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Unpacking socio-economic risks for reading and academic self-concept in primary school: Differential effects and the role of the preschool home learning environment

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Background. Uncertainty remains concerning how children's reading and academic self-concept are related and how these are differentially affected by social disadvantage and home learning environments.

Aims. To contrast the impacts of early socio-economic risks and preschool home learning environments upon British children's reading abilities and academic self-concept between 7 and 10 years.

Sample. *n* = 3,172 British children aged 3–10 years and their families.

Methods. A secondary analysis of the nationally representative UK EPPE database. Multilevel structural equation modelling calculated the direct, indirect, and total impacts of early socio-economic risks (0–3 years) and preschool home learning environments (3–5 years) upon children's reading ability and academic self-concept between 7 and 10 years.

Results. Early socio-economic risk had different effects upon children's reading ability and academic self-concept. Early socio-economic risks affected children's reading at ages 7 and 10 both directly and indirectly via effects upon preschool home learning environments. By contrast, early socio-economic risks had only indirect effects upon children's academic self-concept via less stimulating home learning environments in the preschool period and by limiting reading abilities early on in primary school.

Conclusions. Although the impacts of early socio-economic risks are larger and more easily observed upon reading than upon academic self-concept, they can impact both by making it less likely that children will experience enriching home learning environments during the preschool period. This has implications for social policymakers, early educators, and interventionists. Intervening early and improving preschool home learning environments can do more than raise children's reading abilities; secondary benefits may also be achievable upon children's self-concept.

A central tenet of social science is that socio-economic status – linked to parental income, education, and occupation – has a multitude of effects upon children's development (Foster, Lambert, Abbott-shim, McCarty, & Franze, 2005; Sameroff & Chandler, 1975).

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Children of parents who have lower incomes, lower levels of educational attainment, and/or lower-status occupations are all considered to have elevated levels of socio-economic risk. In turn, high socio-economic risk probabilistically predicts poorer parent, family, and child outcomes. These associations include less enriching home learning environment (Aikens & Barbarin, 2008; Evangelou, Sylva, Kyriacou, Wild, & Glenny, 2009) and poorer reading abilities (Bhattacharya, 2010; Cunningham, 2006; Neuman, 2006).

However, although research has repeatedly linked socio-economic risk to home learning environments and both to children's reading (e.g., Melhuish *et al.*, 2008), the evidence is less clear when considering children's academic self-concept. Most research in this area has focused upon adolescents or young adults (e.g., Birndorf, Ryan, Auinger, & Aten, 2005; Rhodes, Roffman, Reddy, & Fredriksen, 2004) with fewer studies of pre-adolescents. Further, those that have been carried out at this age have yielded at times conflicting findings. For example, Rosenberg and Pearlin (1978) found social class and self-esteem to be unrelated in young children – although none under 8 years were considered. This uncertainty continues today, with researchers continuing to disagree on the extent to which a young child's self-concept is affected by their home environment (Arzubiaga, Rueda, & Monzo, 2002; Katzir, Lesaux, & Kim, 2009; Merlo, Bowman, & Barnett, 2007; Verschueren, Doumen, & Buyse, 2012).

The comparative lack of research into – and consistent findings concerning – the drivers of self-concept in young children as compared to children's reading stands in contrast to the importance of self-concept to their success in school. For example, past research has shown that both reading ability and self-concept have significant reciprocal effects (Craven, Marsh, & Burnett, 2003; Marsh & Craven, 2006; McInerney & Ali, 2006; McInerney, Yeung, & McInerney, 2001; Yeung, 2011) and have even suggested that self-concept might be a better predictor of academic achievement than past academic performance (Pajares & Schunk, 2002).

The need for more research to compare the drivers of children's reading and academic self-concept is not only driven by disparities in the extent and findings of past research. Rather, this research is also needed because it provides empirical evidence that tests theoretical mechanisms of effect. One of the most prominent of these comes from Stanovich (1986) who proposed an educational Matthew Effect: that overtime and in connection to reading, 'the rich get richer, the poor get poorer' (accumulated advantage/disadvantage) and that there may be, 'behavioural/cognitive/motivational spinoffs from failure at such crucial tasks as learning to read' (Stanovich, 1986, p. 386; cited in Chapman & Tunmer, 2003). This latter idea was subsequently extended upon by Chapman and Tunmer (1997, p. 288) who proposed a three-stage process linking academic achievement (particularly reading) to academic self-concept overtime: (1) during primary/elementary school, academic achievement (particularly reading) influences academic self-concept; (2) during early secondary school, reciprocal effects exist between achievement and academic self-concept; (3) by the middle of secondary school, academic self-concept drives academic achievement. Many studies have since provided evidence in support of these associations (e.g., Chapman & Tunmer, 1997; Chapman, Tunmer, & Prochnow, 2001, 2004) and have explored mechanisms of effect (e.g., Kasperski, Shany, & Katzir, 2016; Meltzer, Reddy, Pollica, & Roditi, 2004), but supporting evidence has often featured limited sample sizes. Furthermore, this theory has yet to be integrated into models proposing the psychological and educational effects of children's backgrounds and preschool period home learning environments (e.g., Chevalier, Gibbons, Thorpe, Snell, & Hoskins, 2009; Conlon, Zimmer-Gembeck, Creed, & Tucker, 2006).

