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## ***Predicting Patterns of Early Literacy Achievement: A Longitudinal Study***

A study of 114 young children examined the relationship between children's phonological awareness in the prior-to-school period with literacy achievement after five months in Year 1. The study was conducted in three large metropolitan schools in Queensland, Australia. Measures of children's phonological awareness and later literacy development were gathered using one-on-one interactions. Correlation and cluster analysis were utilized and both showed phonological awareness in preschool predicted a range of literacy measures after five months in Year 1.

The prior-to-school years are regarded as a crucial time for young children to gain language skills and interact consciously with print as these are regarded as critical for the development of early literacy understandings (Clay, 1966, 1979; Hall, 1987; McNaughton, 1995; Snow, Tabors, & Dickinson, 2001; Storch & Whitehurst, 2002; Teale & Sulzby, 1986; Wells, 1985; Whitehurst & Lonigan, 2001; Yaden, Rowe, & MacGillivray, 2000). Despite these research findings, teaching practices within early childhood educational settings are not always fully aligned (Bowman, Donovan, & Burns, 2001).

There has been a shift in beliefs about emergent literacy. In the past few educators believed that all children could succeed as readers (Allington, 1995), as learning to be literate was conceived as mostly relating to innate attributes (McGee & Richels, 2003). More recent research supports the notion that early literacy development involves "the complex interplay of biology and environment" (Roberts & Burchinal, 2001, p. 232). Socioeconomic status differences also have been perceived as relating to literacy achievement in school (Snow, Burns, & Griffin, 1998) and there is a belief that middle class children with well-educated parents generally thrive. In contrast, children from low socioeconomic backgrounds are often perceived to be at greater risk (Neuman & Celano, 2001), but not all of these children experience language and literacy difficulties or failure (Heath, 1983; Heath, 1999; Scribner & Cole, 1981). Studies of home literacy practices have found that most parents interact with their children in a range of ways, irrespective of socioeconomic background (Heath, 1983; Lareau, 1989).

While cognitive abilities cannot be ignored, physical and social environment also must be acknowledged as contributing to literacy-related experiences (Gallimore & Goldenberg, 1993; Neuman & Celano, 2001). Both the physical access to resources and the social access to more-learned others must be considered. Previous ecological research that examined literacy-related experiences within home and educational settings, has not always acknowledged degree of access as a contributing factor for explaining differences. Research on book-reading for middle and lower income groups for example, may be explained not only in terms of frequency of the experience, but also in terms of differences of degree of access (Neuman, 1996; Neuman et al, 2001).

The relationship of oral language development with early reading has been well documented (Lieberman, 1982; Lieberman & Shankweiler, 1985; Scarborough, 2001). Learning to read is one of the most important skills for a young child (National Institute of Child Health and Human Development (NICHD), 2000), but many children experience difficulties in the early stages of beginning literacy (Adams, 1990; Snow, Burns & Griffin, 1998). Problems associated with learning to read and write are often

associated with language-related deficiencies and not visual or auditory difficulties (Lieberman & Shankweiler, 1991).

One area of beginning reading research that has received much attention relates to young children's phonological awareness. A number of studies (Kirby & Parrila, 1999; Scarborough, 2001; Whitehurst & Lonigan, 2001) have found skills of phonological awareness to be reliable predictors of later reading achievement and crucial for beginning reading. Phonological awareness is a broad term and "is the ability to attend explicitly to the phonological structure of spoken words rather than meaning or syntactic roles" (Snow, Burns & Griffin, 1998, p.11). If young children do not achieve the ability to focus on the sound structure of spoken language, it is most likely they will face difficulties relating phonemes to graphemes in the alphabetic symbol system in English. Phonemic awareness, the child's ability to "manipulate individual sounds (phonemes) within words," (Lane, Pullen, & Eisele, 2002, p. 102) also contributes to children's successful emergent literacy. Children with well-developed phonological awareness can "detect, match, blend, segment and manipulate speech sounds" (Lane et al., 2002, p. 102). Not all phonological tasks are the same and a continuum of complexity has been proposed by Chard & Dickson (1999). The simplest tasks include rhyming and sentence segmentation. Moderately difficult tasks include syllable segmentation and blending and detection of onset and rime. The most complex tasks involve segmenting and blending individual phonemes.

## **THE STUDY**

A study of early literacy development was conducted to investigate the predictive potential of measures of phonological awareness (Neilson, 1995, 1999) gathered just prior to commencing Year 1 (preschool in Queensland) and comparing these results with children's literacy achievement five months after commencing Year 1. The study also investigated the potential of using cluster analysis to predict early literacy achievement. Parents of 114 children from three large metropolitan schools in the state of Queensland, Australia gave permission for their children to participate. In a larger study (Young, 2004) several literacy measures were utilised in the prior-to-school period, but phonological awareness measures only are described in this paper.

## **METHOD**

### **Sample**

All three schools in the study catered for children from preschool to Year 7. This arrangement enabled literacy progress to be mapped from the end of the preschool year and throughout the early months of Year 1. Forty-three families from Preschool A, 33 from Preschool B and 38 from Preschool C provided permission for their children to participate. One child from Preschool C was unable to complete the study beyond preschool as he did not continue his enrolment into Year 1.

