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The contribution of spoken language and socioeconomic background to adolescents' educational achievement at age 16 years

Abstract

Background: Well-documented associations exist between socioeconomic background and language ability in early childhood, and between educational attainment and language ability in children with clinically referred language impairment. However, very little research has looked at the associations between language ability, educational attainment and socioeconomic background during adolescence, particularly in populations without language impairment.

Aims: The paper investigated: a) whether adolescents with higher educational outcomes overall had higher language abilities; and b) associations between adolescent language ability, socioeconomic background and educational outcomes, specifically in relation to Mathematics, English Language and English Literature GCSE grade.

Method & Procedures: 151 participants completed five standardised language assessments measuring vocabulary, comprehension of sentences and spoken paragraphs, and narrative skills and one nonverbal assessment when between 13 and 14 years old. This data was compared to the participants' educational achievement obtained upon leaving secondary education (16 years old). Univariate logistic regressions were

employed to identify those language assessments and demographic factors that were associated with achieving a targeted A*-C grade in English Language, English Literature and Mathematics General Certificate of Secondary Education (GCSE) at 16 years. Further logistic regressions were then conducted to further examine the contribution of socioeconomic background and spoken language skills in the multivariate models.

Results & Outcomes: Vocabulary, comprehension of sentences and spoken paragraphs, and mean length utterance in a narrative task along with socioeconomic background contributed to whether participants achieved an A*-C grade in GCSE Mathematics and English Language and English Literature. Nonverbal ability contributed to English Language and Mathematics. The results of multivariate logistic regressions then found that vocabulary skills were particularly relevant to all three GCSE outcomes. Socioeconomic background only remained important for English Language, once language assessment scores and demographic information were considered.

Conclusions & Implications: Language ability, and in particular vocabulary, plays an important role for educational achievement. Results confirm a need for on-going support for spoken language ability throughout secondary education and a potential role for speech and language therapy provision in the continuing drive to reduce the gap in educational attainment between groups from differing socioeconomic backgrounds.

Key words: assessment, education, social class, poverty, vocabulary, secondary school.

Introduction

Socioeconomic Disadvantage and Educational Attainment

The disparity in educational outcomes of children from different socioeconomic backgrounds is a continuing concern in the UK (e.g. Ofsted 2013; Alexander et al 2009; Centre for Social Justice 2013; National Children's Bureau 2013), the USA (Bradbury et al. 2015) and Australia (Smyth and Wrigley 2013). Several factors can be used to assess socioeconomic background, with common measures including: parental income and level of education; household income or children being in receipt of free school meals (FSM) as evidence of low-income; and area-based statistics incorporating data such as employment, crime, living conditions and health. Despite inconsistency in measurement, research has shown that socioeconomic background and pupils' educational attainment are associated at all levels of schooling and further education (Machinm and Vignoles 2004; Sirin 2005; Connolly 2006; Fergusson, Horwood and Boden 2008; Demack, Drew and Grimsley 2000; Strand 2014). In the UK, this association is clear in national attainment statistics, for example in 2012, only 36% of

pupils in receipt of FSM attained five or more grades A*-C in their General Certificate of Secondary Education (GCSE) examinations (including English and mathematics) at the age of 16 years, compared to 63% of pupils who were not eligible for free school meals (Department for Education 2012). This has important consequences for pupils' life chances because many education and employment options after compulsory schooling have entry requirements including obtaining five or more GCSE grades at A*-C level including mathematics and English. Pupils entitled to FSM have also been found to make poorer progress than those not eligible, across primary and secondary education (Strand 2011; DCSF 2009). The Cambridge Primary Review (Alexander et al. 2009) concluded that a top priority for education was to reduce inequity in educational outcomes of children from different socioeconomic backgrounds.

While the association between socioeconomic background and educational outcomes is widely acknowledged, any explanatory mechanisms are the result of multiple factors (e.g. Feinstein and Symons 1999; Robertson and Symons 2003; Perry and McConney 2010; Department for Education 2011; Strand 2011; Thomas et al. 1997). Socioeconomic disadvantage reduces the possibility of benefitting from education in diverse ways, e.g. through the impact on health, wellbeing and housing as well as the availability of high quality schooling (Ball 2013). Research has attempted to understand the multiple layers of causal factors associated with educational inequality. For example, Rasbash, Leckie, Pillinger and Jenkins (2010) examined the relative

contribution of family, schooling, local education authority and neighbourhood effects on variation in educational progress, using data from 5,116 twin pairs within the English national database. Results indicated that family effect accounted for 40% of the overall variation in learning progress, with 22% attributable to the shared environments of primary and secondary school, neighbourhood and local education authority factors. This left 38% of variation at individual pupil level, before including demographic information such as gender, race, neighbourhood deprivation, and special educational need status (Rasbash, Leckie, Pillinger and Jenkins 2010).

There are also intersections between socioeconomic background and other demographic predictors of educational outcomes. Though the impact of socioeconomic factors on educational attainment in the UK is thought to be greater than the impact of either gender or ethnicity (Gillborn and Mirza 2000; Strand 2011), there are important interactions in these factors, particularly between ethnicity and SES, and between ethnicity and gender (Strand 2014). Understanding potential causal pathways between social factors and educational outcomes is complex. For example, research has examined peer effects on attainment in secondary school (e.g. Levin 2001) but this is complicated by biases such as self-selection, whereby pupils select a peer group with similar characteristics, as well as unaccounted for co-variables (Hanushek, Kain, Markman, and Rivkin 2003). There is also likely to be variation in the impact of causal factors on attainment in different curriculum subjects. For example, Steele, Vignoles

and Jenkins (2005) reported that increased financial resources for schools resulted in higher pupil attainment in mathematics and science but not in English. Associations between socioeconomic background and educational outcomes are well documented, though the mechanisms underlying this association are notoriously complex and involve intersections with multiple influences on attainment.