Focusing upon theories that have presented long-term developmental and educational effects from preschool period home learning environments, a number has been articulated and these commonly parse out the concept of a 'home learning environment' into various forms of parent–child interactions prompting altered child behaviours. These theories often conceptualize that there is a 'quality' to these interactions (e.g., Sénéchal, Cornell, & Broada, 1995; Sonnenschein & Munsterman, 2002) and often focus upon literacy (e.g., Leseman & de Jong, 1998). However, these theories are inconsistent and, as with evidence supporting the educational Matthew Effect, they commonly present supporting evidence that is based on low sample sizes. For example, both de Jong and Leseman (2001) and Sonnenschein (with various co-authors) have proposed that the affective quality of parent–preschooler interactions has long-term effects – both on reading (Baker, Mackler, Sonnenschein, & Serpell, 2001; de Jong & Leseman, 2001) and on children's motivation to read (Sonnenschein & Munsterman, 2002). However, none of these studies drew evidence from samples larger than 70 children.

Moreover, developmental consequences from preschool period home learning environments have been linked to more than just the affective quality of parent–preschooler interactions. For example, although Sénéchal and colleagues have studied the quality of shared reading interactions (e.g., Lever & Sénéchal, 2011; Sénéchal *et al.*, 1995), their work has also highlighted the importance of formality when looking at the frequency of parent–preschooler literacy interactions (e.g., teaching letters would be a more formal interaction than shared book reading). The rationale for this focus is that it is the frequency with which both types of interaction (formal and informal) are engaged in that then influences children's language and literacy development (e.g., Sénéchal & LeFevre, 2002, 2014). However, there still remains the limitation mentioned above of supporting evidence for this being drawn from low sample sizes: none of these examples featured more than 168 children.

Therefore, while there is much evidence, that preschool period home learning environments can have long-term effects upon development and academic progress that exceed those linked to socio-economic backgrounds (e.g., Korat, Arafat, Aram, & Klein, 2012; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2008), *how* these effects mesh with longitudinal theories such as the educational Matthew Effect remains uncertain. It is in reply to such inconsistencies and gaps in the literature that this study responds with an investigation that unpacks the relationships between: early socio-economic risk, preschool home learning environments, and the reading abilities and academic self-concepts of pre-adolescents who attended primary schools in England.

Research questions

1. To what extent does early socio-economic risk negatively affect children's preschool home learning environment?
2. To what extent does early socio-economic risk negatively affect children's reading ability and academic self-concept at ages 7 and 10?
3. To what extent does preschool home learning environment mediate the relationships between:
   - Early socio-economic risk and reading ability at ages 7 and 10?
   - Early socio-economic risk and academic self-concept at ages 7 and 10?

Method

Sample

Participants were all those children and families (n = 3,172) who participated in the Effective Pre-School and Primary Education 3-11 Project (EPPE 3-11). Funded by the UK Department for Education (DfE), this was a longitudinal study that aimed to determine the value-added contribution of preschools and primary schools to children's development and educational attainment (Sylva *et al.*, 2008). The anonymized data from EPPE 3-11 are publically available and were accessed for this investigation via the UK Data Service (https://discover.ukdataservice.ac.uk/). Ethical permission for this study was granted by the relevant ethics committee of the British University with which the first author is affiliated.

Begun in 1997, the EPPE study sampled five geographical regions that covered urban, rural, and suburban areas. Within these areas, a stratified random sampling strategy was then used to recruit a sample of children and families from within 141 preschools. The achieved sample – and that which is analysed in this paper – was broadly representative of the English population at the time (Sammons *et al.*, 1999). Further details of the EPPE research design and methodology can be found in the report of Sammons *et al.* (2005).

Measures

Early socio-economic risk

This was measured via a cumulative risk index (Appleyard, Egeland, van Dulmen, & Sroufe, 2005; Rutter, 2001) comprised of seven salient socio-economic risks measuring parental education, income, and occupation that existed within the EPPE 3-11 data set. These were dichotomized via either statistical cut-off or conceptual categorization (Evans, 2003) following procedures used in existing EPPE publications (Sammons *et al.*, 2002) to indicate socio-economic risk (1 = increased risk; 0 = not). The seven measures of socio-economic risk were then summed to produce a scale ranging from 0 to 7. Table 1 shows the seven binary indicators of socio-economic risk, their dichotomizing criteria, and the percentages of the EPPE sample who fell below these. The resulting cumulative risk index of early socio-economic risk had a mean of 1.28 and a standard deviation of 1.63.

