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What You Do Versus Who You Are: Home-Learning Activities, Social Origin and Cognitive Skills among Young Children in Ireland

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Abstract

This article explores the role that home-learning activities (HLAs) play in the relationship between social origin and cognitive development using an Irish birth cohort study, *Growing Up in Ireland*. Numerous studies using different measures of the home-learning environment (HLE) have shown that it has considerable influence on young children's cognitive development, and that the HLE is often linked to social origin. We find a social gradient in vocabulary even at age 3 years, with the largest gaps for mothers' education. Family income, mothers' education, and social class are also associated with vocabulary independently, though these associations are reduced by adding all three measures simultaneously. The extent of HLAs helps explain a very small part of the education differences and none of the income or social class differences in vocabulary. We find some evidence that HLAs may be more salient for children from families with low income and lower social class backgrounds in terms of supporting vocabulary development, thereby compensating somewhat for disadvantage. HLAs also appear to encourage vocabulary development between age 3 and 5, and play a role in reducing the gap in vocabulary between high- and low-income children.

Introduction

A key concern for research on social inequality is how parents pass on advantage or disadvantage to their children (Smeeding *et al.*, 2011). Indeed, social gradients in cognitive outcomes are visible from an early age (Cunha and Heckman, 2007). Social origin is often measured in different ways—using social class, educational achievement, income, or social status. Yet a number of authors have argued that different indicators of social origin are not interchangeable and have an independent and distinct effect on a child's educational attainment (Bukodi and Goldthorpe, 2013; Mood, 2017). Others have argued that different dimensions of social origin may be more salient at different stages of the life course. For example, economic resources and mothers' education may be especially important in early childhood (Erola *et al.*, 2016),

parental education in upper secondary school (Breen and Jonsson, 2005). Social status and social networks may be most salient in the transition to work (Erola, 2009).

Early childhood is a crucial period of cognitive development (Melhuish, 2010). Both psychological and sociological accounts have suggested that the home-learning environment (HLE) may play an important role in cognitive development and early educational outcomes (Anders *et al.*, 2012). This article blends insights from the literature on HLE and social origins in an attempt to understand social inequality in early cognitive outcomes in Ireland.

The main contribution of this article is a multifaceted approach to social origin that considers the role that the different indicators (income, social class, and education) might play (separately and together) in the shaping of cognitive development at the earliest stages of the life course. While differences at this stage may be small, they are perhaps more indicative of the influence of parental resources because they are less influenced by institutional features, such as education systems, which in some cases may act to reduce the impact of parental background. And crucially, the development of literacy skills in early childhood acts as a starting point from which further inequalities may stem.

This article explores these ideas empirically using the infant cohort of a rich child cohort study, *Growing Up in Ireland* (GUI). The Irish case combines a rapid rise in female labour market participation during the economic boom with relatively high fertility, at least in European terms. Ireland is also unusual in that there is not a strong social gradient in fertility, with high fertility also among the more privileged groups in terms of class and education (Fahey and Curran, 2016). The growth in employment was less pronounced for mothers with young children in Ireland; nevertheless, the movement from a more traditional breadwinner model to a dual-earner model came about relatively quickly during the economic boom known as the 'Celtic Tiger' (Russell *et al.*, 2017).

The first section of this article outlines the previous literature concerning different measures of social origin, how they relate to the HLE, and how they might affect cognitive outcomes in early childhood. We also outline hypotheses regarding the role these dimensions play. The second section sets out the analytical approach, the data used, the measurement of our main variables, and methodological considerations. The third section focuses on the description of our research findings and examines the interactions between the home-learning activities (HLAs) that parents carry out and education, income, and social class in separate analyses. We also include robustness checks of the HLE measure using books in the home instead of HLAs. The final section of our article brings together the main findings and discusses our contribution relative to prior investigations outlined in the second section. Our analysis does not make causal claims, but rather investigates how cognitive outcomes among young children vary by social origin, and the potential role of the HLE in understanding these differences. We partly address the limitations of cross-sectional analysis by estimating a final model of how social origin and HLE affect change over time in cognitive scores in early childhood.

Previous Literature

Social Origin and Child Cognitive Outcomes

A large body of research has documented substantial gaps in cognitive and educational outcomes among children of different socio-economic backgrounds. In today's labour market, which rewards skills and penalizes low education, early skill gaps have profound and long-term consequences for individuals, their labour market outcomes and their well-being (Duncan and Brooks-Gunn, 1997; Belfield and Levin, 2007). There is also evidence that differences in cognitive development by social origin can be observed at an early age, even before children start school (Sylva *et al.*, 2010). The early emergence of such social class gradients raises the question of what mechanisms are crucial in reproducing these inequalities.

In studies of social inequality, social origin is often measured in different ways—as social class, educational level, income, or occupational status. On the one hand, one could argue that parental social class indicators such as education, income, and occupational status play a somewhat overlapping role in influencing cognitive outcomes. Highly educated parents often earn higher wages and are employed in better occupational positions with more job flexibility, which provides the opportunity for greater investment in their children (Bianchi *et al.*, 2004). From this perspective, it should not matter which measure of social origin is used as all tap into the same underlying mechanisms.

On the other hand, the multidimensional nature of social origin may mean that access to financial resources, services and human capital accumulated through educational qualifications may influence child development in different ways. Bukodi and Goldthorpe (2013) argue that different indicators of social origin are not interchangeable and have an independent and distinct effect on a child's later educational attainment. They propose decomposing social origins into parental class,

social status, and education, where class is conceptualized in terms of social relations in labour markets or as employment relations and social status is understood as grounded in family socio-cultural resources (social contacts and cultural tastes). Including parental education as an indicator of social origin is envisioned as parental 'educational resources' (i.e. a parent's capacity to participate directly in furthering their children's educational careers) in a model measuring the highest educational attainment of the following generation.