Spoken language ability as a predictor of educational attainment

Spoken language ability includes a range of skills thought to impact on learning in the classroom, such as vocabulary (receptive and expressive), syntactic and semantic knowledge, and narrative discourse processes (including inference, comprehension and storytelling). There are multiple ways that spoken language ability can impact upon educational attainment. Vocabulary skills are important because of the complex and abstract vocabulary used in the curriculum (Nagy and Townsend 2012), and the impact of vocabulary learning on reading comprehension and writing (e.g. Snow, Porche, Tabors and Harris 2007; Chall, Jacobs, and Baldwin, 1990). Spoken language comprehension and expression is also central to learning by teacher talk and pupil discussion (Dockrell, Lindsay and Palikara 2011), particularly during adolescence when understanding and contributing to debate and discussion features increasingly as a mode of learning. Oral language is important in relation to problem solving during group work in the classroom (Mercer and Sams 2006). Verbal reasoning is also a component of cognitive ability, which is relevant to educational attainment (e.g. Deary et al 2005)

and is frequently assessed upon starting secondary school to predict educational progress, for example in England pupils sit the verbal subtest of the Cognitive Abilities Tests (Strand 2006).

Robin Alexander argues that spoken language is pivotal to learning across the curriculum and that the role of language in education is twofold: 1) Oral pedagogy is the particular kind of talk that mediates all learning, in all subjects. Research into dialogic teaching demonstrates that teacher talk can be used to effectively extend pupils' thinking and understanding (Alexander 2008); 2) Teachers have a responsibility to support pupils to develop their capacity to use speech to express their ideas in all areas of the curriculum. Mastery of a subject such as mathematics or music is a mastery of the language (vocabulary, grammar, discourses) associated with the subject. Furthermore, teachers extend pupils' repertoires of talk, for example, to explain, analyse, speculate, and evaluate (Alexander 2008).

Longitudinal studies with clinical populations (e.g. often participants diagnosed with specific language impairment) identify language as a predictive factor in educational attainment at the end of secondary school. Dockrell, Lindsay and Palikara (2011) found that a clinical cohort of 62 adolescents had lower levels of education attainment upon leaving school at 16 years compared to national data and that language contributed to educational attainment, though the impact of language skills appeared to reduce over time. Similarly, Conti-Ramsden et al (2009) reported that for 120 adolescents with a

history of diagnosed language impairment, language accounted for an additional 2% in variance of GCSE exam results in addition to non-verbal IQ, literacy and maternal education levels. A 20-year longitudinal study in Canada showed that 53% of 75 adults with a history of childhood clinical language difficulties completed at least some postsecondary education, compared to 81% of a control group (n = 132) (Johnson, Beitchman and Brownlie 2010). Therefore, there is evidence that language difficulties are associated with educational attainment, but less is known about this association in populations of young people without a history of clinically diagnosed language impairment.

Research with groups of children who have clinical diagnoses of language impairment have given further insights into the relationship between language skills and performance in specific academic subjects such as mathematics (Morin and Franks 2009; Alt, Arizmendi and Beal 2014; Shaftel, Belton-Kocher, Glasnapp and Poggio 2006). Although the underlying mechanisms for this are not fully understood, it is likely that children with language impairment are disadvantaged due to: language-heavy mathematical reasoning tasks (Arvedson 2002); understanding the vocabulary underpinning mathematics, e.g. words such as divide, unit and multiple (Alt, Arizmendi and Beal 2014); the role of symbolic understanding in both language and mathematics (Fazio 1996); and the role of literacy in mathematics lessons (Draper and Siebert 2004). Very little research has looked at the associations between spoken language skills and

mathematics GCSE grade in populations without a clinical diagnosis of language impairment.

Socioeconomic disadvantage and adolescent language

Adolescents in a context of socioeconomic disadvantage have an increased risk of language difficulties, particularly in relation to vocabulary skills (Spencer, Clegg and Stackhouse, 2012). The longitudinal Home-School Study of Language and Literacy Development is one of a few studies in this area. Eighty-three 3 year olds from low-income communities in the USA were recruited and 47 were followed up through adolescence (Snow, Porche, Tabors and Harris 2007). Significant relationships between language, literacy and educational attainment were found throughout the study, but the predictive power of language in explaining educational outcomes reduced in adolescence (Snow et al 2007). While the study is ground breaking in highlighting the role of language skills in educational outcomes, it is based on a relatively small USA-based cohort and it only included adolescents from low-income households.

