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Socioeconomic background, nonverbal IQ and school absence affects the development of vocabulary and reading comprehension in children living in severe poverty

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Abstract

Few studies have examined how socioeconomic status (SES) affects two essential parts of human development, namely vocabulary and reading comprehension, in children facing severe poverty. The Roma population is the largest minority group in Europe, the majority of whom live in severe poverty. This study compared the development of 322 Roma children with the development of 178 non-Roma children, between the ages of 7 and 10 years, living in Romania. The Roma children had poorer initial vocabulary and reading comprehension skills as well as slower growth rates for both compared to the non-Roma children. Importantly, SES had a direct influence on growth in both reading comprehension and vocabulary. The effect of SES was partly mediated by school absence and nonverbal IQ. This is a powerful finding since it suggests that poverty may have detrimental effects not only on reading but also on the development of verbal abilities.

KEYWORDS
absence, poverty, reading comprehension, vocabulary

1 | INTRODUCTION

Developing verbal abilities is an essential part of human development; it is critical for social interaction and is also the foundation for reading and textual comprehension. Thus, limited verbal abilities have the potential to close gateways to higher education as well as limit one's life prospects and employment possibilities. Due to the foundational nature of verbal abilities in regard to human development, such skills also form an aspect of most intelligence tests (Ceci, 1991; Cliffordson & Gustafsson, 2008; Keith & Reynolds, 2010). Verbal abilities are commonly measured with tests related to vocabulary, such as picture vocabulary, word definitions and verbal fluency (e.g. Wechsler, 2003).

It is well known that a relationship exists between socioeconomic background and vocabulary (Hoff, 2006). However, very few studies have examined vocabulary in children living in severe poverty. The World Bank defines poverty as a deprivation in well-being that includes both low income and a lack of the ability to acquire basic goods and services in addition to low levels of health and education, poor access to clean water, sanitation and inadequate physical security. This in turn leads to an insufficient capacity and opportunity to better one's life (World Bank, 2018). There is a need for more studies on vocabulary in children living in poverty and also for studies examining the development of vocabulary into reading comprehension and comparing its growth to the vocabulary development of non-deprived children.

In the study reported here, we examine a large sample of children facing poverty from the Roma minority in Romania, who are traced across five points in time, beginning with first grade; we compare these findings with a sample of children with higher socioeconomic

status (SES) (Romanian children). The Roma minority is the largest minority group in Europe and is among the groups with a very high risk of poverty and social exclusion (European Commission, 2018). In Romania, 70% of the Roma families have an income that is lower than the national at-risk-for-poverty threshold, 68% live in households without tap water inside of their dwellings, and 79% live in dwellings without a bathroom inside of the building (Fundamental Rights Agency [FRA], 2016). The same report points out that only 50% of Roma are covered by national basic medical insurance, only 38% of pre-school children participate in early education programs, and only 11% of the Roma who felt they had been discriminated against because of their ethnic background had reported the incident to the authorities.

Research Highlights

- The Roma children living in poverty had lower initial vocabulary and reading comprehension skills and slower growth in both compared to the non-Roma children.
- SES had a direct influence on growth in both reading comprehension and vocabulary.
- The effect of SES was partly mediated by school absence and nonverbal IQ.
- Poverty can have detrimental effects on vocabulary and reading.

2 | DEVELOPMENT OF VOCABULARY AND READING COMPREHENSION

Vocabulary acquisition is an unconstrained, lifelong task that occurs at a particularly rapid pace in childhood and the early school years. Studies suggest that the average child between second and fifth grade acquires the meaning of about 860 root words per year, or about 2.4 root words per day increasing to approximately 8,400 root words by fifth grade (Biemiller & Slonin, 2001). Moreover, school textbooks from grades three through nine contain approximately 88,500 distinct word families (Nagy, Herman, & Anderson, 1985). Thus, acquiring vocabulary is a formidable learning task. What is also striking is that vocabulary shows remarkable developmental rank-order stability. This implies that, while children broaden their vocabularies over time, they also develop these vocabularies in parallel trajectories; therefore, the children who start off behind do not tend to catch up with the ones who started out more strongly (Blaga et al., 2009; Bornstein, Hahn, Putnick, & Suwalsky, 2014; Klem, Gustafsson, & Hagtvet, 2015; Lervåg, Hulme, & Melby-Lervåg, 2017). There is a strong relationship between children's vocabulary and the number of words and complexity of the sentences they experience at home (Hart & Risley, 1995; Pan, Rowe, Singer, & Snow, 2005). Intervention studies have also demonstrated that at least part of this relationship can be causally attributed to environment, in addition to genetic factors, since language intervention can yield positive and lasting effects on vocabulary (Fricke, Bowyer-Crane, Haley, Hulme, & Snowling, 2013; Hagen, Melby-Lervåg, & Lervåg, 2017).

At the core of learning to read is the ability to extract meaning from text. A large body of empirical evidence indicates that reading comprehension relies heavily on vocabulary (Foorman, Petscher, & Herrera, 2018; Lervåg et al., 2017). This relationship is explained by the 'simple view of reading', which is the theoretical framework that has the strongest support when it comes to explaining reading comprehension of children in primary school (Gough & Tunmer, 1986). According to the simple view of reading, reading comprehension is the product of language comprehension and decoding skills (the technical aspects of reading). These two components explain a large amount (>90%) of the variability in children's reading comprehension (Foorman et al., 2018; Hjetland, Lervåg, Lyster, Hagtvet, Hulme & Melby-Lervåg, 2018). Thus, the ability to understand a text relies not only on the technical decoding aspect of reading but it also relies heavily on understanding the meanings of words. In fact, in secondary school, language comprehension (a verbal abilities construct that draws heavily on vocabulary) and reading comprehension are almost isomorphic (Foorman, Koon, Petscher, Mitchell, & Truckenmiller, 2015). Moreover, not only is vocabulary directly related to reading comprehension, but it also has an indirect effect on reading comprehension. This is due to the fact that in the early years, vocabulary is the foundation for the development of phonological awareness, which is a critical precursor for decoding skills (Hjetland et al., 2018; Hulme, Nash, Gooch, Lervåg, & Snowling, 2015; Metsala, 1999). Thus, vocabulary is a critical life skill, and restricted proficiency can not only detrimentally affect the ability to communicate and interact but may also lead to deficits in reading comprehension and consequently affect learning outcomes in schools (Johnson, Beitchman, & Brownlie, 2010).

3 | PREVIOUS STUDIES OF VOCABULARY AND READING COMPREHENSION IN CHILDREN LIVING IN POVERTY

A number of studies show moderate to high correlations between SES and vocabulary and reading comprehension and those children in poverty are at a considerably lower level of vocabulary than their peers from higher SES backgrounds (Buckingham, Wheldall, & Beaman-Wheldall, 2013; Hart & Risley, 1995; Pan et al., 2005; Sirin, 2005). However, many of these studies have not managed to reach groups living in severe poverty. In studies that have analysed such differences between children facing severe poverty and other children, it is clear that children facing poverty are at a considerably lower level than their peers concerning vocabulary and reading comprehension.