The GUI data do not include social status, but family income, another important measure of social origin, is measured. The direct role of financial resources is invoked in both the family investment model (FIM) and the family stress model (FSM). The FIM ascribes socio-economic disparities in educational attainment to differences in family investments in educationally beneficial materials, experiences, and services (Duncan *et al.*, 1998). The FSM argues that poverty or inadequate income increases the risk of psychological distress and marital conflict, which in turn affects parents' parenting behaviour with consequences for child development, primarily socio-emotional outcomes but also cognitive skills (Conger and Donnellan, 2007).

The role of parental education has been identified as important for promoting social reproduction through differences in the quality and time spent with children and investment in activities that enhance children's cognitive development and educational achievement. Educational level is also associated with parental vocabulary and cognitive skills which will permeate the interactions parents have with children. Linguistic studies report socio-economic status (SES) differences in parent–child interactions, measured as income and education (Rowe, 2008) and social class (Hoff-Ginsberg, 1991); with children from high-SES families getting more encouragement and even SES differences in non-verbal communication (e.g. gesture use, see Rowe and Goldin-Meadow, 2009). Recently published work by McNally *et al* (2019), also using GUI data at 9 months and 3 years, noted that family and parenting variables—particularly financial circumstances—were key mediators of the observed advantage for higher maternal education on child vocabulary scores.

Social class effects on early cognitive development may operate by influencing attitudes and parenting behaviour; for example beliefs and expectations regarding child development. Lareau (2002) argues for the existence of social class differences in the 'logic of childrearing'. She observes a coherent pattern in middle-class families that she terms 'concerted cultivation'. This cultural orientation entails a focus on parents' active development of children's skills and talents. By contrast, working-class families feel compelled to keep children safe and provide them with shelter, food, and love, but they then typically presume that children will grow and thrive spontaneously. Concerted cultivation is part of the wider transmission of cultural capital from parents to children. Cultural capital is understood as access to cultural resources such as knowledge of evaluative norms or 'rules of the game' (Lareau and Weininger, 2003). Those with cultural capital exhibit strategic use of their knowledge, skills, and competence to comply with those 'rules' and improve their children's outcomes. Erola *et al* (2016), using Finnish register data, find parental education is the most salient indicator of social origin for children's occupational outcomes in adulthood, but that using all three measures (education, class, and income) explains more of the variance in outcomes than one single indicator. They argue that parents influence the adult socio-economic attainment of their children through two types of pathway: endowments and investments, where an endowment can be understood as any parental resources or characteristics that children can potentially benefit from, including: human or cultural capital, social status, as well as genetic background influencing cognitive development. An investment can be understood as any intentional parental behaviour aimed at influencing child outcomes. In our case, the quality of the HLE can be considered an investment by the parents in their child's education.

Using Swedish register data, Mood (2017) examines the independent and interactive associations that parental income and social class share with children's later earnings and finds that parental class matters at a given income and income matters within a given social class, and the net associations are substantial. She argues that because measurement error is minimal the results strongly indicate that income and class capture partly different underlying advantages and transmission mechanisms. She also concludes that class is not merely picking up the effect of education as social class differences remain even after controlling for parental educational level. The underestimation of the intergenerational transmission of advantage (measured as children's earnings in adulthood) is as much as 25 per cent if only class or income is included in the models.

Based on these previous findings, we would expect that cognitive outcomes in early childhood will vary by social class, education, and income in Ireland. Following from this, we suggest two competing hypotheses on the way in which different dimensions of social origin can conceivably influence cognitive outcomes: either that these social origin factors tap into the same underlying

mechanisms and can be substituted for one another (H1a) or alternatively that these three factors will have an independent association with cognitive development at age 3 (H1b).

In addition, Erola and Kilpi-Jakonen (2017) argue that it is important to distinguish compensation from other processes of resource transfer, which can lead to multiplication and accumulation of advantages and disadvantages. Compensation takes place when parental resources are lost, reduced, or missing, and tends to affect children at the lower end of the socio-economic spectrum. By contrast multiplication, whereby advantaged children derive greater benefit from additional resources, is likely to take place at the top end of the socio-economic spectrum. These mechanisms of compensation and multiplication are important for our analysis of social inequality in cognitive outcomes in this article, and we return to these concepts and how they might apply to young children in Ireland below.

First, we acknowledge that social scientists have increasingly recognized the potential role of genes or heritability in the relationship between social origin and child cognitive outcomes. These studies suggest that genes and environment correlate and interact in a variety of complex ways. The Scarr–Rowe hypothesis suggests that the heritability of cognitive abilities is higher in more socially advantaged environment, as 'better off' households can create an environment in which genetic abilities can be realized (see Mönkediek *et al.*, 2019, for evidence of this within the German Twin Family Panel). Alternative relationships have also been proposed, for example that poor environments trigger the expression of negative traits (see Selita and Kovas, 2018). The scope of the GUI study does not extend to this type of genetic analysis, but the current study is equipped to examine the effect of HLAs in the *context* of other environmental influences (such as parental education) that are likely to be moderated by familial traits such as intelligence.

Home-Learning Environment

Parental involvement with children's learning is thought of as one mechanism through which socio-economic factors influence child competencies (Hartas, 2011). The role of the HLE in cognitive development is established in both the psychological and sociological literature on the topic. In psychology, the Vygotskian approach highlights the importance of adult-assisted activities for progress in child development (Vygotsky, 1978). Shared activities provide learning opportunities (joint attention and new vocabulary), as well as enabling parents to structure their activities within their child's zone of 'proximal development[1]'(Murray and Egan, 2014). Reading to children (including the use of complex language, responsiveness, and warmth in interactions) has been found to be important for language and emergent literacy as well as other developmental outcomes (Bus *et al.*, 1995).

