

Socioeconomic disparities in early language development in two Norwegian samples

WORKING PAPER

Luísa A. Ribeiro*

Universidade Católica Portuguesa, Research Centre for Human Development, Portugal &
University of Oslo, Norway

Henrik Daae Zachrisson

Department of Special Needs Education, University of Oslo, Norway

Ane Nærde

Norwegian Center for Child Behavioral Development, Norway

Mari Vaage Wang

Norwegian Institute of Public Health, Norway

Ragnhild Eek Brandlistuen

Norwegian Institute of Public Health, Norway

Giampiero Passaretta

European University Institute, Italy

* Corresponding author: laribeiro@ucp.pt

Abstract

Socioeconomic disparities in early language are widespread and have long-lasting effects. The aim of this study is to investigate when social gaps in language problems arise and how they change across the first years of schooling. We address this question in two large longitudinal Norwegian datasets: the Behavior Outlook Norwegian Developmental Study (BONDS) and the Norwegian Mother, Father and Child Cohort Study (MoBa). Despite some slight differences across the two samples, we found that children from higher social backgrounds are less likely to have language difficulties starting from age 18 months and up to age 8 (grade 2). Moreover, while early language problems are strongly predictive of later language, maternal education makes an additional contribution to explaining language difficulties at the beginning of school life. Social inequality in language development arises early, even in a country like Norway, with low unemployment and one of the most egalitarian societies in Europe.

Keywords: early language; social inequality; BONDS; MoBa

Introduction

Education plays a crucial role in attenuating social segregation, reducing poverty, and offering more equalitarian life chances for all (OECD, 2017). A wealth of studies in psychology, sociology, economics, and educational research has emphasized the importance of socio-economic status (SES) in educational development. The social stratification of educational outcomes starts to take place early in the life course and, at least in part, is produced by social differentials in the development of cognitive and academic achievements (Jackson, 2013). It has been consistently found that SES is associated with school readiness and educational achievements in a variety of domains (e.g., Dearing, 2014; Duncan et al., 2015; Marks et al., 2006). Moreover, cognitive skills associated with SES predict career success beyond educational attainment (e.g., Barone & Van de Werfhorst, 2011). Hence, SES disparities in cognitive achievement continue to drive processes of social segregation beyond the school years (Farkas, 2003).

The SES gradient among young children's achievements may be explained by differences in experiences both in the home environment and in Early Childhood Education and Care (ECEC) contexts (e.g., Burchinal et al., 2008; Gustafsson, et al., 2011). Higher SES is associated with better cognitive support to children (e.g., Neitzel & Stright, 2004), and children from higher SES families perform better than their lower SES counterparts in a number of cognitive tasks. Differences between SES groups are striking even before school entry and pervasive to areas such as language (Fernald et al., 2013), mathematics (e.g., Tan, 2015) and spatial reasoning (e.g., Verdine et al., 2014).

Language, in particular, has been the focus of numerous studies starting in early childhood. The development of language comprehension and expression is an important milestone in the preschool years. Language skills lay the foundations for reading and

Socioeconomic disparities in early language development

comprehension skills and predict later language and academic achievement (e.g., Storch & Whitehurst, 2002). Disparities in language development can have long-term impact.

Moreover, language impairments starting early in life can lead to difficulties in children's academic and socioemotional development. Persistent language problems are associated with difficulties in literacy and poor school achievement (e.g., Storch & Whitehurst, 2002). In addition to compromising academic achievement, language impairment may lead to peer rejection (Liiva & Cleave, 2005; Øksendal et al., 2019) and is associated with increased risk of hyperactivity, depression, and other mental health problems (Beitchman et al., 2001).

Beyond childhood, language difficulties are likely to affect career prospects (e.g., Durkin, et al., 2012), social relationships (e.g., Wadman, et al., 2011), and mental health (e.g., Snowling, et al., 2006).

This study focuses on identifying the timing of the emergence of SES disparities in language achievement and on understanding the role of early language difficulties in perpetuating social disadvantage. There is relative consensus about the impact of social disadvantage and family SES on children's language development (e.g., Dearing, 2014; Pace et al., 2017; Vernon-Feagans et al., 2012). Nevertheless, much less is known about when these achievement gaps first become detectable, their magnitude upon school entry, and whether they widen or become narrower over the life course.

Recent longitudinal research suggests that SES disparities in language and other language-related competences (e.g., reading) are already visible in the early years of life, grow before school entry, and remain quite stable or slightly increase over the educational career (e.g., Bradbury et al. 2015; Cheadle, 2008; Lindberg & Schneider, 2019; Potter & Roksa, 2013; Skopek & Passaretta, 2021). However, these longitudinal studies have mostly focused on Anglophone countries (e.g., Bradbury et al. 2015) and, more recently, in the German context (e.g., Skopek & Passaretta, 2021). There is a substantial lack of knowledge on the development

of SES gaps in language in other national settings, thus questioning the generalizability of research findings. Expanding the scope of longitudinal research to a variety of national contexts is particularly important when the focus is on social gaps in language-related skills (rather than focusing on more homogeneous types of competencies, such as math or scientific literacy). Indeed, inequality dynamics in language-related competencies may be idiosyncratic to the mastery of a particular language (e.g., English or German) and, therefore, not generalizable to other national contexts.

In order to fill this knowledge gap, this study employs a longitudinal design, tracing back social inequality in language achievement to the first years of life and following children and their families through primary schooling in Norway. Norway is particularly interesting because it represents a good example of social-democratic welfare regime and sharply contrasts the liberal and conservative welfare regimes analyzed by the existing literature so far.

SES and disparities in child achievement

SES disadvantage is recognised by the OECD as a major barrier to school success. Students from higher SES backgrounds have more educated parents with higher-level occupations. These parents have better financial resources and provide a wider range of opportunities in the home as well as more investments in academic development of their children (OECD, 2016a).

Family SES is a complex construct based on several indicators, which affect children's development in distinct but complementary ways. It involves the degree to which the family has access to financial and material resources, parents' skills and education and social influence (e.g., Conger et al., 2010; Duncan & Magnuson, 2003). SES is often conceptualized as a tripartite construct including parental income, education and occupation. While inter-related, each of these dimensions is distinctly associated with inequality processes driven by SES (Duncan & Magnuson, 2003). Parent education, in particular, is often taken as proxy for

SES and composites of social capital within the family of origin (Bornstein & Bradley, 2003). Given the shared genetic and environmental influences, it is not surprising that parental education is a strong predictor of children's academic achievement (e.g., Magnuson, 2007). However, it has been found that the association between parental educational attainment and child academic performance persists after controlling for shared genetic factors (see e.g., Torvik et al., 2020).

The SES achievement gap points to determinant factors operating within the family. Higher SES families provide, on average, higher quality stimulation and their overall home environment contains higher quality learning materials and opportunities (e.g., Davis-Kean, 2005; Duncan et al., 2015; Zadeh, et al., 2010). Two main models have been proposed in the literature to explain the relation between SES and child achievement. According to the *parent investment model*, originated in economic theories, low-SES parents make less quality investments in child development, both material (e.g., learning materials) and interpersonal (e.g., reading together), than their high-SES counterparts due to educational and financial constraints (for a recent review and empirical investigation see Longo et al., 2017). The *family stress model*, originated in psychological theories, proposes that financial strain undermine parenting behaviors. The stress of poverty affects parents' sensitivity in interactions with children, affecting their development. Poverty directly affects parents' cognitive function consuming mental resources like attention and self-control (Mani et al., 2013). It is also crucial to consider the national/cultural context (i.e., income levels, parental leaves, and parenting ideologies) (Roeters, 2010), as it defines how much family involvement can influence children's cognitive and educational development.

Language development and SES

There are marked differences among parents in terms of engagement and communication with their children, which may be associated with their development (Fernald

& Weisleder, 2015). Variations in the quantity of language that parents direct to their children predict later cognitive and language abilities. Several indicators of language quality (e.g., fluent and connected communication) are as good predictors of later language ability as the number of words used during parent-child interactions (e.g., Hirsh-Pasek et al., 2015), which is also associated with brain development (Romeo et al., 2018).

There are strong language development disparities between children from advantaged and disadvantaged home environments. In the famous study conducted by Hart & Risley (1995), a 30-million-word gap in language was reported between lower versus higher SES children. One recent study which empirically tested that claim, found a more nuanced picture showing that other neglected aspects of children's language environment - such as the existence of multiple caregivers or exposure to by-stander talk - explain the language gap between rich and poor (Sperry et al., 2019). However, this claim has been refuted by Golinkoff et al. (2019), who have stressed the importance of not devaluing the initial findings reported by Hart & Risley (1995) and keeping the focus on the most important elements of language learning, that is, the quality of the speech directed at children and not "over-heard speech".