Ages of the children in preschool ranged from 4 years 11 months to 6 years 4 months with a mean age of 5 years 7 months. No significant age difference was shown for boys and girls with a mean age of 5 years 7 months for boys and 5 years 6 months for girls. Distributions by age are presented in Figure 1 and these are shown in three age group ranges:

- 1) 4:11- 5:4 (59 months – 64 months)
- 2) 5:5 – 5:10 (65 months -70 months) and
- 3) 5:11 – 6:4 (71 months – 76 months).

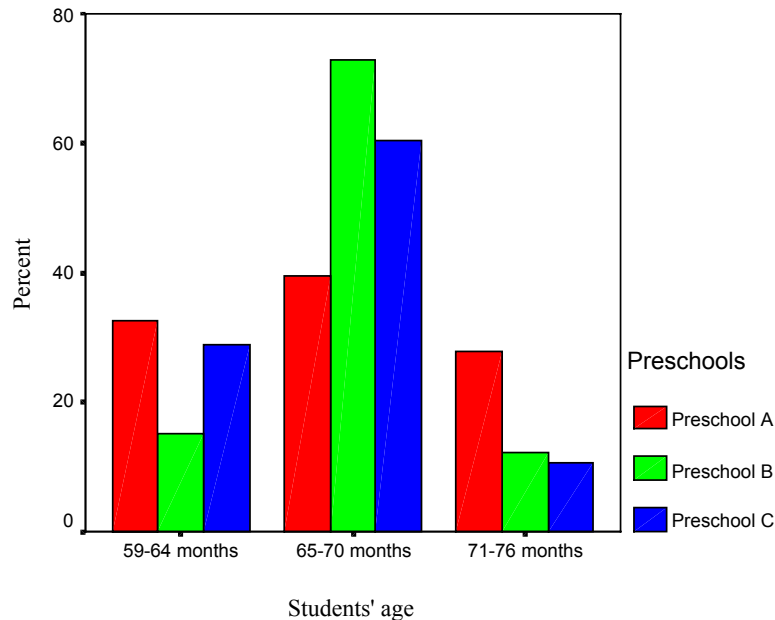


Figure 1. Distribution of children's ages across three age-group ranges

Gender make-up within the study was relatively even across each of the preschools. Preschool A (males 49% / females 51%); Preschool B (males 51.5% / females 48.5%) and Preschool C (males 45% / females 55%).

The total percentage of boys in the study was 48.2%. Most children (94%) had English as their first language with six children, all from Preschool C, who had English as their second language.

### Mothers' Occupations and Education Levels

Parents provided information relating to occupations and the highest level of educational qualification for each adult partner in the family. Occupations were classified into six categories using the Australian Standard Classification of Occupations (ASCO) (Australian Bureau of Statistics, 1990). Some adaptations were made to suit the context of the study. The six categories used to classify occupation were:

- Category 1: professional, manager or administrator;
- Category 2: tradesperson, para-professional or self-employed;
- Category 3: salesperson, clerk;
- Category 4: labourer, plant & machinery operator;
- Category 5: student, unemployed;
- Category 6: home duties.

Occupations for all mothers in the study during the preschool period are shown in Figure 2.

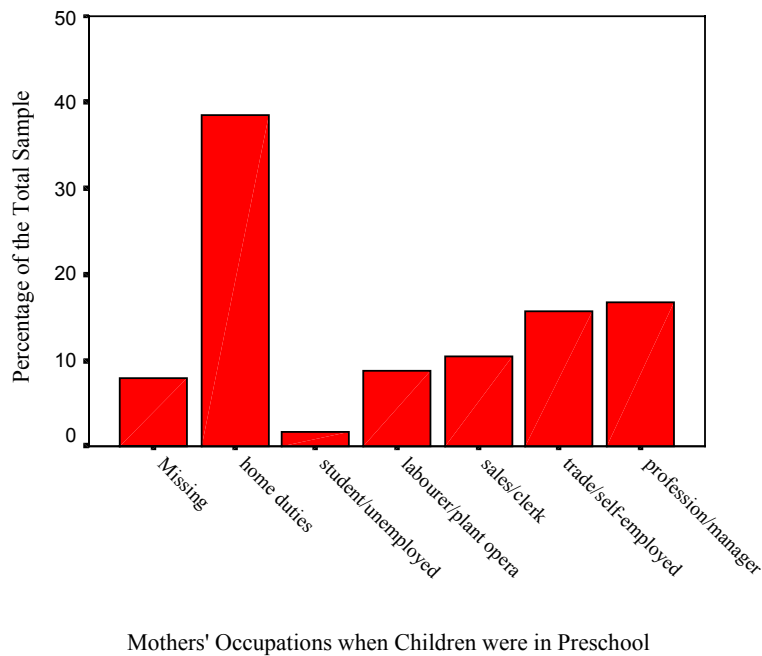


Figure 2. Mothers' occupations when children were in preschool

Approximately 40% of mothers listed home duties as their occupation when the study commenced, and 18% were working in professional employment.

Data relating to the highest level of education for mothers are presented in Figure 3. Education levels were classified into four categories: University; Technical and Further Education (TAFE); Year 12; Year 10 & Year 11.