Preschool home learning environment

This measure was created by the EPPE 3-11 team from a list of 14 home activity questions asked via parent interview during the preschool stage of the EPPE study. Seven activities were 'conceptually and statistically linked' (Sylva *et al.*, 2008, p. 21) as they all had statistically significant effects on later achievement and provided children with opportunities to learn. The seven activities were coded by frequency in the home (0 = 'not occurring'; 7 = 'very frequent') and summed to form an index which ranged from 0 to 49. The resulting measure (n = 3,006) had a mean of 23.42 and a standard deviation of 7.71 (see Sylva *et al.*, 2008). The seven summated home learning activities considered the frequency with which a child was:

(1) Read to
(2) Went to the library
(3) Played with numbers
(4) Painted and drew

(5) Was taught letters
(6) Was taught numbers
(7) Was sung songs/poems/rhymes

Reading ability at ages 7 and 10 years

We used the same two measures of reading as were used by the authors of the original EPPE study. Although both of these were tests of reading comprehension, we follow the terminology used by the original EPPE authors (e.g., Sylva *et al.*, 2008) and treat these as measures of reading to aid the production of a continuous body of knowledge. The EPPE researchers internally standardized and normalized both sets of reading scores (at ages 7 and 10 years) to account for age effects.

At age 7 (Year 2), children's reading was assessed by their teachers as part of the contemporaneous Key Stage 1 (Qualifications and Curriculum Authority, 1999) National Assessments. These returned an ordinal indicator of reading that placed students into six ranked ability groups/levels ('level 2' being the expected level at this age): level (2) not achieved, (achieved) levels 2c, 2b, 2a, level (3) not achieved, and [achieved] level 3 (see Sammons *et al.*, 2004). The level of detail of this measure was then enhanced by the EPPE team through the collection and integration of data on individual student test levels. Using this additional data, a decimalized score of reading ability was created using the following formula (for details, see Sylva *et al.*, 2008): Decimalized score = level of test achieved + ([raw score − lowest valid raw score for corresponding level]/highest valid raw score possible for the level). The mean reading ability score at age 7 (n = 2,722) was 2.38 with a standard deviation of 0.75.

At age 10 (Year 5), children's reading was again assessed by their teachers, but this time as part of the EPPE fieldwork and this time using the NFER-Nelson Primary Reading Level 2 Test (France, 1981). This group test of reading was widely used in the United Kingdom at the time (Topping & Fisher, 2003) and uses a cloze procedure to measure reading comprehension by presenting missing words and asking children to select an appropriate replacement from a list of alternatives. The mean reading ability score at age 10 (n = 2,418) was 95.51 with a standard deviation of 14.90.

Table 1. The seven indicators of socio-economic risk that were used in this study

Measure	*n*	Cut-off criterion indicating increased risk	Percentage below cut-off
Total family salary	2,379	Bottom quartile	27.7
Highest social class in family (mother or father)	3,056	Semi-skilled, unskilled, never worked	18.8
Mother's social class	3,007	Semi-skilled, unskilled, never worked, unemployed	33.6
Father's qualification level	3,061	No qualification or absent father	40.5
Mother's qualification level	3,022	No qualification or absent mother	21.4
Father's employment status before birth of child	1,496	Unemployed or absent father	18.2
Mother's employment status before birth of child	1,897	Unemployed or absent mother	38.3

Academic self-concept at ages 7 and 10 years

Although the EPPE 3-11 study measured children's self-perceptions of educational competence, including various measures of academic and behavioural self-concept, this investigation created novel latent constructs (via confirmatory factor analyses) of academic self-concept from an identical set of four questions that children were asked about this at ages 7 (Cronbach alpha = .60) and 10 years (Cronbach alpha = .64; with .60 the lowest acceptable value; Berthoud & Geshuny, 2000). The four ordinal questions used 4-point frequency scales of belief to assess the nature of children's academic self-concept (1 = *never*; 2 = *some of the time*; 3 = *most of the time*; 4 = *all of the time*). Theta (rather than the standard Delta) parameterization was then used in the specification of latent variables representing academic self-concept at the two time points due the ordinal nature of the original response options (see Chiorri, Hall, Casely-Hayford, & Malmberg, 2015). Table 2 presents the wording of the four repeated items, and the percentage of responses given across the four response options at both ages.

Analytic approach

All analyses were conducted by the authors using IBM SPSS Statistics (IBM Corp, 2013) and Mplus version 7.0 (Muthén & Muthén, 2012). An aggregated multilevel structural equation model (controlling for preschool effects; Sammons *et al.*, 2013) was used to estimate the impact of early socio-economic risk upon preschool home learning environment and the direct, indirect (via intermediate measures), and total (direct plus indirect) effects of both upon children's reading ability and academic self-concept at ages 7 and 10 years (see Figure 1). Missing data were estimated using the weighted least squares approach (Asparouhov & Muthén, 2010); a technique analogous to using Full Information Maximum Likelihood (Chiorri *et al.*, 2015). All variables were standardized (*z*-scored) *a priori* to ease model convergence, and the Weighted Least Squares Means and Variance adjusted estimator was used to mitigate any spurious effects caused by non-normality (Muthén & Muthén, 2012).