HLE is understood in this article as 'Measures taken in the home to encourage children's learning' (e.g. Reynolds and Hesketh, 2012). The HLE has been measured through indices of activities using survey instruments, such as the Home-Learning Index which includes seven activities e.g. reading with child, teaching child numbers and singing (Hunt *et al.*, 2011), or through observational measures of the home environment.[2] Other studies have used measures of learning resources in the home such as books and educational materials. Evans *et al* (2010) found that 'children growing up in homes with many books get 3 years more schooling than children from bookless homes, independent of their parents' education, occupation, and class' (p. 171), and that this relationship was largely independent of national characteristics. Burgess *et al.* (2002) attempted to distinguish between different HLE profiles such as 'passive HLE' where parents essentially model literacy behaviour through their own literacy activities (e.g. reading themselves) and 'active HLE' where the parent specifically engages the child in joint literacy activities like shared reading or word games. In Burgess *et al.*'s work to estimate the contribution of these different HLE profiles to longitudinal measures of skills related to the young child's emerging literacy ability, they concluded that more 'active' profiles had greater benefit (at least in early childhood). In a similar vein, Van Steensel (2006) identified three home literacy profiles in their study in the Netherlands: rich (where parents/siblings frequently read and write for personal purposes); 'child-directed' (i.e. where the adults did not personally engage in literacy activities but nonetheless did engage the child in 'high priority' activities such as shared reading and singing songs), and poor home literacy environment (where parents/siblings hardly engage in such activities). Van Steensel (2006) found that for reading comprehension, children from rich and child-directed HLEs scored higher than children from poor HLEs.

The potential role of the HLE in accounting for the social reproduction of advantage and disadvantage is premised upon differences in the quantity or quality of this environment by social background. The association between availability of educational resources and social background is well established across a range of national contexts, though the relationship is stronger for educational background than income. Anders *et al.* (2012)

investigating the role of the HLE on early numeracy skills, find that once the HLE is included the effect of maternal education and SES are greatly reduced and that this effect was more pronounced when controlling for HLE literacy. The quantity and quality of a child's linguistic environment (number of words or sentences per hour/day; sentence complexity, lexical diversity, etc.) have been shown to be closely related to parental SES and children's verbal abilities (Hoff, 2003). Other studies have found that low socio-economic status and low-parental education are moderately associated with low quality of the HLE (Anders *et al.*, 2012; Bornstein and Bradley, 2014).

Hartas (2011) found no difference in the frequency with which parents of different SES backgrounds engaged in various learning activities with their children such as learning the alphabet and writing, with the exception being reading. In this case, it was only the most disadvantaged that were distinctive: a lower percentage of mothers with no educational qualifications and those below the poverty line read to their children frequently (Hartas, 2011). Indeed a key finding from a longitudinal study of children's development. The Effective Provision of Pre-School Education (EPPE) study is that the quality of the HLE is more important for cognitive development than parental income, social class, or even education: what parents do is more important than who they are (Sylva *et al.*, 2004). Based on this literature, we develop a second hypothesis that the child's HLE is both associated with cognitive outcomes directly and also helps account for the social gradient in childhood cognitive outcomes in Ireland (H2).

For policymakers, perhaps a key question is whether HLE or activities parents do with children in the home can compensate for the social disadvantage. This links to the work by Erola and Kilpi-Jakonen (2017) on compensation and multiplication discussed above. In this case, compensation would imply that the additional resource of educationally enhancing activities with children may enhance cognitive outcomes more for *disadvantaged* children—either disadvantaged in terms of income, parental education, or social class background (H3a). Alternatively, if the activities engaged in by socially advantaged parents are qualitatively different, for example if they use more complex language and extend their toddler's vocabulary more, this might mean that the same frequency of HLAs will enhance cognitive outcomes more for socially *advantaged* children than for disadvantaged children. This would be indicative of a multiplication effect and would serve to exacerbate or widen the social gradient in cognitive outcomes (H3b).

Data, Measurement, and Modelling

This analysis explores these hypotheses using information from the first three waves of the Infant Cohort of GUI. GUI is a national longitudinal study of children and members of the Infant Cohort were born between December 2007 and June 2008. The cohort members were first visited when they were 9 months old ($n = 11{,}134$), again when they had just turned 3 years ($n = 9{,}793$), then age 5 years ($n = 9{,}001$). The key survey instruments for this article are a detailed questionnaire for the primary caregiver (PCG) (in almost all cases the mother) and a series of developmental tests for the children at age 3 and 5 (see Williams *et al.*, 2013 for further details).[3]

The main outcome measure of cognitive development used in the analysis was the child's score on a measure of expressive vocabulary at age 3 years. The test used was the Naming Vocabulary subscale from the British Abilities Scales (BAS) (Elliott *et al.*, 1996). The test was administered directly by a trained interviewer in the child's home and requires the child to name (in English) the objects displayed on a series of illustrated cards (e.g. 'shoe'). The same test was also completed by the children when they were 5 years old. This analysis uses the age-standardized *t* scores as derived from the test publisher's manual. The mean score at age 3 was 51.1 (SD = 13) with a range of 20–80.

The main variables of interest were parental social origin: social class, education, and income. Education was measured as the highest educational qualification attained by the PCG (usually the mother) as measured when the child was aged 3 years (i.e. wave 2). We used a 4-fold classification divided into lower second level or less; upper secondary; short-cycle tertiary qualification (certificate/diploma level), and tertiary degree level or higher. Table 1 provides descriptive statistics for these and other variables used in these analyses.

For social class, we used the family's social class derived from the occupational information of participants and using the dominance method (i.e. the household's social class is taken as the highest Social Class category of both partners in the household). Households where both caregivers are currently economically inactive and have not held any previous employment in the past are classified as 'validly no social class'. The classification used was that adopted by the Irish Central Statistics Office which was collapsed into a 5-fold classification: professionals, those from a managerial and technical background, non-manual, skilled manual and semi/unskilled, and never worked.[4]

Table 1. Descriptive statistics for outcome and predictor variables used in the main regression model in Tables 2–4

Variables	Mean (SD) or percentage	*N*
PCG education		
Degree or higher	41.1%	3,368
Third-level non-degree	22.6%	1,850
Upper secondary	28.2%	2,309
Lower secondary (or less)	8.2%	673
Class		
Professional	19.0%	1,559
Managerial	34.2%	2,800
Non-manual	17.5%	1,437
Skilled/Unskilled manual	23.5%	1,926
Never worked/missing	5.8%	478
Income		
Top income quintile	22.3%	1,825
Quintile 4	19.7%	1,613
Quintile 3	19.1%	1,568
Quintile 2	17.0%	1,390
Lowest	17.0%	1,394
Missing	5.0%	410
Vocabulary age 3		
T-score British Ability Score(BAS) naming vocabulary	51.1 (13)	8,200
Home learning		
Home-learning activities (mean score)	29.3 (8)	8,200
Language		
English not first language	5.3%	431
Child sex		
Female	49.6%	4,068

Notes: *n* refers to the case-base for the main model, not the total sample for a particular wave of Growing Up in Ireland. All variables measured at wave 2 (age 3 years) unless otherwise stated.