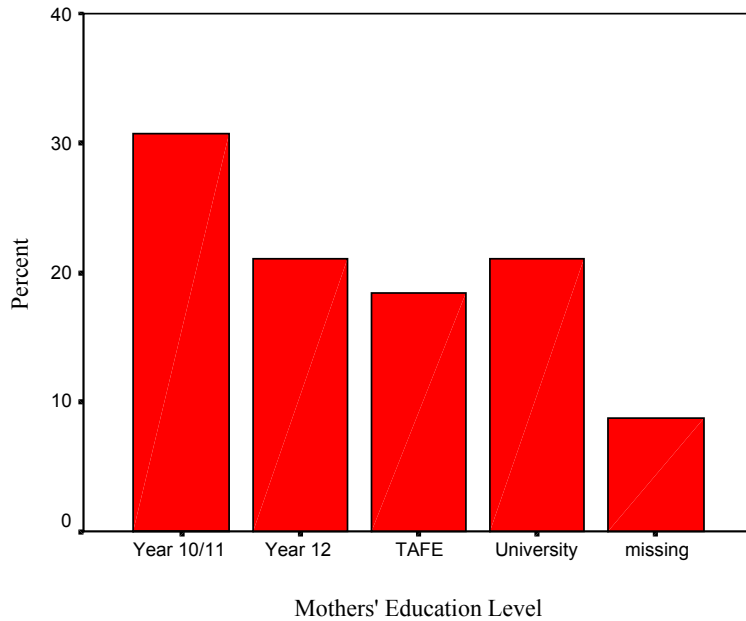
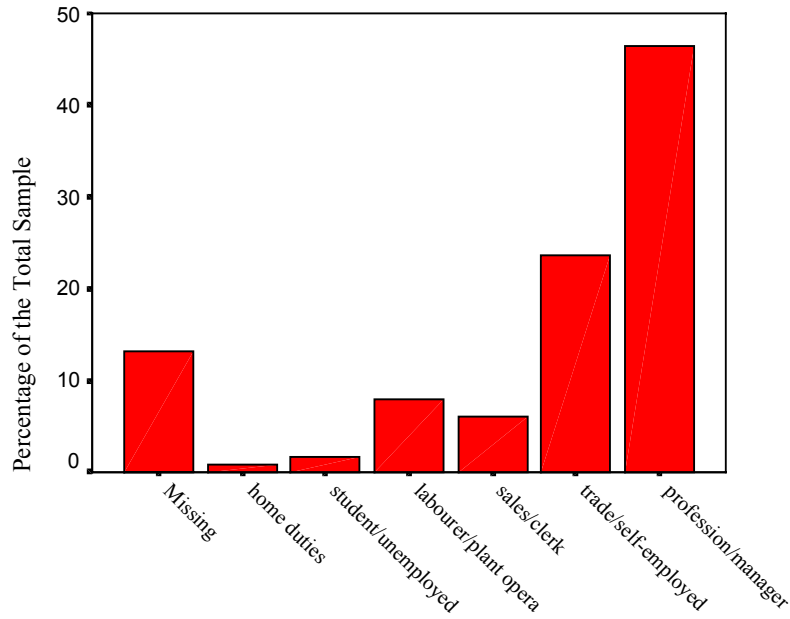


Figure 3. Mothers' education level when their children were in preschool

Approximately 31% of mothers listed Year 10/11 as their highest level of qualification and 22% had a university qualification.

### **Fathers' Occupations and Education Levels**

Data showed that the majority of fathers were working. Their occupational profile is shown in Figure 4.

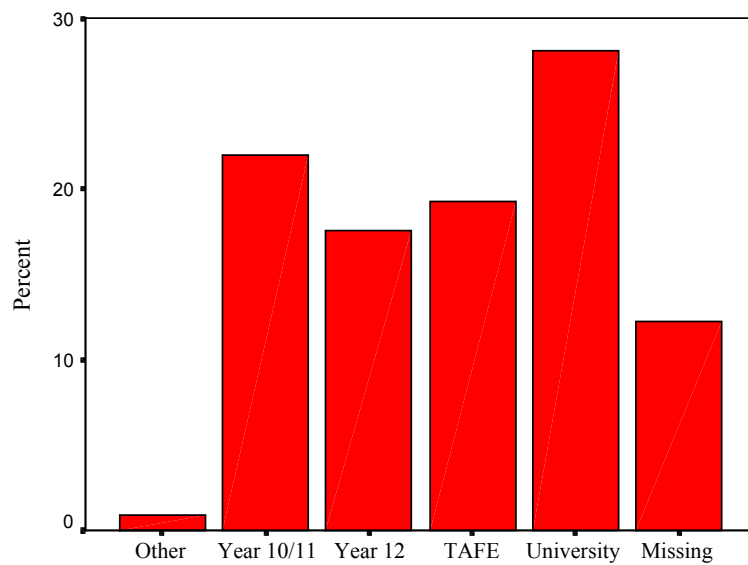


Fathers' Occupation when child in Preschool

Figure 4. Fathers' occupation when their children were in preschool

Fathers' occupation profile contrasted with mothers in that the majority were employed in the workforce and 48% were in professional employment.

Data relating to the highest level of education for fathers are presented in Figure 5.



Fathers' Education Level

Figure 5. Fathers' education level when their children were in preschool

Socio-economic status of families in this study was mixed and could be described as lower middle class to middle class. Almost half of the mothers (40%) worked in the home and 18% worked in professional occupations. In contrast, just one father worked at home and 55% worked in professional occupations. Fathers were educated to higher levels than mothers. Twenty-seven percent of fathers had university qualifications compared to 22% of mothers. In addition, more mothers (32%) than fathers (22%) listed their highest qualification as Year 10 or 11.