Language and educational outcomes in socially disadvantaged contexts

Concern about children's language skills in relation to socioeconomic disadvantage has attracted interest from policy-makers and politicians (Roulstone, Law, Rush, Clegg and Peters 2011) and language skills have been put forward as a foundation for a successful education (e.g. Allen and Duncan Smith 2008; Field 2010; Tickell 2011). The debate

around language ability as a contributor to the discrepancy in educational attainment across different socioeconomic groups is not new (e.g. Bernstein 1971; Wells 1986). However, there has been a renewed interest in this area, arising from a growing body of research suggesting that children from areas of socioeconomic disadvantage are at increased risk of language difficulties (Law, McBean and Rush 2012). For example, a review of the National Curriculum suggests that tackling poor language skills will lead to a reduction in educational inequality (Department for Education 2011: 52) and initiatives such as Every Child a Talker have focused on language as a means of increasing the educational attainment of socioeconomically disadvantaged children (Department for Children, Schools and Families 2008).

Limited research has examined the relationships between language ability, SES background and educational outcomes. Durham, Farkas, Hammer, Tomblin and Catts (2007) examined these associations in a cohort of 502 young children, using a battery of language assessments at 5 years and mathematics and reading grades at 2nd, 3rd and 4th grade of school (aged around 7 to 10 years). Maternal education and family income were used to measure SES. Authors concluded that the more positive school outcomes associated with higher-SES families was in fact largely determined by children's spoken language abilities, hypothesised to be due to the quality of interactions with mothers with a higher education level. Language levels had the strongest effect on reading measures in second grade (around age 7 years) but also had a large effect on

mathematics in third grade. This study highlights the potential relevance of language to reducing educational inequality. However, its sample is from one geographical area in the USA and half of the children were recruited to a wider study originally due to a clinically diagnosis of language impairment. Studies with nonclinical populations are required to test the authors' conclusion that 'much of the intergenerational transmission of socioeconomic status is associated with language transmission' (Durham et al. 2007: 302).

In summary, multiple layers of influence upon children's educational outcomes have been identified and widely researched, but very little research has investigated spoken language as a mechanism by which socioeconomic background may influence educational outcomes. In addition, very little is known about adolescent language ability and educational attainment, and most research has involved clinical populations. This study therefore addresses the following two research questions (RQ):

RQ1. Do adolescents with higher levels of educational attainment have better language skills when compared to those with poorer educational outcomes (as measured by attaining five or more A*-C passes at GCSE including mathematics and English)?

RQ2. What are the associations between socioeconomic background, language ability and educational achievement (as measured by A*-C versus D-Fail grades in GCSE mathematics and English)?

Method

Design

Participants were recruited to a wider study examining adolescent language ability in relation to socioeconomic factors (Spencer, Clegg and Stackhouse 2012; Spencer, Clegg and Stackhouse 2013). As part of this study, adolescents aged between 13 to 14 years old completed a standardised nonverbal assessment and a battery of language assessments selected to investigate: receptive skills at word, sentence, and narrative level and expressive skills using a narrative task. The current paper examines the associations between these assessment scores and educational attainment when participants were 16 years old. This is analysed along with participants' socioeconomic background, as measured by the area-based Indices of Deprivation (McLennan et al 2011). The Indices makes use of scores in seven domains (income, employment, health, education, crime, housing and services, environment) to rank the 32,482 super-ordinate areas of England, with 32,482 being the least deprived (see table 1). Participants' individual postcodes were used to calculate their socioeconomic ranking, which was then converted to percentile scores (lower percentiles had a lower socioeconomic rank). School administrative data on participants in receipt of free school meals (an indication of low household income) was also available, along with demographic information.

Participants were recruited from two secondary schools in a city in the north of England. The first school is situated in an area of low socioeconomic background; the

school's location is ranked in the bottom 2% of England's wards. Less than 20% of students in this school leave with five A*-C grades at GCSE including mathematics and English. Less than 40% of students leave with five A*-C grades in any GCSE subject. The second school is situated in an area with an average socioeconomic background. Using the Indices of Deprivation (McLennan et al 2011) the school is situated in an area ranked around the 50th percentile of England's wards. Approximately 60% of students in this school leave with five A*-C grades at GCSE including mathematics and English, three times that of the Low SES school. Around 70% leave with five A*-C grades in any subject.

Participants

Three hundred and twenty two students from aged 13 to 14 years were invited to participate, (211 from the socially disadvantaged school, 111 from the average SES school). Signed parental consent forms and student consent forms were received for 151 students (103 from the socially disadvantaged school, 48 from the average SES school). Students who were born outside the UK (n=1) and those with statements of special educational needs for learning difficulties (n=3) were excluded from the study.

Thirty-six (24%) participants spoke more than one language at home and were members of ethnic minorities born in the UK, primarily with Bangladeshi and Pakistani heritage. School administrative data confirmed that these participants were bilingual.

No participants were currently known to SLT services or had previous SLT noted in their secondary school record. No participants had statements of special educational needs. Table 1 shows the characteristics of participants.

Table 1 Approximately here.