For the Roma group, there are only two concurrent Serbian studies; one focuses on vocabulary development, while the other targets reading comprehension. The first study showed a large difference in vocabulary levels between Roma children and their non-Roma

peers (0.85 standard deviation units [Biro, Smederevac, & Tovilovic, 2009]). The second study showed a large difference between Roma children and their peers on a national test measuring reading comprehension (1.2 standard deviation units [Baucal, 2006]). Thus, severe poverty seems to be associated with low levels of vocabulary and reading comprehension, and studies have shown that these low levels may potentially have a negative impact on school and life outcomes (Johnson et al., 2010). There are also some U.S. studies that perhaps can inform us since the degree of poverty of the samples is similar to that of the Roma group. As for vocabulary, one study shows that African American children facing poverty had considerably lower vocabulary scores than their peers who were not facing poverty (Guo & Harris, 2000). Another study conducted in the U.S. compared children facing poverty, homelessness and high-residential mobility with the general population (Herbers et al., 2012). The results showed that the gap between children who were facing poverty and children who were not very large even at the first-grade reading level (1.2 standard deviation units).

Notably, there are also lines of literature that have examined children in poverty in low-income countries. A review of such studies finds that the results partially corroborate the findings from high-income countries and, for instance, also demonstrates that home environments impact literacy development (Nag, Vagh, Dulay, & Snowling, 2018). However, this review also indicates that many children living in poverty in developing countries use a different language at home than in school. Although this is often considered as a factor that slows down language development, the review finds that this issue is complicated and that how this bilingualism affects literacy development is context-dependent and not a 'uniform constraint'.

4 | POSSIBLE MECHANISMS IN THE RELATIONSHIP BETWEEN POVERTY, VOCABULARY AND READING COMPREHENSION

To further disentangle whether these correlations might reflect a causal relationship and, more precisely, whether or not poverty and mechanisms related to poverty actually lead to poor vocabulary and reading comprehension, two issues must be critically examined. First, we must examine whether or not SES explains the actual development in these skills over time. Secondly, it is critical to examine which factors related to poverty mediate the relationships between poverty and vocabulary on one hand, and poverty and reading comprehension on the other hand. This analysis will bring us closer to the mechanisms that drive the relationships and will help us generate hypotheses about factors that may be effective to target in interventions.

As for the first question, whether or not SES explains growth in vocabulary and reading comprehension, a review concludes that most studies show only a concurrent correlation between SES and reading (Buckingham et al., 2013). Thus, SES does not explain growth in reading skills over time after growth at the previous point in time has been controlled for. However, it is important to note that children and families facing poverty are difficult to reach in research and that many studies, particularly longitudinal ones, have not been able to include participants with a full variation in SES at the lower end of the distribution (Henrich, Heine, & Norenzayan, 2010). One rare longitudinal study that did examine the development of reading comprehension in children in poverty indicated that high poverty predicted achievement in reading comprehension in grades three to eight even beyond decoding skills in first grade (Herbers et al., 2012). However, this study did not include measures of vocabulary, which, according to the 'simple view of reading' is the other critical component for reading comprehension. Therefore, we cannot know from this study whether the relationship between SES and reading comprehension would hold after controlling for vocabulary. However, this does not seem likely in light of prior studies.

Even if SES cannot explain growth in reading comprehension, it could be likely that vocabulary is more directly influenced by poverty. A rare longitudinal study that has managed to examine this (Sampson, Sharkey, & Raudenbush, 2008) followed a large sample of children in poverty from 6 to 12 years of age. The results revealed that exposure to concentrated disadvantages (poverty, unemployment, households with single parents receiving welfare) not only correlated with verbal abilities but in fact had negative impacts on developmental trajectories, reducing them by four points (0.25 standard deviation units). This is sizeable particularly because 1 year of schooling has been attributed to an increase in verbal abilities by two to four points (Ceci, 1991; Cliffordson & Gustafsson, 2008). Also, another longitudinal study of children in poverty from Bangladesh found that a mean cognitive deficit of 0.2 z scores at age 7 months between the first and fifth wealth quintiles increased to 1.2 z scores of IQ by 64 months (Hamadami et al., 2014). The effects of poverty on children's cognition are mostly mediated through parental education, birth size, growth in the first 24 months and home stimulation in the first 5 years. Also, in a cross-sectional study using the Bayley scale of infant and toddler development, the results show moderate differences in cognition and in receptive and expressive language (0.53, 0.42 and 0.49 standard deviations respectively) between children at the top and at the bottom quartiles of the wealth distribution (Rubio-Codina, Attanasio, Meghir, Varela, & Grantham-McGregor, 2015). These gaps increase substantially for children aged 31–42 months (0.81 *SD* for cognition, 0.76 *SD* for receptive language and 0.68 *SD* for expressive language). The studies by Sampson et al. (2008) and Hamadami et al. (2014) tying poverty to restricted growth in cognitive skills, including language, extend the findings from the many concurrent studies showing an association between severe poverty and general cognitive and language development (Buckingham et al., 2013; Hair, Hanson, Wolfe, & Pollak, 2015).

Another potential mediator of the relationship between poverty and vocabulary and reading comprehension, respectively, is bilingualism. Many of the children living in poverty use a different language at home than the language used at school. Many studies show that bilingual children with low SES have a lower vocabulary and

reading comprehension level in their second language compared to monolingual children (for review, see Melby-Lervåg & Lervåg, 2014). However, few – if any – studies have controlled for this when reporting on children living in poverty.

Another possible mechanism that can mediate the relationship between SES and vocabulary and reading comprehension is school absence. Absence is a proxy for instruction time, and when children receive less instruction than their peers, they stand the risk of falling behind. Several studies have shown that children facing poverty are absent from school more frequently than other children (Morrisey, Hutchinson, & Winsler, 2014; Ready, 2010). Kiprianos, Stamelos, and Daskalaki (2012) found that it was difficult for Roma/Gypsy children to follow the pace of the rest of the students due to their continuously occurring absences influenced by their duties at home, such as looking after their younger siblings or assisting their parents at work. School absence can also be due to the fact that children in poverty may experience more frequent illnesses and/or infections due to overcrowding and poor access to health services (McKee, 1997; Parry et al., 2007). Absence may also be related to bullying and racism at school (Derrington, 2007) and that the educational system in general is constructed in a way that may reinforce social inequalities. This can, for instance, involve failing to give any instruction to children in their mother tongue, even to children who do not know the school language at all, and a lack of support for students at risk of dropping out and having high levels of school absence (Glewwe & Arteaga, 2014). Thus, there are several mechanisms both on a system level and on an individual level that might lead to absence, and absence having a negative impact on their relationship with teachers, peers and the institution in general, ultimately often leading to students dropping out.

Brüggemann's (2012) study on Roma children's school attendance in Central and Eastern Europe shows dramatic rates of absence (>4 days a month) for children between 7 and 13 years old. This statistic includes 30% of the entire Roma school population in Romania, with the differences between Roma and non-Roma being significant in all surveyed countries. Such high absence rates cannot be overlooked when it comes to the progress children can make towards their cumulative school performance. Notably, in a study of decoding development in first and second grade in the same sample as that of the current study, absence mediated the relationship between SES and decoding skills in Roma children after other predictors of decoding were controlled for (Dolean, Melby-Lervåg, Tincas, Damsa, & Lervåg, in press). Thus, absence seems to be critical for school outcomes for children in poverty.