### **Measures of Phonological Awareness in Preschool**

In the final weeks of preschool, five subtests of the Sutherland Phonological Awareness Test (SPAT) (Neilson, 1995; 1999) were administered individually to the children. The full test consists of eleven subtests arranged in approximate order of difficulty and included demonstration and practice items followed by the test items. Four test items of approximately equivalent difficulty are used for each subtest. Subtests 1-5 were used with the children during the final weeks of preschool. The sub-tests included syllable counting; rhyme detection; rhyme production; onset identification and final phoneme identification. Details of these sub-tests are:



### Subtest 1: *Syllable Counting*

Children are asked to tap out the syllables in each word by tapping on boxes drawn on a card.

Demonstration and practice: {kangaroo; alligator}

Test Items 1-4: {picnic; television; elephant; supermarket}

### Subtest 2: *Rhyme Detection*

Children listen to a word and choose a rhyming word from a group of pictures.

Demonstration and practice: {cat - bell, bat} {pig - dig, cup}

Test Items: 1. {map - tap, kite} 2. {sun - shirt, gun} 3. {fox - box, zip} 4. {wall - fish, ball}

### Subtest 3: *Rhyme Production*

Children are given a word and asked to think of a rhyming word for it.

Demonstration and practice: {can, fan, man} {cat, fat, .....}

Test Items 1-4: {night, fight, ...} {toe, show, ...} {bed, red, ...} {four, sore, ...}

### Subtest 4: *Onset Identification*

Children identify the first sound in the word.

Demonstration and practice: {ball = /b/} {sun = /s/}

Test Items 1-4: {fat = /f/} {moon = /m/} {torch = /t/} {girl = /g/}

### Subtest 5: *Final Phoneme Production*

Children identify the final sound in the word.

Demonstration and practice: {game = /m/} {boot = /t/}

Test Items 1-4: {bus = /s/} {cap = /p/} {roof = /f/} {duck = /k/}

## **Literacy Achievement Measures After Five Months in Year 1**

Five months after commencing Year 1, all participants completed seven literacy-related tasks. These tasks were administered individually with each child, and were used to gauge children's literacy knowledge and understanding and to ascertain growth in literacy achievement. The component tasks included:

### 1. *Robinson's Test of Writing Vocabulary* (Clay, 1985, p. 35-36)

Children were asked to write as many words as possible in a period of 10 minutes.

### 2. *Letter Knowledge and Identification* (Clay, 1985)

Children asked to identify lower case letters in three ways as described by Clay (1985). First the name of the letter was given, then the sound it makes and finally children gave a word that starts with the sound.

### 3. *Concepts about Print Test 'Sand'* (Clay, 1993, p. 47-52)

Children completed Clay's Concepts about Print Test version 'Sand' and responded to the 24 items of the test.

4. *Canberra Word Test* (Clough, McIntyre & Cowey, 1990)  
Children were asked to read fifteen words from a list.

5. *Story Comprehension* (Church, 1990)  
The story, *My Brother John*, was read to the children. Literal, inferential and nonsense statements were then posed for verification. Children responded to the ten statements as either true or not true.

6. *Print Knowledge Task*  
This task examined concepts about print using the rhyme *Humpty Dumpty*. The rhyme was printed on a large piece of card and on strips of card. Tasks included pointing to a line of print, a letter or word; matching strips to the whole text, finding a strip that was placed out of order or upside down or pointing to particular words in the text e.g. ‘Humpty’, ‘sat’ and ‘horses’.

7. *Sutherland Phonological Awareness Tasks* (Neilson, 1995; 1999) – (Retest)  
Subtests 1-5 were used again and included syllable counting; rhyme detection; rhyme production; onset identification and final phoneme identification.

## **RESULTS**

### **Sutherland Phonological Awareness Measures in Preschool**

Sutherland Phonological Awareness measures in preschool showed the children achieved best on Rhyme Detection and least well on Final Phoneme Production. Results are presented in Table 1.

Table 1  
*Scores for Sutherland Phonological Awareness Tasks in Preschool*

Phonological Awareness Measures	Mean	SD
Rhyme Detection	3.46	0.84
Syllable Counting	3.11	1.06
Rhyme Production	2.05	1.67
Onset Identification	1.45	1.59
Final Phoneme Production	0.82	1.29

Analysis of variance showed no significant difference due to age:  
Syllable Counting ( $p = .11$ );  
Rhyme Detection ( $p = .17$ );  
Rhyme Production ( $p = .55$ );  
Onset Identification ( $p = .53$ ); and  
Final Phoneme Identification ( $p = .82$ ).

Similarly, no significant gender effect was shown:  
Syllable Counting ( $p = .63$ );  
Rhyme Detection ( $p = .21$ );  
Rhyme Production ( $p = .44$ );  
Onset Identification ( $p = .34$ ); and  
Final Phoneme Identification ( $p = .62$ ).

### Literacy Measures Five Months After Commencing Year 1

Results for literacy achievement measures five months after commencing Year 1 are shown in Table 2.

Table 2  
*Descriptive Statistics for Literacy Measures Five Months into Year 1*

Literacy Measure 5 months into Year 1	Mean	SD
Robinson's Test of Writing Vocabulary	9.09	6.48
Letter Names (Possible score 28)	23.99	4.74
Letter Sounds (Possible score 28)	21.70	5.28
Words for Letters (Possible score 28)	21.05	5.58
Concepts About Print Test (Possible score 24)	16.69	1.40
Canberra Word test (Possible score 15)	9.30	4.04
Story Comprehension (Possible score 10)	7.95	1.75
Print Knowledge (Possible score 17)	14.53	2.51
Syllable Counting (Possible score 4)	3.22	1.11
Rhyme Detection (Possible score 4)	3.68	0.63
Rhyme Production (Possible score 4)	2.84	1.41
Onset Identification (Possible score 4)	3.84	0.54
Final Phoneme Production (Possible score 4)	3.12	1.25

Analysis of variance examined significant effects due to age or gender for each of the tasks and results are shown in Table 3.

