Development of Noun Phrase Complexity Across Genres in Children's Writing

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Complex noun phrases (NP) are central to mature academic writing and often a focus of explicit teaching. The National Curriculum in England, for example, requires specific components of NP complexity to be taught at specific educational stages. However, the evidence base for such practices is unclear. Research on the emergence of NP components is both limited and dated. Moreover, some work has suggested that NP development is late-occurring and genre-specific, calling into question curricular guidance which specifies teaching from the earliest years and which makes no mention of genre. Analysing 240 texts written by children in England aged six to 16, this study shows that overall complexity develops at a roughly constant rate from primary school onwards. Increases are principally driven by postmodification, especially relative clauses and proposition phrases. By the end of their mandatory education, children make some use of genre distinctions evident in adult writing. However, there are also clear patterns of overuse and underuse of particular NP components. Key distinctive features are examined in context to understand the roles NP components play in writing development.

INTRODUCTION

Though children can use the core grammar of English by the time they start school, their written language continues to develop in complexity and contextual sensitivity throughout their educational careers (Applebee 2000; Hoff 2009). As they mature, the types of texts that children write, the range of ideas they express, and the imagined readers they address change (Rose and Martin 2012). This is reflected in the range of language they deploy to develop ideas, construe experience, and establish relationships with their readers. Understanding this process is essential to understanding how children learn to write. It can also offer guidance to practitioners who need to decide what aspects of language to teach and when to teach them. While descriptions of development cannot show us *how* to teach, they can help us understand the outcomes of current practices and, where research findings are accumulated across contexts, give clues to general age-related constraints on learning. More

broadly, they can expand our understanding of education by providing a window onto the developing range of topics, ideas, and text types that children engage with (Christie 2012).

In this study, we focus on written language development from ages six to 16 through analysis of one grammatical structure: the noun phrase (NP). In particular, we focus on development in NP *complexity*, defined as the extent to which children elaborate on nouns through premodification (e.g. *a **black** cat*), post-modification (e.g. *the man **in the corner***) and complementation (e.g. *permission **to skip class***). There are several reasons why NP complexity is important for writing development. First, as a distinctive feature of mature academic writing, gaining control of NP complexity is central to mastering school language (Schleppegrell 2004; Biber *et al.* 2011). Second, previous research has shown growth in NP complexity to be one of the most consistent markers of overall syntactic development in children's writing (Durrant *et al.* 2021). It therefore offers a fruitful focus for studies seeking to understand how children's writing changes as they mature. Third, in the context where the current study was conducted (England), NP complexity features prominently in the National Curriculum (Department for Education 2014). As Table 1 summarizes, the curriculum specifies components of NP complexity that must be covered at different stages of primary education. Interestingly, these stipulations contrast with researchers' claims that NP complexity develops primarily in late adolescence (Ravid and Berman 2010). Evidence is therefore needed to determine whether this teaching schedule reflects realistic expectations about children's linguistic development.

Since NP complexity is known to differ between written genres (Biber *et al.* 1999), it is also striking that, while NP complexity is a major focus of the English National Curriculum, no mention is made of genre in this respect. Teachers, it seems, are to aim for NP complexity as a general feature of sophisticated language, rather than one directed towards specific types of writing. While children may learn to distinguish genres despite this lack of guidance, it is possible that the current curriculum under prepares them in this regard. As well as tracking

Table 1: Focus on noun phrases in the English National Curriculum

Year	Typical ages (years)	Statutory content requirements
2	6–7	"Expanded noun phrases for description and specification" E.g., *the blue butterfly, plain flour, the man in the moon*.
4	8–9	"noun phrases expanded by the addition of modifying adjectives, nouns and preposition phrases." E.g., *the strict maths teacher with curly hair*. (p.78)
5–6	9–11	"using expanded noun phrases to convey complicated information concisely" "using relative clauses beginning with *who, which, where, when whose, that*or an omitted relative pronoun.

(Department for Education, 2014, pp. 49; 76–79).

development across year groups, therefore, a secondary aim of this study is to understand how NP complexity varies across genres in child writing and to what extent children attain adult-like patterns of NP complexity across genres.

With these aims in mind, our research asks:

1. Does NP complexity in the writing of school children in England demonstrate a *late adolescent spurt*, or is development even across the span of mandatory education?
2. Do specific components of NP complexity develop at differential rates, and how does this development relate to stipulations made in the current National Curriculum?
3. To what extent do school children in England demonstrate differential NP complexity across different genres of writing?
4. To what extent does NP complexity across genres in children's writing in Year 11 match that found in adult writing?

NP COMPLEXITY IN CHILDREN'S WRITING

We define complexity as a formal feature of language in texts. This is distinct from *cognitive difficulty* (the psycholinguistic processing load associated with a structure) and *learning difficulty* (how late forms tend to be acquired) (Pallotti 2015). Linguistic structures which are formally complex *may* also be more cognitively difficult or acquired later, but this requires empirical investigation, rather than being part of their definition. It is also distinct from *functional complexity*—the opaqueness or multiplicity of a structure's meanings or functions (Bulté and Housen 2012).

Formal complexity is most commonly defined in terms of the number of consituent units within a form (e.g. words per form, clauses per form) (Berlage 2014). Other approaches, such as the number of operations required to convert a base structure into the target structure, or of the distance between a form and its closest head or dependent node in a syntactic tree (Bulté and Housen 2012) have not been much used in school-age research (Durrant *et al.* 2021).

Historically, much research has focussed on complexity within the verb phrase, i.e. as a matter of increased use of subordination (Díez-Bedmar and Pérez-Paredes 2020; Durrant *et al.* 2020). However, researchers of second/foreign language writing are now increasingly focussing on complexity within NPs (e.g. Bulté and Housen 2014; Verspoor *et al.* 2017; Kyle and Crossley 2018; Díez-Bedmar and Pérez-Paredes 2020). Central to this shift has been Biber *et al.*'s proposal of a developmental scale based on the principle that, as writers of academic texts mature, they move from elaborating sentences with finite dependent clauses functioning as clause components towards elaborating them with phrases functioning as noun phrase modifiers (Biber et al. 2011, 2020). The noun phrase is therefore seen as a key indicator of a maturing academic style.

Though Biber and his colleagues posit their model as applying to both first and second language writing, the literature cited in its support focuses almost exclusively on L2 and adult L1 writing (Biber *et al.* 2020). Indeed, our own review of the literature suggests that few studies have addressed NP complexity in L1 child writing.

An early exception is Hunt (1965), who defined complexity in terms of a binary distinction between modified and unmodified NPs, and found that the number of unmodified NPs decreased from Grades 4–12 in a corpus of writing by children in the US. Fang and Park (2020) also take a binary approach, defining *expanded noun phrases* as those which contain at least three words within their modifiers.[1] This was the only study in our review not to report a significant increase overall in NP complexity across year groups. It found a small non-significant difference in the mean number of expanded NPs from US Grades 7–9. Moving beyond binary definitions, Crossley *et al.* (2011) looked at the mean number of modifiers per NP and found that US Grade 12 students used, on average, more modifiers than Grade 9 students in a corpus of argumentative writing. University-level writers, in turn, used more modifiers than Grade 12 writers.