Mothers provided an exact figure or best-guess estimate of household net income. To calculate the household's position in the income distribution, net household income was then equivalized using a standard procedure depending on the number of adults and children in the household.[5] The sample of households is then distributed equally into five groups or quintiles; 5.5 per cent of respondents who declined to answer the income question in wave 2 are included as missing in the models.

HLE Measurement

To measure the HLE, a composite scale of HLAs was constructed from a set of six items measuring the frequency of the following activities. On how many days in an average week *does anyone at home*: read to child; help child learn the ABC or alphabet; help child learn numbers or counting; help child learn songs, poems, or nursery rhymes; play games (board games, jigsaws, card games, etc.) with child; paint, draw, colour, or play with play-doh at home. When these measures are combined as a simple additive scale the resulting scale ranges from 0 to 42, with an alpha of 0.70.[6] This scale captures activities that are performed with the child which have the potential to enhance their learning and cognitive development. The data also contain a measure of educational resources in the home in the form of the number of children's books (pre-coded categories).

Our preference is HLAs for a number of reasons. Firstly, as a multidimensional measure, it will be more robust than a single-item measure. Secondly, the measure directly assesses activities with the child rather than the availability of learning resources which could be used to a greater or lesser extent. Thirdly, there may be error in the estimation of the number of books in the home or be affected by reverse causality whereby the number of books purchased is influenced by perceptions of the child's interest and abilities (Engzell, 2016). Of course we cannot rule out the problem of reverse causality in

parental behaviour: parents may change their behaviour in response to the child's cognitive and psychological make-up. For example, twin studies find a genetic component to measures such as home environment, both in terms of self-rating of parenting behaviour and parents' actual behaviour (Plomin and Bergeman, 1991).

The number of HLAs that a person reports may also be susceptible to some upward bias in reporting due to social desirability; therefore, we also run models with the number of books in the home as a robustness check. We find that engagement in HLAs is socially structured but that differences by class, income, and parental education are not wide, for example, the average HLA score for children from a professional background is 29.5, compared with 28.9 for those from an unskilled manual background. One reason for this pattern is that different activities in the scale have somewhat different distributions. A significantly higher proportion of those in professional or managerial positions report reading to their children 5–7 days a week (82.5 per cent) compared with those in the 'never worked' (58.2 per cent) and 'unskilled' (64.4 per cent) categories.[7] Similarly 85.2 per cent of those with a university degree read almost daily to their children compared with 53.6 per cent of those with lower secondary education. However, when we look at spending time on the alphabet[8] and counting[9] parents with lower resources invest more time than those in better off positions. Neither the frequency of singing/reciting rhymes nor playing games varies substantially by social origin.

Part of the aim of this article is to explore the association between social origin (as measured by class, education, and income) and cognitive outcomes in early childhood, both separately and combined. However, in the second stage of our analysis, the focus is less on the independent contribution of the different dimensions of social origin than on how the HLAs moderate the impact of each social-origin measure on cognitive outcomes. Consequently, it was considered informative to examine the interactions between the HLAs and education, income, and social class in separate analyses.

Ordinary least squares (OLS) regression was considered the best tool for modelling the association between our outcome measured on a continuous scale and our main independents as measured above. We opt for a relatively parsimonious model without extensive covariates, to avoid inadvertently controlling for social origin using measures. We, therefore, exclude controls for factors with a significant social gradient such as, mother's age at birth, family structure, and child's birthweight. We test for the potential association with non-parental childcare in a separate model. We retain child's gender which is not affected by social origin, and a measure of language spoken at home. The latter is strongly related to language skills and, therefore, excluding it would risk under-specification (McGinnity *et al.*, 2015). Moreover, migrant children in Ireland come from a range of class, income, and educational backgrounds (Darmody *et al.*, 2016).

Results

Social Origin, HLE, and Cognitive Outcomes

Our first set of models (Table 2) consists of a set of regression models where each of the individual components of social origin is modelled separately and then together (m1–m4). Model 5 (m5) examines the impact of the HLAs scale divided into five quintiles. Model 6 (m6) then estimates change over time in vocabulary between age 3 and 5, by adding the vocabulary score at age 3 to a model of vocabulary score at age 5. Our findings suggest that there are pronounced differences in vocabulary by socio-economic background in Ireland even at age 3. Relatively strong independent effects for each social-origin measure on vocabulary score at age 3 are visible (m1–m3). Those with lower-secondary education and those in the residual category for social class (the 'never worked' category) have the lowest vocabulary score relative to those whose parents have a degree-level qualification or who work in a professional occupation. In addition, those in the lowest and second lowest-income quintiles have the lowest vocabulary scores relative to those at the top of the income distribution. This broadly supports previous findings that cognitive outcomes vary by social origin, even at age 3.