Measures

i. The Test for the Reception of Grammar, Version 2 (TROG) (Bishop 2003) is a test of comprehension of English grammar at sentence level and includes inflections, function words and word order. The stimulus sentence is read by the tester and the participant is required to choose a picture which corresponds to the sentence from a choice of four. Standard scores are calculated with a mean of 100 and a standard deviation of 15. It is recommended for use with children aged from 4;0-16;0, as well as adults. The split half reliability of the TROG is 0.88.

ii. The Long Form of the British Picture Vocabulary Scale, Second Edition (BPVS) (Dunn et al. 1997) assesses receptive vocabulary at single word level. The participant is shown four pictures and required to select one that matches a word spoken by the tester. Standard scores are calculated with a mean of 100 and a standard deviation of 15. It is recommended for use with children aged

from 3;0-16;0. Split half reliability of the BPVS is 0.86, with a Cronbach's alpha of 0.93.

iii. The Expression, Reception, Recall of Narrative Instrument (ERRNI) (Bishop 2004) assesses expressive language and narrative skills. A series of fifteen pictures are presented in sequence to elicit a narrative involving false belief. The ERRNI initial narrative was used to give a measure of narrative skills only. The story was audio-recorded and transcribed. The transcription is divided into utterances and two scores were calculated: mean length utterance score for the complexity of grammatical structure; and an information index for the amount of relevant story content. Standard scores and percentiles for both measures can be calculated, with a mean of 100 and a standard deviation of 15. It is recommended for use with children aged from 6;0-16;0 and can be used with adults. Cronbach's alpha for the information score is 0.90.

iv. Clinical Evaluation of Language Fundamentals Third Edition Listening to Paragraphs subtest (CELF-3 Listening to Paragraphs, Semel, Wiig and Secord 1995) was administered to assess receptive skills. The participant is read short paragraphs by the examiner and five corresponding questions are asked to test understanding of the main idea, detail, sequence, inference and ability to predict. A practice paragraph is read (which is not included in calculation of the score), and two test paragraphs with questions follow. Standard scores are calculated

with a mean of 10 and a standard deviation of 3. It is recommended for use with children aged from 6;0-16;0. The Cronbach's alpha for this subtest with 13 year olds is 0.57. This is lower than other subtests of the CELF-3, which is thought to be due to the fewer items on this subtest and the 0-1 range of score points.

v. Wechsler Abbreviated Scale of Intelligence Vocabulary Subtest (WASI Vocabulary, Wechsler 1999) was measured to give a measure of expressive vocabulary, verbal knowledge and verbal reasoning. The participant is presented with a word (written and orally) and asked to define it. Responses are given 0 to 2 points depending on the thoroughness and saliency of their definition. Standard scores are calculated with a mean of 50 and a standard deviation of 10. This assessment was used as it is thought to be a valid measure of expressive vocabulary and definitional skill. It is recommended for use with people aged from 6;0 - adulthood. Split half reliability of this subtest for 13 year olds is 0.86.

vi. The Wechsler Abbreviated Scale of Intelligence Block Design Subtest (WASI Block Design, Wechsler, 1999) is a measure of nonverbal ability which includes spatial visualisation, visual-motor co-ordination, abstract conceptualisation and perceptual organisation. Participants are presented with 13 geographic patterns and are asked to replicate the patterns using their own set of two-colour cubes. The duration of participants' attempts is timed and their score is dependent on successful replication of the target within one of four time

bands. Standardised scores are calculated with a mean of 50 and a standard deviation of 10. Split half reliability of this subtest for 13 year olds is 0.92.

General Certificate of Secondary Education (GCSE) exams: These national measures of academic attainment were used to evaluate pupil progress. GCSEs are graded A*-G; bands of pass grades are described as either level 2 (A*-C), the target higher level, or level 1 (D-G). Many options after compulsory schooling have entry requirements including obtaining five or more GCSE grades at A*-C level including mathematics and English. This is also an important benchmark for school evaluation data as schools with fewer than 40% of pupils achieving at this level are considered to be underperforming and in need of improvement. This benchmark was used as a measure of overall achievement at GCSE in relation to research question 1 because variation in the exam boards and choice of subjects available across the two schools did not allow comparison of total GCSE points. For example, only one school offered BTEC qualifications in subjects such as Health and Social Care and Business (a Level 2 BTEC First Diploma is worth the equivalent of four A*-C grade GCSEs).

For research question 2, grades in the mathematics and English were considered in order to allow a comparison of the role of language in these subject areas. However, the sample size in the current study did not support analysis based on

individuals' grade obtained in mathematics and English. Therefore, the data was dichotomised into achieving a higher grade (A*-C) or not (grade D-G plus fails). Although grades D-G are considered a GCSE pass, grades C and above are the target level.

Participants in the study studied for two English GCSE courses: Language and Literature. The English Language GCSE assesses reading, understanding and analysis of a range of texts along with writing clearly for different purposes. The English Literature GCSE assesses deeper understanding of key texts, for example a Shakespeare play, a novel from the 19th century, a selection of poetry and a work of fiction or drama produced since 1914. These core texts are studied in detail, which, along with wider reading, is preparation for analysis of unseen texts during examinations. Both English GCSE curriculums develop critical reading and comprehension, evaluation of writers' choices of vocabulary, grammar and structural features and comparison of texts.

Procedure

The study gained ethical approval following the [name of institution] ethics procedure. The purpose of the study was explained to all potential participants in year group assemblies. They were then provided with an information sheet and consent form to

give to their parent/carer who returned the consent form to school. Participants also completed a consent form.

Assessment took place individually in a quiet room within the school and was carried out by the first author, a qualified speech and language therapist. At the beginning of this session, the purposes of the study were explained again and participants were given the opportunity to ask any questions and to withdraw from the study if they wished. No participants withdrew from the study. Assessments were administered in a single hour-long session in the following order: TROG, BPVS, ERRNI, CELF-3 Listening to Paragraphs, WASI Block Design, and WASI Vocabulary. These assessments were completed when participants were aged 13-14 years and GCSE results were obtained from the two schools when participants were 16 years old (in 2010 and 2011).