Other recent studies have corroborated the SES gap in child language attainment in early life. Fernald et al. (2013), for example, observed significant SES gaps in vocabulary and language processing efficiency at 18 months, which had increased to a 6-month SES gap in processing skills critical to language development by age 24 months. In another study, based on data from the Kindergarten Cohort of the Early Childhood Longitudinal Study (ECLS-K), Lee and Burkam (2002) found large SES gaps in early reading at the transition to kindergarten, which widened over the elementary school years. Also, using the Canadian National Longitudinal Study of Children and Youth (NLSY), Farkas and Beron (2004) studied detailed trajectories in oral vocabulary from age 3 to 13 years. SES gaps in vocabulary

increased during preschool years, although stabilizing when children reached school age. Bradbury et al. (2015) analysed trajectories of SES gaps in a study contrasting data from several cohort datasets from the US (Early Childhood Longitudinal Study-Kindergarten Class), Canada (NLSY), the UK (Millennium Cohort Study) and Australia (Longitudinal Study of Australian Children). They found that SES gaps in language and reading as observed from ages 5 to 11 remained stable at best, with a slight tendency to widen across time. Similar patterns have been found in radically different national contexts to the Anglophone countries. For example, linking three cohorts from the German National Educational Panel Study (NEPS), Skopek and Passaretta (2021) found that SES gaps in vocabulary are already well-established at age 2 and tend to slightly increase with age. Yet, a recent comparative study found a stronger increase in SES language gaps from age 5 to 11 in the Netherlands compared to Germany and the UK, where gaps are virtually stable (Passaretta et al. 2020).

Finally, large-scale reports based on nation-wide assessments like the Programme for International Student Assessment (PISA) corroborate cross-national findings on the SES disparities in several domains including reading and language (OECD, 2016a). The magnitude of the SES gradient varies across countries and the percentage of variance in student reading performance explained by the PISA *index of Economic, Social and Cultural Status (ESC)*, which results from information about the student's family and background, ranges between 9% and 18% (OECD, 2016b).

Critical mechanisms explaining SES differences in language ability include early childhood indicators of the quality of learning materials in the home, levels of learning stimulation from parents, and the extent to which children have a variety of learning experiences in and outside of the home (Zadeh et al., 2010). It is important to produce a knowledge base on the emergence of language disparities early in life, with the aim of tackling these disparities. Previous studies have found that children from low SES backgrounds (low parent income

and/or education) tend to benefit the most from interventions to increase, among others, language skills (e.g., Weiland & Yoshikawa 2013). The scarcity of learning supports and reduced parental skills within the home may accentuate the positive consequences of learning resources and opportunities that can be provided. Family engagement in schooling and enriched child-care environments have been shown to correlate particularly strongly and positively with the achievement of children with less educated parents (Dearing et al., 2006; Votruba-Drzal et al., 2004).

The debate which places children's ability against a background of different social and economic opportunities is considered even more important in the present context of Covid-19 pandemic. The pandemic has exacerbated social inequality (e.g., Van Dorn et al., 2020) and SES achievement gaps in education (e.g., Haeck & LeFevre, 2020). Indeed, Bradbury (2021) has emphasized the importance of rethinking the way children's educational settings are underpinned by material inequalities in the face of new challenges brought about by a global pandemic.

Norway-Background and context information

Differences across countries in terms of achievement gaps have been well-documented. The work of Bradbury and colleagues is notable for offering a comparative perspective of the US achievement gap with other Anglo-Saxon countries like the UK, Australia and Canada. They have documented patterns of inequality and pinpointed public policies that can help to mitigate disparities, like support paid maternity leaves, strengthening social safety nets, and better public schools (Bradbury et al., 2015).

Norway is a wealthy social democracy with low unemployment and low economic inequality, at least relative to other wealthy nations (Eurofound, 2017). Nonetheless, the distribution of household income is highly skewed in Norway; the top 10% of households own 53% of Norway's wealth and the top 1% own 21% of the wealth (Epland & Kirkeberg,

2012). Child poverty rates (calculated as the proportion of children living in a family with income under the EU 60% poverty line for three consecutive years) surged from 4.1% in 1997-1999 to 10% in 2013-2015, and are projected to reach 15% in ten years (The Norwegian Directorate for Children, 2017).

Norway provides free health care for all, including access to maternal health baby clinics, and regular health checkups prior to school age, when the school health services take over. Norway also provides universal and subsidized ECEC from age 1, following one-year paid parental leave. The percentage of children aged 1-2 years in ECEC is currently around 83%, whereas the percentage of 3-5 year old children is nearly 97% (Statistics Norway, 2021). Children in Norway normally enter school the year they turn six. By far, most children (98%) attend public schools, which are free of charge and with no tracking (i.e., students do not attend different educational tracks based on ability or choice prior to upper secondary school).

Achievement gaps between the most and least affluent students in PIRLS (2011) are somewhat smaller in Norway (75% of a standard deviation [SD]) compared to, for example, the US (1.25 SD). Importantly, gap sizes are strongly related ($r=.64$) to national levels of income inequality (Chmielewski & Reardon, 2016), which is rising in Norway. Moreover, achievement in Norwegian primary schools is strongly predictive of later educational success and ultimately life chances; among children achieving slightly below mean grade points by the end of primary school (i.e., < 34 points, 40 is the average), less than half completed secondary education, while among the top achievers (>50 points) 97% completed secondary education (Statistics Norway, 2014). There are also large differences in achievement scores in Norway attributable to school- and municipality-level factors beyond children's own family socioeconomic conditions (Steffensen et al., 2017).

Another distinct issue in Norway is the specificity of the relation between immigrant status and SES. Very often, immigrant status co-exists with low SES, as documented in poverty rates among immigrant populations. In the EU-context, where there have been dramatic increases in the number of immigrants, data from 2015 show that poverty rates are high, with over 40% of non-EU born immigrants and about 25% of EU born immigrants at risk of poverty (compared to 21.7% for native nationals) (Eurostat, 2017). Immigrant children in the EU do generally worse even after considering differences in family background (Borgna, 2015). Reasons pointed out for this disadvantage include language barriers, less participation in early child-care, and restricted access to high quality schools (OECD, 2010). However, the gap in performance between immigrant and native children may be less accentuated in English-speaking countries (Schnepf, 2007). This can be a reflection of the SES background of immigrants who choose those countries or, most likely, derive from the familiarity with the language of the host country (Rees et al., 2019). In fact, migrant families moving to a country with a different language, like Norway, despite facing the challenges associated with low SES and poverty, may experience an extra burden related to language barriers in the access to education and social participation. It is therefore important to consider variations across the cultural contexts with regard to educational inequalities in language development by extending research to non-English speaking countries where, to date, fewer studies have been conducted.

The present study

Within this context of a progressive wealthy Northern European welfare state, we investigate two research questions. 1) When do social gaps in language problems arise, and how do these gaps develop across early childhood? 2) Are there social gaps in language problems among school-aged children above and beyond social gaps found before school entry, and do these social gaps change across the first years of schooling?

We address these questions in two Norwegian datasets, the Behavior Outlook Norwegian Developmental Study (BONDS; Nærde et al., 2014) and the Norwegian Mother, Father and Child Cohort Study (MoBa; Magnus et al., 2006). While being of very different sample sizes (BONDS approximately $n = 1\ 150$; MoBa approximately $n = 100\ 000$), these studies are both drawn from the general population in Norway, follow children and their families across the earliest years through the first years of schooling, and have used roughly the same measures. While BONDS has its strengths in relatively high participation rates and low attrition, MoBa has the advantage of being a very large scale study. Both studies are limited by not being entirely representative of the Norwegian population since they have population-based sampling with incomplete participation (BONDS is, in addition, limited to five municipalities in southeast Norway, whereas MoBa is nationwide). Moreover, while both studies use similar, well-recognized measures of language problems, they have no available data on actual family income. Thus, we rely on an indicator of economic hardship, available for BONDS, and a crude measure of self-reported income during pregnancy, available in MoBa. Nevertheless, these datasets are valuable sources of information about SES differences in early development in Norway, namely in language skills, and especially relevant if the results from the two datasets converge.

Method

Participants

BONDS

The BONDS study includes three cohorts of children and their families ($N = 1157$), born in 2006 ($n = 433$), 2007 ($n = 529$) and 2008 ($n = 195$) (Nærde et al., 2014). Families were recruited through public child health clinics in five municipalities in southeast Norway (the clinics are attended by almost all families). Parents of 1931 eligible children, with at least one Norwegian-speaking parent, were informed about the study by a staff nurse, 1465 (76%) agreed to be contacted, and, subsequently, 1159 (60%) agreed to participate (two families

Socioeconomic disparities in early language development

later withdrew from the study and their data files were discarded, in a total of 1157). Mothers in participating families were slightly more likely to be born in Europe excluding Norway (7% vs 5.3%) and slightly less likely to be born outside of Europe (6.2% vs 7.7%), and were slightly more likely to have completed some tertiary education (58.1% vs 57.1%), compared to the eligible sample (Nærde et al., 2014). Using diverse data collection methods, data on cognitive, social, and behavioral development was gathered from 6 months to second grade. Retention rates were as follows: 12 months (98%), 24 months (95%), 36 months (93%), 48 months (93%), 1st grade (82%) and 2nd grade (78%), yet not all participants attended all parts of the data collection. The BONDS is approved by the Norwegian Social Science Data Services and the Regional Committee for Medical and Health Research Ethics.