When all three measures of social origin (class, education, and income) are included in the model (m4), the magnitude of the association of each with cognitive outcomes is reduced, with class most affected. In terms of vocabulary scores, children from skilled and unskilled manual class backgrounds no longer differ from children from professional class backgrounds, once education and income are accounted for. The gap between high- and low-parental education backgrounds and family income quintiles is also reduced when other social-origin measures are included (compare m1, m2, m3 with m4). This is consistent with previous findings of overestimation of social origin when component parts are taken separately (Bukodi and Goldthorpe, 2013). The fact that some differences between income, education, and social class groups remain supports the notion that each measure of social origin does have an independent association with cognitive outcomes, as articulated in H1b. However, there are clearly overlapping elements to these

social-origin measures too, particularly in the case of social class. After adding education and income, only children whose parents have never worked differ in their cognitive outcomes from those whose parents work in professional jobs (m4).

As found in previous international studies, in Ireland, there is a clear association between social origin and HLA in favour of those with more resources i.e. those with higher levels of education, income, and better class positions (see Supplementary Table SA1 for more details). The types of HLA parents engage in go some way towards explaining origin differences by educational background, however, independent effects of education remain (m5). HLA does not explain differences between family income groups or social class effects in terms of vocabulary (m5 compared with m4). Thus H2 that HLAs will mediate the effect of social origin is not clearly supported by this analysis. Once all social-origin measures and HLAs are taken into account, there is a 43 per cent reduction in the effect for those children whose parents have a lower-secondary education relative to those with parents who have a tertiary degree between m1 and m5 ($-3.85/-6.81 = 0.57$). The akaike information criterion (AIC) and bayesian information criterion (BIC) indicate that education captures the association between social origin and vocabulary score somewhat better than income or class. Having information on family income, education, and social class, as well as the HLA engaged in with the child (m5) allows us to better predict their vocabulary score at age 3.[10] In the final model (m6), we examine vocabulary score at age 5 using children's vocabulary score at age 3 as a predictor. This allows us to examine the role of social origin and HLE in vocabulary development. The results suggest that children whose mothers have a modest level of education, those whose parents are in the never worked/missing category, and those with the lowest-income levels make less progress in vocabulary formation. This implies a widening of differences between groups regardless of social-origin measure used. M6 also shows that those in the lowest HLA quintile at age 3 show lower vocabulary development between age 3 and 5.

Early childhood care and education can potentially influence the transmission of advantage from parents to children (Blossfeld *et al.*, 2017). Previous research in Ireland found that non-parental childcare for this age group varies by social background, with children from advantaged backgrounds more likely to participate (Murray *et al.*, 2016). McGinnity *et al.* (2017) also find that home-based, non-parental childcare at age 3 is associated with slightly higher vocabulary scores at age 5, though the effects are modest, and they find no effect on vocabulary of participating in centre-based childcare. When we estimate models 1–5 with childcare type included, the findings on the social gradient in Table 2 are not affected, so we prefer the parsimonious specification presented there.[11]

Do HLA Compensate for Social Origin or Do They Exacerbate the Gap?

To test the competing hypotheses that the HLE may moderate the effects of social origin in different ways, we interact the different measures of social origin (class, education, and income) and focus on HLAs as a measure of the HLE (as a continuous measure).

In Table 2 above, the income-quintile measure shows that children in households with income in the bottom two quintiles have the lowest vocabulary scores at age 3 (-5.84 and -5.03, respectively) relative to those from families in the highest-income quintile (m3). Once HLAs are taken into account (m7 in Table 3 below), the results suggest that HLA 'channel' little of the income association. Thus, even though higher-income classes may have higher scores on HLA, and both activities and income appear to have a positive association with vocabulary score, the reason that income affects vocabulary positively is not mainly because of the higher HLA scores in higher-income classes.

However, we find evidence of an interaction effect between income and a high level of HLA, suggesting that how income relates to vocabulary scores differs between groups depending on their HLA score (m8). The interaction term tells us that the gap in vocabulary between the lowest-income quintile and the top-income quintile (-5.66) is somewhat reduced in magnitude for those who engage in more HLA (m8). A similar effect is found for children in income quintile 3, compared with those in the top-income quintile. This supports H3a that HLA may compensate for social-origin disadvantage. The finding is not consistent with the notion of multiplication (H3b) that children from higher-income groups will benefit more from HLA. Additional controls for education and class were added in model 9 with the result that the R^2 increases from 0.12 to 0.14. When we consider change over time in vocabulary score between age 3 and 5 (m10), the main effect of the HLA is no longer significant; however, the interaction effect remains for those in the lowest-income categories. This suggests that a higher level of investment in HLA at age 3 can be beneficial in protecting against a widening attainment gap for those groups with the lowest-income level even at this early stage.

Table 2. Social gradient in childhood cognitive outcomes at age 3 by social origin and HLAs

