

RELAZIONE TRA L'AMBIENTE DI APPRENDIMENTO A CASA (*Home Learning Environment*) E LO SVILUPPO DELLE COMPETENZE MATEMATICHE PRECOCI

<https://www.ljmu.ac.uk/microsites/liverpool-early-number-skills-project>

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Liverpool Early Number Skills: Key questions

Overall...

1. To what extent do preschool language and cognitive skills predict growth in early number skills?
2. To what extent do number-oriented and language and literacy-oriented aspects of the home learning environment predict growth in early number skills?
3. To what extent are the relationships between the quality of the home learning environment and early number skills direct and to what extent are they indirect via the promotion of language skills?

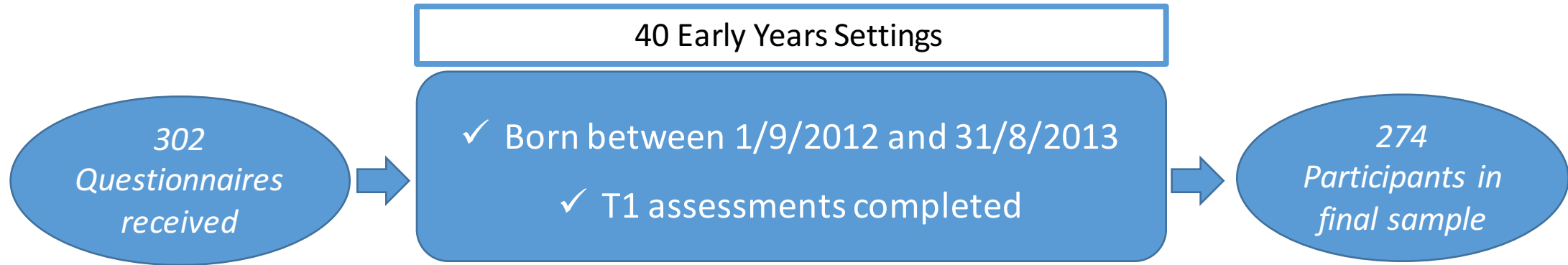
Today...

- Reliability of the questionnaire Scales
- Score distribution of the Early Number Skills tasks
- Relationships between questionnaire scales and Early Number Skills tasks

Liverpool Early Number Skills: Project Overview

	T	When?	What?	Measure/Task	How?
Preschool 2017	T1	Winter & Spring term	Home Environment	SES (postcode and qualifications) Preschool hours Home Learning Environment Reception expectations Attitudes to mathematics & Mathematical anxiety	Questionnaire
			Early Number Skills	Sequential & Cardinal counting Numeral translation Calculation	2 Sessions
	T2	Summer term	Preschool Environment	Early Childhood Environment Rating Scale (ECERS-3)	3-hour
			Language & Reasoning Skills	Expressive and Receptive vocabulary, Phonological awareness, Central executive functioning	3 Sessions
Reception 2018	T3	Summer term	Early Number Skills	Sequential & Cardinal counting Numeral translation Calculation	2 Sessions
			Mathematics & Reading Skills	Standardised mathematics & Word Reading tests	1 Session

Liverpool Early Number Skills: SAMPLE



PARENTS (Respondents)

Gender: 254 Females

Mean Postcode deprivation decile (from [English indices of deprivation 2015](#)): $M = 5.42$ ($SD = 3.32$)

General Qualification (from Regulated Qualification Framework 0-8): $M = 4.80$ ($SD = 2.04$)

Children (Participants)

Gender: 146 Females

Mean age (at end of T1): 48 Months ($SD = 3.63$)

Mean number of preschool sessions a week: 5.33 ($SD = 1.53$)

Ethnicity: 91% white

Additional language at home: 23

SEN: 8 (plus 7 referred)

Questionnaire (1/5): Home Experiences

“Rate **how often** your child experiences the different types of activities **at home**” (*Skwarchuk et al., 2014*)

	NUMBER (8)	LETTERS AND SOUNDS (7)	LANGUAGE & LITERACY (8)
6-point Likert Scale; Never (0) - Several times a day (5)	Is taught the names of numbers	Sings or recites the alphabet	Looks at factual books
	Recites numbers in order	Is prompted to identify letters in books or the environment	Discusses stories with an adult
	Plays games that involve number cards, dice or a number spinner	Is taught the names or sounds of letters	Has stories read to them
	Is encouraged to point out or identify numbers in books	Plays with puzzles or games involving letters	Is encouraged to use books to follow-up interests
	Completes number activities in magazines or workbooks	Forms or traces letters or writes their name	Is encouraged to point out or identify pictures in books
	Discusses numbers or quantity with an adult	Talks about letter sounds with an adult	Discusses with an adult how things work or what they mean
	Writes or traces number	Completes activities involving letters or sounds in magazines or workbooks	Makes up songs, stories or rhymes
	Sings number songs		Is encouraged to choose books that interest them to look at with an adult
<i>M</i>	3.08	2.92	3.50
<i>SD</i>	.82	.97	.74
α	$\alpha = .81$	$\alpha = .81$	$\alpha = .77$

Questionnaire (2/5): Home Resources

$\alpha = .44$

"State the number of the following toys, games and resources that you have in your home"

NUMBER (4)	LETTERS AND SOUNDS (4-1)	LANGUAGE & LITERACY (Book Exposure)
Puzzles or jigsaws involving numbers	Puzzles or jigsaws involving letters	Book Exposure Measure (as in Skwarchuk et al., 2014) *15 Actual story book titles *6 Foil book titles [(Story books titles correctly identified - Foils identified as real books) / total number of actual books] x 100
Magazines, books or workbooks involving numbers	Magazines, books or workbooks involving letters	
Games involving numbers, a number spinner or dice	Sets of wooden, plastic, card or magnetic letters. Count each set as one item	
Sets of wooden, plastic, card or magnetic numbers	Games involving letters	
<i>M = 3.86</i>	<i>M = 2.06</i>	<i>M = 53.51</i>
<i>SD = 3.27</i>	<i>SD = 1.70</i>	<i>SD = 21.60</i>
$\alpha = .58$	$\alpha = .74$	$\alpha = .77$ (for Real Books)

Questionnaire (3/5): Reception Expectations

“Rate how important you think it is for children to have achieved the following **before** they start Reception”

		PERSONAL, SOCIAL & EMOTIONAL DEVELOPMENT (4)	NUMBER (4)	LITERACY (4)
5-point Likert Scale; Very unimportant (1) - Very important (5)	30-50	Be confident in asking an adult for help when they need it	Recite the numbers 1 to 10 in order	Listen to and enjoy a story in a small group
	40-60 months	Recognise and respect rules	Recognise some numerals	Write own name
		Have some strategies for resolving conflicts with other children without aggression	Count up to four objects accurately	Link sounds to letters e. g. Know what sounds letters can make
		Be confident in talking to other children including listening and responding to what others say	Uses ‘more’ and ‘fewer’ to compare two sets of objects	Hear and say the sounds words begin with e. g. dog begins with ‘d’
	Above	Talk confidently in front of a group of others	Complete simple written calculations	Independently read and understand simple books
	M	4.54	4.28	4.08
	SD	.54	.72	.69
	α	.84	.91	.81

Questionnaire (4/5): Maths Attitudes

“Tick the box that relates most closely to how you feel about the statement” (Tapia, 1996).

	Positively Phrased items	Negatively Phrased items (Reversed scoring)
5-point Likert Scale; Strongly Disagree (1) - Strongly Agree (5)	Mathematics is a very worthwhile and necessary subject	My mind goes blank and I am unable to think clearly when working with mathematics
	I get a great deal of satisfaction out of solving a mathematics problem	
	Mathematics helps develop the mind and teaches a person to think	Mathematics makes me feel uncomfortable
	Mathematics is important in everyday life	
	Mathematics is one of the most important subjects for people to study	When I hear the word mathematics, I have a feeling of dislike
	Mathematics does not scare me at all	
	I have a lot of self-confidence when it comes to mathematics	It makes me nervous to even think about having to do a mathematics problem
	I am able to solve mathematics problems without too much difficulty	
	I learn mathematics easily	I feel a sense of insecurity when attempting mathematics
	I am confident that I could learn advanced mathematics	
	I really like mathematics	Mathematics is dull and boring
	Mathematics is a very interesting subject	
	The challenge of mathematics appeals to me	Mathematics makes me feel uncomfortable
	I believe I am good at solving mathematics problems	
		<i>M = 3.68; SD = .71; α = .95</i>

Questionnaire (5/5): Math Anxiety

“Indicate how anxious these activities would make you feel” (Rounds & Hendel, 1980).

	Items		
5-point Likert Scale; Not at all anxious (1) - Very anxious (5)	Determining the amount of change you should get back from a purchase involving several items	Reading your payslip (or other statement showing your earnings and taxes)	Being given a set of numerical problems involving addition to solve on paper
	Dividing a five digit number by a two digit number with pencil and paper	Reading a cash register receipt after your purchase	Figuring out your monthly budget
	Listening to a person explain how he figured out your share of the cost of a meal including food, drinks and a 15% tip	Figuring out which of two job offers is the most lucrative	Hearing people quote the odds as they make bets at a sporting event
	Adding up $976 + 777$ on paper	Working a concrete, everyday application of mathematics that has meaning to you	Being given a set of numerical problems involving addition to solve on paper
<i>M</i>	1.46		
<i>SD</i>	.54		
α	.88		

Early Number Skills ($n = 274$)

Measure	Task	M	What does the mean “mean”?	SD	Max.	Max Possible
Sequential Counting	Highest number	16.57	😊	14.23	110	😊
Cardinal Counting	Give me X	3.17	5 objects	2.47	11	15
	Counting Objects	5.14	8 objects	2.72	14	20
Number Translation	Number Recognition	6.41	Start of double-digit numbers	5.32	20	20
	Numerical Reading	5.07	End of single-digit numbers	3.99	20	20
Calculation (Story Problems)	Additions	1.69	Adds 1 or 2 to a number below 5	2.24	12	12
	Subtractions	2.23	Takes away 1 or 2 from a number below 5	2.23	10	12

Home Experiences Subscales Partial correlations controlling for Age in months (1/4)

with Early Number Skills ($n = 274$, $df = 255$)

		Sequential Counting	Cardinal Counting		Number Translation		Calculation	
		Highest number	Give me X	Counting Objects	Number Recognition	Numeral Reading	Additions	Subtractions
Home Experiences	Number	.140*	.194**	.194**	.226***	.194**	.118	.144*
	Letters & Sounds	.168**	.259***	.222***	.246***	.202**	.196**	.200**
	Language & Literacy	.039	.098	.070	-.008	-.072	-.010	.083

* $p < .05$

** $p < .01$

*** $p < .001$

Home Resources Subscales Partial correlations controlling for Age in months (2/4)

with Early Number Skills ($n = 274$, $df = 258$)

		Sequential Counting	Cardinal Counting		Number Translation		Calculation	
		Highest number	Give me X	Counting Objects	Number Recognition	Numeral Reading	Additions	Subtractions
Home Resources	Letters & Sounds	.113	.194**	.049	.115	.079	.090	.155*
	Book Exposure	.130*	.077	.117	.076	.095	.034	.066

* $p < .05$

** $p < .01$

*** $p < .001$

Reception Expectations Subscales Partial correlations controlling for Age in months (3/4)

with Early Number Skills (n = 274, df = 260)

		Sequential Counting	Cardinal Counting		Number Translation		Calculation	
		Highest number	Give me X	Counting Objects	Number Recognition	Numeral Reading	Additions	Subtractions
Reception Expectations	Personal, Social & Emotional Development	.022	-.038	.004	-.082	-.086	-.053	.001
	Number	-.009	.066	-.013	.072	.005	.049	.011
	Literacy	.040	.114	.056	.095	.056	.099	.122*

* $p < .05$

** $p < .01$

*** $p < .001$

Maths Attitudes & Maths Anxiety Scales Partial correlations controlling for Age in months
 (4/4)

with Early Number Skills (n = 274, df = 248)

	Sequential Counting	Cardinal Counting		Number Translation		Calculation	
	Highest number	Give me X	Counting Objects	Number Recognition	Numeral Reading	Additions	Subtractions
Maths Attitudes	.040	.055	.034	.063	.103	.029	.079
Maths Anxiety	-.125*	-.103	-.068	-.085	-.124	-.112	-.155*

* $p < .05$

** $p < .01$

*** $p < .001$

Liverpool Early Number Skills: Summary of preliminary findings

- All Questionnaire Scales and Subscales (with exception of Home Number Resources) have either acceptable, good or excellent internal reliability
- The Counting and Number Translation skills have a good spread of scores with no floor or ceiling effects
- The Number scale and the Letters and Sounds scale of the Home Experiences are significantly and positively associated with the Early Number skills (but not Language and Literacy Home Experiences)
- The Early Number Skills relate differently to different Home Resources:
 - ❖ Give me X and subtractions are associated with Letters and Sounds Home Resources
 - ❖ Sequential counting is associated with Language and Literacy Resources and Book Exposure Home Resources
- Reception Expectations Literacy (.122*) and Maths Anxiety (-.155*) are only significantly associated with subtractions

Liverpool Early Number Skills: Discussion and future steps...

- Overall, home experiences (what parents report doing) have more consistent relationships with children's early number skills than home resources (what parents report having) or their attitudes and anxiety towards mathematics.
- Experiences that focus on the semantics of language (i. e. Home Experiences Language and Literacy, Home Resources Book exposure) have less consistent relationships with Early Number Skills than experiences that focus on the sub-lexical code of language (Home Experiences Letters and Sounds) or the numerical code (Home Experiences Number).
- Having a parent who incorporates activities and discussion focussing on the symbolic systems for number and for letters and sounds is associated with the development of early number skills
- Our future analyses will focus on the extent that these early experiences inter-relate with language and cognition & the extent that they predict growth in Early Number Skills

Liverpool Early Number Skills: Time for Questions & Hopefully Answers...

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Thank you!! ☺