MoBa

The Norwegian Mother, Father and Child Cohort Study (MoBa; for a complete description, see Magnus et al., 2016 and www.fhi.no/morogbarn) is a population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health. Participants were recruited from all over Norway from 1999-2008. The women consented to participation in 41% of the pregnancies. The cohort now includes 114.500 children, 95.200 mothers and 75.200 fathers. The current study is based on version 10 of the quality-assured data files released for research in 2018. The establishment of MoBa and initial data collection was based on a license from the Norwegian Data Protection Agency and approval from The Regional Committees for Medical and Health Research Ethics. The MoBa cohort is now based on regulations related to the Norwegian Health Registry Act. The current study was approved by The Regional Committees for Medical and Health Research Ethics (2015/1342/REK sør-østA).

Questionnaires covering demographics, health, lifestyle, and child development were administered during the 17th, 22nd and 30th weeks of gestation, and at ages 0.5, 1.5 and 3

Socioeconomic disparities in early language development

years (questionnaires are available online, www.fhi.no/moba-en). Language was assessed at ages 1.5, 3, 5, and 8 years. Retention rates at 1.5, 3, 5 and 8 years were 72.4%, 59.3%, 53%, and 47%, respectively.

Measures

Demographic and family characteristics

BONDS. At age 6 months, parents were interviewed and asked about the child's gender, date of birth, immigrant status (defined as either parent being born outside of Norway, specifying region, recoded into *western* and *non-western*, used as dummy variables with Norwegian as reference group), and maternal education (self-reported years of education). Economic hardship was assessed at age 12 months with a single indicator, where parents reported whether they had financial problems during the last 12 months (paying rent, loans etc.), responding "Yes" (1) or "No" (0).

MoBa. Demographic characteristics were reported by the mother during pregnancy. These include maternal education (the same question used in BONDS), language background (i.e., whether other language than Norwegian was spoken at home, used as proxy for immigrant background), and family income. Family income was reported in crude categories as pre-tax income. Within each cohort, we defined the lowest quartile as being "low income" and use this dummy variable in the analyses. Child gender was retrieved from The Medical Birth Registry (MBRN), which is a national health registry containing information about all births in Norway.

Ages & Stages Questionnaire

For both studies, we used reports on the Norwegian version of the Ages and Stages Questionnaire (ASQ) a series of child development screening questionnaires each made up of 30 items in five domains: Communication, Gross Motor, Fine Motor, Problem Solving, and Personal-Social. We used the communication subscale of the Norwegian validated version of

the ASQ (Richter & Janson, 2007). In order to tap developmental risk appropriately, there are different versions of the scale according to the age of the child. An example of an item used when the child was six months old is: “Does the child make noises like “da”, “ga”, “ka”, and “ba”?”. At 24 months, a sample item is: “Without you first showing, does the child *point* at the correct picture when you say “*Show me the kitty*” or ask “*Where is the dog*”? The child does only have to point at one correct picture”. The items have three response categories: “Yes, very often”; “Yes, sometimes”; and “Not yet”. The ASQ shows good test-retest agreement and concurrent validity (Squires et al., 1997). For the MoBa at 36 months, the items included four original 36-month ASQ items, and one item each from the 18- and 48-month ASQ questionnaires.

Grammar scale, BONDS only

We used a grammar scale developed by Dale et al. (2003) and informed by the MacArthur Communicative Development Inventory: U.K. Short Form (MCDI:UKSF; Dionne et al., 2003). The measure was included in the Twins Early Development Study (TEDS) parent report booklet and has been able to identify children at risk for language impairment in several studies (e.g., Bishop et al., 2006). We had data on this measure for ages 12, 24 and 36 months, rated by an external trained coder and based on a 15-minute video-recorded parent-child interaction. At 24 and 36 months, we also had ratings by the parents. According to the procedure, raters were asked to choose among sentences which best characterize the language skills of the child. For example, for two-year-olds the sentences are: 1) not yet talking; 2) he/she is talking, but you cannot understand him/her; 3) talking in one-word utterances, such as “milk” or “down”; 4) talking in 2- to 3-word phrases, such as “give doll” or “me got ball”; 5) talking in fairly complete sentences, such as “*I got a doll*” or “*can I go outside?*”; 6) talking in long and complicated sentences, such as “*when I went to the park, I went on the*

swings” or “*I saw a man standing in the corner*”. This scale has been used in previously published studies using this same dataset (e.g., Ribeiro et al., 2015).

British Picture Vocabulary Scale-II, BONDS only

Around the time children turned 48 months of age, children’s receptive vocabulary was assessed with the Norwegian version of the British Picture Vocabulary Scale-II (BPVS-II; Dunn et al., 1997). The Norwegian version of this scale includes 12 of the 14 original sets of pictures. These main picture sets are ordered in ascending difficulty level and each include 12 subtasks. The child is requested to choose the picture (out of 4) which best illustrates a word/concept uttered by the person administering the scale. The child can either point to the correct picture or indicate the picture number. Target words cover a wide range of language levels as well as word classes and are allocated to different semantic and/or grammatical groupings (actions, adjectives, animals, emotions, food and so on, cf. Dunn et al. 1997). The sum of all correct answers forms a raw score. For the purpose of the current study, we used raw scores as opposed to standardized scores since no adequate norms have been developed for Norwegian samples. However, in the current analysis, we adjust for age at testing so the scores are normed to our sample (for further details about scoring procedures, see Zambrana et al., 2015). Cronbach’s alpha for the BPVS-II in our sample was .81.

Children’s Communication Checklist – 2nd rev. (CCC2)

The CCC2 was initially designed to be completed by parents, as a report on aspects of their children’s communicative strengths and weaknesses that are not amenable to more conventional forms of assessment (Bishop, 2003). The original version contains 70 items divided into 10 scales. BONDS included 28 items that were completed by teachers in 1st and 2nd grade. The 28 items were selected from the first four scales, assessing structural aspects of language: A: speech, B: syntax, C: semantics, and D: coherence. For each of these four scales, five items (in total 20 items) describe weaknesses and two (in total 8 items) describe

strengths. For the MoBa, a selection of 6 items was used in the 5-year questionnaire, while 16 items were used at 8 years (including the same items used at 5 years). The data from age 5 was available for cohorts from 2004 through 2009 and at age 8 from 2002 through 2009. An example of a “weakness” item on the “coherence” scale is: “*It is hard to make sense of what she is saying (even though the words are clearly spoken)*” and a “strength” item on the speech scale is “*Speaks fluently and clearly, pronounces all speech sounds clearly and without hesitation*”. The teacher is asked to rate the frequency of each behavior, with the following response categories “Less than once a week (or never)” (0), “At least once a week, but not every day” (1), “Once or twice a day” (2), or “Several times (more than twice) a day (or always)” (3). We used items from the official Norwegian translation of CCC2 (Helland & Heimann, 2007), and these were used under licensing agreement with the publisher Pearson.

Analytic Strategy

In our first set of analyses, addressing when SES gaps in language problems arise, and how these gaps develop across early childhood, we first fitted measurement models of all dependent *language* variables in both datasets (except for the BPVS in BONDS data, for which we used the raw score) by using SEM in Mplus. For the BONDS, at age 6 months, we created the latent variable “Lang 6”, which included 6 items of the ASQ communication subscale. For ages 12 (Lang 12), 24 (Lang 24), and 36 (Lang 36) months, items from the ASQ were combined with item(s) from the Grammar Scale (for one- or both raters as available). For age 48 months, we used the raw score for the BPVS. From first and second grades, we fitted models measuring two separate constructs. In the first model, we constructed a two-factor model based on the teacher ratings of CCC2. The first CCC2 (LA) factor includes all negatively phrased items from the four subscales (A: speech, B: syntax, C: semantics, and D: coherence), and the second CCC2 factor (LB) includes all the positively phrased items from the same subscales. For the MoBa, we used ASQ items only at ages 6, 18, and 36 months, and

CCC2-items at ages 5 and 8 years. Due to the selection of items at age 5 in MoBa, which included only 5 items, we restricted our analyses to include the LA (negatively phrased items) subscale in addition to one well-fitting positively worded item. Table S1 in the online supplement provides an overview of measures at each time point.

For both datasets we identified ages at which educational gaps arose, in a cross-sequential manner, by regressing the latent language/achievement score on i) gender, ii) deviations from expected age of testing at each time point (for BONDS only), iii) maternal education, iv) economic hardship, and v) non-western immigrant background, as well as vi) design specific dummies (sites [BONDS only] and birth cohort). Missing data were handled through standard missing estimation procedure in Mplus (Full information maximum likelihood estimation when ML estimator was used, and equivalent procedure when WLSMV estimator was used). To ease interpretability of our tables and figures, we inverted the predictions for the two positively loaded dependent variables (BPVS at age 48 months in BONDS and the second CCC2-factor in both datasets), so that a higher score on the dependent variable always reflected more problems.

In our second set of analyses, we addressed whether social gaps show up at later stages when conditioning on skill-levels at earlier stages. We defined “early” as prior to school entry, while “later” included the two latest time points (1st and 2nd grade in school for BONDS, age 5 and 8 years for MoBa). We fitted an overall latent factor (second order) including all communication/language measures prior to school age, to capture overall early skills (L_0). Then, after first establishing strong factor invariance across the language measures at 1st grade/5 years (L_1) and 2nd grade/8 years (L_2) to ensure that we measured true change, we estimated a latent change factor (L_{12}) for language delay. The latent change factor is the change (difference score) in language problems from L_1 to L_2 and should be interpreted as a slope in a growth model. L_1 should be interpreted as the intercept, i.e., the initial level of

language problems in 1st grade/at 5 years. The correlation (double-arrowed line) between L_1 and L_{12} is the correlation between initial level and change (difference) to second grade in language skills. These variables were included in a latent change model and the intercept (L_1) and change (L_{12}) scores were regressed on the early skills measure (L_0), indicators of maternal education, economic hardship, and immigrant status (in addition to gender, age at testing, and site- and cohort dummies). Substantively, the models estimate the extent to which these predictors are 1) associated with initial level of language problems in 1st grade/at age 5 years (L_1), and 2) with change in language problems to the second time point (L_{12}), conditioning on the initial association with 1st grade/age 5 years problems (L_1).