Results

Zero-order Bivariate correlations between the 12 observed measures in this study are presented in Table 3. While early socio-economic risk can be observed to have negative associations with preschool home learning environments and reading ability at ages 7 and

Table 2. The four measures of children's academic self-concept at ages 7 and 10 years that were used in this study

	Percentages giving responses 1 to 4 at age 7 years					Percentages giving responses 1 to 4 at age 10 years				
Question wording	*n*	1	2	3	4	*n*	1	2	3	4
Q1: 'I try to do my best at school'	2,519	0.8	6.8	29.2	63.2	2,428	0.3	5.4	32.9	61.4
Q2: 'I am clever'	2,521	3.2	14.1	43.8	38.9	2,412	4.4	26.6	50.8	18.2
Q3: 'My teacher thinks I'm clever'	2,518	2.3	15.1	40.9	41.7	2,387	3.9	23.7	50.4	22.0
Q4: 'I behave (well) in class'	2,516	1.6	11.0	36.7	50.7	2,492	1.6	13.1	45.9	39.4

Notes. 1 = *never*; 2 = *some of the time*; 3 = *most of the time*; 4 = *all of the time*.

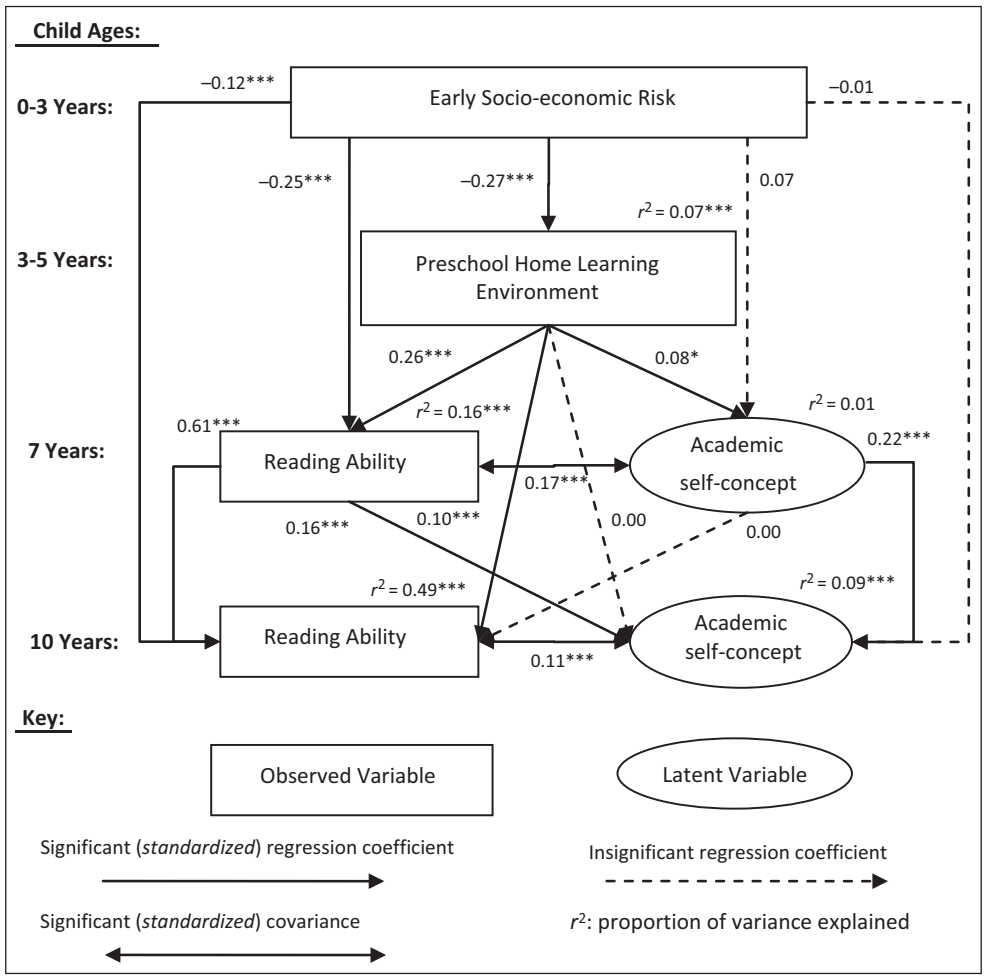

Figure 1. Standardized results from an aggregated multilevel structural equation model estimating the impacts of early socio-economic risk and preschool home learning environments upon children's reading abilities and academic self-concept between ages 7 and 10 years. *$p < .05$; **$p < .01$; ***$p < .001$.

10, no such associations are observed with children's academic self-concept at these ages. Indeed, there is even a positive (though weak) correlation observed between increased early socio-economic risk and children's age 7 belief that their teacher thinks that they are clever ($r = .07$; $p < .05$). By contrast, age 7 reading ability is positive correlated with the questions concerning children's academic self-concept – correlating significantly with 3 (of 4) questions at age 7, and all four questions at age 10.