Analyses

Descriptive statistics for the cohort were carried out to identify mean scores, standard deviation and normality of distribution. Independent t-tests were employed to test for differences on the independent measures (vocabulary (BPVS and WASI Vocabulary) comprehension of sentences (TROG) and spoken paragraphs (CELF LP), narrative skills (ERRNI MLU and Information score) and nonverbal ability (WASI BD)) for participants who achieved 5 or more A*-C grades including mathematics and English versus those who did not achieve this benchmark. A Bonferroni correction was undertaken here to account for multiple testing. Univariate and multivariate logistic

regression analyses were conducted to investigate the association, unadjusted and adjusted respectively, of the various language assessment measures (vocabulary, comprehension of sentences and spoken paragraphs, narrative skills and nonverbal ability) and within child factors (gender, bilingual status and socioeconomic background) and A*-C grades versus D-Fail grades on each of the GCSE subjects (English Language, English Literature and mathematics). The multivariate logistic regression models used those variables found to be significant, $p<.10$, at univariate level and reports which academic factors remained associated when combined in each of the academic outcome models. For the multivariate models, the model fit (chi square), odds ratio (OR) and the 95% Confidence Interval (CI), OR (95%CI), the classification table and Nagelkerke's Rsquare are reported. The odds ratio reports the increase or decrease in the odds for a variable relative to; the variable reference category for binary variables (e.g. girls compared to boys) and for a unit increase in continuous variables (e.g. a score of 21 compared to 20), of being in the outcome category, A*-C grade pass, as opposed to D-Fail grade. For continuous variables an increase of greater than one, inflates the associated odds ratio for that variable by a power of the change (e.g. a score of 25 compared to 20, increases the odds ratio to odds ratio[5]).

Spearman's nonparametric correlation was used to assess the relationship between the independent variables and the academic outcomes, in order to check for multicollinearity. Due to the high correlation between the BPVS and WASI Vocabulary

assessments a composite vocabulary score was included in the multivariate logistic regression models: This was calculated by converting the two assessment scores into z-scores and then calculating the mean of these, e.g. ((BPVS score – 100) / 15) + (WASI Vocabulary score – 50) / 10) / 2.

Due to the interrelation among the socioeconomic indicators, school attended, being in receipt of free school meals and socioeconomic background based on individuals' postcode were entered in separate models where applicable, to assess the robustness of the findings for the other remaining independent variables. The choice of socioeconomic indicator had no effect on the odds ratio.

The level of significance was 0.05, 2 sided and the analyses was undertaken with SPSS Version 22 (IBM 2013).

Results

Table 2 shows descriptive statistics for language, nonverbal and GCSE outcome measures in terms of overall achievement (five or more A*-C grades including mathematics and English) and pass levels in mathematics, English Language and English Literature.

As noted, GCSE data was dichotomised into higher level 2 grade (A*-C) versus lower level 1 grades (D-G) and examination fails. A significant association existed between these dichotomous outcomes; English Language and, Literature (chi square=

94.098(1), p<0.001), Mathematics (chi square= 52.478(1), p<0.001), and English Literature and Mathematics (chi square= 41.122(1), p<0.001).

Table 2 Approximately here

Do adolescents with higher levels of educational attainment have better language skills?

Table 3 compares the language skills of participants who did and did not achieve five or more A*-C grades at GCSE or equivalent. Results show that participants who attained five or more GCSEs at A*-C including mathematics and English scored higher on the nonverbal measure and on all language measures except the ERRNI Information score.

Table 3 Approximately here

What are the associations between socioeconomic background, language ability and educational attainment?

Table 4 shows that both school attended and socioeconomic background influence all the academic outcomes while those in receipt of free school meals was found to affect only English Literature and mathematics. Increasing affluence (based on the individual postcode socioeconomic data) (OR 1.038, 1.024 and 1.030 respectively) indicated a

small increase in odds for each 1% increase in IMD percentile (more affluent direction). An increase in IMD of 3 per cent would imply a 22-fold increase in odds of being in the higher passing group. Attending school in the more advantaged area showed increased odds (OR 7.634, 3.597, 3.534 for English Language, Literature, and Mathematics respectively) of an A*-C grade compared to those attending school in the less advantaged area. Compared to those in receipt of free school meals those who were not in receipt had approximately double the odds for English Literature and Mathematics A*-C passes, (OR 2.375 and 2.110 respectively). Girls had approximately three times greater odds, compared to boys, of an A*-C grade in Language and Literature, (OR 3.257 and 2.747 respectively). A bilingual participant had a threefold increase in odds (OR 3.030) over those monolingual to have a higher grade in English Literature. Understanding sentences (TROG) (OR 1.058, 1.049, and 1.088) and spoken paragraphs (Celf-3 LP) (OR 1.447, 1.544, and 1.322), Mean length utterance (ERRNI MLU) (OR 1.028, 1.031, and 1.027) and the vocabulary composite score (OR 3.658, 3.320 and 5.24) were all associated with a higher grade on all three subjects, (English Language, Literature and Mathematics respectively), with the vocabulary composite score having the greatest affect with approximate three to five times increase in odds (OR 3.658, 3.320 and 5.24) for increasing a score by one. While Nonverbal ability (WASI Block design) was related to English Language (OR 1.048) and Mathematics (OR 1.090), and

the expressive narrative assessment (ERNNI Information score) was not associated with any outcome.

Tables 4 Approximately here

The multivariate analysis results are reported in Table 5.