Another possible mechanism that can mediate the relationship between SES and vocabulary and reading comprehension is nonverbal intelligence. Nonverbal intelligence has been found to be affected by poverty due to a number of factors, including health and nutrition as well as cognitive stimulation (Black et al., 2017; Protzko, Aronson, & Blair, 2013). A survey demonstrated that the system handling pregnancy care and health for young Roma children and their mothers was extremely weak – in fact, it was almost nonexistent (UNICEF, 2011). As for the developmental relationship between nonverbal IQ and vocabulary, some studies have found that these two are highly stable traits and that there are few if any mutual influences between them during the course of childhood development (Blaga et al., 2009; Gustafsson & Undheim, 1992). However, there are also other studies that point in the opposite direction, showing a mutualism model across development in which individuals with higher scores in vocabulary showed greater gains in matrix reasoning and vice versa (Kievit et al., 2017). Thus, if such a mutual relationship exists, then nonverbal IQ can serve as a mediator in the relationship between vocabulary and reading comprehension because vocabulary can affect nonverbal IQ, which in turn affects vocabulary and then reading comprehension, since this is closely tied to vocabulary.

Finally, there is also a possibility that cognitive tests measuring nonverbal problem solving, in themselves, are cultural artefacts (Sternberg, 2004). In line with this view, it has been argued that because culture and intelligence are so inextricably linked, tests of intelligence developed in one culture will not be valid in another. Thus, even if a test taps the same cognitive abilities, the extent to which the tasks used in a particular test are experientially novel to the child might differ from culture to culture. In addition, some cultures might value practical skills more than academic skills, and children might have substantial practical skills that are not recognized in traditional IQ tests (Sternberg, 2004). Thus, this can create artificial differences in levels between the groups and also affect the predictive patterns between nonverbal IQ and the other constructs. It is well known that education and literacy traditions affect nonverbal IQ test scores (Ceci, 1991; Protzko et.al., 2013). The Roma culture and Romani language have a weak literary tradition, and many Romani's are illiterate (Save the Children, 2001). Moreover, the level of school completion is low, and the majority of Roma students drop out after first grade (Kiprianos et al., 2012; Save the Children, 2001). Given the statistics, it is not surprising that children from the Roma group score lower on nonverbal problem solving than is expected for their age group (Bakalar, 2004; Rushton, Čvorović, & Bons, 2007). Furthermore, there is an established relationship between vocabulary, reading comprehension and nonverbal problem solving (Blaga et al., 2009; Hjetland et al., 2018). Nevertheless, one study examined whether or not nonverbal IQ mediated the relationship between SES and reading comprehension but failed to find support (Corso, Cromley, Sperb, & Salles, 2016). It is noteworthy to mention that this study did not include a sample of children living in poverty and that the sample had a mean nonverbal IQ close to average.

5 | THE CURRENT STUDY

Given the importance of the topic, there are surprisingly few studies covering language development and reading comprehension in children facing poverty. This is particularly the case when it comes to longitudinal studies and studies with individual in-depth assessments. Also, there are no longitudinal studies of the Roma group that measure the development of their vocabulary and reading comprehension. As discussed above, there are several unexplained issues

TABLE 1 Means, standard deviations, range, reliability and differences of the study variables across ethnicity groups and time points

		Roma bilingual			Roma monolingual			Non-Roma			Differences between groups
	Reliability[a] (Total)	Mean (*SD*)	Range	Reliability[a]	Mean (*SD*)	Range	Reliability[a]	Mean (*SD*)	Range	Reliability[a]	
Reading comp. t2	0.92	3.46 (4.64)	0 – 21	0.90	5.30 (6.08)	0 – 32	0.93	9.59 (6.13)	0 – 33	0.90	NR > RM> RB[b]
Reading comp. t3	0.94	4.48 (5.73)	0 – 26	0.93	6.44 (6.16)	0 – 28	0.93	12.44 (7.55)	0 – 33	0.94	NR > RM> RB[b]
Reading comp. t4	0.95	8.22 (7.82)	0 – 39	0.94	10.03 (8.24)	0 – 35	0.94	18.21 (9.34)	1 – 40	0.93	NR > RM, RB[b]
Reading comp. t5	0.96	11.42 (10.59)	0 – 42	0.96	12.20 (8.98)	0 – 35	0.94	23.30 (11.86)	0 – 48	0.94	NR > RM, RB[b]
Vocabulary t1	0.85	6.49 (5.35)	0 – 24	0.80	8.95 (5.94)	0 – 28	0.82	12.73 (7.72)	0 – 34	0.85	NR > RM> RB[b]
Vocabulary t2	0.90	9.61 (7.11)	0 – 33	0.85	11.52 (7.36)	0 – 40	0.85	19.53 (10.63)	0 – 49	0.90	NR > RM, RB[b]
Vocabulary t3	0.91	10.18 (7.82)	0 – 38	0.86	11.71 (7.13)	2 – 34	0.88	19.04 (10.51)	2 – 47	0.92	NR > RM, RB[b]
Vocabulary t4	0.93	14.01 (9.43)	1 – 50	0.91	14.99 (8.67)	1 – 42	0.89	24.72 (12.75)	1 – 57	0.93	NR > RM, RB[b]
Vocabulary t5	0.94	16.47 (9.93)	1 – 44	0.92	17.38 (9.67)	0 – 44	0.90	28.45 (13.16)	2 – 57	0.94	NR > RM, RB[b]
Raven	0.86	13.68 (5.61)	1 – 33	0.81	15.83 (5.13)	1 – 30	0.81	20.40 (6.08)	4 – 33	0.87	NR > RM> RB[b]
Mother's education	—	2.00 (1.00)	1 – 6	—	2.00 (1.00)	0 – 6	—	4.00 (1.00)	1 – 7	—	NR > RM, RB[c]
Family income	—	4.00 (3.00)	1 – 11	—	4.00 (3.00)	1 – 12	—	7.00 (3.00)	1 – 13	—	NR > RM, RB[c]
People/room	—	3.37 (1.99)	0.75 – 9	—	3.45 (1.79)	0.5 – 8	—	2.07 (1.26)	0.5 – 10	—	RM, RB> NR[c]
Parents' employment	—	0.26 (0.32)	0 – 1	—	0.31 (0.36)	0 – 1	—	0.63 (0.34)	0 – 1	—	NR > RM, RB[c]
Absences	—	36.52 (30.34)	0 – 145	—	36.12 (40.73)	0 – 199	—	10.20 (13.66)	0 – 97	—	NR > RM, RB[b]

Abbreviations: NR, Non-Roma; RB, Roma bilingual; RM, Roma monolingual.

[a]Internal consistency (Cronbach's α).

[b]ANOVAs with least square differences (LSD) for pairwise comparisons, all ANOVAs with $p < 0.001$, all LSD with $p < 0.05$.

[c]Kruskal–Wallis test with asymptotic significance $p < 0.001$, and Mann–Whitney test for pairwise comparisons, all with asymptotic significance $p < 0.001$.

concerning differences in levels between the groups in vocabulary and reading comprehension, to what extent SES explains growth in these to skills and factors that can mediate the relationship between SES, reading comprehension and vocabulary. Here, we report a longitudinal study involving the first 3 years of school, comparing the development of vocabulary and reading comprehension skills in a large sample of Roma children living in poverty to a sample of non-Roma children attending the same schools who originate from more affluent backgrounds. The study examines the following research questions:

- Do the more affluent non-Roma children have greater vocabulary and reading comprehension skills at the beginning of the study, and do they show quicker development of these skills compared to the Roma children?
- Do the bilingual children have poorer initial skills and a slower development of vocabulary and reading comprehension compared to the monolingual Roma children?
- Does SES explain both beginning skills in vocabulary and reading comprehension as well as the developmental rates (growth) of these skills?
- Is the potential effect of SES on the growth of vocabulary and reading comprehension skills partly mediated through nonverbal abilities and school absence?