Results

Demographic characteristics for both BONDS and MoBa are displayed in Table S2 in the online supplement. Statistics for all the measurement models across age, including number of items, range of factor loadings, and model-based fit indexes are presented in Table S3 in the online appendix. All our initial measurement models fitted the data well and there were no correlated errors in any of the models.

Predicting sociodemographic gaps in language problems

We predicted language problems at each age from child gender and exact age at testing (BONDS only), maternal education, economic hardship and immigrant background (Table 1). In the BONDS, boys seemed to lag behind in language development and exhibit more language problems than girls from 12 months to second grade, with the exception of expressive language at age 48 months. The same pattern was found in MoBa, where boys were rated as having more language problems across all ages. Age of testing (BONDS only), as expected, was significantly associated with language skills throughout in the expected direction (older children performed better on average).

<Insert Table 1 about here>

A surprising pattern emerged with regard to maternal education and economic hardship for ages 6 and 12 months. Across these first two time points in BONDS (6 and 12 months), and the first time point in MoBa (6 months), we observed a positive association between maternal education and communication problems, meaning that higher maternal education was associated with more communication problems. The same pattern was evident with regard to economic hardship in BONDS (at 6 and 12 months); children whose parents reported more economic hardship were rated as having less communication problems. The pattern concerning economic hardship was not evident in MoBa, however. We tested the models leaving consecutively each of these predictors out to ensure there were no suppressor effects. We also tested *post hoc* whether there was measurement invariance between children of mothers with the lowest levels of education (not completed high school) and the rest. Evidence for invariance suggests that this finding was not a measurement artefact.

Immigrant background was not consistently associated with communication problems in BONDS. In Moba, it was so across all ages, with immigrant children being reported as having significantly more language/communication problems ($p < .001$ at all time points).

At 24 months in BONDS, there was no clear evidence that maternal education or economic hardship were associated with language problems, yet the association between maternal education and communication problems was small and negative ($p < .10$), indicating that higher maternal education was associated with less communication problems, albeit not statistically different from zero. In MoBa, there was a negative association, albeit weak, between maternal education and language problems (higher educated mothers had children with less language problems) from 18 months and onwards; one SD increase in maternal education (about 2.6 years) was associated with only .04 SD decrease in language problems at this time point.

In both datasets, this pattern got stronger at 36 months, and remained consistent through second grade (BONDS) and 8 years (MoBa), with the exception of the second CCC2 factor in first grade (LB- language strengths) in BONDS, where we found no significant association. Standardized regression coefficients ranged from $-.04$ to $-.14$ in both studies, meaning that a one SD increase in maternal education (about 2.6 years) was associated with between 4% and 14% of a SD less communication/language problems. The standardized effect sizes varied across ages, with no consistent increase in either of the studies. Notably, because different items and/or measures were used across time points, the size of these coefficients cannot be directly compared. Thus, we cannot say for sure whether the real gaps in language problems fluctuate, or whether this fluctuation is a function of the measures/items. It is, however, worth noting that the strongest coefficients were attained for the two measures capturing a wider range of language skills than merely language problems (i.e., BPVS in BONDS (48 months) and CCC2 (2nd grade/8 years) in both studies). This suggests that there are meaningful maternal education differences across the range of language skills, and that these are not restricted to language problems captured by the screening measures used at most time points.

Economic hardship was (except for ages 6 and 12 months reported above) not related to communication/language problems before school start in the BONDS study. Yet, across 1st and 2nd grade in the BONDS, and from age 36 months in the MoBa, children whose parents reported economic hardship during their first year of life consistently performed worse than their peers who had not had this experience (with the exception of the LB factor- language strengths-factor including positively phrased items in MoBa at age 8 years). In BONDS, non-western immigrant children were rated as having more problems at age 36 months, 48 months and in first grade, although this was only true for one of the CCC2-factors (LA-

problems/weaknesses) with no differences in 2nd grade. In MoBa, children with immigrant background were consistently rated as having more language problems than their native peers.

Fit indexes for all models presented in Table 1 are displayed in Table 2. All models fitted the data well with the exception of the BONDS models at age 6 and 36 months, which showed marginal model fit (thus, prediction models for these two time-points should be interpreted with more caution).

<Insert Table 2 about here>

Estimating changes in language problems during early schooling

Initial analyses. Our initial step in this set of analyses involved the estimation of a model of intercept and change in the two subscales of CCC2 (LA—Language problems/weaknesses; LB—Language strengths) measuring language problems in 1st and 2nd grade, which was our outcome measure in BONDS. Due to the selection of items at age 5 in MoBa, we restricted these analyses to include only the LA (Language problems/weaknesses) subscale for MoBa. Details about the measurement invariance testing can be seen in the online supplement, including fit indexes for the various steps of the model fitting (Table S4).

Our second step was to estimate a latent model capturing language problems prior to school age. We fitted a hierarchical factor model (second order factor model) including each of the ASQ factors described above (at 6, 12, 24, and 36 months in BONDS and at 6, 18, and 36 months in MoBa). In both datasets, the model fit was good. For example, in BONDS: (Chisq [270] = 650.55, $p < .000$, RMSEA = .03, CFI = .92, TLI = .91), with second order factor loadings of .21, .51, .88, and .83, respectively for Lang at 6, 12, 24, and 36 months (all $p < .000$).

Prediction models. The main estimation models (displayed as path diagrams) are shown in Figure 1 (BONDS) and Figure 2 (MoBa). The latent variable DiffLang is the change

(difference score) in language problems in the language constructs measured by CCC2 between the two different time points (1st grade to 2nd grade in BONDS and 5 to 8 years in MoBa). For BONDS, we estimated the two outcomes for LA (Language problems/weaknesses) and LB (Language strengths) simultaneously in one structural model, while these are presented in two separate models for ease of interpretation. The overall model fitted the data well (Chisq [3595] = 5198.03***, RMSEA=.02, CFI=.95, TLI=.95) in BONDS, and (Chisq (522) = 15932.79***, RMSEA=.02, CFI=.94, TLI=.94) in MoBa.

The models suggest that about 1/3 of the variance at time point 2 in both datasets is due to change, whereas 2/3 is stable from time point 1 (indicated by the size of the squared regression coefficients of LA: Language problems/weaknesses and LB: Language strengths in 2nd grade regressed on 1st grade and the difference score). The correlation between the initial level and change (i.e., difference) in both models indicates that children starting with more problems in first grade have higher rates of change (e.g., in BONDS about 34% and 31% of the variance [$r=.59$ for LA and $r=.56$ for LB], respectively, if the change to 2nd grade is accounted for by the child's initial level of problems).

Prediction models in BONDS. Interestingly, in BONDS, a slightly different pattern was evident for the two factors (LA: Language problems/weaknesses and LB: Language strengths), despite their high correlation. Keeping in mind that LA was comprised of negatively phrased questions about the child's speech, syntax, semantics, and coherence, Fig 1a shows the following pattern of predictions: Early language problems was by far the strongest predictor of language problems in first grade (est=.79, $p<.001$, i.e., one SD higher score on early language problems was associated with 79% of an SD higher score on problems in first grade), but not predicting change in language problems to second grade. In addition, maternal education added unique prediction (i.e., controlling for earlier language problems), with an estimate of -.10 ($p<.05$), meaning that above and beyond what was

accounted for by earlier language problems, a one SD higher maternal education (approximately 2.5 years), was associated with 10% of an SD less language problems. Maternal education was unrelated to change in language problems to second grade. None of the other predictors in the model were significantly related to language problems in 1st grade, except for non-western immigrant status (est=.11, $p<.01$). Moreover, none of the predictors in the model were associated with change from 1st to 2nd grade in this first factor measuring language problems. We re-estimated the model excluding maternal education and economic hardship, respectively, to ensure that our results were not subject to multi-collinearity issues. The results were similar to those presented above. Moreover, as the two factors we identified in the initial measurement model (LA and LB) were highly correlated (.73), we re-estimated two structural models including each of the two factors, respectively. Also in these models, the results were identical.

<Insert Figure 1 about here>

Results from the second latent language score LB: Language strengths in BONDS yielded a somewhat different pattern. Keep in mind that, in Fig 1b, the coefficients in the prediction model are inverted, so negative coefficients mean prediction of more problems (while the coefficients in the latent change model are kept in their original direction as these should be interpreted as stability and change). Earlier problems were also in this model the strongest predictor of level of problems in 1st grade, with a similar coefficient (est.= .73, $p<.001$) as for LA (Language problems/weaknesses). However, higher maternal education was not uniquely associated with language problems in 1st grade for this measure. Importantly, both early economic hardship and non-western immigrant background were (est.=.13 and .10, $p<.001$ and $p<.01$, respectively). This converts to Cohen's *ds* of .43 for both variables. Importantly, and in contrast to the model with LA, maternal education was for this measure (LB: Language strengths) negatively associated with change in language problems,

with a standardized coefficient of $-.12$ ($p < .01$), meaning that one standard deviation higher maternal education (2.5 years) was associated with 12% of an SD lower change in problems.