The multilevel structural equation model shown in Figure 1 fitted the EPPE data well, $\chi^2 (42) = 364.882, p < .001$; *RMSEA* = .05; CFI = .93, TLI = .89. Significant proportions of the variations in several measures were explained; in preschool home learning environment, reading at ages 7 and 10, and academic self-concept at age 10. Table 4 presents the results of the two Reflective Confirmatory Factor Analyses that were used to estimate children's academic self-concept at ages 7 and 10. All four observed measures proved statistically significant reflective indicators of the underlying (latent) academic

Table 3. Zero-order Pearson correlations between early socio-economic risk, preschool home learning environment, reading ability at ages 7 and 10 years, and observed measures of educational self-image at ages 7 and 10 years

	12	11	10	9	8	7	6	5	4	3	2
1. Early socio-economic risk	−.02	−.04	−.03	−.04	−.36***	.03	.07*	.05	−.02	−.34***	−.28***
2. Preschool home learning environment	.04*	.03	.06**	.03	.34***	.08***	.02	−.00	.08***	.33***	
3. Age 7 reading ability	.07**	.09***	.18***	.07**	.68***	.10***	.02	.06**	.15***		
Age 7 academic self-concept											
4. 'I try to do my best at school'	.11***	−.00	.03	.10***	.15***	.29***	.20***	.17***			
5. 'I am clever'	.06**	.11***	.15***	.06**	.03	.23***	.40***				
6. 'My teacher thinks I am clever'	.10***	.12***	.10***	.07**	−.01	.31***					
7. 'I behave well in class'	.29***	.04	.05*	.14***	.04						
8. Age 10 reading ability	.06**	.10***	.19***	.07**							
Age 10 academic self-concept											
9. 'I try to do my best at school'	.37***	.27***	.24***								
10. 'I am clever'	.22***	.50***									
11. 'My teacher thinks I'm clever'	.25***										
12. 'I behave in class'											

Notes. *$p < .05$; **$p < .01$; ***$p < .001$.

self-concepts of children at these ages. The measures with wording most similar to academic self-concept had the largest standardized factor loadings: self- and teacher-perceptions regarding children's 'cleverness' (questions numbered 2 and 3 in Table 4) – rather than the more conceptually distant perceptions of exerted effort and good behaviour (questions 1 and 4).

To what extent does early socio-economic risk negatively affect children's preschool home learning environment?

Figure 2 shows the direct impact of early socio-economic risk upon children's preschool home learning environment. Children who experienced more early socio-economic risks were significantly less likely to then experience enriching home learning environments during the preschool period (standardized regression coefficient, $\beta = -.27$; standard error, $SE = 0.028$; $p < .001$).

To what extent does early socio-economic risk negatively affect children's reading ability and academic self-concept at ages 7 and 10?

Figure 2 also reveals the impacts of early socio-economic risk upon children's reading ability and academic self-concept at the ages of 7 and 10 years. However, unlike the impacts of early socio-economic risk upon preschool home learning environment, these impacts can take two forms: both a direct impact, but also a series of indirect impacts via effects on earlier occurring measures (see Figure 1 for a graphical representation). The bar chart shown in Figure 2 summates all the individual indirect pathways into a 'total indirect' effect as well as a 'total effect' (direct + total indirect). Although early socio-economic risk can be seen to have diminishing *direct* impacts (via effect sizes) upon both

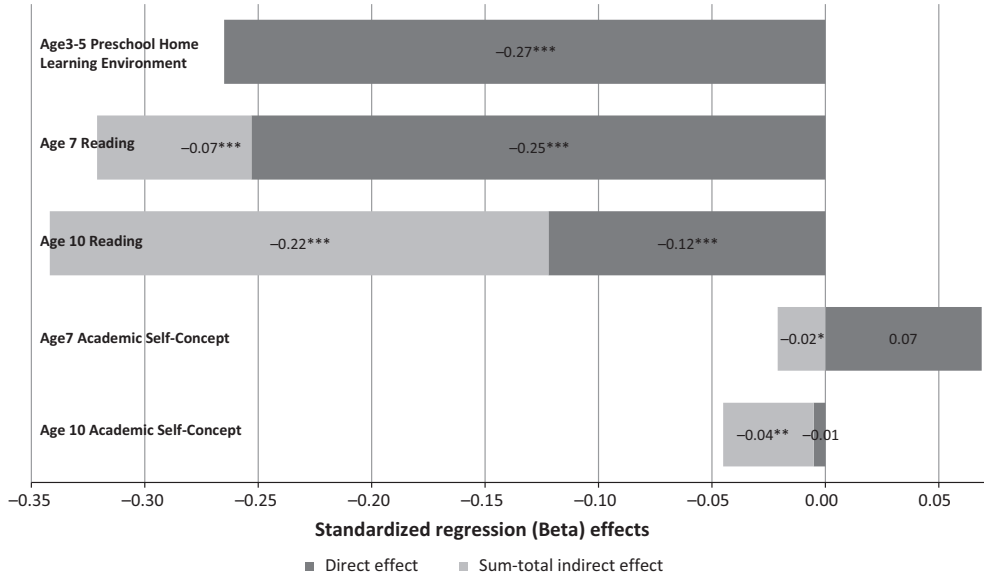

Figure 2. The 'total' impacts of early socio-economic risk upon children's preschool home learning environments and upon their reading abilities and academic self-concept at ages 7 and 10 years. *$p < .05$; **$p < .01$; ***$p < .001$.