		m1 Education	m2 Class	m3 Income	m4 All social-origin measures	m5 Plus HLA	m6 Age 5 vocabulary score
	Vocabulary score 3 years						0.40***
							(0.011)
PCG educ.	Ref: PCG degree						
	Lower	−6.81***			−4.23***	−3.85***	−0.75
	secondary	(0.569)			(0.650)	(0.639)	(0.530)
	Upper	−3.57***			−1.93***	−1.67***	−0.60*
	secondary	(0.371)			(0.429)	(0.425)	(0.363)
	Third-level	−1.61***			−0.85**	−0.72*	−0.23
	Non-degree	(0.382)			(0.403)	(0.398)	(0.334)
Family class	Ref: Professional						
	Never worked/		−8.16***		−3.79***	−3.89***	−2.38***
	Missing		(0.782)		(0.876)	(0.869)	(0.710)
	Skilled/Unskilled		−3.85***		−0.53	−0.62	−0.75
	manual		(0.466)		(0.554)	(0.547)	(0.455)
	Non-manual		−2.78***		−0.59	−0.70	−0.30
			(0.491)		(0.533)	(0.528)	(0.441)
	Managerial		−0.58		0.10	−0.04	−0.25
			(0.421)		(0.424)	(0.423)	(0.351)
Equivalized household income	Ref: Top-income quintile						
	Missing			−3.50***	−2.03***	−1.94***	−1.29**
				(0.734)	(0.731)	(0.725)	(0.620)
	Lowest-income			−5.84***	−3.09***	−3.05***	−0.79*
	quintile			(0.493)	(0.584)	(0.576)	(0.478)
	Quintile 2			−5.03***	−2.92***	−2.81***	−0.46
				(0.493)	(0.544)	(0.542)	(0.458)
	Quintile 3			−3.00***	−1.77***	−1.65***	−0.09
				(0.469)	(0.497)	(0.491)	(0.405)
	Quintile 4			−1.17**	−0.62	−0.49	0.26
				(0.453)	(0.465)	(0.464)	(0.385)
HLAs	Ref: HLA top quintile						
	HLA lowest quintile					−4.76***	−1.87***
						(0.488)	(0.417)
	HLA quintile 2					−2.55***	−0.56
						(0.473)	(0.394)
	HLA quintile 3					−1.69***	−0.66
						(0.505)	(0.407)
	HLA quintile 4					−0.36	−0.43
						(0.508)	(0.408)
	Female	3.41***	3.44***	3.45***	3.48***	3.05***	−0.27
		(0.307)	(0.308)	(0.309)	(0.305)	(0.304)	(0.255)
	English not first language	15.10***	−14.17***	−13.79***	−14.25***	−14.07***	−8.34***
		(0.754)	(0.732)	(0.745)	(0.746)	(0.732)	(0.808)
	Constant	52.34***	52.07***	52.81***	53.30***	55.31***	37.99***
		(0.280)	(0.370)	(0.332)	(0.411)	(0.528)	(0.753)
	Observations	8,200	8,200	8,200	8,200	8,200	8,163
	AIC/BIC	63,883.25/ 63,925.3	63,929.85/ 63,978.9	63,911.27/ 63,967.3	63,778.49/ 63,883.7	63,614.53/ 63,747.8	60,322.55/ 60,462.7
	R-squared	0.10	0.10	0.10	0.12	0.13	0.27

Notes: Robust standard errors in parentheses. Models weighted at age 3.
Significance levels: $***P < 0.01$, $**P < 0.05$, $*P < 0.1$.

Table 3. OLS regression of vocabulary score at age 3 with income interacted with HLAs

		m7 Income add HLA	m8 Add interaction	m9 Add education and class	m10 Age 5 Vocabulary score
	Vocabulary score 3 years				0.40***
					(0.01)
Equivalized household income	Ref: Top-income quintile				
	Missing	−3.33***	−3.40***	−2.05***	−1.40**
		(0.73)	(0.73)	(0.72)	(0.62)
	Lowest-income quintile	−5.60***	−5.66***	−3.12***	−0.84*
		(0.49)	(0.49)	(0.58)	(0.48)
	Quintile 2	−4.69***	−4.76***	−2.83***	−0.54
		(0.49)	(0.49)	(0.54)	(0.46)
	Quintile 3	−2.75***	−2.81***	−1.69***	−0.13
		(0.46)	(0.46)	(0.49)	(0.41)
	Quintile 4	−0.96**	−1.02**	−0.52	0.23
		(0.45)	(0.45)	(0.46)	(0.39)
HLA	HLA continuous (centred)	0.24***	0.16***	0.16***	0.03
		(0.02)	(0.04)	(0.04)	(0.04)
Equivalized household income interacted with HLA	Ref: Top income quintile × HLA				
	Missing × HLA		0.13	0.11	0.15*
			(0.08)	(0.08)	(0.08)
	Lowest quintile × HLA		0.16***	0.15**	0.11**
			(0.06)	(0.06)	(0.05)
	Quintile 2 × HLA		0.07	0.05	0.02
			(0.06)	(0.06)	(0.06)
	Quintile 3 × HLA		0.16***	0.15**	0.06
			(0.06)	(0.06)	(0.05)
	Quintile 4 × HLA		0.01	−0.00	0.04
			(0.06)	(0.06)	(0.05)
	Parental class			✓	✓
	Parental education			✓	✓
	Female	2.94***	2.96***	3.00***	−0.21
		(0.31)	(0.31)	(0.30)	(0.26)
	English not first language	−13.61***	−13.53***	−13.96***	−8.35***
		(0.73)	(0.74)	(0.74)	(0.81)
	Constant	52.85***	52.90***	53.41***	37.40***
		(0.33)	(0.33)	(0.41)	(0.70)
	Observations	8,200	8,200	8,200	8,163
	AIC/BIC	63,702.84/63,765.95	63,695.94/63,794.1	63,580.83/63,728.08	60,313.02/60,467.19
	R-squared	0.12	0.12	0.14	0.28

Notes: Robust standard errors in parentheses. Models weighted at age 3.
Significance levels: $***P < 0.01$, $**P < 0.05$, $*P < 0.1$.

We find similar results for social origin measured as social class (Table 4). There is a negative association between unskilled/skilled manual social classes and vocabulary score relative to those in the professional class; however, a positive interaction for the children of the manual classes is visible when HLA is taken into consideration (m12 in Table 4). In other words, for this class, HLA plays a role in compensating social origin, once again lending support to H3a. The findings from the first three models in Tables 3 and 4 are illustrated using predicted values of vocabulary score in Figure 1. As investment in HLA increases, a compensatory effect is visible for those in the least well-off positions (in particular, those in the unskilled/skilled manual class seem to benefit).[12] The gap in vocabulary scores is much smaller at high values for HLA. In addition, for social class, the