Prediction models in MoBa. Keeping in mind that the MoBa data were restricted in terms of numbers of items available from the CCC2, especially at age 5 years, and the slightly weaker invariance model, the coefficients presented in Fig 2 should be interpreted with somewhat more caution. As was the case with the BONDS, LA was comprised of negatively phrased questions, indicating language problems or weaknesses. Fig 2 shows the following pattern of predictions in the MoBa data: early language problems were again by far the strongest predictor of language problems in first grade (est=.52, $p < .001$, i.e., one SD higher score on early language problems was associated with 52% of an SD higher score on problems in first grade). Note that, while this was a weaker prediction than in BONDS, the measure at 5 years was also weaker. In contrast to the findings from BONDS, early language problems predicted a positive change in language problems to age 8 years (i.e., larger increase in problems). Maternal education added unique prediction (i.e., controlling for earlier language problems) both to the initial level of problems and to change from 1st and 2nd grade. Specifically, an estimate of $-.07$ ($p < .05$) to the intercept meaning that above and beyond what was accounted for by earlier language problems, a one SD higher maternal education (approximately 2.5 years), was associated with 7% of an SD less language problems. Maternal education was also negatively associated with change, meaning that children of higher educated mothers had less increase in problems from age 5 to 8 years. Economic hardship and immigrant background were both uniquely associated with more language problems at age 5 years but did not predict change in problems to age 8.

<Insert Figure 2 about here>

Discussion

This study examined the emergence and progression of social inequality in language across infancy and early childhood in Norway. Contrary to the existing literature, we focused on the early life course dynamics of social inequality in a social-democratic country that is characterized by a very different institutional setting compared to the liberal and conservative welfare regimes analyzed so far. Relying on two distinct Norwegian datasets, we investigated when social inequality in language emerges, and whether social inequality exacerbates or weakens over childhood. Moreover, we investigated the extent to which social gaps in language problems in the very early years of life (before school entry) explain fully social gaps in language when children are in school age. The aim was to understand whether the association between socioeconomic background and language achievement disappears during infancy or whether this continues to shape inequality when children enter the school system.

We found that social background is negatively associated with language problems from approximately age 2 to age 8 (grade 2). More precisely, the negative association between maternal education and language problems started to emerge from 18 months and age 3, in MoBa and BONDS respectively, and was generally maintained through grade 2. However, in the case of economic hardship, we only observe a positive association with language problems starting from age 3 in MoBa and from grade 1 in BONDS. Notwithstanding the advantage of high SES children (those with more educated mothers and less economic hardship) starting to be visible from nearly age 2 and onward, the confidence intervals for SES gradients across time are in most cases overlapping (not shown in the manuscript but available upon request). Hence, assuming comparable latent measures over time (admittedly a contentious assumption), there is, neither evidence for widening, nor narrowing SES gaps between age 2 and 8 years. Differences due to immigrant background varied somewhat between the studies, being more consistent in the MoBa study, while having the largest absolute effect sizes at some timepoints

in the BONDS study. The variable definitions were different in the two studies (based on country of birth in BONDS, and on language spoken at home in MoBa), making comparisons difficult. Moreover, the inclusion of parents mastering Norwegian (as an explicit criterion in BONDS, while implicit in MoBa with questionnaires being available in Norwegian) may add to the uncertainty when interpreting and comparing these findings.

While the results suggest a disadvantage of low SES children, we found a surprisingly positive and unexpected association between SES and language problems at the very beginning of children's life (6 and 12 months for both maternal education and economic hardship in BONDS; 6 months for maternal education only in MoBa). This finding is, however, difficult to interpret in the absence of further empirical evidence. One possible explanation is that, despite good model fit, the language problem measures at ages 6 and 12 were less precise, as suggested by the low factor loadings (i.e., there was more random variation in the measures). It could be that the variance of the indicators is less related to language problems than what happens at later ages, although it is unlikely this would have reversed the coefficients. It is more plausible that this imprecision would have just affected the strength of the associations. Another explanation may be that mothers with higher education are more concerned with their child's development or more critical of their children's performance. Yet, the measure used at these early stages (ASQ) include fairly overt cues toward which the child's performance is rated. Alternatively, this unexpected result may be due to a positive selection of low SES families in the sample. Indeed, participation rates of about 60% in BONDS and 40% in MoBa may have resulted in selective inclusion of low SES families, as suggested by the skewed distribution of parental educational attainment (Magnus et al., 2006; Nærde et al., 2014). It is therefore plausible that the most resourceful of the low educated parents were in fact the ones committing to participate in the two studies. This is an explanation we cannot fully test, however. Worth noting is that a positive selection of low SES parents in the samples would imply that the

negative association between educational and economic resources and language achievement found from age 2 through age 8 is in fact a lower bound of the true association in the population. Hence, the SES inequalities in language achievement that we observed among children between age 2 and 8 may, in fact, be even larger than shown in the present study.

We also found that, while early communication/language problems are strongly predictive of later problems, maternal education added unique prediction to explaining problems measured by one of the latent outcomes (LA, negatively phrased items) at the beginning of school life (grade 1 in BONDS and age 5 in MoBa). However, neither maternal education nor early problems were associated with the change in language problems from grade 1 to grade 2 in BONDS, while both were in MoBa. These findings suggest that educational resources are associated with language development at the very beginning of children's life but continue to do so until children have just entered school. However, it is less clear whether educational resources continue to play a direct role beyond 1st grade, at least when it comes to language problems (LA negatively phrased items).

However, the picture depicted above is quite different when looking at the other latent outcome measuring language strengths (LB, positively phrased items, BONDS only). In this second case, we found no direct association between maternal education and language skills in grade 1 above and beyond the early language problems found in the early years, although maternal education predicted the change in language skills over primary schooling (from 1st to 2nd grade). Moreover, for economic hardship the opposite pattern was found: economic hardship predicted language skills in 1st grade but was not associated with the change from 1st to 2nd grade. It could be that for strengths (LB: Language strengths), initial language problems and economic hardship affect the development of children's skills in the beginning of schooling (1st grade), but cease to have such an important role on the changes in acquisition of language competences from 1st to 2nd grade, when the educational experiences at school have had time to

level out the opportunities to develop language skills. However, maternal education seems to emerge at this stage as a unique predictor of changes in language skills from 1st to 2nd grade, reflecting perhaps the capacity that more educated parents have to build upon school acquisitions and further stimulate their children. Hence, although our pattern of results is quite mixed, it seems that the influence of maternal education on language achievement among school-aged children cannot be solely traced back to SES differentials in early life.

Despite some slight differences across the two samples (BONDS and MoBa), it is apparent that children from higher social background are less likely to have language difficulties starting from age 2 years and throughout their early childhood. This general result is in line with the previous literature (e.g., Bradbury et al. 2015; Skopek & Passaretta, 2021) and suggests that a significant amount of social inequality in language development exists even in countries that emphasize social inclusiveness. Norway is a social democracy with relatively low levels of economic inequality, universal and high-quality child-care, as well as free health care. Still, some inequality persists for example when it comes to access to ECEC. In a recent study, Alexandersen et al. (2021) investigated the socioeconomic selection into ECEC of higher structural quality in Norway and found that parental education (and to a lesser extent income) predicted child attendance of higher quality ECEC as rated by teachers. They conclude that the aim to have equal early opportunity for all children in Norway has not yet been fully attained. Hence, even in what is deemed as one of the most egalitarian countries in Europe, economic hardship and educational resources in the family are associated with the development of a basic skill – language – which is a requirement for the communication with parents, teachers and peers, and, ultimately, a prerequisite for a healthy start into school life and later academic progression.

Author note: The authors acknowledge funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 727069 (ISOTIS).

Completion of the manuscript is also supported by funding from the European Research Council Consolidator Grant ERC-CoG-2018 EQOP [grant number 818425], given to the second author. The Behavior Outlook Norwegian Developmental Study is situated at the Norwegian Center for Child Behavioral Development, which is supported by the Norwegian Ministry of Children and Families. We are indebted to the families participating in this ongoing study who contributed with their time and effort to make this research possible. The Norwegian Mother, Father and Child Cohort Study is supported by the Norwegian Ministry of Health and Care Services and the Ministry of Education and Research. We are grateful to all the participating families in Norway who take part in this on-going cohort study.

The results are previously published as part of a report from the ISOTIS project: http://www.isotis.org/wp-content/uploads/2019/01/ISOTIS_D1.3-Roots-and-Development-of-Achievement-Gaps.pdf

Data Availability Statement

Two sources of data support the findings of this study. Instructions for access to MoBa data from the Norwegian Institute of Public Health can be found here: <https://www.fhi.no/en/studies/moba/for-forskere-artikler/research-and-data-access/>. Restrictions apply to the availability of these data, which were used under license for this study. BONDS data from the Norwegian Center for Child Behavioral Development is not publicly available due to person protection regulations. Inquiries about the data can be addressed to Ane Nærde <ane.narde@nubu.no>.

