

The language of school writing: a developmental comparison of genres across the school years

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Samenvatting

Schrijven is de voornaamste route voor het leren, verwerken, organiseren, opslaan en ophalen van informatie in de schooljaren. Het beheersen van de structuren en functies van teksten uit verschillende genres is een van de belangrijkste doelen van geletterdheid in het onderwijs. De teksten die leerlingen construeren, creëren een ideaal domein voor het tonen van hun taalvaardigheden en voor het onderzoeken van de constructie van verschillende typen tekst, specifiek voor verschillende genres. Deze studie vergelijkt de taalkundige constructies die horen bij verklarende (*expository*) teksten (waar het gaat om argumentatie en overreding bij sociale en conceptuele kwesties) met informatieve teksten, die feitelijke (en minder controversiële) verschijnselen beschrijven. Het onderzoek biedt een perspectief op de schrijfvaardigheden van Hebreeuws sprekende leerlingen in het primair en voortgezet onderwijs, vergeleken met volwassenen. De deelnemers waren 547 leerlingen en volwassenen die vervolgonderwijs hadden gevolgd. Elke deelnemer schreef een informatieve tekst en een argumenterende tekst, wat leidde tot een totaal van 1094 teksten. Er werden drie soorten variabelen onderzocht: lexicale, morfo-syntactische en syntactische. We vonden dat complex lexicon en complexe syntaxis in de teksten toenamen tijdens de schooljaren, met specifieke structuren die karakteristiek zijn voor genres, al naar gelang de positie en de aard van de twee genres die we onderzochten. We vonden ook dat al deze componenten pas op volwassen leeftijd optimaal gebruikt werden, als een culminatie van de periode van latere taalontwikkeling. Onze resultaten impliceren dat informatieve en verklarende teksten inderdaad verschillend zijn in hun kenmerken, en dat het niet-deskundigen vele jaren van taalkundige en cognitieve ontwikkeling aan de ene kant en instructie op school en ervaring aan de andere kant kost om het niveau van kwalitatief academisch schrijven te bereiken.

Abstract

Writing is the highway to learning, processing, organizing, storing and retrieving information during the school years. Gaining command of the structures and functions of

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texts of different genres is one of the main goals of linguistic literacy in education. The texts that school-goers construct provide optimal hunting grounds for unveiling their linguistic abilities during the genre-specific construction of different text types. The current study examines the linguistic constructions typical of expository texts, characterized by argumentation or persuasion regarding social / conceptual issues, versus informative texts, describing factual (or less controversial) phenomena. This examination constitutes a window on Hebrew-speaking students' developing writing abilities in elementary, middle and high school, compared with adults. Participants were 547 students and educated adults with post-high school education. Each participant wrote an informative text and an expository text, yielding a total of 1,094 texts. Three types of variables were examined: lexical, morpho-syntactic and syntactic. We found that complex lexicon and syntax in discourse increased in prevalence across the school years, with specific structures being genre-typical as befits the stance and character of the two genres under investigation. We also found that it was only in adulthood that all of these components were employed in optimal fashion, at the culmination of the period of Later Language Development. Our results imply that informative and expository texts are indeed distinct in their characteristics, and that it takes many years of internal linguistic and cognitive development, on the one hand, and schooling instruction and experience, on the other hand, to achieve qualitative academic writing in non-experts.

Introduction

Gaining command of the structures and functions of texts of different genres is one of the main goals of linguistic literacy in education. Expository and informative texts constitute the prevalent genres in academic reading and writing, underscoring the need to investigate students' developing expressive linguistic abilities in these genres (Beers & Nagy, 2011). Much psycholinguistic research on the development of writing skills has focused on the contrast between narrative and expository writing (Berman, 2009; Nippold & Scott, 2010). The current study turns to the linguistic characteristics of Hebrew informative versus expository writing as a window on language and literacy skills across the school years and beyond, during the period known as Later Language Development (Berman, 2005).

Later language development

Later language development, which takes place between the ages of 9 years to adulthood, ushers in mature native language proficiency (Berman, 2004, 2016; Berman & Ravid, 2008; Nippold, 2016). This is a time of great changes in the individual's brain structures and functions (Fuhrmann, Knoll, & Blakemore, 2015; Kadosh, Linden, & Lau, 2013; Paus, 2005), characterized by growing command of socio-cognitive and executive control abilities (Lecce et al., 2017; Osterhaus, Koerber, & Sodian, 2017). One consequence of adolescent brain development is the dramatic improvement in processing abilities. Unlike young children, who take in a limited number of highly frequent, meaningful and predictable language categories (De Ruiter et al., 2018), older learners can process linguistically complex texts, given

their vastly improved cognitive capacities of attention, memory, and processing (Kilford, Garrett, & Blakemore, 2016; Larsen & Luna, 2018). During adolescence, multimodal integration areas that support higher order cognition undergo structural and functional maturation, enhancing connectivity and task-induced activation (Simmonds et al., 2014), including executive control functions (Crone, 2009). Thus, development increases the complexity of the human learning architecture, allowing learners to filter their attention to less frequent and prominent features in linguistic systems (Ramskar et al., 2018). To accomplish this, the learning system itself changes with time and experience to adapt to the changing structure of the linguistic input (Onnis & Thiessen, 2013), such as the shift from the spoken to the written modality (Berman, 2008).

The impact of these patterns of reorganization in the maturing brain on language learning was construed by Karmiloff-Smith (1992) as reflecting a process whereby knowledge becomes more integrated, denser, and more readily accessible in adolescence (Tibi, Tock, & Kirby, 2019). Along similar lines, Ramskar and Glitcho (2007) show that language acquisition changes its character from unsupervised learning in early childhood to the more agentive, self-monitored, supervised learning typical of older childhood and adolescence. These developments support enhanced metalinguistic abilities and access to higher-order, non-literal language (Berman & Ravid, 2010; Karmiloff-Smith 1992). They also enable increasing text-production abilities (Berman, 2008; Nippold & Scott, 2009).

Later language development is thus characterized by the emergence of mature, complex language capabilities (Berman, 2017; Clark, 2004; Kuhn, 2011; Proverbio & Zani, 2005). Language skills continue to develop across the school years until young adulthood and beyond (Berman, 2007; Berninger et al., 2017; Nippold, 2016). Brain and cognitive developments enable older language learners to extract information from larger and more diverse samples of the data and learn less prominent categories and items. A critical part of the immense growth in language knowledge and skills is due to the consolidation of linguistic literacy during the school years (Egbert, 2020; Ravid & Tolchinsky, 2002), including the ability to shift flexibly between the spoken and written modalities, produce monologic discourse in different text types, adopt different perspectives on events and situations, and gain command of figurative language (Ashkenazi & Ravid, 1998; Beltrán-Planques & Querol-Julián, 2018; Berman, 2008; Berman & Ravid, 2010; Brandes & Ravid, 2019; Colston, 2020; Vulchanova et al., 2019).

A critical component of language proficiency attainment towards adulthood concerns lexical development in the content word domain of nouns, adjectives, and verbs (Beitchman et al., 2008; Clark, 2017). Maturing cognitive and interpersonal skills and the consolidation of linguistic literacy usher in abstract reasoning and increasing analytic capability (Crone, 2009; Fortman, 2003), which find expression in complex words typical of written, academic language (Anglin, 1993). In a recent article, Atanasova et al. (2020) summarize a large body of data showing that the difference between children's and adults' lexical knowledge, measured in terms of accuracy and speed, is both quantitative and qualitative. Their study indicates that with regards to AoA of words in production, young adolescents (14- to 16-year-olds) display intermediate behavior between younger children and adults that may indicate ongoing brain maturation. Studies on Hebrew, where the lexicon is organized by

morphological devices and systems (Ravid, 2019), show that command of derivational morphology and morpho-lexical abilities increases exponentially across adolescence to include mental words, abstract and derived nouns (Ravid, 2006; Ravid & Avidor, 1998), denominal adjectives (Cutillas & Tolchinsky, 2017; Ravid et al., 2016), and specialized vocabulary (Ben Zvi & Levie, 2016; Berman & Nir-Sagiv, 2010; Osterhaus, Koerber, & Sodian, 2017). Lexical growth in adolescence is accompanied by a dramatic increase in syntactic complexity, which is mainly used to identify, comprehend and express complex ideas in texts and to organize the flow of information in a text (Bybee & Noonan 2001; Ravid and Berman, 2006).

Writing in language development

Writing is prototypically a pre-planned, non-interactive activity, impersonal and nondirect - a process that results in editable text (Hyes & Flower, 1981; Murray, 2012). The generation of stable textual products disengaged from their immediate context of production constitutes the basis for a literate society that documents and comments upon knowledge (Olson, 2006). It also brings to consciousness the structures, semantics and functions of linguistic usage that may be absent from awareness in oral expression (Olson, 1994). Writing is considered the ultimate achievement of linguistic literacy (Berman & Ravid, 2008; Ravid & Tolchinsky, 2002), imposing cognitive demands on memory, executive functions, and top-down processing, and promoting the creation of complex syntactic units (Chafe, 1994; Kärkkäinen et al., 2007; Slobin, 2003).

In an educational context, writing is the highway to learning, processing, organizing, storing and retrieving information during the school years, as well as for communicating with teachers and peers (Donovan, 2001). The older the students and the higher their grade level, the more important the quality of writing and its quantity become in integrating information from external resources. Therefore, writing activities increasingly occupy the central arena of linguistic abilities in school age children, while at the same time challenging them with a paradoxical demand. On the one hand, writing calls for the creative production of new content in line with the modality, the communicative circumstances, and the required genre; but at the same time, constructing a piece of written discourse imposes heavy demands on both bottom-up and top-down processing abilities. Writers need to retrieve the specific words for the desired expression of content, combine them in the appropriate syntactic and rhetorical structures, and integrate them smoothly and meaningfully in view of the overall goal of the text under construction, paying attention to facets of the notational system such as spelling and punctuation (McNamara, Crossley, & McCarthy, 2010). To achieve this balance in expressing communicative content in a constrained form, students need to access rich cognitive resources, such as monitoring and executive control, meta-memory, planning, setting goals, and manipulating series of units.

It is no wonder that gaining command of writing abilities is a protracted process requiring both internal resources as well as active mediation, support and guidance by expert teachers. This process interfaces with later language development, as described above, across the school years (Berman, 2005; Nippold, 2016; Silliman & Berninger, 2011). Importantly, it depends on linguistic resources that consolidate over the school years (Berman,

2014; Castillo & Tolchinsky, 2018; Graham & Harris, 2009), in tandem with socio-cognitive developments that take place in adolescence (Blakemore, 2012). A series of psycholinguistic studies compared morpho-syntactic, lexical, and discursive features of written and spoken Hebrew texts produced by native, non-expert school-aged and adult writers. Written texts were found to be informationally denser, lexically richer and more diverse, containing more high-register lexical items and morphological constructions than spoken texts (Berman & Nir-Sagiv, 2010; Ravid & Berman, 2009). Written texts were also shown to have fewer discourse markers, repetitions, false starts, hedges, and other disfluencies than spoken texts (Ravid & Berman, 2006). Written more than spoken texts contained abstract and morphologically complex nominals (Ravid, 2006; Ravid & Cahana-Amitay, 2005), often modified by derived adjectives in the attributive position (Ravid & Levie, 2010), as well as longer and more complex noun phrases (Ravid & Berman, 2010; Ravid et al., 2002), often in the form of heavy compounds (Ravid & Zilberbuch, 2003). These linguistic features increased with age and schooling levels (Berman, 2004, 2007; Berman & Nir-Sagiv, 2007; Ravid, 2006).