6 | METHOD

6.1 | Participants

Five hundred children (261 boys) were initially included in this study. They were recruited from one of the 21 participating schools located in the north-western region of Romania. The schools had an average or above-average representation of Roma ethnicity. Each child was given parental consent to participate in this study.

All children were registered in the first grade at the beginning of the study (Time 1) and their mean age was 89.56 (in months) (*SD* = 4.85). A total of 178 children were monolingual Romanian children (89 boys, M age = 88.22 months, *SD* = 4.18), 151 were bilingual Roma (82 boys, M age = 89.55 months, *SD* = 4.71) and 171 were monolingual Roma (90 boys, M age = 89.60, *SD* = 5.34). The children were instructed at school in Romanian (a Romance language), which is the official language of Romania. The home language of the non-Roma and monolingual Roma children was Romanian, while the home language of the bilingual children was Romani (an Indo-Aryan language).

The data were collected from first through third grades at five points in time, described as follows: Time 1 (October 2014; *N* = 500), Time 2 (May 2015; *N* = 494), Time 3 (October 2015; *N* = 464), Time 4 (May 2016; *N* = 466) and Time 5 (March 2017; *N* = 449). The mean ages in months for the children at each assessment were t1 = 89, t2 = 96, t3 = 101, t4 = 108 and t5 = 119. The attrition rate of the participants was 1.20% during the first grade, 7.20% during the second grade and 11.60% during the third grade.

6.2 | Procedures

Each test was administered individually to the children by trained research assistants. The vocabulary data were collected at each point in time. The reading comprehension data were collected at t2, t3, t4 and t5. The demographic questionnaire was administered at t1 by the classroom teachers during parent–teacher conferences. The teachers assisted those parents who had difficulties in reading and writing. The attendance data were collected at t2, t4 and t5.

6.3 | Instruments

6.3.1 | Reading comprehension skills

These skills were assessed using a Romanian translation of the Neale Analysis of Reading Ability, Second Edition (NARA II) (Neale, 1997). The test contains six stories of increasing difficulty. The participants read one story at a time; after each story, they orally responded to questions relative to the story. There were four questions about the first story and eight questions about each of the five subsequent stories. Each answer was coded by either 0 (incorrect) or 1 (correct). The internal consistency was very high, with alpha scores ranging from 0.90 to 0.96 (see Table 1).

6.3.2 | Vocabulary

This area was measured with the Romanian version of the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) (Wechsler, 2003). The participants were assessed with the vocabulary subtest, which is part of the Verbal Comprehension Index. The measure has 32 items (words) of increasing difficulty. They were read aloud by the administrator, and the participants defined them. Each answer was coded with 0 (incorrect answer), 1 (partially correct) or 2 (correct). The internal consistency was high, with alpha scores ranging from 0.80 to 0.94 (see Table 1).

6.3.3 | Nonverbal intelligence

This area was measured with Raven's Colored Progressive Matrices (Raven, Raven, & Court, 1991). Each item consisted of a visual geometric design that had a missing piece, requiring the test takers to choose the correct missing piece out of several choices displayed at the bottom of the page. The scores ranged on a scale from 0 to 36. The internal consistency of our data was sufficient (α = 0.86).

6.3.4 | SES

This area was measured by a questionnaire that collected parents' responses regarding family income, education, employment and living conditions. Family income was coded on a scale from 1 (<50 USD/month) to 13 (> 1,000 USD/month). The mother's education ranged from 1 (elementary education) to 9 (doctorate). Parents' employment was coded by 0 (no parent was employed full time), 0.5

(one parent was employed) or 1 (both parents were employed). The living conditions were coded as the ratio between the number of people living in the same household and the number of available rooms, and the score ranged from 0.5 to 10.

6.3.5 | School absenteeism

This area was measured by the number of daily recorded absences. Each absence was coded by 1. We collected absenteeism data each year, starting with 2 weeks after school started (October 1st) until approximately 6 weeks before school ended (April 30).

7 | RESULTS

Table 1 shows the descriptive statistics together with differences between the groups on all variables. As can be seen, the non-Roma groups have significantly higher scores compared to the Roma groups on all variables, with the exception of number of people per room. The monolingual Roma group did not differ significantly from the bilingual Roma group, with the exception of the two first time points of vocabulary and reading comprehension. The correlations between all variables at all time points for each of the three groups can be seen in online supplement Table S1–S3. All further analyses were done in Mplus 8.0 (Muthén & Muthén, 1998–2017) using a full information maximum likelihood estimation to handle missing values. To account for potential dependency within schools, the robust maximum likelihood with Huber–White corrections (MLR, Complex) was applied. To compare parameters across groups, we applied the Wald test embedded in Mplus. Also, due to 17 outliers (4 bilingual Roma, 5 monolingual Roma and 8 non-Roma) on reading comprehension at t2 and eight outliers (7 bilingual Roma and 1 monolingual Roma) at t3, all at the upper end of the distribution, we Winsorized these variables per group at these time points.

7.1 | Differences in the development of vocabulary and reading comprehension

A parallel-process three-group latent growth model was estimated to calculate the differences in both initial status and growth of vocabulary and reading comprehension skills between the three groups (bilingual Roma, monolingual Roma and non-Roma). The average growth can be seen in Figure 1a and Figure 1b for vocabulary and reading comprehension respectively. As most of the children could not decode at t1, reading comprehension was measured for the first time at t2. To estimate the nonlinearity, we fixed only the first (to zero) and the last factor loading (to 2.5 as indicative of the number of years) and freely estimated all the middle time points. In addition, residuals of the observed variables measured at the same time points were correlated to take account of time-specific variance. The model had an excellent fit to the data, χ^2 (76) = 91.570, p = 0.108, RMSEA = 0.035 (10% CI = 0.000–0.059), CFI = 0.993, TIL = 0.989, SRMR = 0.042.