References

- Alexandersen, N., Zachrisson, H. D., Wilhelmsen, T., Wang, M. V., & Brandlistuen, R. E. (2021). Predicting selection into ECEC of higher quality in a universal context: The role of parental education and income. *Early Childhood Research Quarterly, 55*, 336-348.
<https://doi.org/10.1016/j.ecresq.2021.01.001>
- Barone, C. & Van de Werfhorst, H.G.. (2011). Education, Cognitive Skills and *Earnings in Comparative Perspective*. *International Sociology, 26*, 483–502.
<https://doi.org/10.1177/0268580910393045>
- Beitchman, J. H., Wilson, B., Johnson, C. J., Atkinson, L., Young, A., Adlaf, E., Douglas, L. (2001). Fourteen-year follow-up of speech/language-impaired and control children: Psychiatric outcome. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*, 75-82.
<https://doi.org/10.1097/00004583-200101000-00019>
- Bishop, D. V. M. (2003). *The children's communication checklist: CCC-2*. London: Harcourt Assessment.
- Bishop, D. V. M., Laws, G., Adams, C., & Norbury, C. F. (2006). High heritability of speech and language impairments in 6-year-old twins demonstrated using parent and teacher report. *Behavior Genetics, 36*, 173–184. <https://doi.org/10.1007/s10519-005-9020-0>
- Borgna, C. (2015). Migration, Education, and Inequality. Which European Educational Systems Provide Fair Opportunities to Learn? WZB Report 2015, Berlin Social Sciences Center, pp. 32–35.
- Bornstein, M. H., & Bradley, R. H. (2003). Socioeconomic Status. *Parenting, and Child Development*. Lawrence Erlbaum.
- Bradbury, B., Corak, M., Waldfogel, J. & Washbrook, E. (2015). *Too Many Children Left Behind. The U.S. Achievement Gap in Comparative Perspective*. Russell Sage Foundation.

- Bradbury, A. (2021). *Ability, Inequality and Post-Pandemic Schools: Rethinking Contemporary Myths of Meritocracy*. Policy Press.
- Burchinal, M., Nelson, L., Carlson, M., & Brooks-Gunn, J. (2008). Neighborhood characteristics, and child care type and quality. *Early Education and Development, 19*, 702-725.
<https://doi.org/10.1080/10409280802375273>
- Cheadle, J. E. (2008). Educational Investment, Family Context, and Children's Math and Reading Growth from Kindergarten Through the Third Grade. *Sociology of Education, 81*(1), 1-31.
<https://doi.org/10.1177/003804070808100101>
- Chmielewski, A. K., & Reardon, S. F. (2016). Patterns of Cross-National Variation in the Association Between Income and Academic Achievement. *AERA Open, 2*(3), 2332858416649593. <https://doi.org/10.1177/2332858416649593>
- Conger, R.D., Conger, K.J., & Martin, M.J. (2010). Socioeconomic Status, Family Processes, and Individual Development. *Journal of Marriage and Family, 72*, 685-704.
<https://doi.org/10.1111/j.1741-3737.2010.00725.x>
- Dale, P. S., Price, T. S., Bishop, D. V. M., & Plomin, R. (2003). Outcomes of early language delay. *Journal of Speech, Language and Hearing Research, 46*, 544-560.
[https://doi.org/10.1044/1092-4388\(2003/044\)](https://doi.org/10.1044/1092-4388(2003/044))
- Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: the indirect role of parental expectations and the home environment. *Journal of Family Psychology, 19*, 294-304. <https://doi.org/10.1037/0893-3200.19.2.294>
- Dearing, E. (2014). *The state of research on children and families in poverty: Past, present, and future empirical avenues of promise*. In K. McCartney, H. Yoshikawa, & L. Forcier (Eds), *Improving the Odds for America's Children* (pp. 203-216). Harvard Education Press.

- Dearing, E., Kreider, H., Simpkins, S., & Weiss, H. B. (2006). Family involvement in school and low-income children's literacy: Longitudinal associations between and within families. *Journal of Educational Psychology, 98*, 653-664.
<https://doi.org/10.1037/0022-0663.98.4.653>
- Dearing, E., & Taylor, B. A. (2007). Home improvements: Within-family associations between income and the quality of children's home environments. *Journal of Applied Developmental Psychology, 28*, 427-444. <https://doi.org/10.1016/j.appdev.2007.06.008>
- Dunn, L. M., Whetton, C., & Burley, J. (1997). *The British picture vocabulary scale* (2nd ed.). NFER-Nelson Publishing Company.
- Dionne, G., Dale, P. S., Boivin, M., & Plomin, R. (2003). Genetic evidence for bidirectional effects of early lexical and grammatical development. *Child Development, 74*(2), 394-412.
<https://doi.org/10.1111/1467-8624.7402005>
- Duncan, G. J. & Magnuson K. (2003). Off with Hollingshead: Socioeconomic Resources, Parenting, and Child Development. In M. H. Bornstein & R. H. Bradley (Eds.), *Socioeconomic status, parenting, and child development*. (pp. 83–106). Lawrence Erlbaum.
- Duncan G. J., Magnuson, K., & Votruba-Drzal, E. (2015). Children and Socioeconomic Status. In *Handbook of Child Psychology and Developmental Science*: John Wiley & Sons, Inc.
- Durkin, K., Fraser, J., & Conti-Ramsden, G. (2012). School-age prework experiences of young people with a history of specific language impairment. *The Journal of Special Education, 45*, 242-255. <https://doi.org/10.1177/0022466910362773>
- Epland, J., & Kirkeberg, M. I. (2012). *Wealth distribution in Norway. Evidence from a new register-based data source*. (Report 35/2012). Oslo, Norway: Statistics Norway.

Eurofound. (2017). *Income inequalities and employment patterns in Europe before and after the Great Recession*. Retrieved from Luxembourg:

https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1663_en.pdf

Eurostat (2017). *Europe 2020 indicators: Poverty and social exclusion*. Retrieved from

http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_poverty_and_social_exclusion

Farkas, G. (2003). Cognitive Skills and Noncognitive Traits and Behaviours in Stratification Processes. *Annual Review of Sociology*, 29, 541–562.

<https://doi.org/10.1146/annurev.soc.29.010202.100023>

Farkas, G. & Beron, K. (2004). The Detailed Age Trajectory of Oral Vocabulary 37

Knowledge: Differences by Class and Race. *Social Science Research*, 33, 464–97.

<https://doi.org/10.1016/j.ssresearch.2003.08.001>

Fernald, A., Marchman, V.A., & Weisleder, A. (2013). SES Differences in

Language Processing Skill and Vocabulary Are Evident at 18 Months. *Developmental Science*, 16, 234–248. <https://doi.org/10.1111/desc.12019>

Fernald, A., & Weisleder, A. (2015). Twenty Years after “Meaningful Differences,” It’s Time to Reframe the “Deficit” Debate about the Importance of Children’s Early Language

Experience. *Human Development*, 58, 1-4. <https://doi.org/10.1159/000375515>

Golinkoff, R. M., Hoff, E., Rowe, M. L., Tamis-LeMonda, C. S., & Hirsh-Pasek, K. (2019).

Language matters: Denying the existence of the 30-million-word gap has serious consequences. *Child Development*, 90(3), 985-992. <https://doi.org/10.1111/cdev.13128>

Gustafsson, J. E., Hansen, K. Y., & Rosén, M. (2011). Effects of home background on student

achievement in reading, mathematics, and science at the fourth grade. *TIMSS and PIRLS*, 181-287.

- Haeck, C., & Lefevre, P. (2020). Pandemic school closures may increase inequality in test scores. *Canadian Public Policy*, 46(S1), S82-S87. <https://doi.org/10.3138/cpp.2020-055>
- Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Paul H Brookes Publishing.
- Helland, W. A., & Heimann, M. (2007). Assessment of pragmatic language impairment in children referred to psychiatric services: a pilot study of the Children's Communication Checklist in a Norwegian sample. *Logopedics Phoniatric Vocology*, 32(1), 23-30. <https://doi.org/10.1080/14015430600712056>
- Hirsh-Pasek, K., Adamson, L. B., Bakeman, R., Owen, M. T., Golinkoff, R. M., Pace, A., Yust, P.K.S. & Suma, K. (2015). The contribution of early communication quality to low-income children's language success. *Psychological Science*, 26, 1071-1083. <https://doi.org/10.1177/0956797615581493>
- Jackson, M. (2013). *Determined to Succeed? Performance versus Choice in Educational Attainment*. Stanford: Stanford University Press. <https://doi.org/10.11126/stanford/9780804783026.001.0001>
- Lee, V. E. & Burkam, D.T. (2002). *Inequality at the Starting Gate: Social Background Differences in Achievement as Children Begin School*. Economic Policy Institute.
- Liiva, C. A., & Cleave, P. L. (2005). Roles of initiation and responsiveness in access and participation for children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, 48, 868-883. [https://doi.org/10.1044/1092-4388\(2005/060\)](https://doi.org/10.1044/1092-4388(2005/060))
- Longo, F., McPherran Lombardi, C., & Dearing, E. (2017). Family investments in low-income children's achievement and socioemotional functioning. *Developmental Psychology*, 53(12), 2273-2289. <https://doi.org/10.1037/dev0000366>