In the most thorough study to date of development in overall NP complexity in child writing in English, Ravid and Berman (2010) investigated expository and narrative writing by US and Israeli children (the former writing in English and the latter in Hebrew) in Grades 4, 7 and 11 and by adults, using five different measures: number of words per NP; degree of semantic abstractness of the head noun; quality and number of modifiers; number of complex governed nodes within the NP; number of different types of modifiers. For all measures, they find a general age-related increase which is most marked in the shift from Grades 7–11. They also find NPs in expository texts to be more complex than those in narrative texts, a distinction which becomes most evident from high school onwards. The authors conclude that children below age 11 are not yet sufficiently cognitively mature, and do not have sufficient experience of literacy-related activities, to create complex NPs and argue for "the special status of adolescence as a watershed in developing cognitive and communicative abilities" (Ravid and Berman 2010, p. 19).

Ravid and Berman's findings have potentially important educational and theoretical implications, but there is reason to treat them with caution. One issue is that they are based on a very small sample. Their English language corpus featured writing by only 12 participants in each age group, each of whom contributed a single text for each genre. Whilst we acknowledge that smaller corpora can provide valuable information, generalizing from Ravid and Berman's sample is clearly problematic. A second is that their measures of complexity are relatively blunt, in the sense that they are not sensitive to variation. Each measure used a four-point scale; for example, NP length was rated as 1 (one–three words); 2 (four–six words); 3 (seven–nine words); and 4 (ten words or more).[2] Such ordinal categories inherently limit the amount that scores can vary, and this lack of variation appears to be reflected in the results. Of the 40 mean scores reported for writing (4 age groups × 2 genres × 5 measures), all but six

are between 1.07 and 1.99. All six scores over 1.99 are found in the *semantic abstractness* measures.

While the studies reviewed so far have provided evidence that overall NP complexity increases as children mature, they do not show which NP components develop. From the perspective of both researchers interested in modelling writing development and teachers interested in plannning teaching and assessment, this more fine-grained level of analysis is crucial (Perera 1984; Biber *et al.* 2020).

Studies of development in specific NP components are summarized in Table 2. As this makes clear, studies are both sparse and dated. Nevertheless, cross-study evidence exists for age-related increases in the use of adjective pre-modifiers and for post-modification by preposition phrases, relative clauses and non-finite clauses. Determiners, noun pre-modifiers and appositions have not been found to develop with age, but it is notable that each of these was addressed by only a single study. The richest evidence relates to relative clauses. While studies are almost unanimous in finding these to increase in frequency across the school years, there does not seem to be a marked increase between older school-level and adult writing (Thompson *et al.* 1967; Peltz 1973; Sampson 2003).

For our purposes, the existing research base has several limitations. First, it is rather dated, with most studies reported in the 1960s and 70s. It therefore reflects development in educational contexts very different from that which formed the primary motivation for this study. Moreover, research is almost entirely limited to US schools. Harpin (1976) and Sampson (2003), both conducted in the UK, were the only non-US studies in our review. Crucially for our goal of evaluating the English curriculum, few studies traced development across both primary and secondary education, making it difficult to evaluate Ravid and Berman's (2010) hypothesis that growth in complexity is strongest in late adolescence. Finally, little is known about the interaction between NP development and genre in children's writing, despite the broader literature indicating genre to be a key determinate of NP complexity (e.g. Biber *et al.* 1999). The only two studies in our review which made genre-based comparisons (Verhoeven *et al.* 2002; Ravid and Berman 2010) found greater complexity in expository than in narrative texts. But the scarcity of literature again makes it difficult to draw strong conclusions. The current study attempts to address these limitations by tracing development in NP complexity in two genres throughout statutory education in England (from years 2 to 11) and will compare the use of NPs by children at the end of the process with that of adults. Our aim is to provide insights into both the nature of NP development in writing and the specific outcomes of the current English National Curriculum.

METHODS

Corpus

This study is based on a corpus of children's writing collected from schools across England between 2015 and 2017.[3] All writing was produced for children's regular

Table 2: Previous research on NP components

NP component	Study	Sample size	Findings
Determiner	Golub and Fredrick (1970)	160	No difference from Grades 4 to 6
Premodifying noun	Hunt (1965)	54	No significant difference across Grades 4, 8 and 12
Premodifying adjective	Hunt (1965)	54	Significant increase across Grades 4, 8 and 12
	O'Donnell, Griffin, and Norris (1967)	90	Significant increase from Grades 5–7; no significant difference between Grades 3 and 5
Relative clause	Hunt (1965)	54	Significant increase across Grades 4, 8 and 12
	O'Donnell *et al.* (1967)	90	Significant increase from Grades 3–5; no significant difference between Grades 5 and 7
	Thompson *et al.* (1967)	180	Increase from Grades 3–6. Little change from Grade 6–adult[*]
	Blount *et al.* (1969)	64	Increase from Grades 8 to 12[*]
	Golub and Fredrick (1970)	160	Significant increase from Grades 4–6
	Harpin (1976)	300	Increase across years 3, 4, 5 and 6[*]
	Loban (1976)	211	Increase across Grades 4–12[*]
	Noyce and Christie (1985)	369	Increase from Grades 3–5[*]
	Verhoeven *et al.* (2002)	160	Significant increase from Grade 4 to adult. More frequent in expository than narrative writing.
	Peltz (1973)	34	No significant difference between Grade 10 and profession writers
	Sampson (2003)	98	No significant difference between 9 and 12 year old children and adults
Post-modifying preposition phrase	Hunt (1965)	54	Significant increase across Grades 4, 8 and 12
	O'Donnell *et al.* (1967)	90	Significant increase from Grades 5 to 7; no significant difference between Grades 3 and 5

Table 2. Continued

NP component	Study	Sample size	Findings
Post-modifying non-finite clause	Hunt (1965)	54	Significant increase across Grades 4, 8 and 12
	O'Donnell *et al.* (1967)	90	Participles: Significant increase from Grades 5–7; no significant difference between Grades 3 and 5
			Infinitivals: No significant differences across grades 3, 5 and 7
Post-modifying appositions	Hunt (1965)	54	No significant difference across Grades 4, 8 and 12

[*] No inferential analysis.

schoolwork and was collected with consent from students, their legal guardians and schools. The full corpus comprises approximately 3,000 texts from approximately 1,000 children in 24 schools and was sampled across the disciplines of English, Science, and Humanities (History, Geography, Religious Studies) at the ends of Key Stage (KS) 1 (year 2, when children are 6–7 years old), KS2 (year 6, when children are 10–11 years old), KS3 (year 9, when children are 13–14 years old) and KS4 (year 11, when children are 15–16 years old).