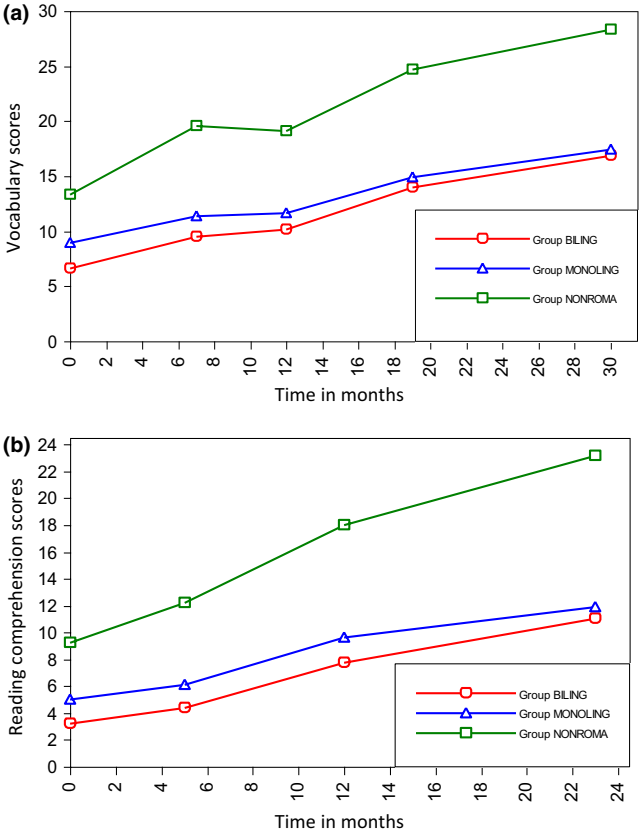

FIGURE 1 (a) Average growth of vocabulary development in non-Roma Romanian, monolingual Roma and bilingual Roma children (non-Roma Romanian at the top, then monolingual Roma and bilingual Roma children at the bottom). (b) Average growth reading comprehension development (from t2) in non-Roma Romanian, monolingual Roma and bilingual Roma children (non-Roma Romanian at the top, then monolingual Roma and bilingual Roma children at the bottom)

Through Figure 1, we can see that the growth is nonlinear, with a very slow growth between t2 and t3 due to the fact that the summer vacation for the children is included in this time period. Figure 2 shows the model with both the correlations between the growth factors and the residual variances of the observed variables. As Figure 2 shows, there are particularly strong correlations both between the initial status and between the growth of the two processes. In addition, there are correlations between initial status for one process and the growth of the other process for the monolingual Roma and the non-Roma group but not for the bilingual Roma group.

Table 2 shows the means and standard deviations for the four growth factors for all three groups. All the means were significantly different from zero, with significant variation around them. Table 3 shows the differences in Cohen's d between all means and the p-value for these differences. As can be seen in Table 3, the two Roma groups have much weaker initial scores compared to the non-Roma group on both vocabulary and reading comprehension, with Cohen ds ranging between −0.784 and −1.280. In addition, the bilingual Roma children had lower initial scores than the monolingual Roma children, with ds of −0.515 and −0.361 for vocabulary and

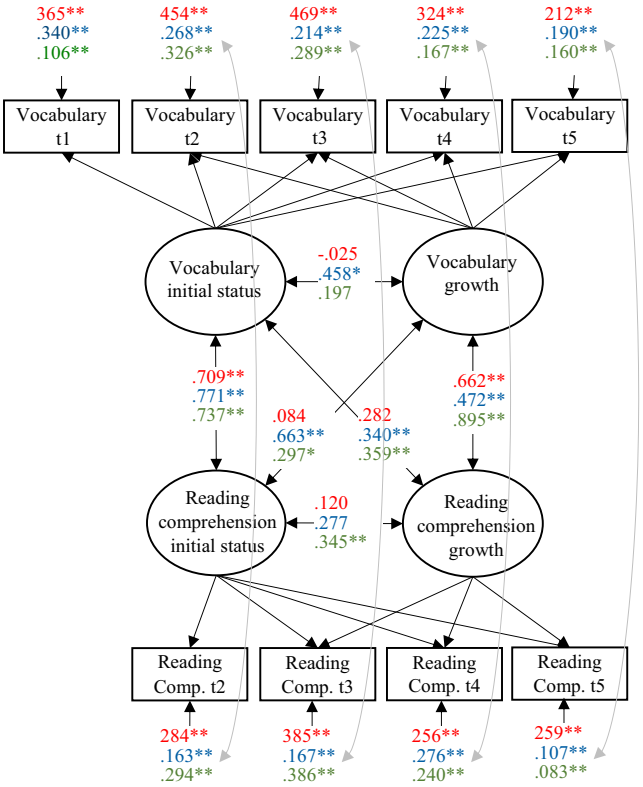

FIGURE 2 Initial status and growth in vocabulary and reading comprehension in bilingual Roma Romanian, monolingual Roma and non-Roma children (coefficients for bilingual Roma Romanian at the top, then monolingual Roma and non-Roma children at the bottom). All coefficients are standardized

reading comprehension respectively. Both Roma groups also had slower growth in reading comprehension compared to the non-Roma group (*d*s.−0.925 and −1.049 for bilingual and monolingual respectively), and the monolingual Roma group also showed slower growth in vocabulary compared to the non-Roma group (*d* = −0.822). Finally, there were no significant differences in growth rates between the two Roma groups.

7.2 | SES and the development of vocabulary and reading comprehension

To examine whether SES predicted the growth of vocabulary and reading comprehension skills, we regressed the initial status and growth factors on a formative SES construct. This construct can be seen as the weighted sum of mother's education level, family income, housing conditions and employment status. In addition, as earlier research has shown that vocabulary is important for developing reading comprehension skills (e.g. Lervåg et al., 2017), we also regressed the growth of reading comprehension on the initial status of vocabulary. As the initial status in reading comprehension was measured 7 months after the start of the estimated vocabulary growth, we could not let the initial status of reading comprehension predict the growth of vocabulary – hence, we estimated a correlation between the residuals of these two constructs instead. To avoid the prediction of differences in growth being confounded with differences initial status, we further regressed the growth factors of vocabulary and reading comprehension on their respective initial status. This three-group model can be seen

TABLE 2 Means (standard deviations) of initial status and growth per year of vocabulary and reading comprehension in the bilingual Roma, monolingual Roma and non-Roma children

	Bilingual Roma		Monolingual Roma		Non-Roma	
	Intercept *M (SD)*	Slope *M (SD)*	Intercept *M(SD)*	Slope *M (SD)*	Intercept *M (SD)*	Slope *M (SD)*
Vocabulary	6.43 (3.80)	3.98 (3.41)	8.71 (4.98)	3.26 (2.19)	13.71 (7.38)	5.76 (3.70)
Reading Comprehension	3.17 (4.33)	3.02 (2.26)	4.94 (5.41)	2.71 (2.16)	9.23 (5.09)	5.63 (3.29)

Note:: All means and standard deviations were significantly different than zero ($p < 0.01$).

TABLE 3 Differences in initial status and growth between the bilingual Roma, monolingual Roma and non-Roma children

	Bilingual Roma versus Non-Roma *d* (*p*)	Monolingual Roma versus Non-Roma *d* (*p*)	Bilingual Roma versus Monolingual Roma *d* (*p*)
Vocabulary initial status	−1.240 (<0.001)	−0.784 (<0.001)	−0.515 (0.023)
Vocabulary growth	−0.500 (0.091)	−0.822 (0.008)	0.251 (0.440)
Reading comprehension initial status	−1.280 (<0.001)	−0.817 (<0.001)	−0.361 (0.026)
Reading comprehension growth	−0.925 (<0.001)	−1.049 (0.006)	0.140 (0.700)