- Magnus, P., Birke, C., Vejrup, K., Haugan, A., Alsaker, E., Daltveit, A. K., . . . Knudsen, G. P. (2016). Cohort Profile Update: The Norwegian Mother and Child Cohort Study (MoBa). *International Journal of Epidemiology*, 45(2), 382-388. <https://doi.org/10.1093/ije/dyw029>
- Magnus, P., Irgens, L. M., Haug, K., Nystad, W., Skjaerven, R., Stoltenberg, C., & MoBa Study, G. (2006). Cohort profile: the Norwegian Mother and Child Cohort Study (MoBa). *International Journal of Epidemiology*, 35(5), 1146-1150. <https://doi.org/10.1093/ije/dyl170>
- Magnuson, K. (2007). Maternal education and children's academic achievement during middle childhood. *Developmental Psychology*, 43(6), 1497–1512. <https://doi.org/10.1037/0012-1649.43.6.1497>
- Mani, A., Mullainathan, S. Shafir, E. & Zhao, J (2013). Poverty impedes cognitive function. *Science*, 341, 976-80. <https://doi.org/10.1126/science.123804>
- Marks, G. N., Cresswell, J. & Ainley, J. (2006). Explaining socioeconomic inequalities in student achievement: The role of home and school factors. *Educational Research and Evaluation*, 12(2), 105–128. <https://doi.org/10.1080/13803610600587040>
- Nærde, A., Janson, H. T., & Ogden, T. (2014). *BONDS (The Behavior Outlook Norwegian Developmental Study): A Prospective Longitudinal Study of Early Development of Social Competence and Behavior Problems. Oslo, Norway: The Norwegian Center for Child Behavioral Development*. Retrieved from <http://www.atferdssenteret.no/getfile.php/Filer/Atferdssenteret.no/Dokumenter/Rapporter/2014%20Report%20Naerde%20et%20al.%20BONDS%20A%20Prospective%20Longitudinal%20Study.pdf>
- Neitzel, C., & Stright, A. D. (2004). Parenting behaviours during child problem solving: The roles of child temperament, mother education and personality, and the problem-solving context. *International Journal of Behavioral Development*, 28, 166-179. <https://doi.org/10.1080/01650250344000370>

- OECD (2010). PISA 2009 results: Overcoming social background–Equity in learning opportunities and outcomes (Volume II). OECD Publishing.
- OECD. (2016a). Low-performing students: Why they fall behind and how to help them succeed. OECD Publishing. <https://doi.org/10.1787/9789264250246-en>.
- OECD. (2016b). PISA 2015 results (Volume I): Excellence and Equity in Education, OECD Publishing. <https://doi.org/10.1787/9789264266490-En>
- OECD (2017). *Educational Opportunity for All: Overcoming Inequality throughout the Life Course*. OECD Publishing. <https://doi.org/10.1787/9789264287457-en>
- Øksendal, E., Brandlistuen, R. E., Holte, A., & Wang, M. V. (2019). Peer-Victimization of young children with developmental and behavioral difficulties -A population-based study. *Journal of Pediatric Psychology, 44*(5), 589-600. <https://doi.org/10.1093/jpepsy/jsy112>
- Pace, A., Luo, R., Hirsh-Pasek, K., & Golinkoff, R. M. (2017). Identifying pathways between socioeconomic status and language development. *Annual Review of Linguistics, 3*, 285-308. <https://doi.org/10.1146/annurev-linguistics-011516-034226>
- Passaretta, G., Skopek, J., & van Huizen, T. (2020). To what extent is social inequality in school-age achievement determined before and during schooling? A longitudinal analysis in three European countries. *SocArXiv, 3*. <https://doi.org/10.31235/osf.io/yqt6n>
- Potter, D., & Roksa, J. (2013). Accumulating advantages over time: Family experiences and social class inequality in academic achievement. *Social Science Research, 42*(4), 1018–1032. <https://doi.org/10.1016/j.ssresearch.2013.02.005>
- Rees, G., Gromada, A., & Chzhen, Y. (2019). More equal and less equal at the same time? Measuring inequality in educational achievement of 15-year olds in 37 countries. In *Culture and Education: Social Transformations and Multicultural Communication* (pp. 666-673).

- Ribeiro, L.A. Zachrisson, H.D. Gustavson, K. & Schjølberg, S. (2015). Maternal distress during pregnancy and language development in preschool age: A population-based cohort study, *European Journal of Developmental Psychology*, 13(1), 20-39.
<https://doi.org/10.1080/17405629.2015.1050373>
- Richter, J., & Janson, H. (2007). A validation study of the Norwegian version of the Ages and Stages Questionnaires. *Acta Paediatrica*, 96(5), 748-752.
<https://doi.org/10.1111/j.1651-2227.2007.00246.x>
- Roeters, A. (2010). *Family life under pressure? Parents' paid work and the quantity and quality of parent-child and family time*. Dissertation, Utrecht University, The Netherlands.
- Romeo, R. R., Segaran, J., Leonard, J. A., Robinson, S. T., West, M. R., Mackey, A. P., . . . Gabrieli, J. D. E. (2018). Language Exposure Relates to Structural Neural Connectivity in Childhood. *The Journal of Neuroscience*, 38(36), 7870-7877.
<https://doi.org/10.1523/jneurosci.0484-18.2018>
- Schnepf, S.V. (2007). Immigrants' educational disadvantage: n examination across ten countries and three surveys. *Journal of Population Economics*, 20, 527–545.
<https://doi.org/10.1007/s00148-006-0102-y>
- Skopek, J., & Passaretta, G. (2021). Socioeconomic inequality in children's achievement from infancy to adolescence: The case of Germany. *Social Forces*, 100(1), 86-112.
<https://doi.org/10.1093/sf/soaa093>
- Snowling, M. J., Bishop, D. V. M., Stothard, S. E., Chipchase, B., & Kaplan, C. (2006). Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. *Journal of Child Psychology and Psychiatry*, 47, 759-765.
<https://doi.org/10.1111/j.1469-7610.2006.01631.x>

Sperry, D. E., Sperry, L. L., & Miller, P. J. (2019). Reexamining the verbal environments of children from different socioeconomic backgrounds. *Child Development, 90*(4), 1303-1318.

<https://doi.org/10.1111/cdev.13072>

Statistics Norway (2014). Gjennomstrømning i videregående opplæring, 2007-2012 [Completion of secondary education, 2007-2012]. Oslo, Norway: Statistics Norway.

Statistics Norway (2021). *ECEC statistics*. Retrieved from

<https://www.ssb.no/en/utdanning/barnehager/statistikk/barnehager>

Steffensen, K., Ekren, R., Zachrisen, O. O., & Kirkebøen, L. J. (2017). *Er det forskjeller i skolers og kommuners bidrag til elevenes læring i grunnskolen? En kvantitativ studie [Are there differences in schools' and municipalities' contributions to student learning in primary school? A quantitative study]* (825379469X).

Storch, S. & Whitehurst, G.J. (2002). Oral language and code-related precursors to reading:

Evidence from a longitudinal structural model. *Developmental Psychology, 38*, 934-947.

<https://doi.org/10.1037/0012-1649.38.6.934>

Tan, C. Y. (2015). The contribution of cultural capital to students' mathematics achievement in medium and high socioeconomic gradient economies. *British Educational Research Journal, 41*, 1050-1067. <https://doi.org/10.1002/berj.3187>

The Norwegian Directorate for Children, Y. a. F. A. (2017). *Oppvekstrapporten 2017 [The report on children's and adolescent's developmental conditions, 2017]*.

Torvik, F. A., Eilertsen, E. M., McAdams, T. A., Gustavson, K., Zachrisson, H. D., Brandlistuen, R., ... & Ystrom, E. (2020). Mechanisms linking parental educational attainment with child ADHD, depression, and academic problems: a study of extended families in The Norwegian Mother, Father and Child Cohort Study. *Journal of Child Psychology and Psychiatry, 61*(9), 1009-1018. <https://doi.org/10.1111/jcpp.13197>

- Van Dorn, A., Cooney, R. E., & Sabin, M. L. (2020). COVID-19 exacerbating inequalities in the US. *Lancet (London, England)*, 395(10232), 1243-1244. [https://doi.org/10.1016/S0140-6736\(20\)30893-X](https://doi.org/10.1016/S0140-6736(20)30893-X)
- Verdine, B. N., Golinkoff, R. M., Hirsh-Pasek, K., & Newcombe, N. S. (2014). Finding the missing piece: Blocks, puzzles, and shapes fuel school readiness. *Trends in Neuroscience and Education*, 3, 7-13. <https://doi.org/10.1016/j.tine.2014.02.005>
- Vernon-Feagans, L., Garrett-Peters, P., Willoughby, M., Mills-Koonce, R., & Family Life Project Key Investigators. (2012). Chaos, poverty, and parenting: Predictors of early language development. *Early childhood research quarterly*, 27(3), 339-351. <https://doi.org/10.1016/j.ecresq.2011.11.001>
- Votruba-Drzal, E., Levine Coley, R., & Lindsay Chase-Lansdale, P. (2004). Child care and low-income children's development: Direct and moderated effects. *Child Development*, 75, 296-312. <https://doi.org/10.1111/j.1467-8624.2004.00670.x>
- Wadman, R., Durkin, K., & Conti-Ramsden, G. (2011). Close relationships in adolescents with and without a history of specific language impairment. *Language, Speech, and Hearing Services in Schools*, 42, 41-51. [https://doi.org/10.1044/0161-1461\(2010/10-0003\)](https://doi.org/10.1044/0161-1461(2010/10-0003))
- Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*, 84, 2112-2130. <https://doi.org/10.1111/cdev.12099>
- Zambrana, I. M., Dearing, E., Nærde, A., & Zachrisson, H. D. (2015). Time in early childhood education and care and language competence in Norwegian four-year-old girls and boys. *European Early Childhood Education Journal*, 24(6), 793-806. <http://dx.doi.org/10.1080/1350293x.2015.1035538>

Zadeh, Z. Y., Farnia, F., & Ungerleider, C. (2010). How home enrichment mediates the relationship between maternal education and children's achievement in reading and math. *Early Education and Development, 21*, 568-594. <https://doi.org/10.1080/10409280903118424>

Socioeconomic disparities in early language development

Table 1 – Predictors of communication problems/poor language development from 6 months to 2nd grade (BONDS)/8 years (MoBa).