reading and academic self-concept as children age, the *indirect* effects increase in magnitude (again via effect sizes). Sammons *et al.* (2013) refer to this alteration of the effects of socio-economic risk as, 'developmental internalization'. The total effects of early socio-economic risk upon children's reading at age 7 were therefore $\beta = -.32$ ($-.25 + -.07$; $SE = 0.025$; $p < .001$), while at age 10, this was $\beta = -.34$ ($-.12 + -.22$; $SE = 0.024$; $p < .001$).

Although Figures 1 and 2 show early socio-economic risk to have effects that become developmentally internalized within reading and academic self-concept as children age, the size of both the direct and indirect effects of early socio-economic risk is much smaller upon academic self-concept than upon reading. This in turn means fewer incidents of effects upon academic self-concept reaching $\alpha = .05$. Considering children's academic self-concept, there was no statistically significant direct impact from experiencing greater early socio-economic risk at either ages 7 ($\beta = .07$; $SE = 0.040$; $p = .085$) or 10 years ($\beta = -.01$; $SE = 0.040$; $p = .905$). Further, there were also no statistically significant *total* effects from early socio-economic risk on children's academic self-concept at ages 7 ($\beta = -.05$; $SE = 0.040$; $p = .200$) or 10 years ($\beta = -.05$; $SE = 0.040$; $p = .232$). However, there were statistically significant indirect effects at both of these ages, the sum total of which are shown in Figure 2. The nature of these indirect effects (and indeed all effects) is explored below with special consideration given to indirect effects involving the preschool home learning environment.

To what extent does preschool home learning environment mediate the relationships between early socio-economic risk and reading ability, and between early socio-economic risk and academic self-concept, at ages 7 and 10?

Table 5 unpacks the effects of early socio-economic risk upon children's reading ability and academic self-concept at ages 7 and 10 years (English school years 2 and 5). The preschool home learning environment can be seen to have a significant role in explaining how early socio-economic risk impacts both reading ability and academic self-concept at these ages. Children exposed to greater early socio-economic risk were less likely to enjoy stimulating home environments during their preschool years. These less stimulating home learning environments were then associated with poorer academic self-concept at age 7 and with poorer reading ability at ages 7 and 10. The negative chain of effects linking

Table 4. Estimating children's academic self-concept at ages 7 and 10 years with Confirmatory Factor Analysis: factor loadings and explained variances

	Academic self-concept at age 7		Academic self-concept at age 10	
Observed measures	Standardized factor loadings	r^2	Standardized factor loadings	r^2
Q1: 'I try to do my best at school'	0.56	.237***	0.61	.272***
Q2: 'I am clever'	0.89	.443***	0.98	.489***
Q3: 'My teacher thinks I'm clever'	1.01	.506***	1.11	.552***
Q4: 'I behave (well) in class'	0.56	.238***	0.61	.273***

Notes. r^2 = Proportion of variance explained; *$p < .05$; **$p < .01$; ***$p < .001$.

socio-economic risk to preschool home learning environment and then to children's reading and self-concept at age 7 was then found to have further impacts upon children's reading ability and academic self-concept at age 10 years.

Discussion

Although educational psychology has postulated theories that link children's reading ability to their academic self-concept (e.g., Stanovich, 1986) and then both to later school success (e.g., Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005), the research evidence is less consistent concerning how these are affected by social disadvantage and parenting practices. This study also sought to address the fact that more evidence exists concerning

Table 5. Unpacking the effects of early socio-economic risk upon children's reading abilities and academic self-concept at ages 7 and 10 years

Statistical regression relationships ('>' meaning 'statistically predicts')	Standardized beta	*SE*	*p*
Early SER > reading at age 10 years			
Total effect (total indirect + direct)	−.34	0.02	<.001
Total indirect effect	−.22	0.02	<.001
Direct effect	−.12	0.02	<.001
Specific indirect effects			
Early SER > HLE > age 10 reading	−.03	0.01	<.001
Early SER > age 7 reading > age 10 reading	−.15	0.02	<.001
Early SER > Age 7 self-concept > age 10 reading	.00	0.00	.939
Early SER > HLE > age 7 reading > age 10 reading	−.04	0.01	<.001
Early SER > HLE > age 7 self-concept > age 10 reading	.00	0.00	.939
Early SER > academic self-concept at age 10 years			
Total effect (total indirect + direct)	−.05	0.04	.232
Total indirect effect	−.04	0.01	.006
Direct effect	−.01	0.04	.905
Specific indirect effects			
Early SER > HLE > age 10 self-concept	.00	0.01	.923
Early SER > age 7 reading > age 10 self-concept	−.04	0.01	<.001
Early SER > age 7 self-concept > age 10 self-concept	.02	0.01	.090
Early SER > HLE > age 7 reading > age 10 self-concept	−.01	0.00	<.001
Early SER > HLE > age 7 self-concept > age 10 self-concept	−.01	0.00	.020
Early SER > reading at age 7 years			
Total effect (total indirect + direct)	−.32	0.03	<.001
Total indirect effect	−.07	0.01	<.001
Direct effect	−.25	0.03	<.001
Specific indirect effects			
Early SER > HLE > age 7 reading	−.07	0.01	<.001
Early SER > academic self-concept at age 7 years			
Total effect (total indirect + direct)	.05	0.04	.200
Total indirect effect	−.02	0.01	.014
Direct effect	.07	0.04	.085
Specific indirect effects			
Early SER > HLE > age 7 self-concept	−.02	0.01	.014