Table 3  
*Analysis of Variance for Literacy Measures Five Months into Year 1*

Literacy Measures in June of Year 1	Age	Gender
Robinson's Test of Writing Vocabulary	$p = 0.88$	<b><math>p = 0.02</math></b>
Letter Names	$p = 0.43$	<b><math>p = 0.01</math></b>
Letter Sounds	$p = 0.68$	$p = 0.32$
Words for Letters	$p = 0.97$	$p = 0.19$
Concepts About Print Test	$p = 0.94$	$p = 0.12$
Canberra Word test	$p = 0.80$	$p = 0.16$
Story Comprehension	$p = 0.62$	$p = 0.94$
Print Knowledge	$p = 0.49$	$p = 0.06$
SPAT (total)	$p = 0.59$	$p = 0.90$

Two significant effects were shown for the Year 1 literacy measures. First for Robinson's Test of Writing Vocabulary where the girls wrote significantly more words (mean score 10.4) than boys (mean score 7.6). The second significant effect for gender was shown for knowing letter names with girls achieving a mean score of 25.03 compared to 22.85 for boys.

### Correlations of SPAT Measures in Preschool with Literacy Measures after Five Months in Year 1

Pearson's bivariate correlation was conducted to measure associations between SPAT preschool measures and literacy achievement measures in Year 1. Results showed a number of significant correlations occurred. These are shown in Tables 4 and 5.

Table 4

*Significant Correlations of SPAT Measures and Literacy Measures Five Months into Year 1 (A)*

Scores	Subtest 1 Syllable Counting	Subtest 2. Rhyme Detection	Subtest 3 Rhyme Production	Subtest 4 Onset ID	Subtest 5 Final Phoneme ID	CAP total	Canberra words
Subtest1			.19*				
Subtest 2			.28**		.34**	.23*	.27**
Subtest 3				.28**	.40**	.45**	.34**
Subtest 4					.35**	.35**	.19*
Subtest 5						.47**	.35**

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

\* Correlation is significant at the 0.05 level (2-tailed)

Table 5

*Significant Correlations of SPAT Measures and Literacy Measures Five Months into Year 1 (B)*

Scores	Story Comprehension	Letter names	Letter Sounds	Letter words	Robinson's test of Writing	Print Knowledge Task
Subtest1					.22**	
Subtest 2		.19*	.19*	.31**	.30*	
Subtest 3		.34**	.40**	.53**	.40**	.43**
Subtest 4	.23*	.28*	.40**	.39**		.37**
Subtest 5		.37**	.40**	.48**	.41**	.37**

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

\* Correlation is significant at the 0.05 level (2-tailed)

## Principal Component Analysis of SPAT Measures in Preschool

Principal Component Analysis (PCA) was conducted on the five sub-tests of SPAT to examine underlying factors. The initial analysis resulted in a one-factor solution with an eigenvalue greater than 1.0. In the light of the Scree Test shown in Figure 6 and in the interests of interpretation, a two-factor solution seemed preferable and this solution accounted for 68% of the variance.

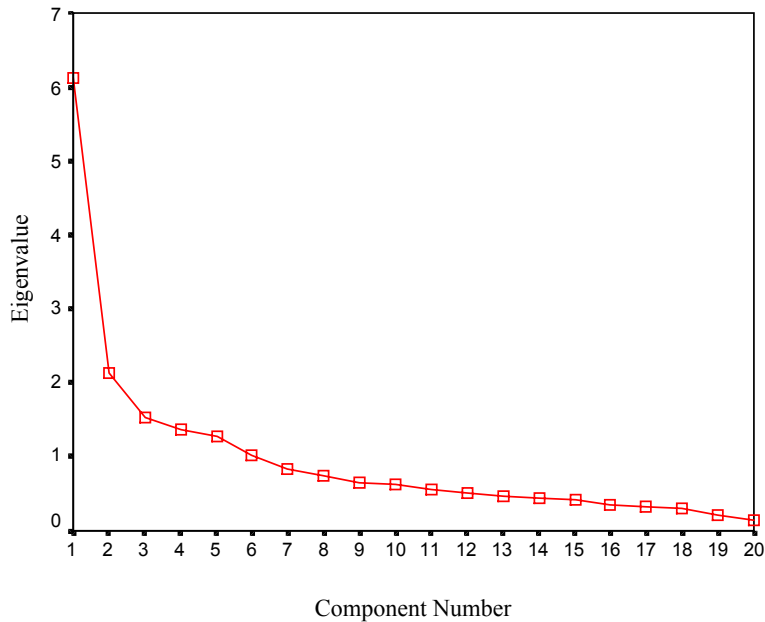


Figure 6. Scree test for PCA of Sutherland phonological awareness test in preschool

The two-factor solution shown in Table 6 showed heavy weighting for Factor 1 (named ‘rhyme, onset, final phoneme’) on onset identification, final phoneme identification and rhyme production tasks. Factor 2 (named ‘rhyme and syllables’) weighed heavily on syllable counting, rhyme detection and rhyme production. It should be noted that both factors contained almost equal weighting of rhyme production.