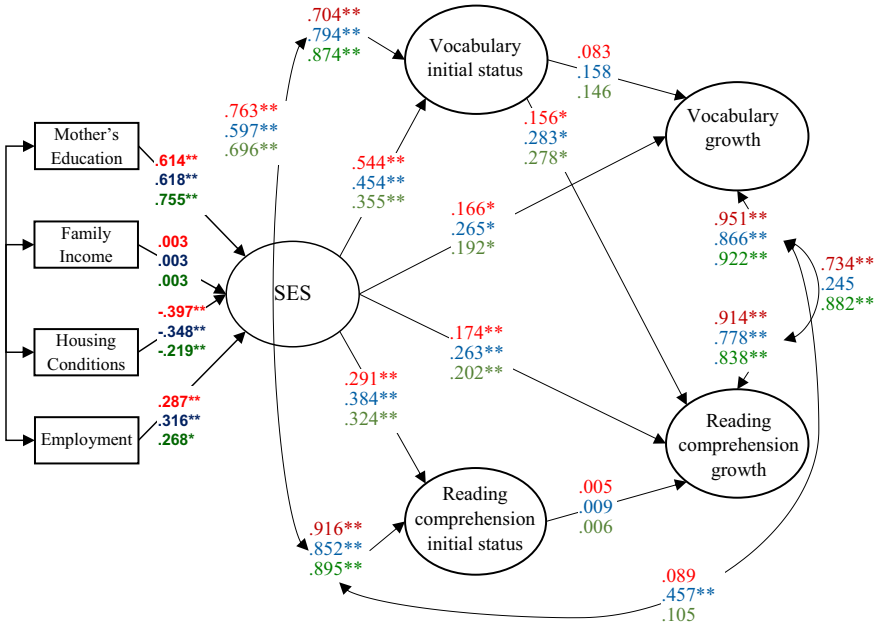

FIGURE 3 Initial status and growth in vocabulary and reading comprehension in bilingual Roma Romanian, monolingual Roma and non-Roma Romanian children predicted from a formative SES construct (coefficients for bilingual Roma Romanian at the top, then monolingual Roma and non-Roma children at the bottom). All coefficients are standardized

in Figure 3. All invariant (unstandardized) regression paths were fixed to be equal across groups. The invariance tests were applied construct for construct and showed invariance for all of the dependent constructs in the model, with the exception of the initial status of reading comprehension. The results of the invariance testing can be seen in online supplements Table S4. The reason why the standardized path coefficients (shown in Figure 3) vary across groups even if the unstandardized coefficients are fixed to be equal is that the variances of the variables differ across groups. This model had very good fit to the data, χ^2 (181) = 237.395, p = 0.003, RMSEA = 0.043 (10% CI = 0.026–0.058), CFI = 0.980, TIL = 0.975, SRMR = 0.062.

As expected, SES predicted the initial status of both vocabulary and reading comprehension. SES explained 29.6%, 20.6% and 12.6% of the variance in vocabulary initial status for the bilingual Roma, the monolingual Roma and the non-Roma groups, respectively, and 8.4%, 14.8% and 10.5% of the variance in reading comprehension initial status for the bilingual Roma, the monolingual Roma and the non-Roma groups respectively. More interestingly, SES also predicted the growth of both vocabulary and reading comprehension in all three groups. Reading comprehension growth was additionally predicted by the initial status of vocabulary in the three groups. A total of 4.9%, 13.4% and 7.8% of the variance in vocabulary growth was explained for the bilingual Roma, the monolingual Roma and the non-Roma groups, respectively, and a total of 8.6%, 22.2% and 16.2% of the variance in reading comprehension growth was explained (bilingual Roma, monolingual Roma and non-Roma groups respectively). In addition, there were strong correlations between the residuals of the two constructs at the initial status as well as between the growth of the two constructs, indicating that vocabulary and reading comprehension share a large portion of variance that is not explained by SES.

7.3 | School absence and nonverbal abilities as mediators between SES and growth in vocabulary and reading comprehension

To see whether the effect of SES on the growth of vocabulary and reading comprehension was mediated through nonverbal abilities and school absence, we added these two variables to our model, as shown in Figure 4. Also, here we executed invariance tests in which we fixed the invariant regression paths to be equal across all three groups. The invariance tests were done construct for construct and showed invariance for all of the dependent constructs in the model, with the exception of the initial status of reading comprehension and school absence. The results of the invariance testing can be seen in online supplement Table S5. This final three-group model had very good fit to the data, χ^2 (241) = 349.842, p < 0.001, RMSEA = 0.052 (10% CI = 0.040–0.064), CFI = 0.967, TIL = 0.959, SRMR = 0.063.

The addition of school absence and nonverbal abilities yielded some interesting changes compared to the former model. First, the direct effect of SES on reading comprehension growth was still significant for all groups. In addition, there were significant paths from both school absence and the initial vocabulary skills. Children with more absences and poor initial vocabulary skills had a slower development of reading comprehension compared to children with fewer absences and good initial vocabulary skills in all three groups. The two significant predictors of vocabulary growth were school absence and nonverbal abilities. The direct path from SES to vocabulary growth became nonsignificant when nonverbal abilities and absence were controlled for. Absence was predicted from by SES in the bilingual Roma and the non-Roma groups and from nonverbal abilities in the two Roma groups. Initial status of vocabulary was predicted by SES and nonverbal abilities, and the same was the case