Texts were hand-coded for syntactic features as automated parsing software (Manning *et al.* 2014) was found not to identify key forms with sufficient accuracy. Due to the labour-intensive nature of this work, we used a stratified random sample of 240 texts, comprising 30 *literary* and 30 *non-literary* (see Section 3.2) texts from each year group (see Table 3). All children in the sample attended state-funded schools and none spoke English as an Additional Language. 51.3 per cent were female, and 19.6 per cent received free school meals, the main proxy for socio-economic status in the English education system

Table 3: Sampled corpus

Year	Genre	Number of				Mean words/text
		Texts	Writers	Distinct topics	Schools	
2	Literary	30	29	9	3	83.87
	Non-literary	30	25	9	3	55.90
6	Literary	30	29	12	5	316.20
	Non-literary	30	26	15	4	214.30
9	Literary	30	30	5	4	350.13
	Non-literary	30	29	19	8	279.70
11	Literary	30	26	6	4	343.27
	Non-literary	30	27	19	6	327.70

Operationalizing genre

As discussed above, we conceptualize school-aged writing development as happening both through and in response to shifting communicative demands. It was therefore important to apply a genre scheme that would help identify educationally meaningful patterns of language use.

Genre categorization posed three challenges. First, because the range of texts that children write changes as they progress through school, a fine-grained categorization would preclude comparison across year groups. To determine how children are progressing in specific types of writing, we needed to identify types that exist across year groups.

Second, many texts in our corpus did not fit easily into existing genre schemes (e.g., Nesi and Gardner 2012; Rose and Martin 2012). In part, this was because texts often straddled multiple genres. Thus, for example, it was rare to find pure *expositional* texts with no complementary *narrative* element. However, it also reflected the fact that students are often asked to produce writing for educational purposes which do not align well with existing categories. For example, one group of primary-aged students were asked by their Science teacher to produce an imaginative piece of writing that depicts an animal's life cycle as if they were that animal. This is clearly not a genre of writing characteristic of adult Science. Rather, it represents a complex mix of style and purpose, written in the style of a fictionalized autobiography to develop and assess a student's understanding of the domain at hand.

Third, our review of the literature showed use of traditional genre terms to be highly inconsistent between studies. The widespread term *expository*, for example, has been variously used to refer to texts that express "factual information in order to inform or explain" (Cox *et al.* 1991, p. 179), to texts that "argue for a point of view" (Rose and Martin 2012, p. 56), to texts that express a personal preference (Yates *et al.* 1995), and to texts that do anything other than narrate a story (Berman and Nir-Sagiv 2007). This diversity of use implies that it is problematic to simply adopt such labels without further consideration.

In consultation with subject leaders on a university teacher training programme, we defined a distinction between *literary* and *non-literary* writing to reflect a split between two broad approaches to evaluating the success of a text. Specifically, literary texts are those which can be evaluated without considering their propositional or directive relationship to the world. That is, their contents do not need to be judged as either accurate or making a persuasive argument. Rather, they are written primarily to be appreciated in their own terms as pieces of stylized writing. Prototypical examples include *creative fiction* and *literary imitations* (Durrant and Brenchley 2019). Non-literary texts, in contrast, do need to bear a propositional or directive relationship to the external world. Their main purpose is either to describe, evaluate or argue for a particular state-of-affairs. Archetypical examples include autobiographies, essays, literary criticism, and experimental reports.

The labels *literary* and *non-literary* were chosen for several reasons. First, they flagged our genre scheme as distinct from existing alternatives, which we felt helpful to prevent different schemes being conflated. Second, the *literary* label captures the fact that these texts were produced in order to be evaluated as stylized pieces of writing—in other words, effectively as pieces of literature. It was also easier to give this genre a positive label, as these were a much more homogenous kind of writing than the non-literary texts, which tended to be broader and produced in multiple disciplines. Conversely, the non-literary label captures a number of important features. Firstly, it points to the literary texts being effectively the default form of extended writing expected of students for much of the English education system, at least in terms of pure frequency of opportunity of production. Secondly, and as already noted, it underlines this genre as comprising a broader and varied form of writing versus the literary texts, at least when considered as a whole. Finally, it taps into the key educational distinction as we have framed it. Namely, the split between literary texts, which are to be evaluated on their own terms as pieces of stylistic writing, and non-literary texts, which are substantively evaluated in terms of some orientation to the external world.

Our primary goal in operationalizing this split was the pragmatic one of identifying an educationally meaningful set of categories which enabled us to separate texts that were clearly distinct whilst still being reliably applicable across year groups. As a result, we were able to straightforwardly classify, not just the archetypal examples, but also those texts which were more problematic according to existing schemes. Thus, for example, were a student to have produced a piece of primary-age Science writing in which they narrate an animal's life-cycle from the animal's own perspective, then this would straightforwardly go into the non-literary category. For all its imaginative trappings, it is foundationally a piece of writing that is set in order to be evaluated for its propositional relationship to the external world.

This coarse-grain categorization implies that linguistic differences across year groups will simultaneously reflect changes in both language ability and (more narrowly defined) text types. However, for the reasons discussed above, drawing a sharp distinction between language and text type is neither possible nor desirable. As we have argued elsewhere, learning to write is "about gaining parallel mastery over particular text types and the linguistic forms that are associated with those types" (Durrant *et al.* 2020). We therefore theorize writing development as a single construct of language use in context. Attempting to unpack this into separate constructs of language development and text type development is likely to present a false picture.

Procedure: corpus annotation

The corpus was coded by a team of annotators using a dependency grammar framework developed specifically for the project and based on Biber *et al.* (1999). As Figure 1 illustrates, texts were transferred to spreadsheets, with one word

per row and each word indexed with a sentence and word number. Annotators were asked to identify: the head of each NP and SC ('status' column); the part of speech of each word within each NP or SC ('pos' column); specific syntactic functions defined within the framework ('dep' column. See Table 4 for a listing of functional tags relevant to the current study); the word on which each of those constituent words is grammatically dependent ('dep_on' column). The head of each NP and SC was also given a dependency to show its role in the broader sentence. During analysis, subtypes of pre-modification were identified by combining the pre-modification dependency tag with information about part of speech (e.g. adjective pre-modifiers are items marked as pre-modifiers that have 'adj' in the part of speech column). Subtypes of post-modification were identified using a series of tag affixes added to the 'dep' column (see Table 4). These affixes classified post-modifiers as finite, non-finite, appositive, and

	sentence_number	word_number	word	status	pos	dep	dep_on
1							
2	1	1	As		conj_sub		4
3	1	2	the		det		3
4	1	3	celebration	np	noun_com	subj	4
5	1	4	came	sc	verb_lex_act	adv_fin_fronted	11
6	1	5	to		prep		4
7	1	6	an		det		7
8	1	7	end	np	noun_com	prepobj	5
9	1	8	,				
10	1	9	the		det		10
11	1	10	guests	np	noun_com	subj	11
12	1	11	were				

Figure 1: Sample of syntactic coding.

Table 4: Relevant dependency ('dep') codes

Type	Code	Gloss	Example*
Main NP modifier tags	premod	Any element which comes between an NP and its determiners/numerals, and which is directly dependent on this NP	**Dried** paint was peeling from the **dull, depressing** walls
	post-mod	Any element which is directly dependent on a preceding NP	Words **like** believed
Affixes to the *post-mod* tag	_fin	Any finite subordinate clause	I couldn't shake the feeling that something **was** terribly wrong
	_nfin	Any non-finite subordinate clause	…the time **allowed** to cool down
	_app	Any subordinate clause that is appositionally dependent on a preceding NP	Eddie Carbone, the **lead**, is portrayed as the tragic hero
	_rel	Any relative clause	…the creatures that **come** out in the night

* Words that carry the relevant code are bolded.

relative (note that multiple tagging was also possible, such that, for example, a post-modifier could be identified as both finite and relative). The full set of features tagged can be found, along with operational definitions and examples, in the project annotation manual, which is reproduced in Supplementary Materials.

Each text was annotated independently by two annotators. Inter-rater agreement was generally high (status column: 96 per cent; pos column: 94 per cent; sep column: 89 per cent; dep_on column: 92 per cent). Where annotators disagreed, the code was adjudicated by the second author of the present article.

Developmental analysis

An R script (R Core Team 2014) was written to quantify the frequency and length (in words) of syntactic features of interest in each coded text. To allow comparison of texts of different lengths, frequencies were normalized to occurrences per 1,000 words. These frequencies and lengths served as the basis for the quantitative analyses which follow.

It is important to note that the texts that form the data points in our analyses are not statistically independent. Multiple texts were written by individual writers and multiple writers sampled from individual schools. Because such data violate standard statistical assumptions, our analyses used MEMs for inferential analysis. In this, we adopted a three-stage stepwise procedure (Gries 2015).[4]

Stage One identified the maximal fixed effects structure and maximal random effects structure. Fixed effects structure comprised the main effects of year group and genre plus their interaction. Random effects comprised: schools; disciplines; writers nested within schools; titles nested within disciplines. The two nested structures are crossed because individual titles were written by multiple writers, whilst individual writers wrote on multiple titles. Titles also cut across schools as students from multiple schools wrote on common titles, reflecting the influence of a national curriculum with shared public examinations.

In Stage Two, the optimal random effects structure was determined by (a) removing each random effect in turn, and (b) comparing the overall quality of the model when the effect is present versus when it is absent. Random effects were retained only if their removal made the model quality significantly worse.

Stage Three determined the optimal fixed-effects structure relative to the optimal random effects structure identified in Stage Two. This involved sequentially removing any fixed effects which were neither significant in themselves nor participated in any higher order interactions. As with Stage Two, an effect was retained only if removing it significantly reduced model quality. In both stages, model quality was determined with reference to the Akaike Information Criterion (AIC) score.

The assumptions of MEMs (Zuur *et al.* 2009; Tabachnick and Fidell 2014) were checked as follows: histograms of residuals were checked for significant outliers; residuals vs. observed values were checked to confirm the linearity of the data; Q–Q plots were checked to confirm the normal distribution of residuals and

random effects; plots of standardized residuals vs. fitted values were checked to confirm homoscedacity of residuals. To correct for non-normally distributed residuals, dependent variables were transformed to their base 10 logarithm.[5]

Comparison with adult writing

In addition to tracing development in NP complexity across children's year groups, we wanted to estimate how NP complexity near the end of statutory education (i.e., in year 11) compared with that of adult writing of the sort for which their education might plausibly prepare them. To this end, we used the frequency data for adult fiction and academic writing provided by Biber *et al.* (1999). It should be noted that these registers are not precise matches for our year 11 writing. Biber *et al.*'s (1999) academic texts, for example, which comprise book extracts and research articles, are different in important ways from the texts written by our year 11 children, which are not exact matches for any adult genre. Just as the writing that is expected of a year 2 student differs from that expected of a year 11 student, the writing expected of the latter differs from that expected of adults. Again, therefore, we are not comparing how writers at different levels write in the same situation (such a comparison would be highly artificial, since adults and school children are not in the same situation). Rather, Biber *et al.*'s registers were selected as representing plausible targets towards which children's writing can be seen as progressing.

As we do not have access to the original data on which Biber *et al.*'s figures are based, we do not perform inferential comparisons for this part of the analysis. Moreover, because Biber *et al.* present their data in bar charts rather than tables, we do not have their exact figures but rather have relied on our best reading of these charts. These are, therefore, rounded versions of the originals. We therefore focus only on differences between the two corpora which are large enough to be robust against rounding errors.

FINDINGS

Frequency and length of NP components in child writing

Figure 2 shows the differences in NP complexity, quantified in terms of mean words per NP, across year groups and genres. The best-fitting mixed-effects model (MEM) is shown in Table 5. These data show a clear and significant increase in complexity across year groups, with no indication of the acceleration in late adolescence claimed by Ravid and Berman (2010). There is also no clear difference in NP complexity between literary and non-literary writing. The genre distinctions which are seen in adult writing, and which were found in Ravid and Berman's (2010) study, are not evident here.

Turning to specific NP components, Tables 6 and 7 summarize the best-fitting MEMs for frequency and length respectively. Since nine separate comparisons are made for each dependent variable, a Bonferroni correction is applied,
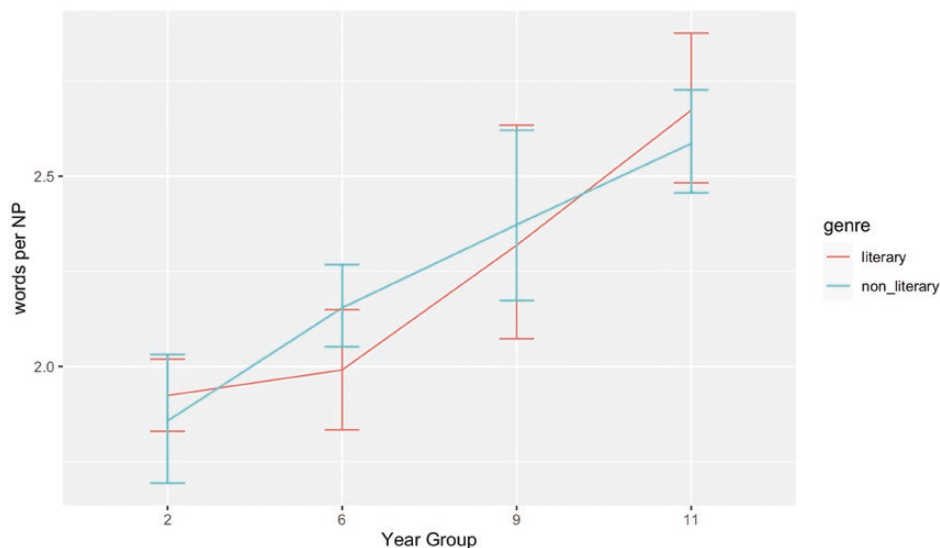
Figure 2: NP length across year groups and genres.

Table 5: Mixed effects model for NP length in words

	Value	SE	df	t-value	p-value
Fixed effects					
Intercept	1.804	.130	62.41	13.836	<.0001
Year group	.070	.016	63.90	4.285	<.0001
	Variance	Std. Dev			
Random effects					
Title within discipline	.176	.418			
Residual	.149	.387			
Goodness of fit					
R^2 marginal	.15				
R^2 conditional	.61				

reducing the significance threshold to .005. Differences across year groups and genres for statistically significant components are illustrated in Figures 3 and 4.

Both frequency and length of post-modification by preposition phrases (PPs) and relative clauses increase significantly across year groups. Considering the strength of fit of these models (marginal R^2) and the high frequencies of the forms, these appear to be the strongest drivers of the overall increase in NP complexity. There is also a significant increase in the use of non-finite post-modifier clauses, though the model fit is much weaker, and these clauses are much less frequent overall. Participials were the only type of pre-modifier to show significant patterning. These increased significantly across year groups and were

Table 6: Mixed effects model for frequency of NP components

Component	Year	Genre	Year* Genre	Random effects	R^2 Marginal	R^2 Conditional
Pre-modifiers						
Adjective	*ns*	*ns*	*ns*	–	–	–
Noun	*ns*	*ns*	*ns*	–	–	–
Participial	<.0001	<.0001	*ns*	title	.24	.37
Post-modifiers						
Preposition phrase	<.0001	*ns*	*ns*	title	.28	.44
Relative clause*	<.0001	*ns*	*ns*	discipline	.26	.31
Non-finite clause*	<.0001	*ns*	*ns*	title	.11	.32
Appositive	ns	*ns*	*ns*	–	–	–
Noun complement clause+	–	–	–	–	–	–

* Log frequency.
+ Violated test assumptions.

Table 7: Mixed effects model for length of NP components in words

Component	Year	Genre	Year* Genre	Random effects	R^2 Marginal	R^2 Conditional
Pre-modifiers						
Adjective	*ns*	*ns*	*ns*	–	–	–
Noun	*ns*	*ns*	*ns*	–	–	–
Participial	*ns*	*ns*	*ns*	–	–	–
Post-modifiers						
Preposition phrase	<.0001	*ns*	*ns*	title	.15	.24
Relative clause*	<.0001	*ns*	*ns*	writer	.14	.20
Non-finite clause*	*ns*	*ns*	*ns*	–	–	-
Appositive	*ns*	*ns*	*ns*	–	–	–
Noun complement clause+	–	–	–	–	–	–

* Log frequency.
+ Excluded: no occurrences at year 2 and year 6 literary.

significantly more frequent in literary than non-literary writing, making participial pre-modification the only NP component to differentiate between genres across year groups.

Comparison between year 11 and adult writing

Figure 5 compares the frequency of each NP component in year 11 writing with those found in adult writing by Biber *et al.* (1999). Several points stand out.
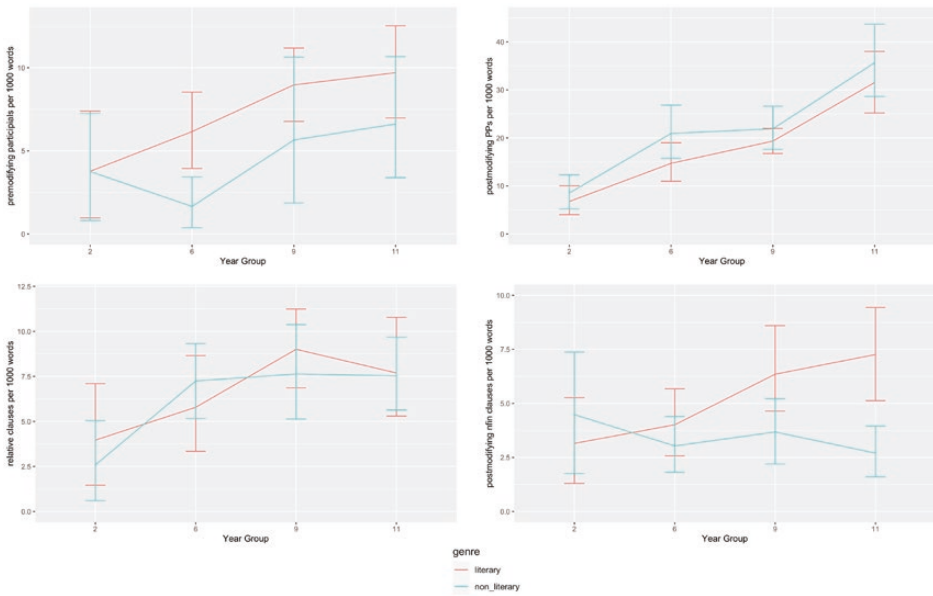
Figure 3: Statistically significant patterns in frequencies of NP components.
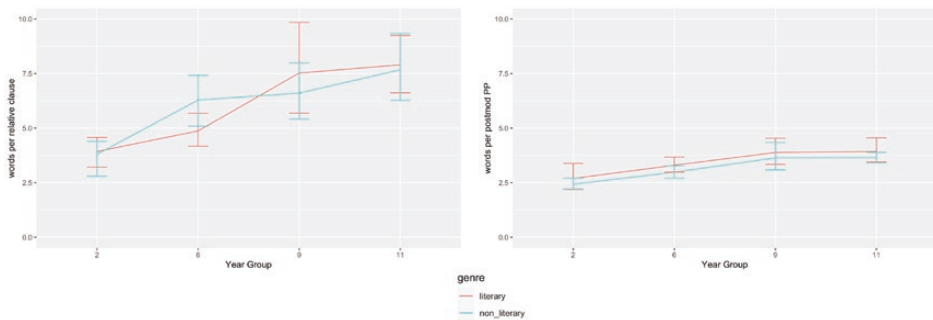

Figure 4: Statistically significant patterns in lengths of NP components.

First, pre-modifying nouns are over three times more common in adult fiction than child literary writing and almost four times more common in adult academic than child non-literary writing. This may reflect the semantic challenges posed by the form, which, as Biber *et al.* (1999, p. 590) note, involves an "extremely dense packaging of referential information" and relies heavily on inference as the meaning relationship between premodifier and head is left implicit. Biber *et al.* (1999, pp. 590–591) record "a bewildering array" of 15 possible logical relations between the two parts, including composition (protein granules); purpose (safety device); content (algebra text); and source (whale meat).
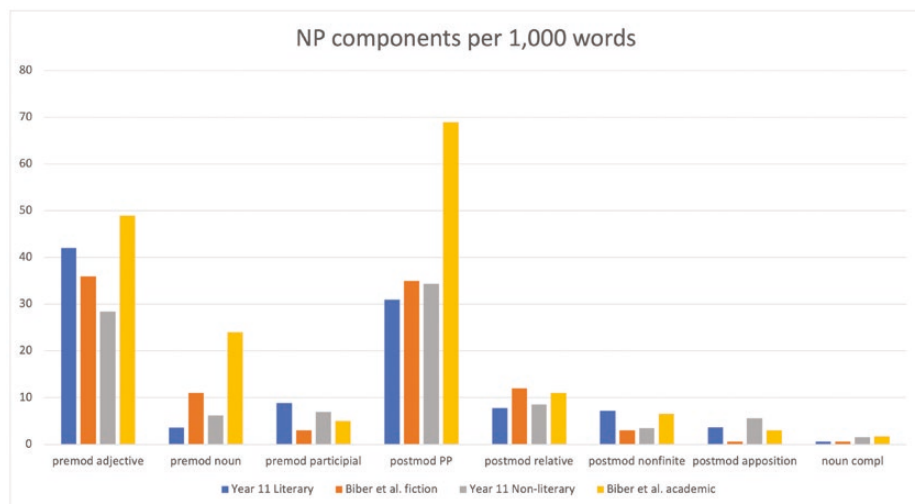
Figure 5: Year 11 vs. adult NP component frequencies.

Along with noun pre-modifiers, Biber *et al.*'s (1999) data identify three further features that are distinctive of academic writing: post-modifying PPs, pre-modifying adjectives, and post-modifying non-finite clauses. Unlike noun pre-modifiers, children do not have a general aversion to these features; their overall use is roughly in-line with that in adult fiction (indeed, year 11 literary writing uses more adjectives and non-finite clauses than adult fiction). However, in all cases, their use in year 11 non-literary writing is well below that in the adult academic writing.

For PPs, the difference can be ascribed to the heavy embedding of this form in adult academic writing. Biber *et al.* (1999, p. 607) describe how PPs often occur in "extremely dense, embedded sequences", which they exemplify with a passage containing four post-modified nouns. Such embeddings were rare in our data. We have already seen (Figure 4) that PPs in year 11 non-literary writing average only four words in length, suggesting that extensive combination of forms is unusual. Further analysis of the 335 post-modifying PPs in this part of the corpus further showed that only 90 (27 per cent) either embedded or were embedded within another PP; six contained two embedded PPs, and none contained more than two. The dense packaging of referential information with multiple PPs seen in adult academic writing is therefore not reproduced by our year 11 writers.

With regard to adjectives, Biber *et al.* (1999, p. 511) describe how a large majority of frequent types (i.e. those occurring more than 100 times per million words) in adult academic writing fulfil a classificatory function, particularly the relational (54 types, e.g. same, whole) and topical (30 types, e.g. social; political) functions. Much less frequent is the descriptive function; i.e., the evaluative (12 types, e.g. good, important), size (nine types, e.g. high, large) and time

(one type, new) functions. Due to the relatively small size of our corpus, we cannot reliably estimate which adjectives appeared more than 100 times per million words. However, as Table 8 shows, if we take adjectives appearing at least four times to represent the most common, the pattern attested by Biber *et al.* is reversed, with the majority (17 out of 24) being descriptive. Amongst these, evaluative types were particularly common (12 types). The specialized classificatory roles played by adjectives in adult academic writing are therefore not yet evident in the non-literary writing of these year 11 children.

Biber *et al.* (1999, pp. 630–634) have relatively little to say about the functions of postmodifying nonfinite clauses, but they do report that the most common type in academic writing is the *ed-* participle clause. *Ing-* participles are less frequent, and *to*-clauses by far the least common. In our Year 11 non-literary texts, in contrast, *to*-clauses were the most common (16 cases), followed by *ed-* (14) and *ing-* (4) clauses. This does not reflect a general avoidance of participle clauses; both forms were common in year 11 literary writing (31 × *ed-*; 35 × *ing-*; 10 × *to*). This again suggests that adult academic writers are using them for

Table 8: Frequent premodifying nouns in year 11 non-literary writing

Adjective	Occurrences	Function
Younger	16	Time
Same	15	Relational
Older	10	Time
Different	9	Relational
New	8	Time
Socialist	8	Topical
Emotional	7	Topical
Human	7	Topical
Whole	7	Relational
Bad	6	Evaluative
Clear	6	Evaluative
Fair	5	Evaluative
Overall	5	Relational
Stable	5	Evaluative
Strong	5	Evaluative
Useful	5	Evaluative
Wrong	5	Evaluative
Able	4	Evaluative
Best	4	Evaluative
Dangerous	4	Evaluative
Important	4	Evaluative
Lower	4	Size/amount
Old	4	Time
Suitable	4	Evaluative

functions that are less common in child writing. This impression is reinforced by the fact that, as Table 9 shows, of the nine verbs that Biber *et al.* found to occur frequently in academic *ed-* clauses, only three (*given, produced, taken*) were found in our data. Still more strikingly, none of the high frequency *ing* verbs appeared. The most frequent of these 'absent' forms are used in university-level writing[6] to specify the grounds or sources of a noun (e.g. *an approach **based** on formal theories of logic*), or to add details about a method or technique (*a circuit **containing** variable resisters*). We might therefore speculate that these functions are less used by Year 11 writers.

Two forms in Figure 5 stand out in that they indicate higher frequencies in child than in adult writing for both genres: participials and apposition. Participials, it will be recalled, are the only pre-nominal form to increase significantly in frequency as children mature. In year 11 literary writing, *-ing* forms are slightly more common than *-ed* forms (51, as opposed to 44 occurrences). These tended to evoke vivid, often violent, scenes, which the children appear to relish:

1. it just silently whistles into your ears a **blood curdling** <u>tune</u> mocking you at just how much damage it can do.
2. **Thrashing** <u>waves</u> of vengeance pushed and flung themselves at the cliffs in a desperate attempt to get closer to me.
3. The innocent guests stood with shock as the Joker fired a **deafening** <u>gun shot</u> into the ceiling.

In many cases, participials were used in literary writing with striking originality and flexibility, often to create novel compounds. It seems that the children have latched onto this form as a fecund area for language play:

4. A slight hum of **early-waking** <u>cars</u> can be heard roaming the streets.
5. In his wrinkled, **veins-popped-out** <u>hands</u> lay a fat book.
6. Hundreds upon hundreds of people thrust their way down the **spit-stained** <u>grey concrete step</u>s.

Table 9: Verbs appearing in participle clauses

Participle type	Biber *et al.* academic	Year 11 non-literary
ed-clause	> 100 occurrences per million words *based, given, used* > 50 occurrences per million words *caused, concerned, made, obtained, produced, taken*	*given* (x3), *allowed* (x2), *produced* (x2) *exposed, involved, killed, known, said, taken, used*
ing-clause	> 100 occurrences per million *being, containing, using* > 50 occurrences per million *concerning, having, involving*	*cooling, learning, looking, showing*

In non-literary writing, use of participials is more strongly skewed towards *-ing* forms (53 *-ing* vs. 20 *-ed* forms). Unlike the literary texts, most are concentrated in a few repeated forms in a narrow range of texts. In particular, six texts, all written by students in the same class in response to a single assignment (*GCSE Science Experimental Investigation Paper—Water Cooling—Parts 1 and 2*) accounted for 47 of the 73 total occurrences. Most prominently, these included: 28 occurrences of *starting temperature*; eight occurrences of *fixed period/time*; five occurrences of *(un)insulated tank*; five occurrences of *measuring cylinder*. The high frequency of participials in this genre can therefore be largely attributed to their extensive formulaic use in a single task.

Apposition was also far more frequent than in adult writing, especially in literary/fiction texts (where they are over six times more frequent). Closer analysis shows that this form is highly unevenly distributed across texts. 14 of our 30 non-literary texts and 14 of 30 literary texts did not use apposition at all. Moreover, 43 of the 61 uses of apposition in non-literary writing were found in only seven texts, each using the form five or more times. Similarly, 17 of the 39 uses in literary writing were found in only three texts, again each using the form five times or more.

These skewed distributions are related to the fact that apposition was used for very specific textual functions, especially in non-literary writing. 36 of the 61 non-literary appositions were used to quote part of a text being analyzed. This is what Biber *et al.* (1999) describe as the *metalinguistic function* of apposition, which unpacks a word, phrase, expression, etc. that has been previously mentioned:

7.   The use of <u>the word</u> **full grown** creates yet another link to human growth.
8.   This is further referenced in <u>the line</u> **"the unresting castle thresh into full grown thickness"**.

This use is highly formulaic, with 23/36 uses following one of three head nouns (*word; line; quote/quotation*).

While the metalinguistic function of apposition is found exclusively in texts written for English classes, the second common function is found mostly in science texts. This is the *listing* function (Biber *et al.* 1999), in which apposition is used to itemize members of a class. This accounted for 10/61 cases:

9.   There are four main <u>antacids</u>: **sodium bicarbonate**, **magnesium hydroxide**, **aluminium hydroxide** and **calcium carbonate**.

Whereas Biber *et al.* (1999) found one of the main uses of apposition in academic writing to be parenthetical, this was attested only three times in our non-literary corpus:

10. So Sissy represents emotion, <u>positivity in life</u> **(believing for the best)** and realism, just what everybody should be like.

Also rare was the use of apposition to modify a technical name, which in Biber *et al.* (1999) accounted for 65 per cent of cases in academic writing but was not found in our corpus.

In literary writing, perhaps the most striking feature of apposition was its tendency to span sentence boundaries. In these cases, children would introduce a noun in an opening sentence and then use a second 'sentence' consisting of an NP only, to explain or give further detail about that noun. 9/39 cases of literary apposition were of this sort.

11. Now it's back to our humble <u>home</u>, where the overcast skies embody our mood and where the grass takes shape of a metropolitan city. **A home where helpless coaches hopelessly try to get their messages across to a group of footballers**.
12. Nature's dying icy <u>wind</u> rips through life like daggers to the heart, destroying love, life and laughter. **Icy wind that tears tall trees up from its roots and tosses them away. Icy wind the soul of the storm. Nature's last breath.**

It should be noted at this point that, though we take these to be clear cases of apposition,[7] consistent with the apparent treatment in Biber *et al.* (1999, pp. 638–640), it is possible that Biber *et al.*'s coding would instead have treated them as instances of non-clausal material.[8] This potential definitional difference does not, however, alter our main conclusion that apposition is far more frequent in children's writing. When cross-sentence apposition is removed from the results, year 11 literary writing maintains its strong profile of overuse in comparison to adult fiction (2.84 vs. 0.6 cases per 1,000 words). It also does not alter the conclusion that cross-sentence structures of this kind—in which an NP introduced in one sentence is unpacked using a following NP that is punctuated as an independent sentence—appears to be an important feature of these children's writing.

In literary texts, *multiple post-modification*, where two or more NPs modified an initial NP (cf. Biber *et al.* 1999, pp. 640–644) was common, as exemplified in Examples 14 and 15. These accounted for 14/39 cases of apposition in these texts:

13. Other familiar <u>senses</u> too, **noises**, **smells**, **sights**
14. They come carrying the <u>swords</u> and shields of the business world, **handbags** and **briefcases**.

As these examples illustrate, the primary driver of apposition in literary texts appears to be an attempt to add colour and depth by describing the same thing in alternative ways or from alternative perspectives. Given the low occurrence of apposition in Biber *et al.*'s (1999) fiction texts, our findings suggest such usage may be a distinctive feature of school-aged writing, although we again caveat these findings as being subject to the potential differences in operationalization noted above. Regardless of such potential differences, our findings point to this form being an important structure in the development in school-aged writing.

DISCUSSION AND CONCLUSIONS

Our findings point to several main conclusions. First, development in NP complexity occurs throughout primary and secondary education. NP development

does not appear to be, as Ravid and Berman (2010) claim, primarily associated with late adolescence. Teaching NP features from the earliest ages (as stipulated by the English National Curriculum) may not, therefore, be unrealistic.

A second set of conclusions concerns the NP components underlying overall increases in complexity. We have seen that the strongest, and most frequently used, correlates of development are post-modification by PPs and relative clauses. These both increase in frequency and become more internally complex as children mature.

While both these forms are mentioned in National Curriculum guidance, our wider results do not suggest that development closely matches the curriculum contents. Use of adjectives and noun pre-modifiers, which are specifically cited in the curriculum, do not increase across year groups; whereas non-finite clauses, which are not mentioned, do increase. The case of participials, which played an important and increasing role in children's writing, is slightly different in that, though not explicitly cited in the curriculum, it is often taught under the heading of *adjectives*. The contrasting roles and trajectories of participials and *adjectives proper* in our findings suggest that the curriculum could benefit from distinguishing these.

Since data collection started within a year of the introduction of the 2014 curriculum, we cannot conclude that the curriculum is failing to have its intended effects. The secondary school children in our sample completed their primary education under the previous curriculum, which did specify grammatical features to be taught. We can conclude, however, that features cited in the curriculum do not correspond reliably to those that were characteristic of writing maturity in 2015–17. Although this does not in itself show the curriculum to be misguided, it should raise questions as to how features were chosen.

Comparison of NP complexity in year 11 writing with that in adult fiction and academic writing revealed only one component (noun pre-modifiers) that was used consistently less by the child writers. We have speculated that this may be due to semantic challenges posed by the form, which is informationally dense and requires high levels of inference to unpack semantically. Three further forms (PPs, nonfinite clauses, and adjectives) are not avoided in general, but are considerably less frequent in year 11 non-literary writing than in adult academic writing. We have argued that the higher frequency of PPs in adult writing is due to embedding. Like noun premodification, this results in informationally dense texts that may be challenging for child writers. The greater frequency of nonfinite clauses and adjectives is likely the result of functional differences. The former we have speculated, may be due to adults' more frequently specifying the grounds or sources of entities, processes, or ideas, or adding details to a description of a method or technique. The latter appears to be due to the greater use of classification in the adult texts.

Some previous literature has suggested that adjective pre-modification is a developmentally significant form. The two L1 child writing studies giving specific information on adjectives both found an increase in use across year groups (Hunt 1965; O'Donnell *et al.* 1967). Similarly, Staples *et al.* (2016) found

a significant increase across year groups in L1 university student writing and several studies have found higher proficiency L2 writing to use more attributive adjectives (Grant and Ginther 2000; Taguchi *et al.* 2013; Staples and Reppen 2016). This might, at first glance, be taken to suggest that the difference in adjective use between child and adult texts is attributable to developmental, rather than purely textual, factors. Importantly, however, none of these studies appears to distinguish adjectives from participials. Participials are not mentioned as a separate category and, when examples of adjectives are given, they include cases that we would have classified as participials, e.g. *cantilevered shaft, arranged marriage, bottled water* (Staples *et al.* 2016; Staples and Reppen 2016). In contrast, Parkinson and Musgrave (2014), who do distinguish participials from adjectives, find the former to be more common and the latter *less* common in more advanced than less advanced EAP writing. Together with our own results, this suggests that pre-modifying adjectives may not be a developmentally significant feature, when they are distinguished from participials. This highlights once more the importance of drawing this distinction.

Our analysis also pointed to two features—participial pre-modification and apposition—being used substantially more in year 11 than adult writing. In literary writing, these were a source for children's creativity. Participials were frequently exploited to coin novel phrases, and both forms were used to add colour and depth to descriptions. While these forms offered children a way of exploring their linguistic creativity, it was notable that apposition was sometimes repeated within a text to an extent that undercut its stylistic force. This repetition may represent students hitting upon a form with which they consciously experiment. At the same time, it suggests that teachers and students should be sensitive to the potential overuse of forms to ensure they do not become a *creative crutch* which prevents active exploration of additional forms.

Non-literary use of participials and apposition was highly context-specific. Participials were found exclusively in texts written for a single Science assignment, while over half of cases of apposition were used to cite elements of texts discussed in English assignments. Uses were also rather formulaic. Most participials were found in a restricted set of collocations and most appositions in a small number of *frames*. This may indicate a process in which children are learning to develop their writing through concentrated practice in predictable contexts. Similar patterns have been observed in children's use of subordinate clauses (Durrant *et al.* 2020) and are consistent with usage-based models of language acquisition, which propose that complex linguistic forms are mastered by first gaining control over a narrow set of formulaic exemplars (Kemmer and Barlow 2000).

The influence of context on use of NP components was not limited to participials and apposition. MEMs showed *assignment title* to be the key random variable in predicting the frequency of non-finite clauses, and both the frequency and length of PPs. In a sense, the influence of individual topics (and, to a lesser extent, individual writers) on feature counts highlights a limitation of our relatively small sample. In a larger corpus, with a wider range of topics and greater

number of writers, such patterns may have been sufficiently diluted that they no longer registered as developmentally interesting.

However, two points should be noted in this respect. First, the significant MEMs (which took account of writer, discipline, and topic as potential confounding variables) suggest that developmental patterns would be retained in a larger sample. Second, the possibility that context-specific patterns of the sort evidenced for participials and apposition might have gone unnoticed in a larger sample draws attention to a benefit of working with smaller corpora. We have seen that, for individual learners working towards a mature writing style, peculiarities of the local context—such as the need to frequently cite and describe linguistic entities, or to describe an experimental setup—are an important influence on their linguistic choices. We have also seen how individual children show stylistic preferences for particular forms (as in the extensive use of apposition as a descriptive strategy in literary writing). That such patterns might be hidden in larger samples underlines the importance of working with multiple types of corpora in multiple ways.

Our research also highlights several points for further investigation. Firstly, our corpus covers the length of statutory education in England, which ends at age 16. As the results have made clear, development in NP complexity does not finish at that age. It is therefore important to continue this investigation into later years. A particular priority should be the years between 16 and 18 to understand how students prepare (or fail to prepare) for university-level writing, where NP complexity is of central importance (Staples *et al.* 2016). Secondly, our data were collected shortly after the introduction of a new curriculum which introduced a focus on specific elements of syntax. To evaluate the impacts of this curriculum, it would be interesting to replicate our study once students who were exposed to it from the start of their primary education have reached year 11. Thirdly, it is important that this study be replicated across other English-speaking contexts. This would give us a basis to understand more clearly the impacts of individual curricula and to identify any general maturational constraints on writing development.

SUPPLEMENTARY DATA

Supplementary material is available at *Applied Linguistics* online.

END NOTES

1   Fang and Park's definition actually refers to phrases including three or more modifiers, but the examples cited show that NPs with a single modifier comprising three words are counted as expanded (e.g. *creatures with big eyes*). Hence we have adjusted their definition to capture the analysis they appear to have conducted.

2   The authors report this as "over 10 words" (Ravid and Berman, p. 9), but this is presumably a mistake as it would leave no category for 10-word NPs.

3 For full details of the corpus and information about access, see https://reshare.ukdataservice.ac.uk/853809/.

4 All models were implemented using R version 3.2 and the *lmerTEST* R package (Kuznetsova *et al.* 2017), with goodness of fit statistics calculated using the MuMIn package (Barton 2018).

5 Because some texts had a value of 0, the actual transformation was the log of the original value plus .00001.

6 The following examples are taken from the British Academic Written English Corpus (Alsop and Nesi 2009).

7 Apposition needed to meet three conditions in our analysis. Firstly, they further specify the meaning of the preceding NP. Secondly, they are co-referential with this NP. Thirdly, the NP could be deleted and replaced by the appositional unit without affecting the formal grammaticality of the surrounding material.

8 We are grateful to one of our reviewers for pointing out this particular possibility. We take these to be clear cases of apposition, meeting our three core criteria. Firstly, they further specify the meaning of the preceding NP. Secondly, they are co-referential with this NP. Thirdly, the NP could be deleted and replaced by the appositional unit without affecting the formal grammaticality of the surrounding material.

DATA ACCESS STATEMENT

The research data supporting this publication are openly available from the UK Data Service at: https://reshare.ukdataservice.ac.uk/853809/.

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