Table 6

*Rotated Component Matrix for Sutherland Phonological Awareness Measures in Preschool*

Sutherland Phonological Awareness Measures	Factor 1: Rhyme, onset, final phoneme	Factor 2: Rhyme & syllables
Total for onset identification	<b>.86</b>	.19
Total for final phoneme identification	<b>.85</b>	.07
Total for rhyme production	<b>.58</b>	<b>.52</b>
Total syllable counting	.02	<b>.81</b>
Total for rhyme detection	.26	<b>.73</b>

## Cluster Analysis of SPAT Measures in Preschool

Cluster analysis of Sutherland Phonological Awareness measures from preschool was conducted to identify children with similar profiles and enable an examination of preschool measures as predictors of early literacy achievement. Variable Set X was calculated using the two factors that underpin Sutherland Phonological Awareness Test. An ISODATA routine split the preschool children into five groups accounting for 80.9% of the variance. Standardised cluster mean vectors for the groups within Variable Set X are shown in Table 7. Scores above and below the mean are marked in italics and scores well above and well below the mean are marked in bold.

Table 7

*Standardised Cluster Mean Vectors for Groups within Variable Set X*

Sutherland Phonological Awareness Factors	Cluster 1 N = 20	Cluster 2 N = 27	Cluster 3 N = 41	Cluster 4 N = 21	Cluster 5 N = 5
Rhyme, onset, final phoneme	<b>1.75</b>	.34	-.85	-.34	-.37
Rhyme & syllable	-.08	.67	.45	-.97	<b>-2.97</b>

A description of each cluster was made possible by examining cluster mean vector scores. A description of the groups follows: Note that variables not mentioned are those for which the cluster mean was around the overall mean (i.e. within the range  $-.5$  to  $+.5$ ):

Cluster 1 (20 children):

- well above the mean for onset identification, final phoneme identification and rhyme production.

Cluster 2 (27 children):

- above the mean for syllable counting, rhyme detection and rhyme production.

Cluster 3 (41 children):

- below the mean for onset identification, final phoneme identification and rhyme production.

Cluster 4 (21 children):

- below the mean for syllable counting, rhyme detection and rhyme production.

Cluster 5 (4 children):

- well below the mean for syllable counting, rhyme detection and rhyme production.

A range of performance patterns was shown. For further analyses of cluster groups Cluster 5 will not be included as the results determined only four children within this profile.

## Principal Component Analysis for Literacy Measures Five Months into Year 1

The underlying dimensions of three Year 1 literacy measures Letter Knowledge, Concepts about Print Test and SPAT measures were examined using Principal Component Analysis. Results for Letter Knowledge showed the extraction of a single factor (named 'letter knowledge') and accounted for 87.7% of the variance. Table 8 shows the component matrix for the factor.

Table 8  
*Component Matrix for Letter Knowledge Factor Five Months into Year 1*

Literacy Task Measures	Component
Total letter sounds	<b>.96</b>
Total words for letters	<b>.93</b>
Total letter names	<b>.91</b>

Prior to conducting PCA for Concepts about Print Test, frequency scores for each test item were examined. Those where 98% of the children successfully completed the item were left out of the factor analyses. This was done to prevent skewing of the results. Test items left out of the factor analyses were:

- Item 1 (pointing to the front of the book) 99.1% of children gave a correct response
- Item 3 (knowing where to start reading) 98.2% of children gave a correct response.

Principal Component Analysis with the remaining 22 test items was conducted and eight factors with eigenvalues greater than one emerged. These eight factors accounted for 63.75% of the variance and the rotated component matrix is shown in Table 9.

Table 9  
*Rotated Component Matrix for CAP Factors Five Months into Year 1*

CAP Item	Factor 1 Directionality of print	Factor 2 Sequencing of letters and words	Factor 3 Letter ID.	Factor 4 Concept of a word	Factor 5 Letter identification and punctuation	Factor 6 Place to start reading	Factor 7 Quotation marks & line sequencing	Factor 8 Reading left then right
Cap4	<b>.93</b>							
Cap5	<b>.87</b>			-.10				-.10
Cap14	<b>-.57</b>	.38		-.14	.13	.11		-.11
Cap2	<b>.54</b>			.21	.51	.17		.30
Cap13		<b>.85</b>						
Cap12		<b>.76</b>		.16		-.15	.20	
Cap20	-.12	<b>.54</b>	.21	.10		.43		
Cap24	-.13	<b>.42</b>	.25	.18		.38		.14
Cap21			<b>.78</b>					
Cap8	.14	.18	<b>.59</b>	-.31	.14	-.14	-.22	-.13
Cap19		.14	<b>.56</b>	.11				.37
Cap23	.19		<b>.50</b>	.36	.22	.29	.20	

CAP Item	Factor 1 Directionality of print	Factor 2 Sequencing of letters and words	Factor 3 Letter ID.	Factor 4 Concept of a word	Factor 5 Letter identification and punctuation	Factor 6 Place to start reading	Factor 7 Quotation marks & line sequencing	Factor 8 Reading left then right
Cap17		-.15		<b>-.74</b>	.10	.17		
Cap22				<b>.61</b>	.26	.25	.18	
Cap6	.20	.12		<b>.46</b>		.41		.18
Cap15	.22	.16	.31	-.36	.17	.19	.32	
Cap7					<b>.81</b>		-.18	.20
Cap16					<b>.68</b>		.26	-.21
Cap9						<b>.84</b>		
Cap18							<b>.75</b>	.16
Cap10		.22	.29	.16	.10		<b>.56</b>	
Cap11							.11	<b>.87</b>

The composition of each of the eight factors is highlighted in Table 9 and the names of each factor are presented below.