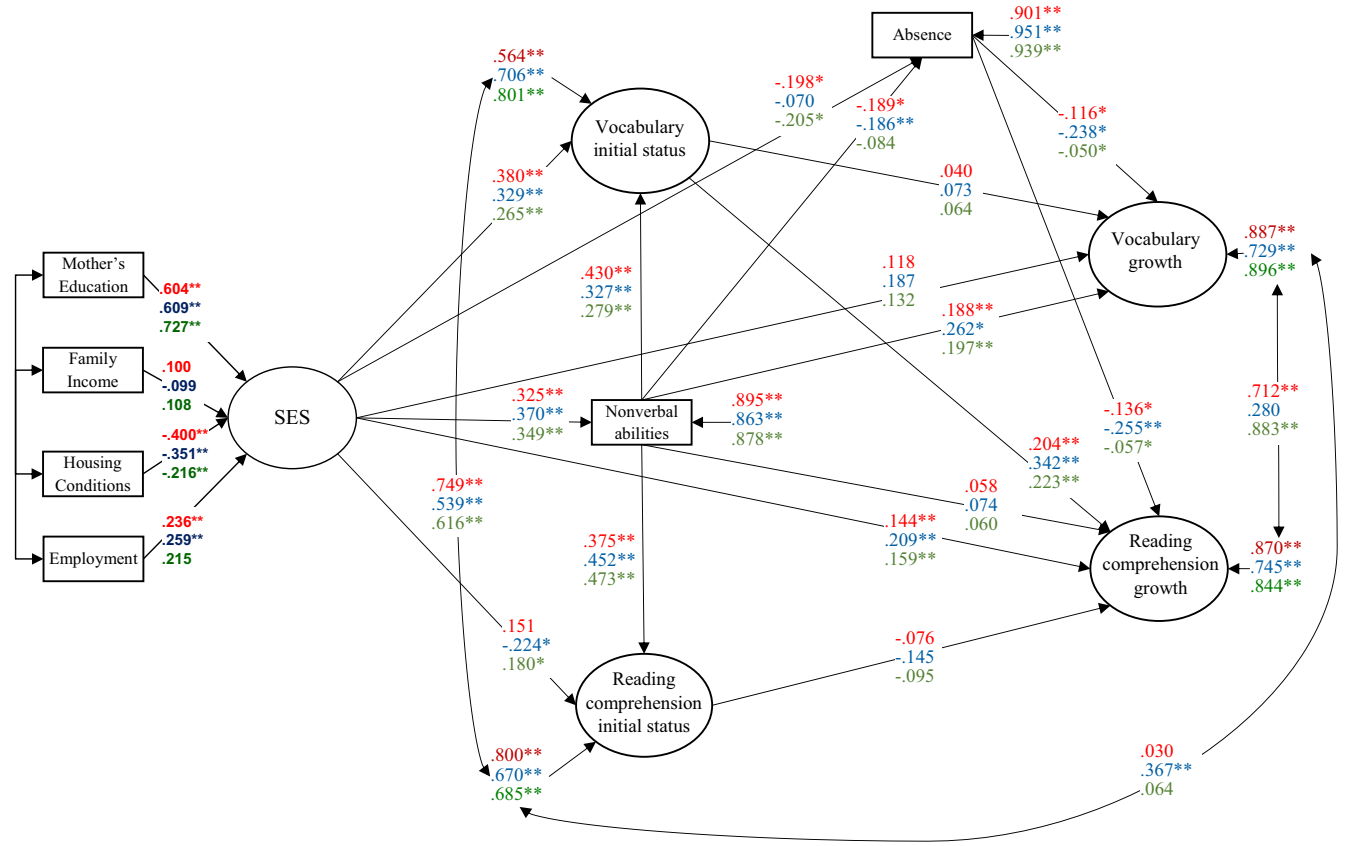

FIGURE 4 Initial status and growth in vocabulary and reading comprehension when the relationship with SES was partly mediated through absence and nonverbal IQ in bilingual Roma Romanian, monolingual Roma and non-Roma children (coefficients for bilingual Roma Romanian at the top, then monolingual Roma and non-Roma children at the bottom). All coefficients are standardized

for the initial status of reading comprehension, with the exception of the path from SES in the monolingual group.

We also tested for indirect effects by bootstrapping the confidence intervals of the indirect effects of SES on the growth of vocabulary and reading comprehension. All of the total indirect effects were significant: The total indirect effects of SES on vocabulary growth were 0.112 (95% CI = 0.010, 0.298), 0.163 (95% CI = 0.021, 0.398) and 0.104 (95% CI = 0.010, 0.246) for the bilingual Roma, the monolingual Roma and the non-Roma respectively. The total indirect effects of SES on reading comprehension growth were 0.139 (95% CI = 0.061, 0.254), 0.159 (95% CI = 0.039, 0.333) and 0.118 (95% CI = 0.045, 0.217) for the bilingual Roma, the monolingual Roma and the non-Roma respectively. However, none of the specific indirect effects were significant, making it difficult to isolate specific mechanisms in which SES affects the growth of vocabulary and reading comprehension.

Finally, the bootstrapped confidence intervals confirmed that all total effects (direct plus indirect effects) were significant for all three groups: The total effects of SES on vocabulary growth were 0.229 (95% CI = 0.075, 0.516), 0.349 (95% CI = 0.103, 0.582) and 0.236 (95% CI = 0.061, 0.430) for the bilingual Roma, the monolingual Roma and the non-Roma, respectively, and the total effects of SES on reading comprehension were 0.284 (0.131, 0.388), 0.369 (0.143, 0.541) and 0.277 (0.115, 0.395).

8 | DISCUSSION

Through this longitudinal study, we have revealed several important findings concerning the development of vocabulary and reading comprehension in children facing severe poverty. First, the results demonstrate that the poorer Roma children had both significantly lower initial levels and slower growth rates in vocabulary and reading comprehension skills compared to the more fortunate non-Roma children. Second, the bilingual Roma children had poorer initial vocabulary and reading comprehension skills compared to the monolingual Roma children, but the growth in these skills did not differ across these two groups. For all groups, initial vocabulary affected reading comprehension growth. Third, SES predicted not only initial status but also growth in vocabulary and reading comprehension for all three groups. In all three groups, school absence and nonverbal abilities predicted growth in vocabulary. Absence was predicted by SES in the bilingual Roma and non-Roma group but also by nonverbal abilities in the two Roma groups. Finally, there were also significant indirect effects of SES on both vocabulary and reading comprehension growth through nonverbal abilities and school absence. However, the specific indirect effects were not significant, making it difficult to pinpoint specific indirect effects through nonverbal abilities and school absence in isolation.

8.1 | Differences in levels and growth of vocabulary and reading comprehension across groups

The study revealed worrisome differences in initial levels between the Roma children and non-Roma children for both vocabulary and reading comprehension. This coincides with other previous studies focused on children facing poverty, both in the U.S. (Guo & Harris, 2000; Herbers et al., 2012) and in other countries, including Serbia (Baucal et al., 2006; Biro et al., 2009). The differences between children facing poverty and children originating from more ordinary SES backgrounds in these studies ranges from 0.8 to 1.2 standard deviation units on vocabulary and reading comprehension, which is similar to our findings. These results are clearly worrisome and confirm that Roma children have a conclusive disadvantage when they start school.

Moreover, our study demonstrated that bilingual Roma children possessed even lower levels than the monolingual children. None of the other studies focusing on children living in poverty have controlled for bilingualism; however, there are several existing studies showing that bilingual children have a collectively lower level in vocabulary and reading comprehension in their second language than monolingual children (Melby-Lervåg & Lervåg, 2014). Several reviews indicate that this is particularly the case for children from low SES backgrounds (Hoff, 2006; Melby-Lervåg & Lervåg, 2014).

Perhaps even more worrisome than the differences in initial levels of vocabulary and reading comprehension is the fact that the gap between the Roma and non-Roma groups increases rather than decreases over time since the growth rates of the two Roma groups were slower compared to the growth rates of the non-Roma children. For reading comprehension, this difference was as large as one standard deviation. A post-hoc analysis of our current data also showed that the mean growth of vocabulary and reading comprehension was not significantly different across groups after controlling for SES (i.e. in the model shown in Figure 3 [χ^2 (4) = 5.421, p = 0.247]), while the differences were still present for the initial statuses (χ^2 [4] = 20.33, p < 0.001). Furthermore, initial status did not predict the growth rates after controlling for SES. Thus, it is not necessarily the level at the beginning of school that seems to affect the growth rates of vocabulary and reading comprehension; rather, it is the differences in SES. Hence, SES can explain the differences found between the Roma and non-Roma children in regard to how fast they develop their vocabulary and reading comprehension skills. Notably, the variables in this study explained between 4.9% and 13.4% of the growth in vocabulary for each group and between 8.6% and 22.2% of the growth in reading comprehension for each group. This reflects the complex and multifactorial nature of poverty, child development and learning, and that understanding these aspects require a number of variables to be taken into account.

It is important to note that the differences between the groups may be due to both differential input and differential uptake. It has been demonstrated that teachers of Roma children can show preferences for one group over another and that educational material is not adapted to the Roma group and can be alienating for them (Derrington, 2007). This differential input can contribute towards Roma children not profiting from school as much as the non-Roma children as well as having a slower growth rate compared to their non-Roma peers. In addition, differences in growth may also be due to differences in uptake; for instance, the Roma children have more absences than the other children, and bilingualism affects their development.

None of the previous studies concerning Roma children has had data suited to examining vocabulary and reading comprehension development over time. However, a study of children in the U.S. being exposed to concentrated disadvantages (poverty, unemployment, households with single parents receiving welfare) showed a comparable result: being severely disadvantaged also had a negative impact on vocabulary development, not only initial status (Sampson et al., 2008). A similar finding for children living in poverty was also reported in regard to reading comprehension (Herbers et al., 2012), which is in line with our findings.