In addition to the *spoken – written* dichotomy, the factor of *genre* knowledge profoundly affects all linguistic and discursive domains (Louwerse, McCarthy, McNamara & Graesser, 2004; Figueroa, Meneses & Chandia, 2018; Snow & Uccelli, 2009). We know that in addition to reader competencies that depend on text genre (Best, Floyd & McNamara, 2008), text production abilities are also highly dependent on text genre (Berman & Nir-Sagiv, 2009; Brandes & Ravid, 2016, 2019). A plethora of developmental psycholinguistic studies have examined narrative versus expository writing across the school years (Berman, 2008; Berman & Katzenberger, 2004; Nippold & Scott, 2010; Nippold & Sun, 2010; Ravid & Berman, 2010), focusing on text content, discourse structure, lexicon, and morphosyntax. These studies indicate that growing familiarity with different text types and genres enables writers to employ various genre-appropriate complex syntactic constructions by adolescence (Aparici, Rosado, & Perera, 2016; Brimo & Hall-Mills, 2019; Ravid, 2005, 2013; Ravid, Dromi & Kotler, 2009). The analysis of narrative and expository texts has also served to highlight differences in the syntactic skills of disordered or deprived and typically developing children and adolescents (Berman, Nayditz & Ravid, 2011; Gillam & Johnston, 1992; Nippold et al., 2008, 2009; Scott & Windsor, 2000).

Academic writing

The current study examines the linguistic constructions typical of the non-narrative continuum in academic writing. At one end of this continuum lie expository texts, characterized by argumentation or persuasion regarding social / conceptual issues; and at the other lie informative texts, describing factual (or less controversial) phenomena. The previous section shows that expository texts have been the focus of many developmental psycholinguistic studies, especially contrasting them with narrative writing. However, while informative texts (together with expositives) constitute the prevalent genre in academic reading and writing, to date, not much research has been carried out on students' developing linguistic and discursive expressive abilities in this genre (Beers & Nagy, 2011). This is especially necessary in view of the fact that writing expository and informative texts is commonly requested

in school (Donovan & Smolkin, 2001; Nippold et al., 2009; Schleppegrell, 2003). Therefore, expository and informative texts constitute the genres of the current study on the development of academic writing in school age. The characteristics and the specific communicative purposes of each genre, as elaborated below, are expected to affect students' production.

Table 1: The main properties of expository and informative texts: Typical Stance, Content, Protagonists.

Genre → Properties	Expository	Informative
Stance	Abstract, generic	Concrete, generic
Content	Presentation of socio-cultural issues and concepts	Description of objects, people, natural and man-made events, processes
Protagonists	Ideas	Informational topic

Table 1 depicts the main features of expository versus informative texts in terms of Stance or tone, content, and the typical protagonists (Berman, 2005; Ravid, 2005; Scott & Baltazar, 2010). The language and general tone or stance of expository texts (on themes such as *animal consciousness, how to eliminate violence*) is abstract and generic, with ideas as the main protagonists and socio-cultural issues as the typical content. The literature shows that from the early school years, expository texts, which depict the unfolding of ideas, are highly nominal and contain high register vocabulary, including lexically diverse, abstract nouns, and denominal adjectives. They are characterized by complex syntax (both subordinating and coordinating), heavy NPs, non-dynamic constructions, passive voice, non-finite verbs, and epistemic hypothetical constructions. Thus, it takes the whole span of adolescence to achieve writing skills in expositorys (Cutillas & Tolchinsky, 2017; Nippold & Sun, 2010; Oblinghouse & Wilson, 2013; Ravid & Berman, 2010; Ravid & Levie, 2010).

In contrast, informative texts (e.g., *how lightning works, perfumes*) focus on description of objects, events and natural processes from a concrete yet generic point of view. They present information about the world in ways that are intrinsic to these topics. We are in possession of less knowledge about the development of informative text production – certainly much less than what we know about narrative and expository text production – and that is despite the fact that they constitute the majority of texts read and written across the school ages. Research so far has focused on lower grades (Tower, 2003), showing that 5th graders used more basic structures in writing informative texts versus more sophisticated structures in narrative texts (Donovan, 2001). On the other hand, students' informative texts contained more content words, more complex syntax and elaboration than narrative or persuasive texts (Beers & Nagy, 2011; Olinghouse & Wilson, 2013). And as for Hebrew, a single study on school-going populations shows that Hebrew-speaking 7th graders wrote very concrete, scarcely developed informative texts (Ravid & Shalom, 2012).

In sum, investigating the texts that school-goers construct provides a window on their linguistic abilities, in a period when command of written language is opening up new av-

enues to linguistic knowledge and on the genre-specific construction of different text types (Jisa & Tolchinsky, 2009; Sanders & Schiperoord, 2006).

Methods

Against this background, the current study is based on the assumption that gaining command of the structures and functions of texts of different genres is one of the main goals of linguistic literacy in education. The study aimed to gain psycholinguistic information and insights regarding the development of informative versus expository text writing abilities in Hebrew-speaking elementary, middle and high school students, compared with adults. Our study focuses on features such as text content, text structure, lexicon, and morpho-syntax. We aimed to determine when and to what extent participants are able to provide a full description of an informational topic that is familiar to them, and to explore the linguistic and cognitive resources they employ in elaborating on an informational topic – and thus to shed light on the language-cognition interface in writing development (Baaijen & Galbraith, 2018; Deane et al. 2008; Kellogg, 2008; Sanders & Schiperoord, 2006). A related aim of this study was to specify the characteristics of expository versus informative texts, two genres that constitute two ends of the non-narrative continuum. In practical terms, we aimed to (i) assess students' written products in the context of their age and literacy level; and to (ii) pinpoint certain areas where some of the students might be in need of remediation (Berman et al., 2011; Scott & Balthazar, 2010; Scott & Windsor, 2000) - as against the two main variables of the study – genre (expository vs. informative text type) and age / schooling, as described below.

Hypotheses

We had two main hypotheses. The first one was that all textual measures (see below) would increase with age and schooling (Berman & Katzenberger, 2004; Crossley et al., 2011; Nippold, Ward-Lonergan, & Fanning, 2005). A second hypothesis predicted differences between the expository and informative texts (Tolchinsky, 2019). However, we could not predict the direction of this hypothesis, as this is a first study of its kind in Hebrew.

Participants and data base

Participants constituted 547 students (roughly half male, half female) in three school levels, and adults, as follows: 139 4th graders, 135 7th graders, 126 11th graders, and 147 educated adults with post-high school education. All participants were monolingual, native Hebrew speakers, with typical development, from mid-high SES schools. The school children and adolescents were recruited in their own classrooms on a voluntary basis. Given the educational and psycholinguistic nature of the current study, no students were excluded from participation, as we wished to represent the whole range of grade-level writing performance in typical schools of the Israeli national system (Bar-On & Ravid, 2011).

Each participant wrote two texts, as delineated in Table 2: one informative text and one expository text, yielding a data base of 1,094 texts. Students wrote both texts (in the order they chose) within a school period of 45 minutes, the length of a typical lesson. Students who asked for more time were granted an extension until they were done. Adults were recruited individually, and having filled out an internet questionnaire about their background, they each wrote the requested texts and sent them to the first author.

The topic of the expository text was Success and Failure, and the instructions for participants were as follows: *“Success and failure are topics which interest youth and adults, and every person has different opinions and understandings regarding these topics. Think about the topic of success and failure, about their reasons and outcomes, and write an exposition that will present your thoughts on the topic”*. The topic of the informative text was The Cellular Phone, and the instructions for participants were as follows: *“Write a text that presents and describes the cellular phone (for example, the Iphone or the Android). Do not write a story: describe the cellular phone, its uses and functions, as though you were writing for Wikipedia. Also think of the implications of the use of the cellular phone for people and for society”*.

Table 2: The study database (N = 1,094 texts).

Informative texts	Expository texts
Cellular phones N = 547	Success and failure N = 547

Coding and analyses

Two kinds of dependent variables were coded in the texts. A first type were *count* variables that measured the volume of the text in three different ways, as follows: (i) number of words; (ii) number of clauses; and (iii) Mean Clause Length (MCL), the number of words divided by the number of clauses, a derived measure of lexical and syntactic density in the clause (Berman & Ravid, 2008; Ravid, 2005). Text size as assessed by these three measures gives us a good idea of students' productive ability to express themselves in writing. A second type of variable, related to the linguistic properties of the texts, was *recompensed* – variables designed to reflect the linguistic properties of the text, adjusted for number of words, i.e., calculated as a ratio of variable/length in words. Recompensed variables were lexical (abstract nouns, attributive adjectives), morpho-syntactic (compounding devices), syntactic (conjunct structures, complement clauses, headless clauses, and relative clauses), as well as demarcation markers (a measure composed of connecting words and punctuation marks). These linguistic features were found in the literature described above to be typical of the literate language typical of advanced, though non-expert, writing. The Results and Discussion sections will elaborate on these structures and their meaning for the development of writing skills in later childhood and adolescence.

Analyses of both count and recompensed dependent variables were carried out with regards to the two key variables in the current study – *age/schooling* - a developmental perspective, with the adults as a point of comparison given their mature language abilities; and *genre*, with the idea that text type affects the linguistic properties of the text. We also expected age/schooling differences to be expressed differently in the two text types. Analysis was carried out in two stages for each textual measure, using the Generalized Estimating Equations (GEE) model. For each analysis, the first stage started with genre and age/schooling level, and then examined the interaction of these two variables. Interactions were analyzed within each text type using the Bonferroni Pairwise test in contrasting every possible age/schooling pair.

Results I: Text size - count variables

We start by presenting the results of the text size measures – words, clauses and MCL – in terms of the two variables of age/schooling and genre. Appendix A (i, ii, iii) shows the results of the GEE model for these three analyses. Table 3 summarizes the results of the GEE model. Appendix A (i) and Table 3 indicate that texts written by adults were longer in words than those written by school children, but shorter than those written by 11th graders, with no effect for genre, but with an interaction that is shown in Figure 1.