- CAP factor 1: directionality of print;
- CAP factor 2: sequencing of letters and words;
- CAP factor 3: letter identification;
- CAP factor 4: concept of a word;
- CAP factor 5: letter identification and punctuation;
- CAP factor 6: place to start reading;
- CAP factor 7: quotation marks and line sequencing;
- CAP factor 8: reading left then right.

A third Principal Component Analysis was conducted on the Sutherland Phonological Awareness measures in Year 1 to examine underlying factors. The analysis showed two factors with an eigenvalue greater than 1.0 accounting for 61% of the variance. The rotated component matrix is shown in Table 10.

Table 10

*Rotated Component Matrix for Sutherland Phonological Awareness Five Months into Year 1*

Phonological awareness subtests	Component	Component
Subtest 4: Onset identification	<b>.83</b>	-.26
Subtest 5: Final phoneme production	<b>.71</b>	.36
Subtest 3: Rhyme production	<b>.63</b>	.38
Subtest 1: Syllable counting	-.05	<b>.75</b>
Subtest 2: Rhyme detection	.24	<b>.67</b>

Factor 1 (named ‘onset final rhyme production’) loaded heavily on subtests four, five and three. Factor 2 (named ‘syllable rhyme detection’) loaded on subtests one and two.



## Examining Relationships of Variable Set X and Literacy Measures in Year 1

Analysis of variance was carried out with Literacy measures conducted in Year 1 and Variable Set X to examine predictive abilities. Results showed four non-significant effects. One occurred for Concepts about Print Test ( $p = .19$ ); one for Story Comprehension ( $p = .11$ ); one for Letter Knowledge ( $p = .10$ ); and one for Canberra Word Test ( $p = .08$ ). Four significant effects were shown and these are presented in Table 11.

Table 11

*Significant Results for Variable Set X With Literacy Measures in Year 1*

Factors/variables	p value
Factor 1- (onset identification; final phoneme and rhyme production)	<b>&lt;.01</b>
Factor 2 - (syllable counting; rhyme detection)	<b>&lt;.01</b>
Print knowledge task	<b>.02</b>
Robinson's test of writing vocabulary	<b>&lt;.01</b>

Means and standard errors of each score/factor are examined where significance occurs so each of the clusters from Variable Set X may be examined more closely. As indicated previously, Variable Set X, cluster five, in which there are only four children has been left out of the analyses. A significant effect was shown for Variable Set X with both factors devised from Sutherland Phonological Awareness measures. The first of these entails aspects of onset identification, final phoneme and rhyme production and is shown in Table 12.

Table 12

*Means and Standard Errors for Variable Set X With Onset Identification, Final Phoneme and Rhyme Production Factor Measures in Year 1*

(Note that +++ = well above the mean; ++ = above the mean; -- = well below the mean; - = below the mean.)

(Note that cluster 5 is not in the analysis as the number of children (4) is too small)

Cluster and description	N	Mean	St. Error
1. ++ onset identification,; ++ final phoneme identification; ++ rhyme production	20	.38	.22
2. + syllable counting,; + rhyme detection; + rhyme production	27	.44	.18
3. - onset identification; - final phoneme identification; - rhyme production	41	-.34	.15
4. - syllable counting; - rhyme detection; - rhyme production	21	-.38	.21

Variable Set X predicted phonological awareness results in Year 1. Cluster 2 performed best and cluster 4 was the lowest performing group. A significant effect was also shown for the second phonological awareness factor devised from literacy measures in Year 1. This factor captured aspects of syllable counting and rhyme detection. Means and standard errors are shown in Table 13.

Table 13

*Means and Standard Errors for Variable Set X on Syllable Counting and Rhyme Detection Measures in Year 1*

(Note that ++ = well above the mean; + = above the mean; -- = well below the mean; - = below the mean.)

(Note that cluster 5 is not in the analysis as the number of children (4) is too small)

Cluster and description	N	Mean	St. Error
1. ++ onset identification,; ++ final phoneme identification; ++ rhyme production	20	.41	.22
2. + syllable counting,; + rhyme detection; + rhyme production	27	.37	.18
3. – onset identification; - final phoneme identification; - rhyme production	41	.02	.15
4. – syllable counting; - rhyme detection; - rhyme production	21	-.60	.21

Variable Set X predicted children's results for the factor containing aspects of syllable counting and rhyme detection. This relationship indicated children's knowledge of phonological awareness in preschool related to their knowledge in Year 1. Cluster 1 performed best on syllable counting and rhyme detection factor and cluster 4 was the lowest performing group.

A significant effect also was shown for Variable Set X with Print Knowledge Task using the rhyme Humpty Dumpty. Means and standard errors are shown in Table 14.

Table 14

*Means and Standard Errors for Variable Set X on Print Knowledge Task Measures in Year 1*

(Note that ++ = well above the mean; + = above the mean; -- = well below the mean; - = below the mean.)