From Table 5, the tests of the full model against constant only models (chi square) for each outcome was statistically significant, indicating that the variables reliably distinguished between those gaining a A*-C grade and those with a D grade to fail for each of the GCSE outcomes. Nagelkerke's Rsquare indicated a moderate relationship between the observed and predicted categories. Prediction success overall was; Language 76.4% (75.3% for D-Fail and 72.2% for A*-C grade), Literature 80.6% (83.3% for D-Fail and 77.8% for A*-C grade) and for Mathematics 80.6% (80.8% for D-Fail and 69.6% for A*-C grade). The regression analyses demonstrated that composite vocabulary score only made a significant contribution to each of the academic outcomes (OR 3.095, 4.720 and 5.240 for English Language, Literature and Mathematics respectively). The associated adjusted odds ratio indicated that increasing the score by one here resulted in the pupils having quadrupled their odds of having an A*-C grade in Language and Mathematics, and fivefold for Literature. Similarly; for Language and Literature girls had a trifold increase in odds over boys to have a higher grade (OR 2.966 and 3.063 respectively), and for Literature alone those who were bilingual had seventeen fold increased odds (OR 16.887) to have a higher grade than

those who were not and an increased score of one in comprehension of spoken paragraphs (CELF-3 LP) gave an approximate 30% increase in odds (OR 1.289) of higher level passing. Socioeconomic background as measured by individual postcode data indicated an increase in odds of a higher grade for English Language (OR 1.022). Note that the separate models including either school attended, eligibility for free school meals or socioeconomic background as measured by individual postcode data produced similar results and hence the results reported above are from the models with socioeconomic background as measured by individual postcode data in the model, where applicable.

Table 5 Approximately here

Discussion

The aim of this paper was to examine the associations between socioeconomic background, language skills and educational outcomes during adolescence. The paper investigated: a) whether participants who achieved higher educational outcomes overall had higher language abilities; and b) associations between language ability, socioeconomic background and educational outcomes, specifically in relation to GCSE mathematics, English Language and English Literature achievement.

In the cohort of 151 adolescents, participants who did achieve five or more GCSE qualifications or equivalent at grades A*-C including mathematics and English had higher language abilities than those who did not. This suggests that language skills are relevant for overall achievement at the end of secondary school. The effect of language on outcomes in English and mathematics specifically was then examined. Univariate analyses showed that all language assessment measures contributed to GCSE outcomes in mathematics and English, with the exception of the ERRNI information score, a measure of narrative skill. The nonverbal measure, WASI block design, was associated with Language and Mathematics (not English Literature). Gender was also relevant to English Language and Literature achievement and bilingualism was relevant to Literature only. At the univariate level, socioeconomic background and school attended affected all three subject outcomes, while claiming free school meals was significant for English Literature and Mathematics. Further logistic regressions were then conducted to further examine the contribution of socioeconomic background and spoken language skills in the multivariate models. Results showed: the effect of gender remained for English Language and Literature with bilingualism and understanding of spoken paragraphs was relevant for English Literature; socioeconomic background played a role in English Language. A vocabulary composite, based on receptive vocabulary (BPVS) and definitional skills (WASI Vocabulary), was significant for outcomes across all three subjects. Therefore, vocabulary skills emerged as particularly relevant to GCSE

outcome, suggesting that on going support for vocabulary knowledge through the secondary years may be particularly important in order to facilitate positive educational outcomes (Biemiller 2012).

These results demonstrate that language ability is an important factor in young people's educational attainment. Very little research has examined this with mainstream secondary school pupils, although the finding is consistent with previous studies of adolescents with a history of clinical language difficulties (e.g. Dockrell, Lindsay and Palikara 2011; Conti-Ramsden et al. 2009). The relevance of language to adolescents' educational outcomes is important given that a) much policy and practice regarding support for language skills has focused on early years education (e.g. DfE 2008; Field 2010; Tickell 2011); b) there is a long-standing concern that very few services are provided for adolescents with language difficulties (Lindsay et al 2002) and c) whole-school support for the development of language skills are rare at secondary level (Roulstone et al 2012), although some examples have been positively evaluated (The Word Generation Project, Snow, Lawrence and White 2009; Secondary Talk, Clegg, Leyden and Stackhouse 2011).

Findings suggest that spoken language ability is relevant to the debate about reducing unequal educational outcomes of adolescents from different socioeconomic groups (e.g. Perry and McConney 2010; Department for Education 2011). Extensive research has examined the association between socioeconomic background and educational

outcomes (e.g. Strand 2011; Thomas et al 1997), and identified multiple layers of causal factors (e.g. Rasbash et al. 2010). However, there is a paucity of research into the relevance of spoken language skills in educational inequality. This study relates to the findings of Durham et al (2007) with younger children in the USA, demonstrating that language may be an important consideration when addressing the inequitable school outcomes of children and young people from low SES backgrounds.

Vocabulary was similarly associated with GCSE grades for both English and mathematics, which is perhaps surprising given the more explicit role of spoken language skills in relation to English when compared to mathematics lessons. However, the finding that spoken language skills are associated with mathematics GCSE grade is in line with research involving children with clinically diagnosed language impairment (Morin and Franks 2009; Alt, Arizmendi and Beal 2014; Shaftel, Belton-Kocher, Glasnapp and Poggio 2006; Fazio 1996; Donlan et al 2007). The current study furthers this work by demonstrating an association between mathematical ability and spoken language skills in a mainstream population without a clinical diagnosis of language impairment. The reasons for this association are unclear but may be related to the importance of verbal reasoning and vocabulary knowledge for mathematical learning (Arvedson 2002; Draper and Siebert 2004; Friedland, McMillen and del Prado Hill 2011). This is significant because it suggests that spoken language skills are strongly

associated with academic achievement across the curriculum and not just within the study of English.

In this study, bilingual status was relevant in predicting an A*-C grade in English literature, with bilingualism being an advantage associated with higher outcomes. This is consistent with research demonstrating that at age 16 all ethnic minority groups achieve significantly better than White British students in low SES contexts (Strand 2014). Further research is needed to investigate the interactions between such demographic information, spoken language ability and educational outcomes given previous research which has shown intersectionality between such factors and educational outcomes (e.g. Strand, 2014).

Vocabulary emerged as particularly relevant in educational attainment – more relevant than nonverbal ability and socioeconomic factors in multivariate models. However, socioeconomic background influences the possibility of benefitting from education in diverse ways, e.g. through the impact on health, wellbeing and housing as well as the availability of high quality schooling (Ball 2013). This study's findings suggest that spoken language ability may be one relevant consideration in the dynamic and complex relationship between socioeconomic background and educational outcomes, among many other structural, institutional and individual factors (e.g. Feinstein and Symons 1999; Robertson and Symons 2003; Perry and McConney 2010; Department for Education 2011; Strand 2011; Thomas et al 1997).

Study limitations

The sample size of this study is small for conducting a multivariate logistic regression and the associated effects can be seen in the wide confidence intervals for some variables. Future research with a larger cohort from a wider geographical area would increase the capacity for generalisation. Further research should also retest and extend our findings with data including previous academic attainment (Strand 2006) and literacy information, given the relationship between spoken and written language (Snow 2007). This study was only able to investigate outcomes in mathematics and English due to differences in subjects offered to pupils at GCSE level in the two schools and indeed a further limitation is the potential differences in assessment due to differing adopted examination boards. Due to the strong correlations between the WASI vocabulary measure and the BPVS, a composite vocabulary measure was used in our analyses. However, these assessments cover a range of skills (receptive vocabulary, definitional skill, verbal reasoning linked to cognitive ability). It is also important to note that standardised vocabulary assessments are open to cultural bias, as exposure to individual words will impact on scores and some items may be more favourable to more middle class experiences (e.g. the item ‘easel’ in the BPVS) (de Villiers 2004). Therefore, further research is needed to examine which aspects of vocabulary ability are important in predicting educational attainment.

Conclusion

This study is one of the first to empirically investigate the associations between language, educational outcomes and SES during adolescence. Its strength is in the comprehensive measures of spoken language and the non-clinically referred sample of adolescents. The conclusion that language is strongly implicated in predicting educational outcomes now warrants further research with a larger cohort and more detailed analysis of the intersections between factors. The results add empirical support to the recommendation that language skills should be supported within secondary schools as a means of supporting educational success (Department for Education 2011; The Communication Trust 2011). Language skills, and in particular vocabulary skills, may play a key role in the continuing drive to reduce the gap in educational attainment between groups from differing socioeconomic backgrounds and need continuous support throughout secondary education.

What this paper adds

What is already known on this subject

Socioeconomic background and pupils' educational attainment are associated at all levels of schooling and this is a continuing concern for policy-makers in the UK. Multiple and interacting factors have been put forward to explain this educational disparity. There is emerging evidence that language difficulties are associated with: a) socioeconomic background, and b) educational attainment in populations of adolescents

with a history of diagnosed language impairment. Adolescent language in non-clinical populations is understudied and very little previous empirical research has examined the associations between spoken language ability and educational outcomes at the end of secondary school.

What this study adds

The present study contributes to existing knowledge by examining associations between language and educational attainment at the end of secondary school. Results show that adolescents who achieved higher educational outcomes had higher language abilities and that language ability was associated with GCSE achievement in mathematics, English language and English literature. Vocabulary skills were particularly relevant for GCSE grades in both English and Mathematics.

This study suggests that vocabulary skills require ongoing support throughout secondary education and that spoken language skills may be important in the drive to reduce educational inequity.

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Tables

Table 1: Summary of participant characteristics

Gender (%)		**Language status (%)**		**In receipt of free school meals (%)**		
Girls	**Boys**	**Bilingual**	**Monolingual**	**Not in receipt**	**In receipt**	**Socioeconomic background - centile Indices of Deprivation**
81 (54%)	70 (46%)	37 (24%)	114 (76%)	105 (70%)	46 (30%)	Mean 20.70 (SD 26.49) Range - 0.25 – 96.34

Table 2: Descriptive statistics for language assessment standard scores (at age 13 – 14 years) and GCSE grades in mathematics, English Literature and English Language (at age 16 years).