Table 4. OLS regression of vocabulary score at age 3 with social class interacted with HLAs

		m11 Class add HLA	m12 Add interaction	m13 Add education and income	m14 Age 5 vocabulary score
	Vocabulary score 3 years				0.40***
					(0.01)
Family class	Ref: Professional				
	Never worked	−7.97***	−7.99***	−3.88***	−2.43***
		(0.78)	(0.78)	(0.87)	(0.71)
	Unskilled/skilled manual	−3.68***	−3.67***	−0.60	−0.74
		(0.46)	(0.46)	(0.55)	(0.46)
	Non-manual	−2.69***	−2.70***	−0.69	−0.31
		(0.49)	(0.49)	(0.53)	(0.44)
	Managerial/technical	−0.65	−0.66	−0.05	−0.23
		(0.42)	(0.42)	(0.42)	(0.35)
HLA	HLA continuous (centred)	0.24***	0.17***	0.16***	0.11***
		(0.02)	(0.04)	(0.04)	(0.04)
Class × HLA	Ref: Professionals × HLA				
	Never worked × HLA		0.05	0.07	−0.06
			(0.11)	(0.11)	(0.07)
	Unskilled/skilled manual × HLA		0.12**	0.12**	0.03
			(0.05)	(0.05)	(0.05)
	Non-manual × HLA		0.08	0.08	−0.08
			(0.06)	(0.06)	(0.05)
	Managerial/technical × HLA		0.06	0.06	−0.07
			(0.05)	(0.05)	(0.05)
	Parental education			✓	✓
	Parental income			✓	✓
	Female	2.93***	2.93***	2.99***	−0.24
		(0.31)	(0.31)	(0.30)	(0.26)
	English not first language	−13.99***	−13.96***	−14.00***	−8.32***
		(0.72)	(0.72)	(0.74)	(0.81)
	Constant	52.27***	52.28***	53.37***	37.35***
		(0.37)	(0.37)	(0.41)	(0.70)
	Observations	8,200	8,200	8,200	8,163
	AIC/BIC	63,721.83/63,777.92	63,724.7/63,808.84	63,589.34/63,729.57	60,310.19/60,457.34
	R-squared	0.12	0.12	0.14	0.28

Notes: Robust standard errors in parentheses. Models weighted at age 3.
Significance levels: ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

main effect of HLA remains when considering change over time in vocabulary scores (m14), suggesting that the HLA plays an important role in protecting children from widening class differences between age 3 and 5. We find no evidence of an interaction effect for social origin measured by education level (see Supplementary Table SA4).

Robustness Check with Books in the Home

As a robustness test, we estimate a model with another popular measure used to capture the HLE, namely number of children's books in the home (Supplementary Table SA5). There is a much stronger social gradient between social origin and number of books than there is for HLA. Generally speaking, books in the home capture more of the influence of social origin than HLA. In models mA5.1–mA5.3, the number of books in the home has a relatively strong association with vocabulary, independent of each specific measure of social origin. As was the case for activities, we find that the magnitude of the social-origin coefficients is reduced, with class most affected when all three measures of social origin are included and the number of books in the home is taken into account (mA5.4).

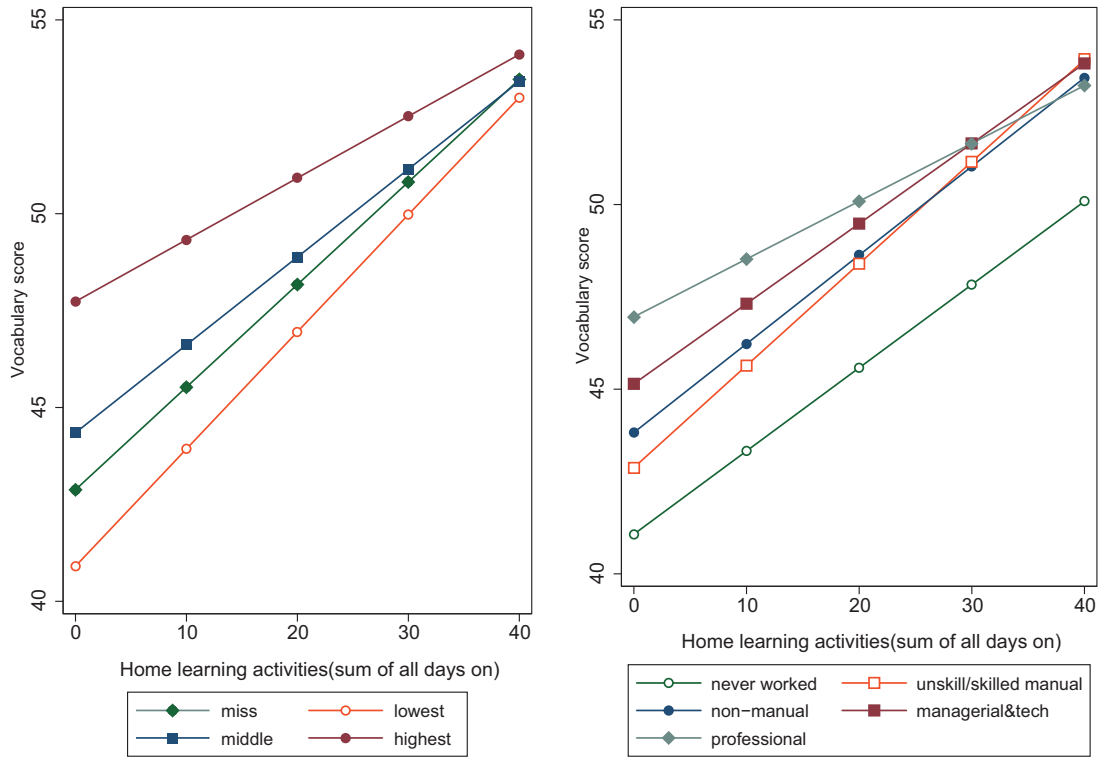

Figure 1. Children's vocabulary score (age 3) according to social origin, income (left figure) and social class (right figure) and HLAs; predicted values of vocabulary score

Source: Own calculations based on GUI data.

Overall, we find that there is not a large difference between our models containing alternative measures of HLA and all three social-origin variables (comparing m5 and mA5.4).