(Note that cluster 5 is not in the analysis as the number of children (4) is too small)

Cluster and description	N	Mean	St. Error
1. ++ onset identification,; ++ final phoneme identification; ++ rhyme production	20	15.44	.58
2. + syllable counting,; + rhyme detection; + rhyme production	27	15.07	.47
3. – onset identification; - final phoneme identification; - rhyme production	41	13.68	.39
4. – syllable counting; - rhyme detection; - rhyme production	21	14.55	.55

Variable Set X predicted children's ability to understand various print-related tasks using the rhyme Humpty Dumpty. Cluster 1 performed best and cluster 3 was the lowest performing group.

The final task where a significant effect was shown relates to Robinson's Test of Writing Vocabulary where children were asked to write as many words as possible in a 10-minute period. Means and standard errors are shown in Table 15.

Table 15

*Means and Standard Errors for Variable Set X on Robinson's Test of Writing Vocabulary Measures in Year 1*

(Note that ++ = well above the mean; + = above the mean; -- = well below the mean; - = below the mean.)  
(Note that cluster 5 is not in the analysis as the number of children (4) is too small)

Cluster and description	N	Mean	St. Error
1. ++ onset identification,; ++ final phoneme identification; ++ rhyme production	20	12.66	1.41
2. + syllable counting,; + rhyme detection; + rhyme production	27	13.03	1.15
3. – onset identification; - final phoneme identification; - rhyme production	41	6.92	.97
4. – syllable counting; - rhyme detection; - rhyme production	21	6.35	1.33

Results showed quite a large margin between clusters 1 and 2 and 3 and 4. Cluster 2 once again performed best with a mean score of 13.03 words. The lowest performing group was cluster 4 with a mean score of 6.35.

**Summary of Variable Set X Associations**

Variable Set X related significantly to four Literacy Achievement measures in Year 1 and predicted children's performance on a range of literacy-related tasks five months after commencing Year 1. Significant relationships were found for aspects of phonological awareness, print knowledge and writing words. Clusters 1 and 2 performed best while Clusters three and four consistently performed least well on the four significant tasks. A summary of these results is shown in Table 16.

Table 16

*Variable Set X (Based on Phonological Awareness in Preschool) with Significant Year 1 Literacy Achievement Measures Depicting the Highest and Lowest Cluster Mean Scores*

Factor/Score	Highest result/Mean score	Lowest result/Mean score
Factor 1(onset identification, final phoneme production , rhyme production)	Cluster 2 (.44)	Cluster 4 (-.38)
Factor 2 (syllable counting, rhyme detection)	Cluster 1 (.41)	Cluster 4 (-.60)
Print knowledge task	Cluster 1 (15.44)	Cluster 3 (13.68)
Robinson's test of writing vocabulary	Cluster 2 (13.03)	Cluster 4 (6.35)

## DISCUSSION AND CONCLUSIONS

This study has shown measuring phonological awareness in the prior-to-school period (preschool) is of value for predicting literacy achievement five months after commencing Year 1. Results for Phonological Awareness tasks (Neilson, 1995, 1999), Print Knowledge task using the rhyme *Humpty Dumpty* and Robinson's test of writing vocabulary (Clay, 1985) in Year 1 were predicted from phonological awareness tasks measured in preschool.

Correlation analyses showed a number of significant relationships between preschool measures of phonological awareness and literacy measures five months after commencing Year 1. Cluster analysis that determined children with similar profiles in preschool also allowed for an examination of the measures as predictors of early literacy achievement in Year 1. The analysis split the children into 5 sets with similar phonological awareness profiles. Two clusters, Cluster 1 (20 children) and Cluster 2 (27 children), were shown to be the highest achieving for the Year 1 measures. An examination of phonological awareness profiles for these two clusters revealed the children had achieved either very high or high results in preschool:

- Cluster 1 – well above the mean for onset identification, final phoneme identification and rhyme production;
- Cluster 2 – above the mean for syllable counting, rhyme detection and rhyme production.

Consistency was shown when the least well achieving clusters were examined. Cluster 3 (41 children) and Cluster 4 (21 children) performed least well on the four Year 1 results predicted by the preschool data. Their profiles in preschool revealed below the mean results for a number of phonological tasks:

- Cluster 3 (41 children) – below the mean for onset identification, final phoneme identification and rhyme production;
- Cluster 4 (21 children) – well below the mean for syllable counting, rhyme detection and rhyme production.

While correlation analysis revealed Year 1 results can be predicted from phonological awareness results in preschool, cluster analysis also has been shown to be of value.

While learning to be literate is complex and there appears not to be one pathway in early literacy development, studies such as this one that utilise a range of analyses of children's developing literacy skills shed new light on ways of analyzing emergent literacy. This study confirms the importance of phonological awareness in the prior-to-school period and the relationship of these measures to a range of literacy achievement results after five months in Year 1. Highest performing children in preschool maintained their results five months after commencing Year 1 and the lowest performing children did likewise.

These results highlight the need to ensure children are given opportunities at home and in early childhood settings to develop understandings of the phonological structure of spoken language (Beecher & Arthur, 2001; Lane & Pullen, 2004). Failing to attend to phonological awareness in the prior-to-school period increases risk factors associated with young children learning to be literate. Early identification of those at risk using screening batteries (Scarborough, 2001) is recommended, but it is acknowledged these have a high, but not perfect accuracy record. While diagnosing risk with young children is complex, results have shown phonological awareness plays “a causal role in learning to read” (Scarborough, 2001, p. 108) and should not be neglected.

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