GCSE outcomes		
Overall achievement	**Yes % (N)**	**No % (N)**
Achieved 5 or more A*-C grades including mathematics and English	35.8 (54)	62.3 (94)
Subject grades	**A*-C grade % (N)**	**D-Fail % (N)**
English Literature GCSE grade	48.0 (71)	52.0 (77)
English Language GCSE grade	49.7 (74)	50.3 (75)
Mathematics GCSE grade	47.3 (70)	52.7 (78)
Language assessment scores		
	Mean (SD)	**Range**
BPVS	90.09 (17.28)	61 - 144
ERRNI Information score	93.34 (13.96)	64 - 126
ERRNI Mean length utterance	96.78 (15.16)	65 - 135
TROG	94.43 (9.77)	67 - 116
CELF-3 Listening to paragraphs	9.55 (2.58)	3 - 16
WASI Vocabulary	42.76 (10.95)	21 - 78
Nonverbal assessment score		
	Mean (SD)	**Range**
WASI Block design	50.42 (9.92)	29 - 70

Note: BPVS, ERRNI Information score, ERRNI Mean Length Utterance, and TROG have standard scores of 100, with standard deviations of 15. CELF-3 Listening to Paragraphs has a standard score of 10, standard deviation 3. WASI Block Design and WASI Vocabulary have standard scores of 50 with standard deviation of 10.

Table 3: Comparison of the language skills of participants with and without five or more A*-C GCSE or equivalents including mathematics and English (Both cohorts combined)

	Group means (SD)		t-test for equality of means		
Assessment	**With 5 x A*-C with maths and English**	**Without 5 x A*-C with maths and English**	**t**	**df**	**Sig. (2-tailed)**
BPVS	101.5 (18.4)	83.0 (11.9)	6.5	77.8	<.001
CELF-3 Listening to paragraphs	10.9 (2.4)	8.8 (2.4)	5.2	144	<.001
ERRNI Information	96.4 (13.9)	91.9 (13.9)	1.9	143	.061
ERRNI Mean length utterance	103.1 (15.0)	93.5 (14.3)	3.8	143	<.001
TROG	98.5 (9.5)	92.0 (9.2)	1.0	145	<.001
WASI Block design	55.1 (9.6)	48.0 (9.2)	4.4	145	<.001
WASI Vocabulary	51.2 (11.9)	37.9 (10.3)	8.1	87.6	<.001

Bonferroni corrections set the alpha value at .007 instead of .05.

Note: BPVS, ERRNI Information score, ERRNI Mean Length Utterance, and TROG have standard scores of 100, with standard deviations of 15. CELF-3 Listening to Paragraphs has a standard score of 10, standard deviation 3. WASI Block Design and WASI Vocabulary have standard scores of 50 with standard deviation.

Table 4: Univariate regression analyses with GCSE outcome

	Language	**Literature**	**Mathematics**
	(D-Fail / A*-C)	**(D-Fail / A*-C)**	**(D-Fail / A*-C)**
	Odds Ratio (95% CI)	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
School (Affluent cf Less Affluent)	7.623*** (3.315, 17.534)	3.595*** (1.712, 7.545)	3.537*** (1.698, 7.366)
SES+ (increasing is more affluent)	1.038*** (1.02, 1.057)	1.024** (1.009, 1.039)	1.03*** (1.014, 1.046)
Free school meals (Not in receipt cf In receipt)	1.894 (0.932, 3.848)	2.375* (1.154, 4.888)	2.109* (1.026, 4.336)
Gender (Girls cf. Boys)	3.252*** (1.653, 6.397)	2.743** (1.405, 5.357)	1.875 (0.971, 3.620)

Bilingual status (Bilingual cf. Not Bilingual)	1.343 (0.631, 2.856)	3.03** (1.359, 6.756)	0.859 (0.404, 1.828)
TROG	1.058** (1.021, 1.097)	1.049** (1.013, 1.087)	1.088*** (1.045, 1.132)
CELF-3 LP	1.447*** (1.227, 1.706)	1.544*** (1.294, 1.843)	1.322*** (1.138, 1.534)
MLU	1.028* (1.005, 1.052)	1.031* (1.007, 1.055)	1.027* (1.004, 1.05)
Information	1.004 (0.981, 1.028)	1.012 (0.989, 1.036)	1.013 (0.989, 1.037)
Vocabulary assessment mean	3.658*** (2.219, 6.032)	3.32*** (2.062, 5.345)	5.24*** (2.928, 9.377)
WASI block design	1.048** (1.013, 1.085)	1.027 (0.993, 1.061)	1.09*** (1.047, 1.134)

*p< .05, **p< .01, ***p<.001

[+]SES as measured by individual participants' postcode Indices of Deprivation data (McLennan et al 2011), converted to percentile scores. Higher percentile = less socioeconomic disadvantage.

Table 5: Standard multiple regression of socioeconomic background (postcode data), language assessment (vocabulary) and demographic information on GCSE outcome

	Language (D-Fail / A*-C)	**Literature (D-Fail / A*-C)**	**Maths (D-Fail / A*-C)**
	Odds Ratio (95% CI)	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
Gender (Girls cf. Boys)	2.966** (1.331, 6.610)	3.063* (1.180, 7.954)	-
Vocabulary assessment mean	3.095*** (1.784, 5.37)	4.72*** (2.42, 9.208)	5.240*** (2.928, 9.377)
SES^{+} **(increasing is more affluent)**	1.022* (1.002, 1.044)	-	-
Bilingual (Bilingual cf. Not Bilingual)	-	16.887*** (5.122, 55.675)	-
CELF-3 LP	-	1.289* (1.022, 1.626)	-
Nagelkerke's Rsq	0.414	0.546	0.417
Chi square (df), p	53.570(3), p<0.001	75.818(4), p<0.001	55.064(1), p<0.001

*p< .05, **P< .01, ***p<.001