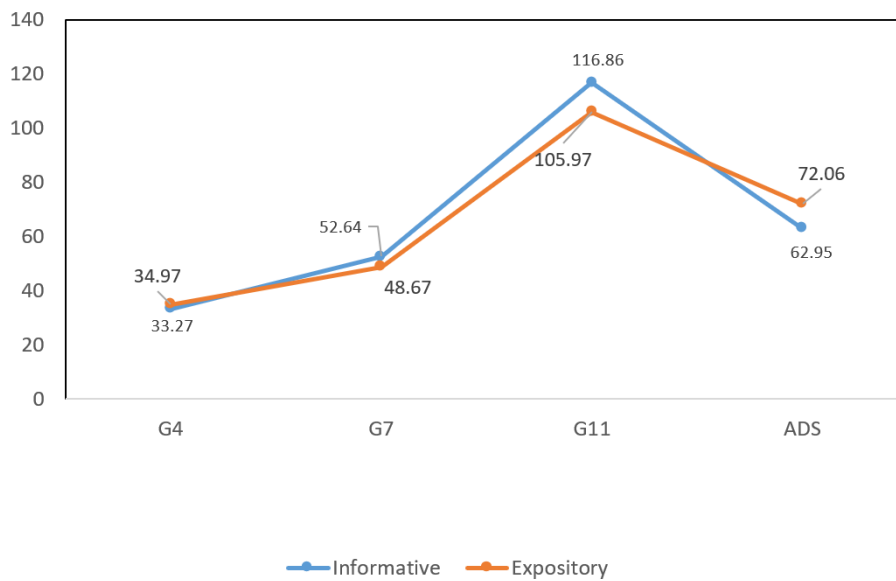


Figure 1: Interaction of age/schooling and genre in mean number of words.

Appendix A (ii) and Table 4 indicate that texts written by adults were longer in clauses than those written by younger children, but shorter than those written by 11th graders; and that expository texts had more clauses than informative texts. The interaction is shown in Figure 2.

Table 3: Summary of differences between age groups and genres regarding mean number of words, clauses, and Mean Clause Length.

Category	Age/Schooling	Genre	Interaction
# Words	Ads > 4 th ($b=0.51$, $p<.001$), Ads > 7 th ($b=0.75$, $p<.001$); 11 th > Ads ($b=1.62$, $p<.00$)	X	✓
# Clauses	Ads > 4 th ($b=0.78$, $p<.001$); 11 th > Ads ($b=1.89$, $p<.001$)	E > I	✓
Mean Clause Length	Ads > 4 th , 7 th , 11 th ($b=-2.01, -1.20, -.077$, $p<.001$)	X	✓

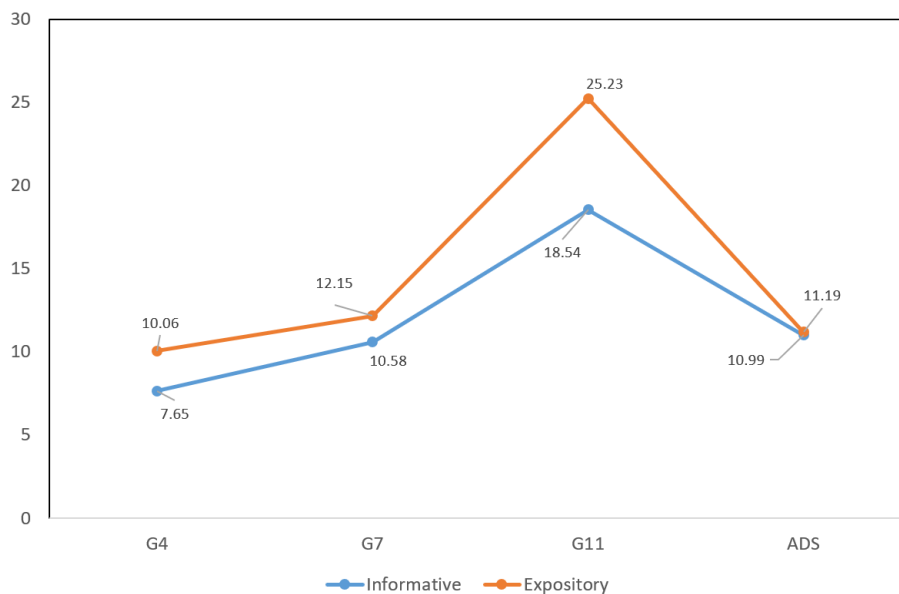


Figure 2: Interaction of age/schooling and genre in mean number of clauses.

Appendix A (iii) and Table 3 indicate that adult clauses were longer than clauses in texts by younger writers; and informative clauses were longer than expository clauses. Figure 3 shows the interaction.

Summary of results regarding text size

Our first hypothesis was partially confirmed. 11th graders produced the most words and clauses, and 4th graders produced the fewest numbers of words and clauses. MCL increased with age, with the longest clauses in the adult texts. Although the number of words did not differ across genres, expository texts had more clauses, and MCL was larger in the informative texts.

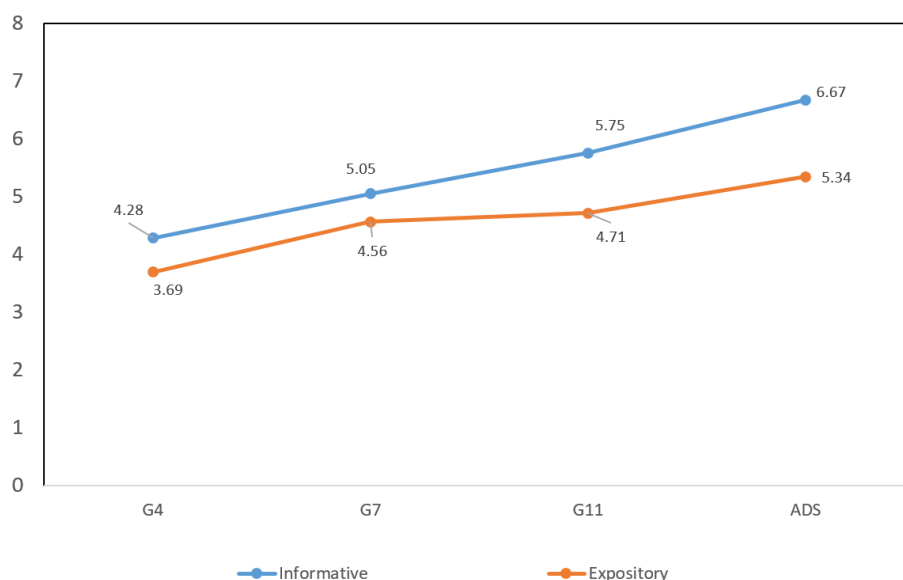


Figure 3: Interaction of age/schooling and genre in mean clause length (MCL) – words divided by clauses.

Results II: Recompensed lexical, morpho-syntactic and demarcation variables

We now move on to the linguistic measures characterizing our participants' texts, which were recompensed by standardizing text length. A proportion of each variable was calculated in relation to the number of words in the text, given that text sizes are different in the different age/ schooling groups (Salas & Caravolas, 2019).

Lexical measures

The lexical measures focused on two classes of words in Hebrew, which have been shown to be of critical importance in later language development: abstract nouns (e.g., *xoxma* 'wisdom', *kabala* 'reception') and attributive, specifically denominal adjectives (e.g., *merkazi* 'central' from *merkaz* 'center') (Ravid, 2006; Ravid & Levie, 2010; Ravid et al., 2016).

Abstract nouns. **Abstract nouns** were identified in the texts and analyzed in two different ways: their frequency of usage (**tokens**); and their category size, i.e., the number of different abstract nouns (**types**). In addition, **abstract nouns in compounds** (e.g., *havtaxat ha-eyxut* 'assurance (of) the-quality') were identified and analyzed both as **tokens** and **types**, as indicating the production of heavy noun phrases with abstract cores (Ravid & Berman, 2010). Appendix B (i) shows the results of the GEE model for the recompensed abstract noun analyses. Table 4 summarizes the results of the GEE model. Figures 4-5 present the interactions.

Appendix B (i), Figures 4-5 and Table 4 indicate that the cutoff point in development re-

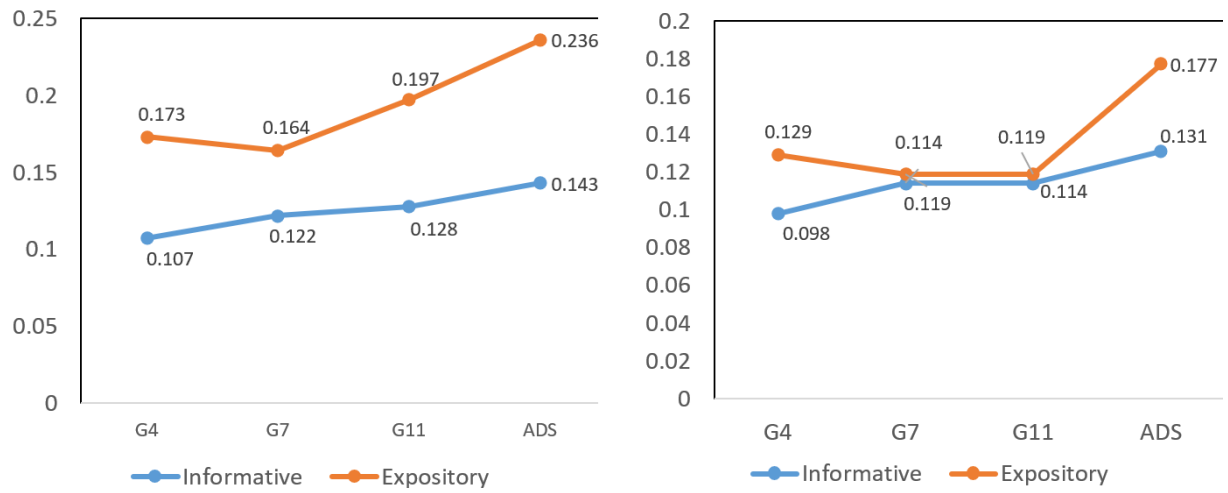


Figure 4: The age/schooling and genre interactions on numbers of recompensed abstract nouns in the texts (tokens on the left, types on the right).