Discussion

Merging insights from the literature on social origins and the HLE, this article investigates differences in cognitive outcomes among young children in Ireland from different social backgrounds. Using a rich cohort study, the article finds pronounced differences in mean scores in naming vocabulary at age 3, an early stage in children's development. Mothers' education, family social class, and income quintile are all separately associated with naming vocabulary scores at age 3, with education capturing the association between social origin and vocabulary score somewhat better than income or class. These social origin measures are also associated with children's vocabulary scores even when all three are included simultaneously. The effect sizes are reduced, suggesting some overlapping of the social-origin categories, but independent effects remain. These findings suggest that using one measure of social origin, for example social class or mothers' education, will overestimate the effect of that one measure, but underestimate the *combined* association of social origin with cognitive outcomes. This is consistent with previous research using later outcomes (Bukodi and Goldthorpe, 2013; Mood, 2017), but applies the theoretical approaches to cognitive outcomes (vocabulary scores) of very young children.

Higher HLA scores, which include reading, singing, painting, and crafts—what parents 'do'—are associated with higher vocabulary scores at age 3. The quality of a child's HLE measured by these scores varies by social origin, but this only helps to explain a small part of the education differences, and none of the income or social class differences in vocabulary scores. It is certainly not the case that HLA, the activities that parents do with their children account for the differences in vocabulary between children from different social backgrounds. We cannot rule out some level of socially desirable responding in terms of activities with children, though it is not

clear whether and how this would vary by social origin and affect our results. The fact that findings persist when we use books in the home, arguably less prone to socially desirable responding, suggests the findings are robust. We also find an impact of HLE in change over time in vocabulary scores, with those in the lowest environment quintile showing less progress in vocabulary acquisition between age 3 and 5.

We find some evidence of a potential compensation effect for HLA on vocabulary scores of children from lower-income households. Children from the lowest and the middle-income quintiles appear to gain more from HLA in terms of vocabulary at age 3 than those from the highest-income quintile households. HLA also benefit low-income children more in their vocabulary development between age 3 and 5, closing the gap (somewhat) in vocabulary between these groups. We also find a compensatory effect of HLE for children from unskilled/skilled manual class backgrounds at age 3. Thus, engaging in HLA in these families is associated with a reduced gap in vocabulary scores, at age 3, between high- and lower-income children, and manual and professional class backgrounds. We find no evidence of multiplication effects, at least if we consider the HLE as an additional resource (Erola and Kilpi-Jakonen, 2017). There is no such compensatory relationship for children whose mothers have low educational qualifications.

Why do we find a compensating relationship for social class and income but not for mothers' education? It could be that both processes of compensation and multiplication are at work and cancel each other out. For example, highly educated mothers can interact in a way that enhances their child's vocabulary more (multiplication), yet when low-educated mothers do these activities, they are more salient for vocabulary acquisition (compensation). Note HLA plays more of a role in the main effect of mother's education than social class or income (see Table 2), and education is linked to the mother, not the family, as in the case of social class and income. Parental educational qualifications are not likely to change, even in a recession, but class and income can potentially see more variation based on labour market conditions, welfare cuts, and upward/downward occupational mobility.

While this article could not explicitly consider the role of genetics in cognitive outcomes, we acknowledge that genetics plays an important role in the intergenerational transmission of advantage, as illustrated by Van Bergen *et al.* (2016).

Further research could investigate resource compensation in more depth using these data, that is does higher education compensate for a lower family social class background or lower income, in terms of cognitive outcomes, for example? Following Erola and Kilpi-Jakonen (2017), does one resource (e.g. education) take on a stronger compensating role when the other (income) is low?

In terms of the practical implications of our study, our findings suggest that it may be beneficial for policymakers to consider ways of supporting and educating all parents in how to enrich the educational potential of individual homes (such as schemes to widen access to suitable books and providing advice on how parents can foster children's early learning). However, we also appreciate that the cognitive stimulation parents provide for their preschool children form only one element of a larger and more complex relationship between social origin and cognitive outcomes. Wider structural social inequalities affect parents' mental and physical health, the quality of their own educational experiences, and the availability of social support, all of which are likely to influence parents' capacity to provide a home environment that facilitates cognitive development. Interventions that focus just on 'improving parents' without addressing wider structural inequalities are likely to have limited effects.

Notes

1 The zone of proximal development can be understood as '...the distance between a child's current ability and their potential ability with the support of a more experienced individual, such as an adult or older child' (Murray and Egan, 2014, p. 305).
2 The NICHD study in the United States (2006) uses the Home Observation for Measurement of the Environment which assesses the stimulation and responsiveness of the family environment and includes both parent-reported and interviewer-observed items.
3 The sample is limited to those responding at age 3 and 5 for consistency between the age 3 models and change over time models.
4 Those missing on social class in wave 2 were recoded to include the family social class given in wave 1.
5 This equivalence scale assigns a value of 1 to the first adult, 0.66 for any additional household member aged 14 and over and 0.33 for any children under 14.
6 We undertook further factor analysis of the HLE scale. The analysis showed that there was only one factor onto which all of the components loaded and when we tested the effect of this alternative factor-weighted variable in the model we found that the weighted HLE variable accounted for slightly less variance than the unweighted scale. Therefore, we do not adopt the factor-weighted measure.

7 Sig: Pearson $\chi^2(6) = 346.7552$, $P = 0.000$.
8 Thirty-eight per cent of 'professional or managerial' class spend some time on the alphabet almost daily compared with 46 per cent 'never worked' and 44 per cent 'unskilled' Sig: Pearson $\chi^2(6) = 38.0865$, $P = 0.000$. Results are similar for education and income.
9 65.5 per cent of the 'professional' class spend some time counting with their children 5–7 days a week compared with 67.1 per cent of those who never worked and 68.2 per cent of the unskilled. Sig: Pearson $\chi^2(6) = 10.4329$, $P = 0.108$.
10 More formal testing showed that on average HLAs mediate the relationship between social origin and cognitive outcomes approximately 4–5 per cent between those in the least well-off positions relative to those in the most advantaged positions. A simple average of decomposition percentages over class contrasts was calculated following the method outlined by Karlson and Holm (2011). All models control for gender and language in the home and results are available from the authors on request.
11 Models which include the effect of childcare type are available from the authors on request.
12 The confidence intervals for 'never worked' are wide due to smaller number of cases in this category.

Supplementary Data

Supplementary data are available at *ESR* online.

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