Notes. *SE* = standard error; SER = socio-economic risk; HLE = (preschool) home learning environment.

the drivers of children's reading (rather than self-concept) by demonstrating how both may be affected by early socio-economic risk and the preschool home learning environment. It compared effects from socio-economic risk and home learning environment upon children's reading and academic self-concept between the ages of 7 and 10 years, and it estimated the potential for impacts that were both direct and indirect.

The results of our analyses suggest four sets of findings which variously confirm, expand upon, and at times challenge existing theories and the findings of past investigations. First, the negative effect of early socio-economic risk upon children's reading at ages 7 and 10 was broadly equivalent at the two ages but the nature of this effect differed. The direct effect at age 10 was less than half the size of that observed at age 7, but the indirect effect at age 10 was over three times larger. This finding of 'developmental internalization' (Sammons *et al.*, 2013) is wholly in-keeping with past research that has demonstrated how background factors alter children's educational trajectories (e.g., Aikens & Barbarin, 2008; Bhattacharya, 2010).

Second, the negative effect of early socio-economic risk upon children's academic self-concept at ages 7 and 10 was also (broadly) equivalent at both these ages. However, this effect was different in form to that upon reading: early socio-economic risk was only indirectly related to academic self-concept at both of these ages. These links challenge the conclusions reached by Rosenberg and Pearlin (1978) who found no link between socio-economic risk and self-concept amongst young children, and also extend the findings of Chevalier *et al.* (2009) who found socio-economic differences in, 'academic self-perceptions' but within a sample of 15-year olds. Our results suggest that there is a link between early socio-economic risk and the academic self-concept of pre-adolescents, but that this is likely to be indirect, operating via negative impacts to first preschool home learning environments and second then to reading abilities.

Third, preschool home learning environments were found to play a significant role in the impacts of early socio-economic risk upon children's reading and academic self-concept. This was because preschool home learning environments were negatively related to early socio-economic risks and yet positively related to children's academic self-concept (at age 7) and their reading (at ages 7 and 10). Our results concerning home learning environments and children's self-concept stand in contrast to the theoretical model developed by Conlon *et al.* (2006): that home learning environments influence reading via intermediate effects upon children's self-concept (a model also operationalized by Katzir *et al.*, 2009; see below). Not only did we find no evidence of this, but rather evidence of the opposite. Preschool home learning environments were found to affect children's academic self-concept via reading ability. This is evidence that operationalizes and supports educational Matthew Effects in reading (Stanovich, 1986; that overtime 'the rich get richer, the poor get poorer') and the first of the three-stage process described by Chapman and Tunmer (1997; p. 288) that extends Stanovich (1986) theory by addressing his comment that the relationship between self-perceptions and reading performance, 'remains to be worked out' (Stanovich, 1986, p. 389; cited in Chapman & Tunmer, 2003). Our results support the notion of educational Matthew Effects in reading by demonstrating that early reading probabilistically predicts both subsequent reading and academic self-concept. Our findings also support the first of the three-stage extension of Chapman and Tunmer (1997) by demonstrating that primary school reading only promoted academic self-concept and not vice versa.

Fourth, the effects of early socio-economic risk upon children's academic self-concept at age 10 years were partly due to earlier effects upon their reading at age 7. These results support the idea that educational Matthew Effects may, in part, be due to the

developmental internalization of cumulative independent effects from both early socio-economic risks and preschool home learning environments. Speculating, it seems plausible that the direct effects of early socio-economic risk on preschool home learning environments and (then) children's reading at least partially reflect diminished pedagogical opportunities due to limited capital (economic, social, cultural) with indirect (secondary) effects then occurring upon children's self-concept, with children's peer-group comparisons likely to play a role in this process (following social psychology theories such as Bandura, 1986).

The identified links between preschool home learning environments and children's reading and academic self-concept through to age 10 years intersect in many places with the study conducted by Katzir *et al.* (2009). They found that children's age 10 reading comprehension was related to reading self-concept and that reading self-concept in turn was related to the contemporaneous age 10 'home literacy environments'. Our results provide a partial test of their hypothesis that home literacy may affect reading comprehension via reading self-concept (with the sample size and statistical power that they call for) and we find evidence suggesting the opposite chain of effects from activities in the home: our results suggest that activities boost pre-adolescent reading and this boosted reading then boosts self-concept. Nonetheless, both these studies would benefit from a follow-up investigation featuring longitudinal measurement of developmentally appropriate pedagogical parent–child interactions.

Practically, the findings of this study have implications for policymakers, interventionists, and others involved in children's development and education. For example, by outlining the many pathways through which socio-economic risk functions, this study highlights the many places where one might intervene; some of which are likely to prove more effective than others. Although the well-known Heckman Curve (arguably, 'ubiquitous'; Steven Barnett, 2015) attests to the efficiency of intervening early in children's lives, there are options in how this is done. Applied to the findings of this study, one might intervene (via universal or targeted services) to raise the quality of preschool home learning environments or to improve children's reading ability or their academic self-concept either through direct work with children or through programmes and interventions that aim to work with both parents and children (e.g., Triple P; Sanders, 1999). Alternatively or additionally, one might also intervene to reduce the negative associations that these each share with social disadvantage (cf. Masten, 2014). Furthermore, there already exist universal services that aim to have all these effects – with Sure Start Children's Centres in the United Kingdom being one example (although this service and its protective effects are also under threat; Hall *et al.*, 2016).

Strengths, limitations, & future directions

One of the greatest strengths of this research comes from its analysis of the EPPE 3-11 sample. Benefits are inherited from the large size of the EPPE study (3,172 families and children) and from the fact that it was representative of the British population at the time (Sammons *et al.*, 1999). As such, the findings from this investigation can be argued as generalizable to UK children and families at the time, have more power than previous studies with smaller non-representative samples (e.g., Katzir *et al.*, 2009), and can therefore better inform educational and psychological theories as well as the design of interventions which aim to meet the needs of UK children and families.

A second strength of the study concerns the internal validity of its findings. This was boosted through the use of a relatively novel (and particularly accurate) approach to the

specification of latent measures (of children's academic self-concept) from ordinal observed predictors. Unlike much past research, we respected the ordinal nature of the four self-concept questions that the original EPPE researchers asked of children rather than (mis)treating them as continuous (for details of this procedure, see Chiorri *et al.*, 2015).

However, our findings are also limited in their ability to replicate or contradict recent past studies due to limitations with the measures that we used and limitations with the sample that we employed. Regarding limitations to the measures, we investigated a conceptually broad area of children's self-concept (academic) rather than one more specific such as towards reading (which itself has been broken down into three areas by Professor James Chapman; e.g., Chapman & Tunmer, 1997) or across multiple areas (e.g., math and reading). Further, our measure reflects just one of the two psychological domains articulated by Marsh, Craven, and Debus (1999): competency rather than affect. The results of this study therefore need replicating and extending while using additional measures of children's self-concept (particularly of reading). This would also be in-keeping with research conducted after the EPPE study; research that has increasingly used domain-specific measures of self-concept (e.g., Chapman *et al.*, 2001, 2004; Kasperski *et al.*, 2016; Meltzer *et al.*, 2004). It is also worth noting that a similar approach could be taken to measuring preschool home environments: moving from general to domain-specific (e.g., the home literacy environment), and measuring both affective quality and more formal pedagogical interactions (cf. the work of Sénéchal presented in the Introduction).

A second limitation concerning the measures that were used to index reading ability. The use of different measures at ages at ages 7 and 10 obliges caution when considering how they related to early socio-economic risk, the preschool home learning environment, and children's academic self-concept. Although both scores provide a measure of overall reading ability and were highly correlated ($r = .68$, $p < .001$; see Table 3), these are not repeated measurements. As a result, a small amount of random error is introduced when comparing how consistently reading ability is related to other measures. Nonetheless, our treatment of the two measures of reading is consistent with that carried out by the authors of the original EPPE study (e.g., Sylva *et al.*, 2008).

Our use of a cumulative risk index to measure early socio-economic risk is also not without problems. Although widely used in the developmental science literature (e.g., Evans, 2003; Schoon, 2006), a cumulative risk approach involves the dichotomization of continuous measures and the equal weighting of all risks – which introduces error into estimates (Hall *et al.*, 2010). Nonetheless, this approach remains widely used, accepted, and produces results that are simple to understand and interpret.

The dated age of the EPPE 3-11 data set also limits the findings of this study. Although the EPPE sample was broadly representative of the United Kingdom when conducted, this is an increasingly historic dataset with the early years landscape having changed considerably over the past 10+ years (e.g., the offer of free preschool places to 2 year olds). A replication of these results with a more recent sample (of matching size, representativeness, longitudinal scope, and measures) would ensure the robustness of our results when in application to Britain in 2017.

Conclusions

These results clarify the impact of socio-economic risks and preschool home learning environments upon children's reading and self-concept between the ages of 7 to 10 years.

Although the impact of social disadvantage is larger and easier to identify upon children's reading rather than upon their academic self-concept, it can impact both by lessening the quality of the home learning environments that parents provide during the preschool period. This has implications for social policymakers and interventionists. More succinctly, these results confirm the need to intervene early to improve young children's reading, but also that that this could constitute an effective intervention benefitting children's self-concept.

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