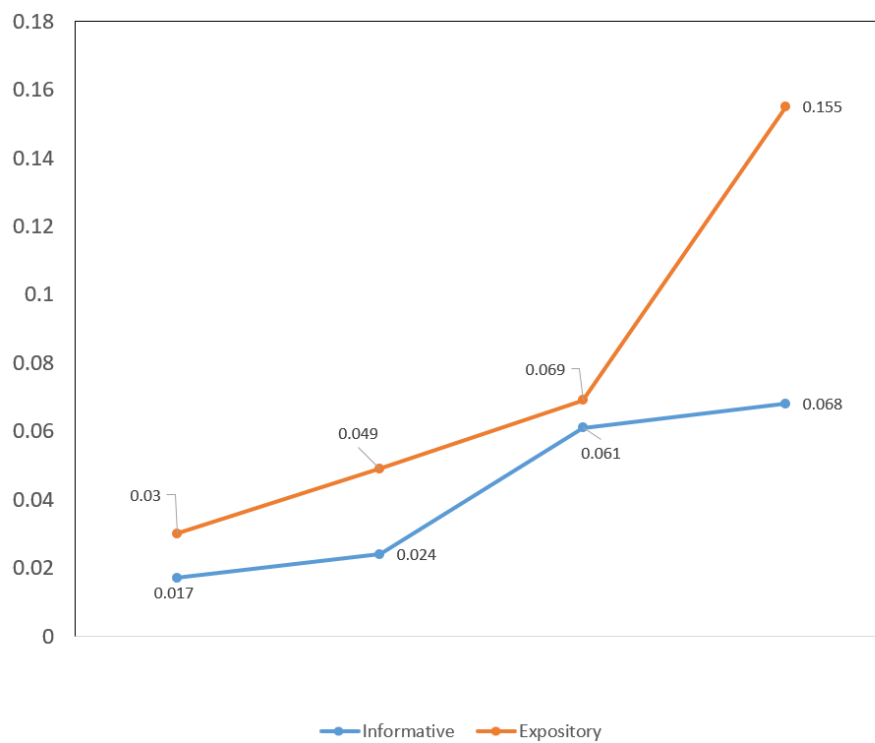


Figure 5: The age/schooling and genre interaction on compounds with recompensed abstract noun types in the texts.

Table 4: Summary of differences between age groups and genres regarding recompensed abstract noun measures.

Category	Age/Schooling	Genre	Interaction
Abstract noun tokens	Ads > 4 th , 7 th , 11 th ($b=-.30, -.26, -.15, p<.001$)	E > I	✓
Abstract noun tokens in compounds	Ads > 4 th , 7 th , 11 th ($b=-1.41, -1.05, -.37, p<.001$)	E > I	X
Abstract noun types	Ads > 4 th , 7 th , 11 th ($b=-.30, -.26, -.26, p<.001$)	E > I	✓
Abstract noun types in compounds	Ads > 4 th , 7 th , 11 th ($b=-.30, -.26, -.26, p<.001$)	E > I	✓

garding abstract nouns is in later adolescence – on all analyses, adults have more abstract nouns than the younger groups; and expository texts are richer in abstract nouns than informative texts.

Attributive adjectives. **Attributive adjectives** were identified in the texts and analyzed in two different ways: their frequency of usage (**tokens**); and their category size, i.e., the number of different attributive adjectives (**types**). In addition, a specific class of attributive adjectives – **denominal adjectives** (e.g., *eyxuti* ‘of high quality’ from *eyxut* ‘quality’) were identified and analyzed both as tokens and types, as indicating a literate lexicon (Ravid & Levie, 2010; Ravid et al., 2016). Appendix B (ii) shows the results of the GEE model for the analysis of recompensed attributive adjective analyses. Table 5 summarizes the results of the GEE model regarding attributive adjective analyses. Figure 6 presents the interactions.

Table 5: Summary of differences between age groups and genres regarding recompensed attributive adjective measures.

Category	Age/Schooling	Genre	Interaction
Attributive adjective tokens	Ads > 4 th , 7 th , 11 th ($b=-.39, -.35, -.18, p<.001, .001, .01$)	I > E	X
Attributive adjective types	Ads > 4 th , 7 th , 11 th ($b=-.43, -.38, -.22, p<.001$)	I > E	X
Denominal attributive adjective tokens	Ads > 4 th , 7 th , 11 th ($b=-1.77, -1.09, -.54, p<.001$)	I > E	✓
Denominal attributive adjective types	Ads > 4 th , 7 th , 11 th ($b=-1.78, -1.16, -.70, p<.001$)	I > E	✓

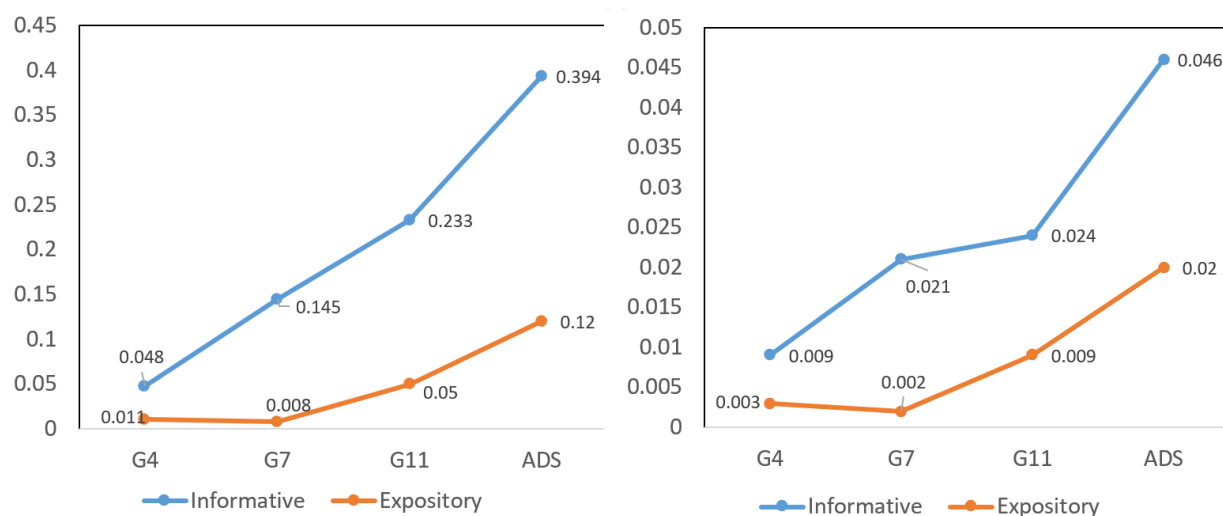


Figure 6: The age/schooling and genre interactions on recompensed denominal attributive adjectives in the texts (tokens on the left, types on the right).

Summary of lexical measures

Our first hypothesis was fully confirmed: development had an effect on all lexical measures, which increased with age and schooling and were significantly more abundant in the adult group. Moreover, as per our second hypothesis, genre plays an important role in learning to produce academic texts: while abstract nouns are always more numerous in expository texts, all analyses of attributive adjectives, including denominal adjectives which are the hallmark of Hebrew literacy (for example, *ta'asiyati* 'industrial' from *ta'asiya* 'industry'), indicate they are more numerous in the informative texts. Note that this does not imply that informative texts are more "academic" than expositions, but rather more linked to school-type writing, as elaborated in the Discussion.

Morpho-syntactic measures

The morpho-syntactic measures focused on compounds of various kinds in Hebrew, which straddle the boundary between morphology and syntax – and have also been shown to be of critical importance in later language development, given their role in enhancing the structure and semantics of noun phrases (Ravid & Zilberbuch, 2003; Ravid & Assuline Tsabar, 2017). Three compound structures were coded and analyzed in terms of tokens: Classical bound adjacency compounds (e.g., *anfeyha-ec* 'branches-the-tree', where the compound head is morphologically bound to its complement; an English example is network reception); **free compounds** (*ha-anafim shel ha-ec* 'the-branches of the-tree', or *ha-klita shel ha-reshet* 'the reception of the network'), considered to be the gateway to heavy nominal syntax (Ravid & Assuline Tsabar, 2017); and **chained compounds** (e.g., *masax ha-maga shel ha-maxshir* 'the touch screen of the device'), which are composed of chains of compounds.

Appendix B (iii) shows the results of the GEE model for the analysis of recompensed compounds. Table 6 summarizes the results of the GEE model regarding compound analyses. Figure 7 presents an interaction.

Table 6: Summary of differences between age groups and genres regarding recompensed compound measures.

Category	Age/Schooling	Genre	Interaction
Adjacency compound tokens	Ads > 4 th , 7 th , 11 th ($b=-.99, -.64, -.18, p<.001,.001$)	I > E	X
Free compound tokens	Ads > 4 th , 7 th , 11 th ($b=-.79, -.54, p<.001$)	X	✓
Chained compound tokens	Ads > 4 th , 7 th , 11 th ($b=-1.34, -1.36, -.62, p<.001$)	I > E	X

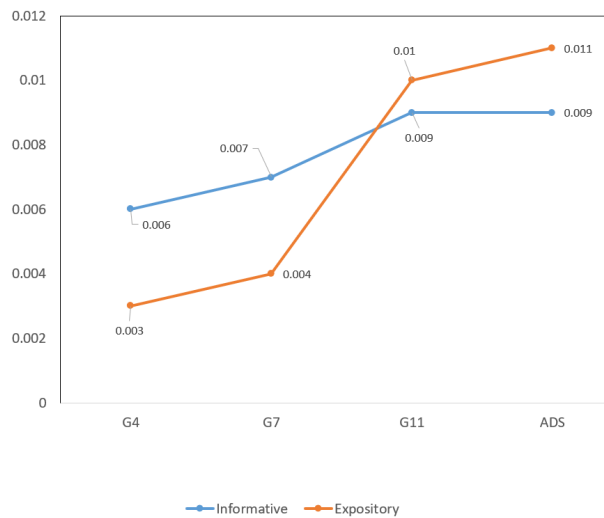


Figure 7: The age/schooling and genre interactions on recompensed free compounds in the texts.

Summary of morpho-syntactic measures

Our first hypothesis was fully confirmed: development had an effect on all compound measures, whose numbers increased with age and schooling and were significantly more abundant in the adult group. Moreover, as per our second hypothesis, genre plays an important role in learning to produce academic texts: Adjacency compound tokens and chained structures are more numerous in the informative texts – again, as elaborated in the Discussion, as a measure that reflects the facilitation of school-type language by this genre.

Syntactic measures

This analysis focused on two kinds of categories – syntactic categories and demarcation markers. Appendix C shows the results of the GEE model for the analysis of these recompensed structures. Tables 7 and 8 summarize the results of the GEE model regarding these analyses. Figures 8 and 9 present the interactions.

Syntactic structures. The syntactic measures focused on four categories that have been shown to characterize written text production in Hebrew-speaking higher grade levels and adults. First, **conjunct structures**, coordinating structures attached to a single unit as in *success is critical in life and in school*, where *critical* governs *in life* and *in school* (Ravid, 2013; Ravid & Hershkovitz, 2017); **complement clauses**, typically composed of a mental or dicendi verb followed by a clause delineating the content of the mental or saying activity, e.g., *he explained that failure might occur*; **headless relative clauses**, e.g., *someone who received a low grade*; and **relative clauses**, e.g., *a device that changed our lives*. While relative clauses are known to characterize richer academic language (Brandes & Ravid, 2016; Ravid & Berman, 2010; van Rij, van den Broek, & De Maeyer, 2021), this is the first time we examine the frequencies of headless relatives and complement clauses in the development of text production. Appendix C (i, ii, iii, iv) and Table 7 provide the statistical analyses and summary of differences for the syntactic measures. Figure 8 shows the interactions.

Table 7: Summary of differences between age groups and genres regarding recompensed attributive adjective measures.

Category	Age/Schooling	Genre	Interaction
Conjunct structures	Ads > 4 th ($b=-.21, p=.001$)	E > I	✓
Complement clauses	Ads > 4 th , 7 th ($b=-1.30, -.76, p<.05$)	E > I	X
Headless clauses	Ads > 4 th , 7 th , 11 th ($b=.92, .49, .29, p<.001, .01, .05$)	E > I	X
Relative clauses	Ads > 4 th , 7 th ($b=-.79, -.45, p=.001$)	I > E	✓

Appendix C (i-iv), Table 7 and Figure 8 indicate that all syntactic measures increased with age and schooling, with the cutoff point between 7th or 11th grade and adults; and that genre had an effect on these productions, as conjunct structures, complement structures and headless relatives were more numerous in expository than informative texts; whereas relative clauses were more abundant in informative than expository texts.

Demarcation markers. Alongside the syntactic measures we examined **textual demarcation**, a measure of information flow that takes into account connectivity and coherence in writing. This measure took the form of three analyses: **Conjoining lexical markers**, such as *in addition, first and foremost*; **commas** and **full stops**. All measures were recompensed by number of words. Appendix C (v, vi, vii) and Table 8 provide the statistical analyses and summary of differences for the syntactic measures. There were no interactions.

Appendix C (v, vi, vii) and Table 8 indicate that text connectivity and demarcation improved with age and schooling as expressed by the three measures presented above; and

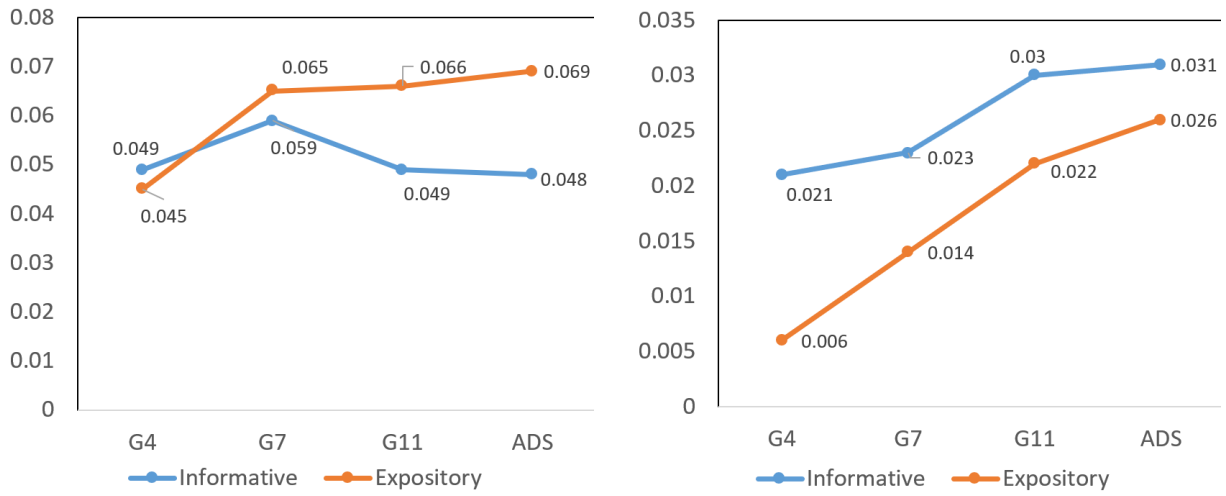


Figure 8: The age/schooling and genre interactions on recompensed conjunct structures in the texts (on the left) and relative clauses (on the right).

that informative texts were better demarcated than expository texts.

Table 8: Summary of differences between age groups and genres regarding recompensed demarcation measures.

Category	Age/Schooling	Genre	Interaction
Connective lexicon	Ads > 4 th , 7 th (b=.20, .27, p~.05, <.01)	I > E	X
Commas	Ads > 4 th , 7 th (b=-1.23, -.26, p<.001, <.05)	I > E	X
Full stops	Ads > 4 th , 7 th (b=-.39, -.16, p<.001, ~.05)	X	X

Summary of syntactic and demarcation measures

Our first hypothesis was fully confirmed: development had an effect on all syntactic and demarcation measures, whose numbers increased with age and schooling and were significantly more abundant in the adult group. Moreover, as per our second hypothesis, genre plays an important role in learning to produce academic texts: most syntactic structures were more numerous in expository texts (whereas relative clauses were more numerous in informative texts); and informative texts were better demarcated than expository texts in terms of connectives and commas.

Discussion

The current study investigated the linguistic characteristics of 1,094 informative and expository texts written by 547 native Hebrew-speaking participants in three grade levels (4th, 7th, and 11th grades), compared with educated (but non-expert) adults. Informative texts described cellular phones, while expositions discussed the themes of success and failure. Each text was coded and analyzed by lexical, morphological, and syntactic measures.

In line with the literature reviewed above, we had two major hypotheses. One expected to detect more and richer linguistic measures with age and schooling. A second hypothesis expected to see differences in the distributions of these measures across the two genres, but since informative texts have been scarcely investigated in the framework of developmental text production, we did not have a direction for these expected differences. Indeed, both our hypotheses were confirmed in interesting ways. Below we discuss the results in two perspectives – a developmental outlook and a genre-specific outlook.

A developmental perspective on written text production

A broad array of studies describe the pathway undertaken by children and adolescents in developing their writing skills across the school years. A critical part of the immense growth in language knowledge and skills during these years is due to the consolidation of linguistic literacy (Egbert, 2020; Ravid & Tolchinsky, 2002), including the ability to shift flexibly between the spoken and written modalities, produce monologic discourse in different text types, adopt different perspectives on events and situations, and gain command of figurative language (Ashkenazi & Ravid, 1998; Beltrán-Planques & Querol-Julián, 2018; Brandes & Ravid, 2019; Colston, 2020; Vulchanova et al., 2019).

In Hebrew, special attention has been paid to the developing linguistic features of text production abilities across the school years, such as high-register lexicon (Ravid, 2004; Ravid & Berman, 2009); optional inflectional morphology (Cahana-Amitay & Ravid, 2000); derived, abstract nouns (Ravid, 2006; Ravid & Avidor, 1998; Ravid & Cahana-Amitay, 2005); compounding structures (Ravid & Zilberbuch, 2003); denominal and syntactically expanded adjectives (Berman, Naydic & Ravid, 2011; Ravid & Levie, 2010; Ravid et al., 2016); large noun phrases (Ravid & Berman, 2010; Ravid et al., 2002); prepositional phrases (Brandes & Ravid, 2016); adverbial clauses (Brandes & Ravid, 2019); conjunct structures (Ravid & Hershkovitz, 2017); and a plethora of other morpho-syntactic, discursive and content measures (Berman, 2018; Ravid, Dromi, & Kotler, 2009). Across all of these domains in diverse studies, the high-register, abstract, lexically specific, alternative linguistic devices characterizing richer, advanced language increased with age and schooling, especially in later adolescence and in adulthood as compared to younger writers.

The current findings of morpho-syntactic analyses in a new corpus of over 1,000 written texts support and enhance this picture of the increasing linguistic complexity in the development of writing. While 11th graders wrote the longest texts in raw numbers of words and clauses, the derived measure of MCL, which provides mean clause length in words, showed that clauses increased in length with age and schooling, and that adults had the

longest clauses. Clauses (simplex sentences) can become longer in two ways – either by having more phrases (nominal, prepositional), which indicate more argument or circumstance structures; or by having longer phrases, with more noun and verb modifications. In both ways, longer clauses convey more information in clause-internal, syntactically complex structures. Thus, text production involves selecting your wording carefully with fewer repetitions and learning to produce more meaningful, tightly packaged clauses with age and schooling (Elsabbagh & Karmiloff-Smith, 2004; Northey, McCutchen, & Sanders, 2016). For example, a single clause describing the cellular phone in an adult text reads as follows (loosely translated from Hebrew) *cellular telephone devices in our times are usually rectangular, hand-sized, with several buttons*. Writing such clauses is part of the literacy and language skills needed from linguistically proficient individuals, aided by cognitive, linguistic and literacy development, who are able to put together a coherent text consisting of multiple ideas (Crossley et al., 2011; Greg & Nelson, 2018; Lindgren, Leijten, & Van Waes, 2011; McNamara et al., 2010).

More support for this developmental view was found in the lexical, morpho-syntactic and syntactic analyses performed while taking text length in words into consideration. As the results section indicates, the recompensed numbers of abstract nouns (e.g., *madad* ‘measure’, *mexkar* ‘research’) increased with age and schooling, culminating in a dramatic rise in adults; and they also appeared more in complex NPs based on N-N compounding, e.g., the high-register ‘double’ compound *haclaxato shel adam* ‘lit. the-success,3rd.Sg.Masc of (a) person’, or the chained compound *yexolet hafacat ha-meyda* ‘(the) ability (of) dissemination (of) information’. According to Schmid (2012), many abstract nouns act as conceptual shells that encode propositions and larger information chunks within a noun phrase, and serve as cohesive devices as their content is determined by referring to their context – very typical of academic discourse, of which both expository and informative texts are examples (Prados, 2018). It is no wonder that in addition to amassing the discipline-related and world knowledge lexicon that is necessary to expressing abstract concepts in academic writing (Khokhlova, 2014), it takes developmental time to gain command of encasing them correctly in dense syntactic environments (Nippold et al., 1999; Ravid, 2006). Attributive adjectives typically qualify nouns, e.g., *shipurim xadashim* ‘new improvements’. They are thus optional nominal modifiers whose main function is qualification - that is, to subdivide classes or specify among particular instances within classes on the basis of characteristics (Bolinger, 1967; Feris, 2014; Nelson, 1976) – which are among the properties of grammatically complex and mature linguistic expression (Biber, Gray & Staples, 2016; Parkinson & Musgrave, 2014; Staples et al., 2016). Just like abstract nouns, the amounts of attributive adjectives rose with age and schooling, culminating in the adult group. This was also true of a specific morphological class of adjectives – denominal (noun-derived) adjectives such as *koli* ‘voice-based’ from *kol* ‘voice’, which are known to characterize literate, especially academic Hebrew (Ravid et al., 2016). Many of the N-A combinations in the older-group texts were composed of an abstract noun and a denominal attributive adjective, e.g., *zminut tmidit* ‘constant accessibility’ or *madadim xomriyim* ‘concrete measures’ – indicating a mature ability to describe an abstract entity with its specific qualification.

The domain of morpho-syntax was represented in this study by the class of compounds,

which in Hebrew takes only the form of N – N combinations. Compounds are one of the major ways of expanding the Hebrew noun phrase (Ravid & Berman, 2010), especially in later language development (Ravid & Zilberbuch, 2003). The two major types of compounds – bound and free – again increased with age and schooling and were most numerous in the adult texts, e.g., *ma'agrey meida* 'information bases' or *migvan shel efsharuyot* '(an) array of opportunities'. These nominal combinations serve to express the complex sub-categorization of entities that are the typical referents in academic texts. The chained compounds, where several nouns are chained together, depicting larger and complex entities, had the same distributional behavior, e.g., *ha-hashlaxot shel hamca'at ha-telefon ha-nayad* 'the implications of the invention of the cellular phone'.

Complex syntax is well known as an important property of the language of school aged children and adolescents (Brimo & Hall-Mills, 2019; Nelson, 2013), although much work has targeted younger children and / or populations with impairments (Balthazar & Scott, 2018; Delage, Stanford & Durrleman, 2021; Kavar, 2021; Schuele & Dykes, 2005). Lexical and morpho-syntactic devices - abstract nouns, denominal adjectives and compounding, as well as noun phrases - have been studied before in the framework of Hebrew text development research, as in other languages (see above). Also, clause packaging has been the highlight of several important developmental psycholinguistic studies by Berman and associates on text production in Hebrew-speaking school age children (Berman, 2014, 2018; Berman & Nir-Sagiv, 2009). However, this is the first time that syntactic coordinating and subordinating constructions are individually investigated to characterize the language of Hebrew academic texts in development.

We looked at four constructions, which all increased with age and schooling, and were significantly more prevalent in the adults' texts. Conjunct structures, as in *young children already **consolidate their self appreciation and self perception** from early on* (conjoined elements bolded), constitute a arena of much relevance to the development of writing in Hebrew. While being a coordinating rather than subordinating device, Ravid (2013) and Ravid and Hershkovitz (2017) show that this construction is one of the earliest emerging harbingers of complex syntax in Hebrew, as several phrases are conjoined to a single syntactic construct, containing or being contained by other syntactic devices. Headless relative clauses and relative clauses both attach to a nominal head and expand it while referring to the matrix nominal (Corrêa, 2018; Lau & Tanaka, 2021; O'Grady, 2011). Note how the next example demonstrates the Hebrew-specific interweaving of a relative clause with a conjunct structure: *there are children who tend to compare themselves to older children such as their siblings, relatives or neighbors*. The remaining construction that we focused on was complement clauses, subordinated clauses attached to a verb as in *several researchers claim that the use and accessibility of the cellular device affect the socialization habits of users*. Complement clauses are not difficult to produce or comprehend, and children produce them early on (Boeg Thomsen et al., 2021; Ögel-Balaban & Aksu-Koç 2020). Their importance lies in the type of predicates – especially mental verbs and adjectives – that govern such clauses (Brandt, 2020; Maekelberghe, 2021), promoting the ultimate development of Theory of Mind and social cognition.

In sum, the results of the current study underscore the critical importance of language

knowledge and use, especially those that answer to the Typological Impact in serving the specific attributes of the language of young writers (Le Bruyn et al., 2022). Moreover, this section shows that complex syntax in its most mature form is found only in the adult texts. True, the constructions under study did appear in the children's and the adolescents' texts, but the only arena they congregated in large, statistically significant numbers were in the adults' texts, showing that the developmental processes we delineated during Later language acquisition culminate in maturity.

A genre perspective on the development of written text production

The overwhelming majority of our results were mitigated either by simple effects and / or interactions where genre – in this case expository and informative texts – was prominent. To begin with, given the absence of similar studies analyzing the linguistic features of these two particular genres in development, we did not have a particular direction on which to hang our hypotheses. The results have pinpointed the differences between the two genres in the acquisition of Hebrew writing skills. Table 9 summarizes the major genre- related differences detected in our study, showing in which genre each category type is more numerous.

Table 9: Summary of genre-dependent results of the current study.

Category	Expository Texts	Informative Texts
1. # Clauses	✓	
2. Abstract noun tokens	✓	
3. Abstract noun tokens in compounds	✓	
4. Abstract noun types	✓	
5. Abstract noun types in compounds	✓	
6. Attributive adjective tokens		✓
7. Attributive adjective types		✓
8. Denominal attributive adjective tokens		✓
9. Denominal attributive adjective types		✓
10. Adjacency compound tokens		✓
11. Chained compound tokens		✓
12. Conjunct structures	✓	
13. Complement clauses	✓	
14. Headless clauses	✓	
15. Relative clauses		✓
16. Connective lexical markers		✓
17. Commas		✓

As the Results section and Table 9 show, the measures used in the current analysis were diagnostic in two perspectives – genre characteristics and the acquisition of genre-oriented

writing. The linguistic categories we investigated had different distributions in the two genres, thus reflecting the overall character of either expositions or informative texts. Informational and expository texts are indeed close in what Berman (2005) designates as having academic and non-narrative *stance* - that is, being generic, non-personal, non-dynamic, and with no unfolding of events and no focal, overarching narrative point. However, the different distributions of the studied constructions indicate that these are two *different* non-narrative genres.

Expositions typically serve the discussion of social-related values, concepts and processes, and are highly abstract by nature. Their protagonists are ideas and propositions (Britton, 1994). In our case the expository theme we asked participants to write about was the notions of *success and failure*. It is no wonder that abstract nouns by any count as well as compounds based on abstract nouns were more numerous in expositions rather than in informative texts. The following array of abstract nouns occurred in one adult text (in addition to *success and failure*) – testifying to the abstract nature of the text: *musag* ‘concept’, *hevdel* ‘difference’, *matara* ‘goal’, *haga’a* ‘attainment’, *toca’a* ‘result’, *txum* ‘domain’, *histaklut* ‘observation’, *parshanut* ‘interpretation’, *meci’ut* ‘reality’, and *nisyonot* ‘experiences’. As noted above, these abstract nouns function as attractors for complex syntactic constructions of various kinds, including compounding and noun-adjective structures such as *téva ha-adam* ‘man’s=human nature’, *nifla’ot ha-maxshir* ‘(the) marvels (of) the-device’; *shalom pnimi* ‘internal peace’, *sviva enoshit* ‘human environment’. This important characteristic of expositions underscores their abstract stance and tendency towards complex syntax. This characteristic is enhanced by the fact that clauses are longer in expositions than in informative texts, with all of the implications discussed above. Moreover, three out of four syntactic measures indicating syntactic complexity - conjunct constructions, complement clauses and headless relatives – were more numerous in expository texts, often working together to create discourse chunks based on complex syntactic combinations as in *it is necessary to find the suitable balance between the abilities of the child and the assignments required of him, so that he will experience feelings of success and sometimes also feelings of failure to some extent*.

A second set of linguistic features shed light on the characteristics of informative texts. Informative texts offer a specialized outlook on topics, objects, entities, personae, locations, phenomena and processes in the present and the past, providing objective information on their nature and properties (Giora, 1993). This makes informative texts highly relevant throughout the school years (van Rijk et al., 2017). Like expositions, informative texts take a generic outlook (even on the life history of specific people), and they are not driven by the psychological relationships and motivations, as are narratives (Ravid & Zilberbuch, 2003). In non-expert writers, informative texts typically start with an Aristotelian definition (e.g., *the cellular phone is a device that is used for communication in our modern times*) and then elaborate on its predicate, so that the whole of the text is such an elaboration (Watson, 1985). This essential character of informative texts calls for much description and elaboration in

¹A word of caution here: The two genres are not always clearly separated in studies of the development of writing, and are sometimes used interchangeably, as in Ray and Meyer (2011).

static, generic stance, as is evident from two types of constructions that are more prevalent in informative texts – attributive adjectives and relative clauses. These two constructions elaborate upon a nominal nucleus, so that more information is provided about various aspects of the noun. For example, note the array of denominal attributive adjectives in *gormim politiyim umixariyim* ‘**political and commercial** factors’, *informacya xiyunit* ‘**vital** information’, *metauxim xiconiyim* ‘**external** mediators’ – most often coupled with abstract nouns. And the following example of three relative clauses in a single long sentence shows to what extent the elaboration of the nominal nucleus adds relevant information: *a cellular telephone (mobile telephone) is a device **that is possible to carry on a person's body**, with a mechanism **that enables carrying a conversation between two people who are in possession of this device***. These two constructions constitute two typical facets of the components of complex syntax that are found in informative texts and contribute to its information density (Ravid & Berman, 2006).

Note that here, too, fully mature informative texts in the sense of having all of the typical linguistic features delineated here were only found in the adult group, underscoring the culmination of Later language development. However, there was one property that is a harbinger and a companion of complex syntax that proved to be significantly more prevalent in the informative genre – demarcation markers in the form of lexical connectives such as *benosaf* ‘in addition’, *kmo xen* ‘likewise’, *lemashal* ‘for example’, *lefixax* ‘therefore’, as well as commas. These two features signify the organization of the text into coherent, logical and causal segments that contribute to the flow of information. These are two important properties of cohesive texts which tie together in various ways – elaborating, illustrating, comparing, delineating the pieces of information that make up the whole text. Clearly, young writers found it easier to produce more coherent, well demarcated informative texts than expositorys, probably due to the more concrete nature of the former and the more difficult cognitive demands of the latter genre.

In conclusion, the study we have presented delved deep into the constituents of academic writing in a developmental perspective. We found that complex lexicon and syntax in discourse increase in prevalence across the school years, with specific structures being genre-typical as befits the stance and character of the two genres under investigation. We also found that it was only in adulthood that all of these components were employed in optimal fashion, at the culmination of the period of Later Language Development. Our results imply that informative and expository texts are indeed distinct in their characteristics, and that it takes many years of internal linguistic and cognitive development, on the one hand, and schooling instruction and experience, on the other hand, to achieve qualitative academic writing in non-experts.

References

- Anglin, J. M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development*, 58(10).
- Aparici, M., Rosado, E., & Perera, J. (2016). Later development of relative clauses across

- discourse genres and modalities of production. In J. Perera, M. Aparici, E. Rosado, & N. Salas (Eds.), *Written and spoken language development across the lifespan* (pp. 201-225). Cham: Springer.
- Ashkenazi, O. & Ravid, D. (1998). Children's understanding of linguistic humor: An aspect of metalinguistic awareness. *Current Psychology of Cognition*, 17, 367-387.
- Atanasova, T., Fargier, R., Zesiger, P., & Laganaro, M. (2020). dynamics of word production in the transition from adolescence to adulthood. *Neurobiology of Language*, 2(1), 1-21.
- Baaijen, V. M. & Galbraith, D. (2018). Discovery through writing: Relationships with writing processes and text quality. *Cognition and Instruction*, 36(3), 199-223.
- Balthazar, A. H., & Scott, C. B. (2018). Targeting complex sentences in older school children with specific language impairment: results from an early phase treatment study. *Journal of Speech, Language, and Hearing Research*, 61, 713-728.
- Bar-On, A. & Ravid, D. (2011). Morphological analysis in learning to read pseudowords in Hebrew. *Applied Psycholinguistics*, 32, 553-581.
- Beers, F.B. & Nagy, W.E. (2011). Writing development in four genres from grades three to seven: syntactic complexity and genre differentiation. *Reading and Writing: An Interdisciplinary Journal*, 24, 183-202.
- Beitchman, J.H., Jiang, H., Koyama, E., Johnson, C.J., Escobar, M., Atkinson, L., ... & Vida, R. (2008). Models and determinants of vocabulary growth from kindergarten to adulthood. *Journal of Child Psychology and Psychiatry*, 49, 626-634.
- Beltrán-Planques, V., & Querol-Julián, M. (2018). English language learners' spoken interaction: What a multimodal perspective reveals about pragmatic competence. *System*, 77, 80-90.
- Ben-Zvi, G. & Levie, R. (2016). Development of Hebrew derivational morphology from preschool to adolescence. In R.A. Berman (Ed.), *Acquisition and development of Hebrew: From infancy to Adolescence* (pp. 135-173). Amsterdam: Benjamins.
- Berman, R.A. (2004). Between emergence and mastery: The long developmental route of language acquisition. In: *Language Development across Childhood and Adolescence*. (pp. 9-34). Amsterdam: John Benjamins.
- Berman, R.A. (2005). Introduction: Developing discourse stance in different text types and languages. *Journal of Pragmatics*, 37, 105-124.
- Berman, R.A. (2007). Developing language knowledge and language use across adolescence. In E. Hoff & M. Shatz (Eds.), *Handbook of Language Development* (pp. 346-367) London: Blackwell.
- Berman, R.A. (2008). The psycholinguistics of developing text construction. *Journal of Child Language*, 35, 735-771.
- Berman, R. A. (2009). Acquisition of compound constructions. In: R. Lieber & Stekauer, P. (Eds.), *Handbook of Compounding* (pp. 298-322). Oxford: Oxford University Press, .
- Berman, R.A. (2014). Syntactic complexity: Development of clause-combining. In P. Brooks & V. Kempe, (eds.), *Encyclopedia of language development* (pp. 634-640). New York: Sage.
- Berman, R.A. (2016). Linguistic literacy and later language development. In J. Perera, M. Aparici, E. Rosado, and N. Salas (Eds) *Written and spoken language development across*

- the lifespan* (pp. 181-200). Springer, Cham,
- Berman, R.A. (2017). Word class distinctiveness versus polycategoriality in Modern Hebrew: Psycholinguistic perspectives. In V. Vapnarsky & E. Veneziano (Eds.) *Lexical polycategoriality: Cross-linguistic, cross-theoretical, and language acquisition approaches* (pp. 343-376). Amsterdam: Benjamins.
- Berman, R.A. (2018). Development of complex syntax: From early clause-combining to text-embedded syntactic packaging. In A. Bar-On & D. Ravid. *Handbook of Language Disorders* (pp. 235-256). Mouton de Gruyter.
- Berman, R.A., & Katzenberger, I. (2004). Form and function in introducing narrative and expository texts: A developmental perspective. *Discourse Processes*, 38(1), 57-94.
- Berman, R.A., & Nir-Sagiv B. (2007). Comparing narrative and expository text construction across adolescence: A developmental paradox. *Discourse Processes*, 43 (2), 79-120.
- Berman, R.A., & Nir-Sagiv B. (2009). The language of expository texts: Developmental perspectives. In M. Nippold & C. Scott (Eds.), *Expository discourse in children, adolescents, and adults: Development and disorders* (pp. 101-123). NY: Taylor & Francis.
- Berman, R.A. & Nir-Sagiv B. (2010) The lexicon in speech-writing differentiation: Developmental perspectives. *Written Language & Literacy*, 13, 181-203.
- Berman, R.A., R. Nayditz, & D. Ravid. (2011). Linguistic diagnostics of written texts in two school-age populations. *Written Language & Literacy*, 14, 161-187.
- Berman, R.A. & Ravid, D. (2008). Becoming a literate language user: Oral and written text construction across adolescence. In D. R. Olson and N. Torrance (Eds.), *Cambridge handbook of literacy* (pp. 92-111). Cambridge: Cambridge University Press.
- Berman, R.A. & Ravid, D. (2010). Interpretation and recall of proverbs in three pre-adolescent populations. *First Language*, 30, 155-173.
- Berninger, V., Abbott, R., Cook, C. R., & Nagy, W. (2017). Relationships of attention and executive functions to oral language, reading, and writing skills and systems in middle childhood and early adolescence. *Journal of Learning Disabilities*, 50(4), 434-449.
- Best, R. M., Floyd, R. G., & McNamara, D. S. (2008). Differential competencies contributing to children's comprehension of narrative and expository texts. *Reading Psychology*, 29(2), 137-164.
- Biber, D., Gray, B., & Staples, S. (2016). Predicting patterns of grammatical complexity across language exam task types and proficiency levels. *Applied Linguistics*, 37(5), 639-668.
- Blakemore, S. J. (2012). Imaging brain development: the adolescent brain. *Neuroimage*, 61(2), 397-406.
- Boeg Thomsen, D., Theakston, A., Kandemirci, B., & Brandt, S. (2021). Do complement clauses really support false-belief reasoning? A longitudinal study with English-speaking 2-to 3-year-olds. *Developmental psychology*, 57(8), 1210.
- Bolinger, D. (1967). Adjectives in English: attribution and predication. *Lingua*, 18, 1-34.
- Brandes, G. & Ravid, D. (2016). Prepositional phrases as manner adverbials in the development of Hebrew L1 text production. In: Ortega L., Tyler A. E., Park, H. I. & Uno M. (Eds.), *The usage-based study of language learning and multilingualism* (pp. 55-73). Washington D.C.: Georgetown University Press.

- Brandes, G. & Ravid, D. (2019). The development of adverbial clause functions in Hebrew narrative and expository writing across adolescence. *Written Language and Literacy*, 22(1), 130-158.
- Brandt, S. (2020). Social cognitive and later language acquisition. *Current perspectives in child language acquisition: how children use their environment to learn*, 155-170.
- Brimo, D., & Hall-Mills, S. (2019). Adolescents' production of complex syntax in spoken and written expository and persuasive genres. *Clinical Linguistics & Phonetics*, 33(3), 237-255.
- Britton, B. K. (1994). Understanding expository text: Building mental structures to induce insights. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 641-674). Academic Press.
- Bybee, J. L., & Noonan, M. (Eds.). (2002). *Complex sentences in grammar and discourse: Essays in honor of Sandra A. Thompson*. Amsterdam: Benjamins.
- Cahana-Amitay, D., & Ravid, D. (2000). Optional bound morphology in the development of text production. In S.C. Howell, S.A. Fish & T. Keith-Lucas (Eds.), *Proceedings of the 24th Annual Boston University Conference on Language Development* (Vol. I, pp. 176-184). Somerville, MA: Cascadilla Press.
- Castillo, C. & Tolchinsky, L. (2018). The contribution of vocabulary knowledge and semantic orthographic fluency to text quality through elementary school in Catalan. *Reading and Writing*, 31(2), 293-323.
- Chafe, W. L. (1994). *Discourse, consciousness, and time: the flow of language in speech and writing*. Chicago: Chicago University Press.
- Clark, E. V. (2004). How language acquisition builds on cognitive development. *Trends in Cognitive Sciences*, 8(10), 472-478.
- Clark, E. V. (2017). Later lexical development and word formation. In P. Fletcher and B. MacWhinney (Eds.), *The handbook of child language* (pp. 393-412). Oxford: Blackwell.
- Colston, H.L. (2020). Figurative language development/acquisition research: Status and ways forward. *Journal of Pragmatics*, 156, 176-190.
- Corrêa, L.M.S. (2018). The relative difficulty of children's comprehension of relative clauses: A procedural account. In *Children's language* (pp. 225-243). Psychology Press.
- Crone, E.A. (2009). Executive functions in adolescence: inferences from brain and Behavior. *Developmental Science*, 12, 825-830.
- Crossley, S.A., Weston, J.L., McLain Sullivan, S.T. & McNamara, D.S. (2011). The development of writing proficiency as a function of grade level: A linguistic analysis. *Written Communication*, 28, 282-311.
- Cutillas, L., & Tolchinsky, L. (2017). Use of adjectives in Catalan: A morphological characterization in different genres and modes of production through school-age development. *First Language*, 37(1), 58-82.
- Deane, P., Odendahl, N., Quinlan, T., Fowles, M., Welsh, C., & Bivens-Tatum, J. (2008). *Cognitive models of writing: Writing proficiency as a complex integrated skill*. ETS Research Report Series.
- Delage, H., Stanford, E., & Durreleman, S. (2021). Working memory training enhances complex syntax in children with Developmental Language Disorder. *Applied Psycholin-*

- guistics*, 42(5), 1341-1375.
- De Ruiter, L., Theakston, A., Brandt, S., & Lieven, E. (2018). Iconicity affects children's comprehension of complex sentences. *Cognition*, 171, 202-224.
- Donovan, C.A. (2001). Children's development and control of written story and informational genres: Insights from one elementary school. *Research in the Teaching of English*, 394-447.
- Donovan, C. A., & Smolkin, L. B. (2001). Genre and other factors influencing teachers' book selections for science instruction. *Reading Research Quarterly*, 36(4), 412-440.
- Egbert, J. (2020). The new normal?: A pandemic of task engagement in language learning. *Foreign Language Annals*, 53(2), 314-319.
- Elsabbagh, M. & Karmiloff-Smith, A. (2004). Modularity of mind and language. In Brown, K. (ed.), *Encyclopedia of language and linguistics* (pp. 218-222). Amsterdam: Elsevier.
- Ferris, C. (2014). *The meaning of syntax: A study in the adjectives of English*. Routledge.
- Figuroa, J., Meneses, A., & Chandia, E. (2018). Academic language and the quality of written arguments and explanations of Chilean 8th graders. *Reading and Writing*, 31(3), 703-723.
- Fortman, J. (2003). Adolescent language and communication from an intergroup perspective. *Journal of Language and Social Psychology* 22(1), 104-111.
- Fuhrmann, D., Knoll, L. J., & Blakemore, S. J. (2015). Adolescence as a sensitive period of brain development. *Trends in Cognitive Sciences*, 19(10), 558-566.
- Gillam, R. B., & Johnston, J. R. (1992). Spoken and written language relationships in language / learning-impaired and normally achieving school-age children. *Journal of Speech, Language, and Hearing Research*, 35(6), 1303-1315.
- Giora, R. (1993). On the function of analogies in informative texts. *Discourse Processes*, 16(4), 591-611.
- Graham, S. & Harris, K.H. (2009). Almost 30 years of writing research: making sense of it all with the wrath of Khan. *Learning Disabilities Research & Practice*, 24, 58-68.
- Gregg, N. & Nelson, J. (2018). Empirical Studies on the Writing Abilities of Adolescents and Adults with Learning Difficulties. In: Miller, .B, McCardle, P. & Connelly, V. (Eds.), *Approaches to Improving Writing Research, Instruction, and Performance. Understanding the Needs of Writers across the Life course* (pp. 73-98). Brill.
- Hayes, J. R., & Flower, L. (1981). *Uncovering cognitive processes in writing: An introduction to protocol analysis*. ERIC Clearinghouse.
- Jisa, H. & Tolchinsky, L. (2009). Developing a depersonalized stance through linguistic means in typologically different languages: Written expository discourse. *Written Language & Literacy*, 12(1), 1-25.
- Kadosh, K. C., Linden, D. E., & Lau, J. Y. (2013). Plasticity during childhood and adolescence: innovative approaches to investigating neurocognitive development. *Developmental Science*, 16(4), 574-583.
- Kärkäinen, E., Sorjonen, M. L., & Helasvuo, M. L. (2007). Discourse structure. In *Language typology and syntactic description: Volume II: Complex constructions* (pp. 301-371). Cambridge: Cambridge University Press.
- Karmiloff-Smith, A. (1992). *Beyond modularity: A developmental perspective on cognitive*

- science*. Cambridge: MIT Press.
- Kawar, K. (2021). Morphology and Syntax in Arabic-Speaking Adolescents Who Are Deaf and Hard of Hearing. *Journal of Speech, Language, and Hearing Research*, 64(10), 3867-3882.
- Kellogg, R.T. (2008). Training writing skills: A cognitive developmental perspective. *Journal of Writing Research*, 1, 1-26.
- Khokhlova, N. (2014). Understanding of abstract nouns in linguistic disciplines. *Procedia-Social and Behavioral Sciences*, 136, 8-11.
- Kilford, E. J., Garrett, E., & Blakemore, S. J. (2016). The development of social cognition in adolescence: An integrated perspective. *Neuroscience & Biobehavioral Reviews*, 70, 106-120.
- Kuhn, D. (2011). What is scientific thinking and how does it develop? In U. Goswami (Ed.), *Handbook of childhood cognitive development* (2nd ed., pp. 472-523). Oxford: Blackwell
- Larsen, B., & Luna, B. (2018). Adolescence as a neurobiological critical period for the development of higher-order cognition. *Neuroscience & Biobehavioral Reviews*, 94, 179-195.
- Lau, E., & Tanaka, N. (2021). The subject advantage in relative clauses: A review. *Glossa*, 6(1), 1-34.
- Le Bruyn, B., Fuchs, M., van der Klis, M., Liu, J., Mo, C., Tellings, J., & De Swart, H. (2022). Parallel corpus research and target language representativeness: The contrastive, typological, and translation mining traditions. *Languages*, 7(3), 176.
- Lecce, S., Caputi, M., Pagnin, A., & Banerjee, R. (2017). Theory of mind and school achievement: The mediating role of social competence. *Cognitive Development*, 44, 85-97.
- Lindgren, E., Leijten, M., & Van Waes, L. (2011). Adapting to the reader during writing. *Written Language & Literacy*, 14(2), 188-223.
- Louwerse, M. M., McCarthy, P. M., McNamara, D. S., & Graesser, A. C. (2004). Variation in language and cohesion across written and spoken registers. In *Proceedings of the Annual Meeting of the Cognitive Science Society* (Vol. 26, No. 26).
- Maekelberghe, C. (2021). Assessing the impact of syntactic complement type on the modifying status of complement-taking predicates: the case of imagine. *Language Sciences*, 86, 101390
- McNamara, D.S., Crossley, S.A. & McCarthy, P.M. (2010). Linguistic features of writing quality. *Written Communication*, 27, 57-86.
- Murray, N. (2012). *Writing essays in English language and linguistics: Principles, tips and strategies for undergraduates*. Cambridge: Cambridge University Press.
- Nelson, K. (1976). Some attributes of adjectives used by young children. *Cognition*, 4(1), 13-30.
- Nelson, N.W. (2013). Syntax development in the school-age years: Implications for assessment and intervention. *Perspectives on Language and Literacy*, 39(3), 9-17.
- Nippold, M.A. (2016). *Later language development: School-age children, adolescents, and young adults*. Austin, TX: PRO-ED.
- Nippold, M.A., Hegel, S. L., Sohlberg, M. M., & Schwarz, I. E. (1999). Defining abstract entities: Development in pre-adolescents, adolescents, and young adults. *Journal of*

- Speech, Language, and Hearing Research*, 42(2), 473-481.
- Nippold, M.A., Mansfield, T.C., Billow, J.S. & Tomblin, J.B. (2008). Expository discourse in adolescents with language impairments: Examining Syntactic Development. *American Journal of Speech-Language Pathology*, 17, 356-366.
- Nippold, M.A., Mansfield, T.C., Billow, J.S. & Tomblin, J.B. (2009). Syntactic development in adolescents with a history of language impairments: A follow-up investigation. *American Journal of Speech-Language Pathology*, 18, 241-251.
- Nippold, M.A., & Scott, C.M. (Eds.) (2010). *Expository discourse in children, adolescents, and adults: Development and disorders*. New York, NY: Psychology Press.
- Nippold, M. A., & Sun, L. (2010). Expository writing in children and adolescents: A classroom assessment tool. *Perspectives on Language Learning and Education*, 17(3), 100-107.
- Nippold, M.A, Ward-Lonergan, J.M. & Fanning, J.L. (2005). Persuasive writing in children, adolescents, and adults: A study of syntactic, semantic, and pragmatic development. *Language Speech and Hearing Services in Schools*, 36, 125-138.
- Northey, M., McCutchen, D., & Sanders, E. A. (2016). Contributions of morphological skill to children's essay writing. *Reading and writing*, 29(1), 47-68.
- Ögel-Balaban, H., & Aksu-Koç, A. (2020). Clause Chaining and Discourse Continuity in Turkish Children's Narratives. *Frontiers in psychology*, 11, 115.
- O'Grady, W. (2011). Relative clauses: Processing and acquisition. *The acquisition of relative clauses: Processing, typology and function*, 13-38.
- Olinghouse, N. G., & Wilson, J. (2013). The relationship between vocabulary and writing quality in three genres. *Reading and Writing*, 26, 45-65.
- Olson, D.R. (1994). *The world on paper: The conceptual and cognitive implication of writing and reading*. Cambridge: Cambridge University Press.
- Olson, D.R. (2006). Oral discourse in a world of literacy. *Research in the Teaching of English*, 41(2), 136-143.
- Onnis, L., & Thiessen, E. (2013). Language experience changes subsequent learning. *Cognition*, 126(2), 268-284.
- Osterhaus, C., Koerber, S., & Sodian, B. (2017). Scientific thinking in elementary school: Children's social cognition and their epistemological understanding promote experimentation skills. *Developmental Psychology*, 53, 450-62.
- Parkinson, J., & Musgrave, J. (2014). Development of noun phrase complexity in the writing of English for Academic Purposes students. *Journal of English for Academic Purposes*, 14, 48-59.
- Paus, T. (2005). Mapping brain maturation and cognitive development during adolescence. *Trends in Cognitive Sciences*, 9(2), 60-68.
- Prados, M. D. (2018). Abstract nouns as metadiscursive shells in academic discourse. *Capiletra. Revista Internacional de Filologia*, 64, 153-178.
- Proverbio, A.M., & Zani, A. (2005). Developmental changes in the linguistic brain after puberty. *Trends in Cognitive Sciences*, 9, 164-167.
- Ramscar, M., & Gitcho, N. (2007). Developmental change and the nature of learning in childhood. *Trends in Cognitive Sciences*, 11(7), 274-279.

- Ramscar, M., Dye, M., Blevins, J., & Baayen, H. (2018). Morphological development. In A. Bar-On and D. Ravid (Eds.), *Handbook of Communications Disorders: Theoretical, Empirical, and Applied Linguistic Perspectives* (pp. 181-202). Berlin: de Gruyter.
- Ravid, D. (2004). Later lexical development in Hebrew: derivational morphology revisited. In R.A. Berman (Ed.) *Language development across childhood and adolescence: Psycholinguistic and crosslinguistic perspectives* (pp. 53-82). Amsterdam: Benjamins.
- Ravid, D. (2005). Emergence of linguistic complexity in written expository texts: Evidence from later language acquisition. In: Ravid, D. & Bat-Zeev Shyldkrot, H. (Eds.), *Perspectives on language and language development* (pp. 337-355). Dordrecht: Kluwer.
- Ravid, D. (2006). Semantic development in textual contexts during the school years: Noun scale analyses. *Journal of Child Language*, 33, 791-821.
- Ravid, D. (2013). Syntactic complexity in discourse production across different text types. In: Bolly, C. & Degand, L. (Eds.), *Text-structuring. Across the line of speech and writing variation* (Corpora and Language in Use series No. 2). Louvain-la-Neuve: Presses Universitaires de Louvain.
- Ravid, D. (2019). Derivation. In R. A. Berman (Ed.), *Usage-based studies in Modern Hebrew: Background, morpho-lexicon, and syntax* (pp. 203-265). Amsterdam: Benjamins.
- Ravid, D. & Assulin Tzabar, N. (2017). Compounding in early child speech: Hebrew peer talk 2-8. In Wolfgang U. Dressler, F. Nihan Ketrez and Marianne Kilani Schoch (Eds.), *Nominal compound acquisition* (pp. 251-274). Amsterdam: Benjamins.
- Ravid, D. & Avidor, A. (1998). Acquisition of derived nominals in Hebrew: developmental and linguistic principles. *Journal of Child Language*, 25, 229-266.
- Ravid, D., Bar-On, A., Levie, R. & Douani, O. (2016). Hebrew adjective lexicons in developmental perspective: Subjective register and morphology. *The Mental Lexicon*, 11, 401-428.
- Ravid, D. & Berman, R.A. (2006). Information density in the development of spoken and written narratives in English and Hebrew. *Discourse Processes*, 41, 117-149.
- Ravid, D. & Berman, R.A. (2009). Developing linguistic register across text types: The case of Modern Hebrew. *Pragmatics and Cognition*, 17, pp. 108-145.
- Ravid, D. & Berman, R.A. (2010). Developing noun phrase complexity at school age: a text-embedded cross-linguistic analysis. *First Language*, 30, 3-26.
- Ravid, D. & Cahana-Amitay, D. (2005). Verbal and nominal expression in narrating conflict situations in Hebrew. *Journal of Pragmatics*, 37, 157-183.
- Ravid, D., Dromi, E. & Kotler, P. (2009). Linguistic complexity in school-age text production: Expository vs. mathematical discourse. In M. A. Nippold & C. M. Scott, (Eds.), *Expository discourse in children, adolescents, and adults: Development and disorders* (pp. 125-156). NY: Psychology Press.
- Ravid, D. & Hershkovitz, L. (2017). The development of Hebrew conjunct constructions in narration. In Eliane Segers and Paul van den Broek (Eds.) *Developmental perspectives in written language and literacy. In honor of Ludo Verhoeven* (pp. 119-135). Amsterdam: Benjamins.
- Ravid, D. & Levie, R. (2010). Adjectives in the development of text production: Lexical, morphological and syntactic analyses. *First Language*, 30, 27-55.

- Ravid, D. & Shalom, T. (2012). *The Standards report. Final report to Yad Hanadiv* (Rothschild Fund). Tel Aviv: CET and Tel Aviv University. [in Hebrew]
- Ravid, D. & