western Australia for older children. For the oldest group starting school in Scotland there is a discrepancy of about 0.31 standard deviation units (Effect size). This is equivalent to nearly four months of development. Unlike the reading data, the New Zealand results are in line with the results for the other countries.

5.2 Further investigation

Factor analyses of the PIPS BLA maths and reading scores suggested that those things which would be expected to be taught at school, such as word recognition, reading simple sentences and more formally presented maths problems, and which are usually not taught to children before the start of school form a different factor from those that are acquired more naturally (Tymms 1999). By developing ‘more naturally’ we mean that for areas such as vocabulary, a child is interacting with their environment and engaging in conversations with other children and adults. An understanding of the concepts of print is once again developed from interaction with adults and exposure to a range of literature. Other sections of the PIPS BLA (Repeating Words, Rhyming Words, Ideas about Maths, Counting and Numerosity, Shape Identification, Addition and Subtraction problems presented without formal notation, and Single Digit Identification) reflect areas that will develop as a consequence of a child’s interactions with their environment, adults and other children.

It was therefore hypothesised that the higher scores of older children outwith Scotland were the result of more formal teaching in the pre-school setting. This would fit with the findings reported in the PIRLS encyclopaedia written in 2001/2 which compares pre-school curricular among the PIRLS countries. In an effort to explore this hypothesis, the scores on sub-tasks that contributed to the reading and mathematics scores were further investigated by plotting the same kinds of diagrams shown above but for actual (raw) scores rather than Rasch scaled scores. Figures 10-16 below show the outcomes of this analysis. It was expected that the Scottish children would show the greatest discrepancies for formal sums and the reading of words, sentences and passages.

Figure 10

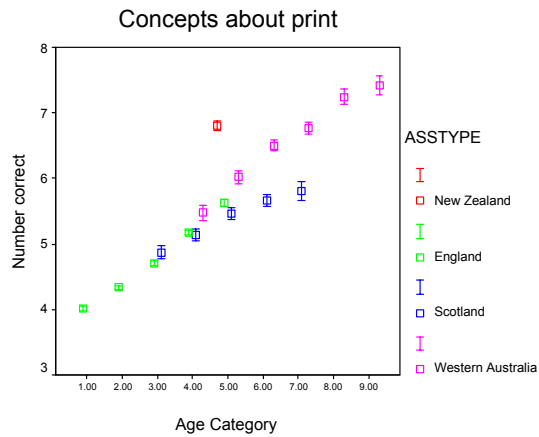


Figure 11

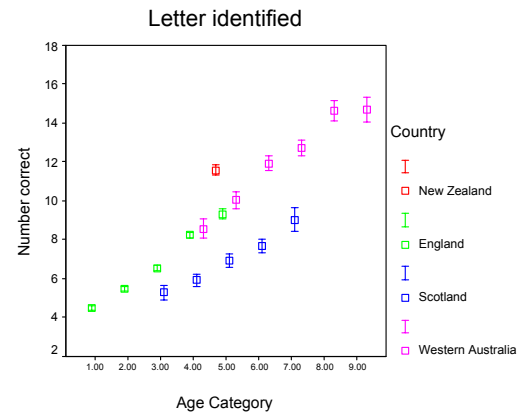


Figure 12

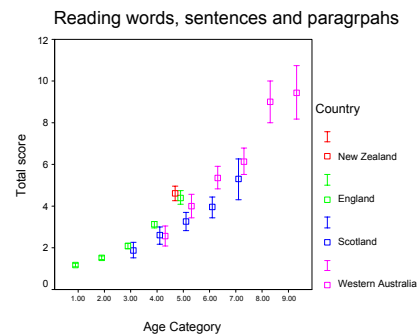


Figure 13

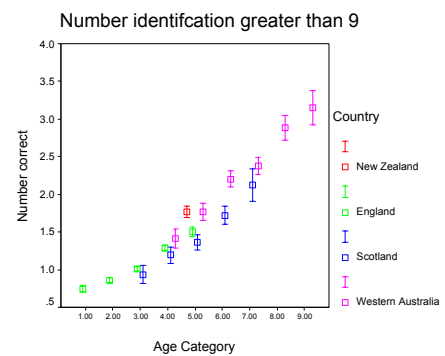


Figure 14

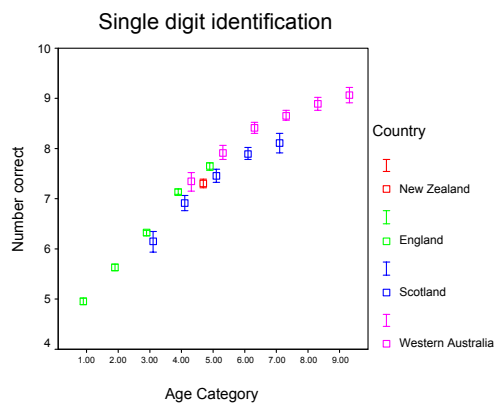


Figure 15

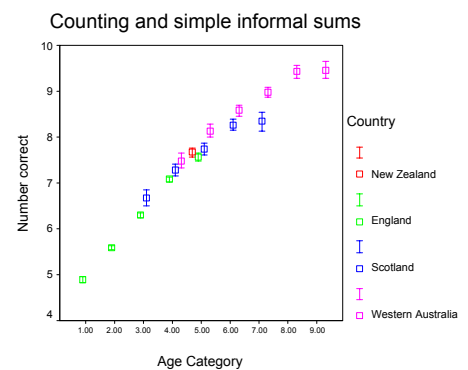
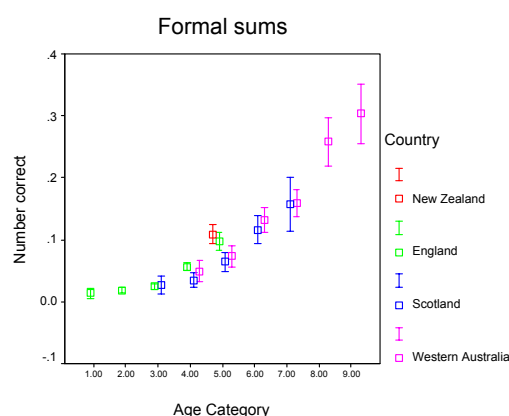


Figure 16



It had been expected that the Scottish children would show the greatest discrepancies for formal sums and the reading of words, sentences and passages since these might have been specifically taught. However, the charts do not support this hypothesis. The most formal parts of the assessment (formal sums, the identification of numbers greater than nine and the reading of words, sentences and paragraphs) showed little difference from Western Australia, although the scores from England and New Zealand were a little higher for older children. Further, the identification of single digit numbers, counting and simple informal sums were also more or less in line with the results for England and Western Australia, although once again the scores for Scotland were a little lower for older children.

But the greatest discrepancies were for Concepts about Print and letter identification. Interestingly, Concepts about Print were particularly high for New Zealand, the country in which the work of Marie Clay, who pioneered Reading Recovery and invented the Concepts about Print scale, has been so important.

5.3 Summary: Comparison of Scottish children starting school with three other countries

Scottish children start school at the age of 5 years on average. This is six months later than in England but the same as in New Zealand. In that country however, children start on or after their fifth birthday whereas in Scotland they generally start between the ages of 4.5 and 5.5. In Western Australia they start about six months later.

After taking age into account the starting points of children in the four areas is very similar. However, older Scottish children appear to be behind in mathematics and early reading but not in vocabulary.

5.4 Interpretation

It is not easy to come to clear conclusions as to why the data for Scotland should differ in some cases quite markedly from other countries. However, earlier in this report it was noted that the relationship between the outcome measures on the baseline assessment and pre-school experience was weak, and it could be that there is

a connection here. It may be that the kind of pre-school provision being provided outside Scotland is different from the kind of provision provided within Scotland, but without further information about the pre-school curricula of the different countries it is difficult to draw any conclusions. It is also difficult to know exactly what the long-term consequences of the differences seen above are likely to be. However, the data do raise questions about possible differences between pre-school in Scotland and the other countries.

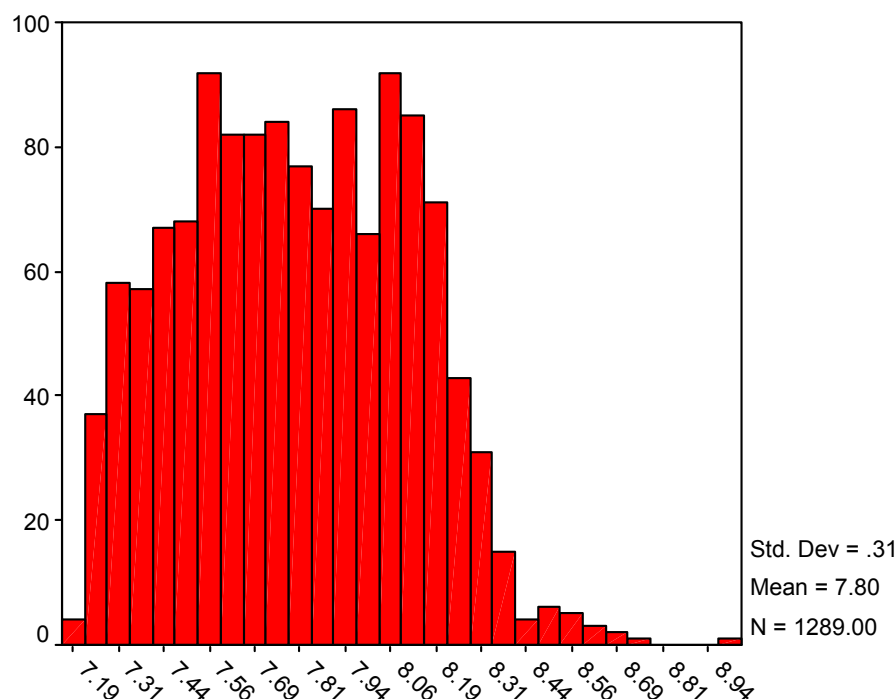
6 Is there any evidence of an optimal age of starting school in Scotland?

6.1 The Dataset

A unique dataset exists for 1289 pupils who were assessed on entry to school and then again three years later in P3. The assessment in P3 was of mathematics, reading, non-verbal ability, vocabulary and of attitudes to maths, reading and school. These data were used to explore the possibility that there might be an optimum age for starting school.

The age of children who took the PIPS BLA and the PIPS P3 assessments had the profile shown below:

Figure 17 Distribution of ages in P3



Age in years where P1 and P3 dob is equal

To a first approximation the distribution is rectangular, corresponding to a single cohort of children with ages 6 months either side of the mean. But there are clearly some exceptions to this general pattern in that there are some pupils who are older than might be expected in the group and a smaller number who are younger. These pupils were presumably delayed for some reason in their entrance to school or moved ahead. Whatever the causes, the pattern is not unexpected and has been seen in other data sets in other countries.

This report concentrates on the cohort of pupils shown in the above distribution and asks questions about their attainment, value-added and attitude scores in the search for evidence of an optimal age for starting school. We further extend this

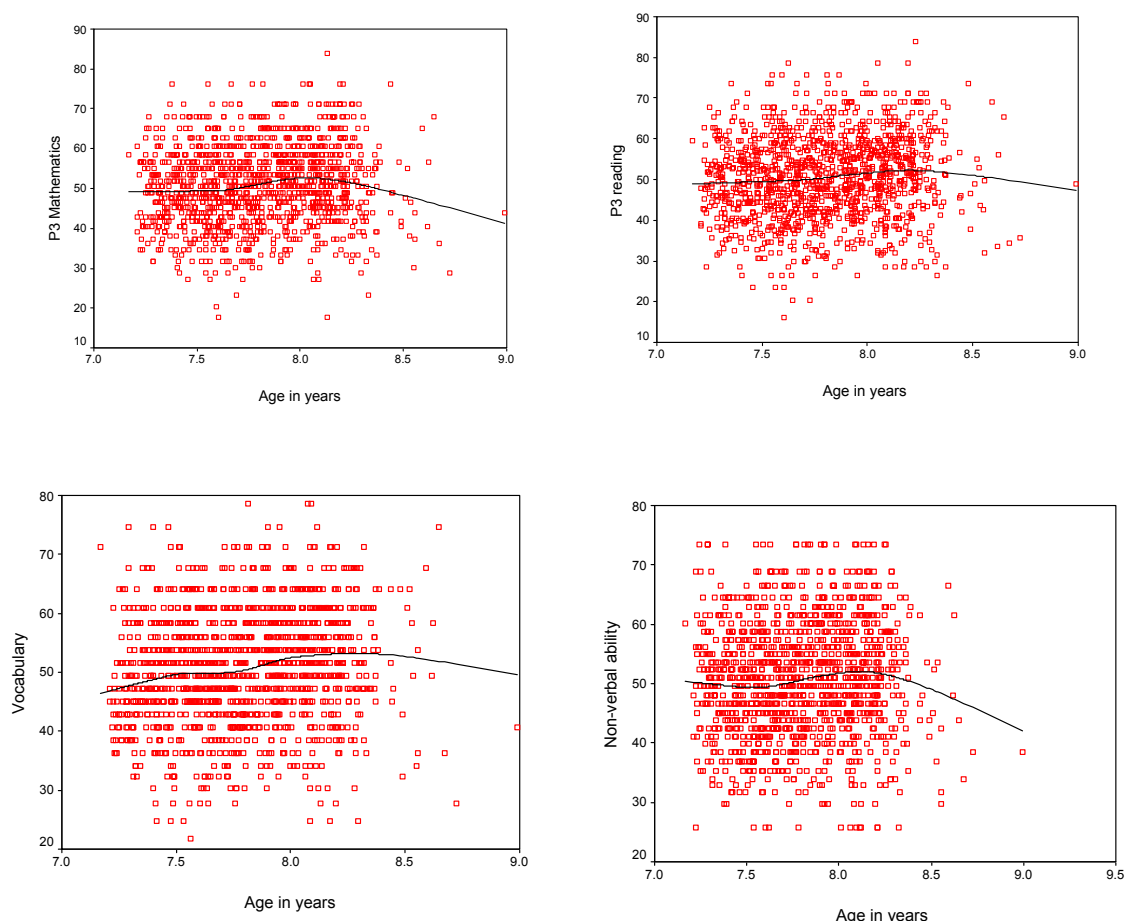
question to include children with different pre-school experience, different home backgrounds and different cognitive profiles.

First the P3 data were explored visually in relation to the age of the children. We then constructed multi-level models to investigate the progress of children between the start of P1 and the end of P3. The models allowed us to look at the link between the age of starting school and the relative achievements in reading and mathematics as well as at the attitudes towards reading, maths and school. Other examples of this approach being employed with PIPS data can be found in (Croxford, 1999, Tymms et al. 2000).

6.1 First look at the data

The P3 measures were plotted against age in the figures below. A line showing the relationship between age and outcome has been added to each plot. This line is a regression line but it is locally weighted⁷ to show any waves and bumps in the relationships.

Figures 18-21

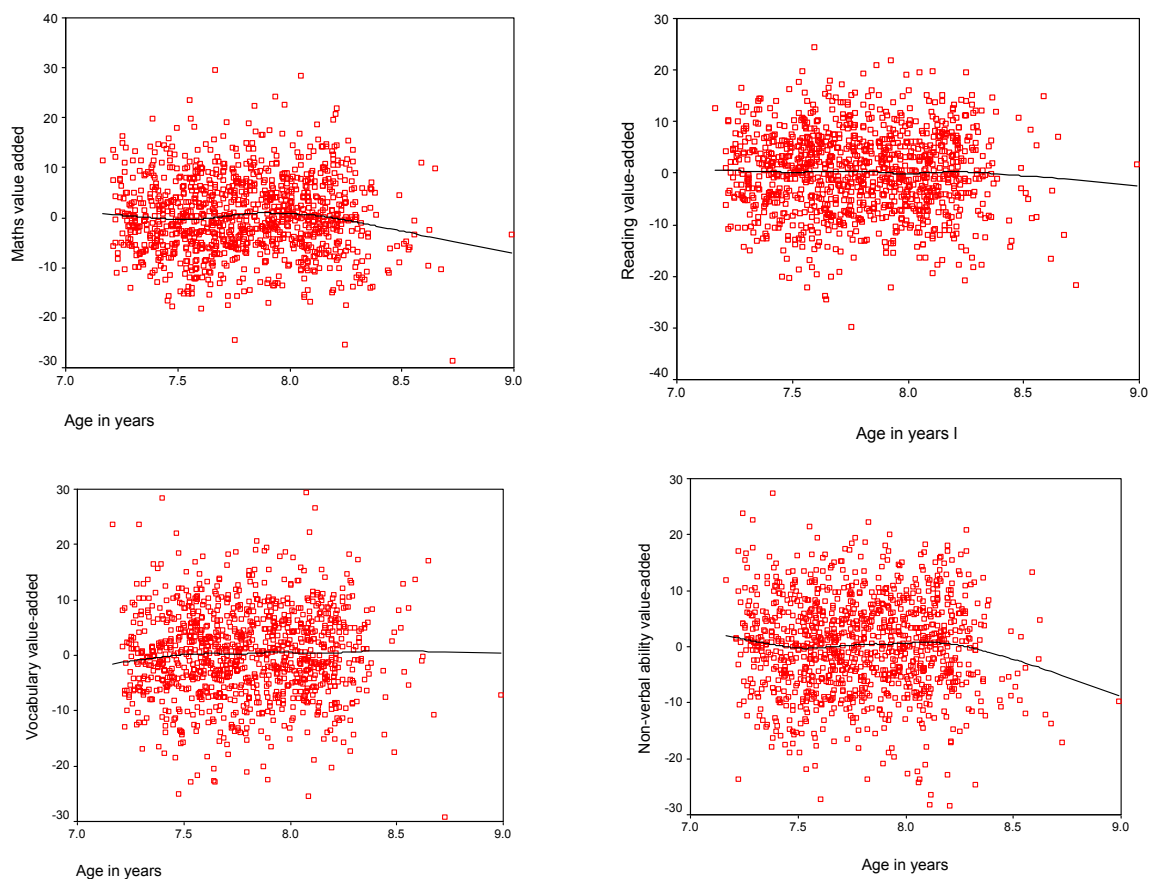


⁷ LOWESS: (Locally weight sum of squares) This is a regression technique which constructs a line of best fit by taking more notice of points that are near a point on the line than those that are at some distance. The result is a curve which is sensitive to local variations but does smooth over local bumps. The technique is available in SPSS.

The charts show little evidence of an optimum age with slight ups and downs for older and younger children. In all charts the highest score is for the children who were five and a half on entry but the link to age is weak. There is also a tendency for the line to fall away for the older children. For non-verbal ability there is a slightly higher score for very young children than for young children.

A more probing question, which asks whether there is an optimum age for value-added, demands additional charts, which are plotted below. The value added measures for the charts were the residuals calculated from a simple regression of maths or reading against the scores on the baseline assessment when starting school.

Figures 22-25



Some waviness is still seen but the rise by age is no longer apparent, although there is still a falling away for the older pupils. The oldest pupils are likely to have repeated an academic year due to low attainment, which is likely to explain the lower residuals for those children.

The visual pattern was then checked using multi-level models.

Table 10 Mathematics and Reading

	Mathematics		Reading	
	Null	Full	Null	Full
Fixed				
Cons	-0.021 (0.07)	0.14 (0.065)	-0.050 (0.070)	0.047 (0.071)
Baseline total		0.61 (0.02)		0.61 (0.02)
Very young (<6mths)		0.006 (0.06)		0.04 (0.064)
Young (3-6 mths)		-0.126 (0.069)		0.004 (0.069)
Old (3-6 mths)		0.001 (0.071)		-0.031 (0.071)
Very old (>6 mths)		-0.095 (0.064)		-0.025 (0.064)
Random				
Pupil	0.80 (0.03)	0.50 (0.02)	0.76 (0.03)	0.50 (0.02)
School	0.20 (0.04)	0.11 (0.03)	0.23 (0.05)	0.15 (0.04)

Table 11 Vocabulary and non-verbal ability

	Vocabulary		Non-verbal ability	
	Null	Full	Null	Full
Fixed				
Cons	-0.077 (0.070)	0.063 (0.068)	-0.008 (0.056)	0.9 (0.059)
Baseline total		0.49 (0.03)		0.43 (0.03)
Very young (<6mths)		-0.080 (0.066)		0.036 (0.076)
Young (3-6 mths)		0.010 (0.070)		-0.053 (0.081)
Old (3-6 mths)		0.032 (0.073)		-0.050 (0.084)
Very old (>6 mths)		-0.029 (0.066)		0.001 (0.076)
Random				
Pupil	0.74 (0.03)	0.52 (0.02)	0.84 (0.03)	0.70 (0.03)
School	0.24 (0.05)	0.13 (0.03)	0.14 (0.03)	0.05 (0.02)

The multilevel models were constructed in such a way that the main predictor of the P3 outcomes (mathematics, reading, vocabulary and non-verbal ability) was the baseline total score, which is the best indicator of later progress. Four dummies were used to indicate (a) the very young children, more than six months below the average age of children starting school, (b) children who were between three and six months younger than the mean starting age, (c) children who were older than the mean starting age by three to six months, and (d) children who were much older. The four separate categories were compared against the children within three months of the average starting age.

None of the coefficients for the dummies in the models were significant and the conclusion therefore is that despite some of the waviness in the lines that we see in the value-added charts above, none of the differences by age were significant. It would appear from this analysis that there is no clear optimum advantage in terms of the progress made by children from their starting point for any particular age on starting school.

6.2 Sex

The data were then checked to see if there was any evidence to suggest that girls or boys were particularly affected by the age of starting school. Terms were introduced in the multi level model for sex and for interactions between sex and the various age categories used above. For each of the four outcomes ten explanatory variables were introduced making 40 in all. Of these, one was significant at the 5% level, indicating that very young girls make less progress than predicted relative to their starting points to the tune of about a fifth of a standard deviation. However, in any large analysis the odd spurious result is to be expected and it is unlikely that this one finding for one subject would be reproduced in further studies.

6.3 Socio-economic status

The home postcodes of the children were linked to the 1991 census data and deprivation indices (Carstairs) were calculated for each neighbourhood from which the pupils originated. The resulting variable was used in the multi level model in two ways. Firstly it was introduced alongside the starting baseline as an additional explanatory variable. This made little difference to the age related coefficients – none were significant. Secondly it was used in combination with each age category to see if children from affluent or deprived backgrounds were particularly advantaged or disadvantaged by starting school at different ages. No evidence for such interactions was found.

6.4 Attitudes

Figures 26 – 27 below show scattergrams of the three measures of attitude in P3 against age. The attitude scales run from 1 to 3 and are formed from an average of the responses children made to a series of statements by selecting frowning (☹), neutral (☺) or smiley (😊) faces. These were coded 1 to 3 respectively.

Visually, there is an indication that the older and younger pupils were slightly more positive for all three outcome measures. Multi-level models were then constructed to quantify the relationships.

Figure 26

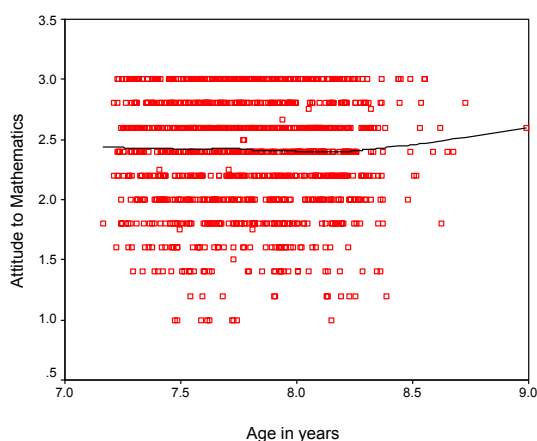


Figure 27

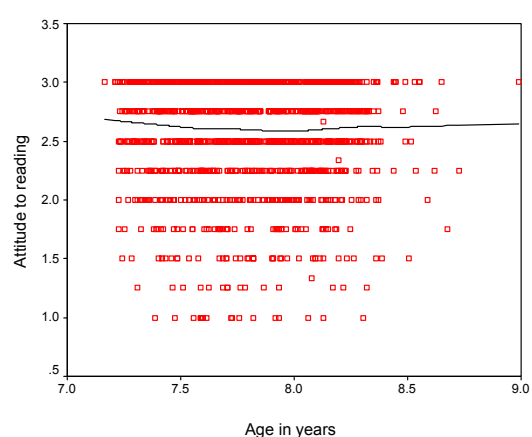


Figure 28

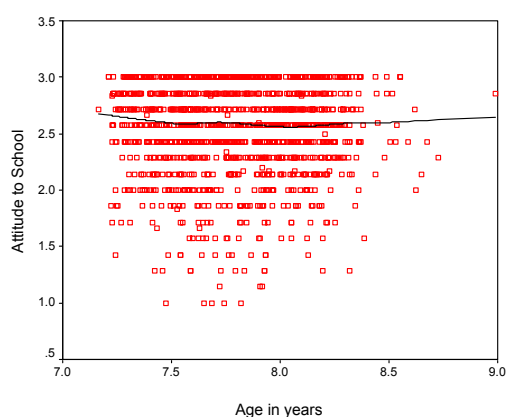


Table 11 Attitudes to Mathematics and Reading

	Mathematics		Reading		School	
	Null	Full	Null	Full	Null	Full
Fixed						
Cons	-0.019 (0.034)	-0.29 (0.060)	-0.031 (0.028)	0.059 (0.054)	-0.023 (0.034)	-0.054 (0.062)
Baseline total		-0.073 (0.030)		-0.013 (0.029)		-0.065 (0.030)
Very young (<6mths)		0.031 (0.082)		0.093 (0.079)		0.134 (0.081)
Young (3-6 mths)		0.019 (0.088)		0.086 (0.084)		-0.023 (0.087)
Old (3-6 mths)		0.104 (0.091)		0.003 (0.087)		0.054 (0.090)
Very old (>6 mths)		-0.013 (0.030)		0.040 (0.079)		-0.029 (0.030)
Random						
Pupil	0.86 (0.029)	0.825 (0.036)	0.78 (0.03)	0.771 (0.034)	0.84 (0.03)	0.808 (0.036)
School	0.034 (0.012)	0.039 (0.016)	0.018 (0.008)	0.018 (0.011)	0.035 (0.012)	0.048 (0.018)

None of the coefficients associated with age were significantly different from zero and, in view of the large sample size, it was concluded that the link between age and attitudes seen in the diagrams was very slight and not of educational importance.

6.5 Sex

Girls were generally more positive than the boys. This was particularly true for the Attitude to School measure where the difference was about 0.6 of a standard deviation. However, the multi-level models did not indicate that younger or older boys or girls were particularly positive or negative in their attitudes.

6.6 SES

The multilevel models gave no evidence for deprivation levels changing the conclusions drawn earlier, nor was there any evidence of interactions between age and home background.

6.7 Summary: The age of starting school

No evidence could be found for an optimum age for starting school. More specifically, the cognitive progress and attitudes of children in P3 were unconnected with their age on starting school.

The implications of this are fairly clear so far as changes to policy are concerned: there is no reason to change the age of starting school in Scotland on the basis of the analysis in this report. It provided no evidence that children of four and a half were suffering by starting school too early. Nor did it suggest that five and a half year olds were inappropriately placed. However, this study could not assess the impact of the total amount of schooling on later outcomes at school-leaving age.

7 Overall Summary

7.1 The widespread use of the PIPS On-entry Baseline Assessment has created a unique database that had not been examined in detail from a Scottish perspective until now. The research was divided into three parts and the main findings in response to the three research questions are outlined below:

7.2 What do children know and what can they do when they start school in Scotland?

- There was a very large variation across children with some reading fluently and adept at working with numbers and others having difficulty counting a few objects and not yet in a position to identify any letters of the alphabet.
- Older children started school at higher levels to the tune of about 0.05 standard deviations per month.
- There was no difference in mathematics development of boys and girls at the start of school. Girls had higher scores for reading, vocabulary and phonological awareness. The greatest advantage was for reading where they were a fifth of a Standard Deviation ahead of the boys. The standard deviations for the boys' scores in vocabulary and mathematics were higher than for girls, meaning that there were proportionately more boys with extreme scores (both high and low) than girls.
- Children with an entitlement to free school meals scored about a third of a standard deviation below those who did not have such an entitlement.
- The amount of pre-school experience was almost unrelated to the baseline scores. This contrasts with the strong relationship found in the English data.

7.3 Do children starting school in Scotland have the same age related development profile as children in England, Western Australia and New Zealand?

- The developmental patterns of children starting school in Scotland was very similar to children in three other English-speaking countries. Children in Scotland found the same tasks as easy or as difficult as children in other countries. The correspondence was very tight.
- When the age of the children at the start of school was taken into account, the mean reading and mathematics scores of the older children starting school in Scotland were lower than expected. However, the vocabulary scores of these older pupils were in line with children of the same age from other countries.

7.4 Is there an optimum age for starting school?

- Multi level analysis found that the age of pupils when they started school did not influence the amount of progress that they made in reading, mathematics vocabulary and non-verbal ability between the start of Primary 1 and Primary 3. Younger children were not

disadvantaged. Nor was there any significant interaction with age, sex or socio-economic status. These findings also applied to pupils' attitudes.

8 Concluding Comments

Research reports invariably call for more research and the call is heard so often that it can fall on deaf ears. But we believe that there are findings in this document that urge further investigation. Two specific questions could profitably be addressed:

- Why is there such a weak link between the pre-school experience for children in Scotland and their starting points at school?
- Why do older children starting school in Scotland seem to be starting school at a lower level than children in other countries?

Such questions suggest qualitative work in the first instance, which would seek to explore differences between Scotland and other countries in the approach to pre-school. It would be important to link this to a review of the evidence base of pre-school practice.

In calling for this work we are aware that it may be taken as an implied criticism of current provision but this would be a misreading of our intentions. The research has thrown up some puzzling findings that need further investigation. We really do not know why we have found what we have found.

In addition to investigating aspects of cognitive development it would be interesting to look at the personal, social and emotional development of children in relation to age of starting school.

The age of starting school is a contentious issue and this report has thrown some light on the matter, which does not suggest any need for a change in the status quo. We note however, that international research has never satisfactorily answered questions about the best age for starting school. There are strong opinions but no strong evidence base. If Scotland were to consider changing its policy in this vital area then we would recommend an evidenced based approach with different approaches being introduced in a controlled fashion in different parts of Scotland. This would be a world first and could parallel the enormously important work from Tennessee on class size.

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