Notably, although there were differences in initial levels, there were no significant differences in growth rates between the bilingual and monolingual Roma children. We did not measure vocabulary on the bilingual Roma's first language. Thus, this can perhaps partly explain why they are more disadvantaged when they start out but then develop at the same pace as monolingual Roma children. It may be that, if tested on their first language and adding the words they know only in their mother tongue to the words they know in both languages (or only in the school language) (see Oller, 2005), the vocabulary in total would be comparable to that of the monolingual Roma children. However, the differences in initial status are in line with a number of studies in the area of bilingualism, vocabulary and reading comprehension (for a review, see Melby-Lervåg & Lervåg, 2014). It is hypothesized that bilingual children face an additional challenge with the joint activation of two languages and that this causes poorer performance on vocabulary tests than monolingual children even when they are given the choice to respond in a preferred language (Bialystok, 2017; Oller, 2005).

Moreover, the insignificant differences in growth suggest that, even if the bilingual Roma children are more disadvantaged when they start school, they develop at a similar pace as the monolingual Roma children. This seems to be somewhat at odds with other studies in the area, which have demonstrated that bilinguals also can have a slower growth rate than monolinguals (Lervåg & Aukrust, 2010). However, it should be noted that very few studies in the area of bilingualism have used growth models and that the samples in terms of SES are very different compared to the samples used for the current study.

8.2 | The Relationship between SES, absence and nonverbal abilities

The study also showed a strong relationship between not only initial status in vocabulary and reading comprehension with SES but also a growth in vocabulary and reading comprehension across all three groups. This contradicts the conclusion in a previous review, which

states that SES is merely a correlate and explains neither growth in reading nor in components related to reading over time (Buckingham et al., 2013). However, the difference between this study and the previous review may be that the studies included in the review have had a restricted SES range and have not been able to include children from SES-deprived backgrounds. As mentioned earlier, for children facing poverty, there now seems to be compelling evidence that low SES is not merely a correlation but also a restriction on the pace of developing these skills (Herbers et al., 2012; Sampson et al., 2008). It may be the case that reading at home is less prevalent for children facing poverty since parents with low SES backgrounds often have little tradition regarding reading due to illiteracy and a weak educational foundation (Hoff, 2006). This explanation is in line with a study indicating that the strongest mediator of the relationship between SES and a latent construct of vocabulary and reading comprehension, among other things, was cognitive stimulation at home (Guo & Harris, 2000).

Finally, the study has also revealed information about the mechanisms that might explain why SES affects vocabulary and reading comprehension; one such factor is nonverbal IQ. It is well known that living in poverty affects nonverbal IQ biologically because stress, poor nutrition and health services received during pregnancy and early childhood affects nonverbal IQ (Guo & Harris, 2000). Notably, nonverbal IQ scores in different cultural contexts may vary based on relative experience with these types of factors. Also, evidence suggests that children raised in a context of poverty may receive less cognitive stimulation at home perhaps due to low literacy levels in the individuals living there (Guo & Harris, 2000). Low nonverbal abilities may subsequently affect vocabulary and reading comprehension (Lervåg & Aukrust, 2010). Importantly, there is considerable individual variability among children raised in low SES contexts, as we have also demonstrated here. It is important that both risk and protective factors operating at the individual level may vary considerably, although on average there may be large SES-based differences. Another critical factor is absence. Given that it has long been known that attending school increases both nonverbal and verbal IQ, it is not surprising that being absent from school has negative consequences (Ceci, 1991). In addition, it has been demonstrated that children with low SES are particularly prone to absence from school due to family duties and obligations to contribute towards the family income from an early age (Morrisey et al., 2014). In our study, both SES and nonverbal abilities predicted absence, but not in all groups. Why SES did not predict absence in the monolingual Roma group and why nonverbal abilities did not predict absence in the non-Roma group are, however, difficult to explain and are left unanswered from our data.

9 | CONCLUSION

9.1 | Recommendations for future research

This study claims that SES affects the development of reading comprehension and that living in poverty can have detrimental effects on verbal abilities because it constrains vocabulary development. This issue is highly worrisome and must be followed more closely in future research and policy making. First, there is a great need for more studies conducted on children living in poverty to further reveal the mechanisms responsible for the resulting negative consequences. Here, we have studied absence and nonverbal IQ. However, future studies should also examine in further detail how the nature of cognitive stimulation at home, nutrition and mother/child health services received during pregnancy and early childhood affect children's development.

Moreover, there is a great need for intervention studies and randomized controlled trials that aim to improve school and life outcomes for Roma children. One important pathway may be to develop family–school collaborative educational programs that would assist parents on how to improve the home literacy environment (Reynolds et al., 2017). A non-supportive home environment is persistent, and instructional activities conducted at school can only partially compensate for the disadvantages of a low SES (Hoff, 2006). There are also randomized controlled trials that have shown promising effects from parent-delivered early language enrichment programs in socially diverse areas (Burgoyne, Gardner, Whiteley, Snowling, & Hulme, 2018). Roma parents might present a particular challenge to target because, on average, literacy and education rates are lower, and resources in the home (e.g. books) may be less prevalent. Therefore, additional consideration of existing resources and home-based supports might be required to facilitate the implementation of a parent-delivery model. Thus, because of the challenges in targeting the parents, interventions and high-quality instruction in school is of vital importance to break the poverty cycle for the Roma group. Our study shows that it is vital for interventions to focus on building these children's language comprehension and vocabulary. Language comprehension skills also serve as a foundation for decoding skills, which is also vital for reading comprehension (Metsala, 1999). Thus, intensive interventions targeting language comprehension and vocabulary potentially give benefits for vocabulary, decoding and reading comprehension. Prior studies have shown that small-group instruction seems particularly effective for this (see for a systematic review). However, providing effective interventions to this group in school also requires working with the teachers and school leaders. Studies have shown that the Roma group often experiences prejudice, lack of support from school and discrimination (Derrington, 2007). These are also important issues to deal with to ensure that Roma children get the high-quality education and instruction they need.

Thus, the Roma group requires interventions relating to several aspects of their lives, and in addition to parental involvement, engagement in school, and high-quality instruction in school, interventions should also target other aspects of these children's lives, such as family income and access to healthcare. Most likely due to the associated complexities, only a small number of studies have attempted to intervene in factors outside school. Nevertheless, the few studies that have actually accomplished this task (i.e. not only

targeted school factors but also family SES and health) show promising results (Dearing et al., 2016). Thus, in the future, more studies are needed to examine and develop well-targeted interventions focusing on broader aspects of children's lives that include both instruction in school as well as family income, health, parental involvement in homework and engagement in school. It is important to conduct such interventions from an early age since a poor vocabulary might have cascading effects over time.

ACKNOWLEDGEMENTS

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CONFLICT OF INTEREST

No conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author (Arne Lervåg) upon reasonable request.

ENDNOTE

[1] In our sample, the two Roma groups had an average income in category 4, which corresponds to between 30 and 130 Euros a month and the non-Roma group had an average income in category 7, which corresponds to between 270 and 310 Euros a month. The Romanian Labor Department reported the average monthly net salary to be about 400 Euros (this data pertains to state and private sector employees only (and not entrepreneurs)).

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