BONDS									
Age/grade	6 months	12 months	24 months	36 months	48 months	1st grade		2nd grade	
N	1071	1077	1042	1032	897	840		860	
	Lang 6	Lang 12	Lang 24	Lang 36	Lang 48	LA	LB	LA	LB
Child gender (boy)	-.02(.05)	.15(.04)***	.24(.03)***	.37(.07)***	-.01(.03)	.22(.04)***	.18(.35)***	.18(.04)***	.18(.04)***
Exact age at testing	-	-.25(.04)***	-.14(.03)**	-.16(.06)**	-.08(.03)*	-.15(.04)***	-.15(.04)***	-.14(.05)**	-.15(.04)***
Maternal education	.15(.05)**	.17(.04)***	-.06(.03) ⁺	-.05(.01)***	-.14(.03)***	-.11(.04)*	-.04(.04)	-.10(.05)*	-.14(.04)***
Econom. hardship	-.13 (.05)**	-.08(.04)*	.02(.03)	.07(.11)	.02(.03)	.08(.04)*	.13(.04)***	.12(.04)**	.10(.04)**
Non-west immig.	-.06 (.05)	.03(.04)	.06(.03) ⁺	.66(.15)***	.08(.03)*	.08(.04)*	.26(.17)	.07(.04)	.04(.04)
Western immig.	.03(.05)	-.01(.04)	.07(.03)*	.37(.14)**	.05(.03)	-.01(.04)	.02(.15)	.03(.04)	.02(.04)

MoBa						
age	6 months	18 months	36 months	5 years	8 years	
N	80 372	68 483	54 568	38 466	40 111	
	Lang 6	Lang 12	Lang 36	LA	LA	LB
Child gender (boy)	.03(.07)***	.24(.01)***	.16(.01)***	.14(.01)***	.08(.01)***	.12(.01)***
Maternal education	.05(.01)***	-.04(.01)***	-.12(.01)***	-.06(.01)***	-.10(.01)***	-.13(.01)***
Econom. hardship	.01 (.01)	-.00(.01)	.03(.01)***	.03(.01)***	.02(.01)***	-.01(.01)
Immigrant	.04 (.01)***	.04(.01)***	.06(.01)***	.08(.01)***	.07(.01)***	.05(.01)***

Notes: ⁺ p>.1 *p<.05 **p<.01 ***p<.001

Higher score on the dependent variable means more problems. All coefficients are standardized on the x and y variables.

Table 2 – Fit indexes for full models with predictors, BONDS and MoBA.

		BONDS				
		Df	Chi sq	RMSEA	CFI	TLI
Language	6 months ^a	63	91.51***	.02	.92	.89
/communication	12 months ^b	69	130.02***	.03	.90	.87
	24 months	69	212.09***	.05	.93	.91
	36 months	69	161.45***	.04	.89	.86
	1 st grade	623	2261.19***	.06	.94	.93
	2 nd grade	623	1434.49***	.04	.97	.96
		MoBa				
		Df	Chi sq	RMSEA	CFI	TLI
Language	6 months ^a	53	364.32***	.01	.92	.89
/communication	18 months	24	265.20***	.01	.99	.98
	36 months	69	317.09***	.01	.99	.99
	5 years	37	818.97***	.02	.96	.95
	8years	215	14128.03***	.04	.95	.94

Note: *** $p < .001$ ** $p < .01$

^a Values corresponding to the model with missing value estimation for all predictors; without missing value estimation indexes are as follows:

Chi sq (63)= 89.13, $p < .05$, CFI = .92, TLI = .90, RMSEA = .02

^b Values corresponding to the model with missing value estimation for all predictors; without missing value estimation indexes are as follows:

Chi sq (69)= 131.16, $p < .001$, CFI = .90, TLI = .87, RMSEA = .03

Socioeconomic disparities in early language development

Table S1a: Measurements across ages in BONDS using the instruments i) Ages and Stages Questionnaire, ii) Grammar Scale, iii) British Picture Vocabulary Scale-II, and iv) Children’s Communication Checklist.

Age (months/grade)	ASQ com.	Grammar Scale		BPVS	CCC2
		R1	R2		
6	x				
12	x	x			
24	x	x	x		
36	x	x	x		
48				x	
1 st					x
2 nd					x

Table S1b: Measures across ages in MoBa using the instruments i) Ages and Stages Questionnaire and ii) Children’s Communication Checklist.

Age (months/years)	ASQ com.	CCC2
6	x	
18	x	
36	x	
5		x
8		x

Table S2a: Descriptives of demographic and family characteristics and language/achievement measures (N = 1 157) for the BONDS study.

	% Missing	%/M(range)	SD
<i>Child, family & maternal characteristics</i>			
Child gender (boy)	0	51.77%	-
Maternal education (years)	1.1	14.30 (9-18)	2.56
Western immigrant	1.47	6.75%	-
Non-Western immigrant	1.47	6.40%	-
Economic Hardship	5.27	11.86%	-
Exact age at testing 12 mo ^a	0	.20 (-1.36-3.24)	.54
Exact age at testing 24 mo ^a	0	.19(-1.43-5.27)	.62
Exact age at testing 36 mo ^a	0	.24(-2.03-3.06)	.67
Exact age at testing 48 mo ^a	0	.19(-2.50-2.96)	.63
Exact age at testing 1 st grade ^a	25.06	5.64 (-18.27-12.63)	3.44
Exact age at testing 2 nd grade ^a	22.90	5.62(-8.53-14.43)	3.34

Table S2b: Descriptives of demographic and family characteristics and language/achievement measures (N = 112 762) for the MoBa study.

	% Missing	%/M(range)	SD
<i>Child, family & maternal characteristics</i>			
Child gender (boy)	0.03	51.28%	-
Maternal education (years)	13.93	14.66 (9-18)	2.58
Immigrant	13.27	11.33%	-
Economic Hardship	16.59	20.60%	-

^a These values represent deviations in months in relation to the age at testing (e.g., how many months under or over 12 months)

Table S3a: Fit indexes for measurement models, BONDS.

	Number of items	Range of factor loadings	CFI	TLI	RMSEA
Lang 6	6	.20-.39	.97	.94	.03
Lang 12	6	.37-.58	.97	.95	.04
Lang 24	6	.41-.84	.97	.94	.08
Lang 36	6	.47-.83	.99	.98	.04
Two-factor model (1 st gr)					
LA	19 ^a	.60-.90	.93	.92	.08
LB	8	.73-.96			
Two-factor model (2 nd gr)					
LA	19 ^a	.70-.95	.95	.95	.06
LB	8	.77-.93			

Table S3b: Fit indexes for measurement models, MoBa.

	Number of items	Range of factor loadings	CFI	TLI	RMSEA
Lang 6	5	.33-.72	.96	.91	.02
Lang 18	3	.62-.89	1.00	1.00	.00
Lang 36	6	.73-.89	.99	.99	.03
One-factor model (5y)					
LA	5 ^b	.31-.75	.99	.98	.04
Two-factor model (8y)					
LA	9	.60-.83	.95	.94	.06
LB	7	.58-.92			

^a The item # 20 was discarded due to convergence problems

^b Fit index after removing one of the two “positively phrased” items with a weak (>.20) factor loading. Due to only 5 items, only an LA factor was tested for CCC2 at age 5.

Table S4a: Fit indexes measurement invariance testing of a two-factor (LA & LB) model of CCC2 across 1st and 2nd grades, BONDS.

	Df	Chi sq	RMSEA	CFI	TLI
Free model	1144	2214.59***	.03	.97	.97

Socioeconomic disparities in early language development

Constrained factor loadings	1167	2103.94***	.03	.97	.97
Constrained thresholds	1242	2438.70***	.03	.97	.97

Table S4b: Fit indexes measurement invariance testing of a one-factor (LA, negatively phrased items) model of CCC2 across 5 and 8 yrs, MoBa.

	Df	Chi sq	RMSEA	CFI	TLI
Free model	60	2272.27***	.03	.99	.98
Constrained factor loadings ^a	62	3953.31	.03	.97	.96
Constrained thresholds	69	4126.97***	.03	.97	.97

^aOne item estimated freely.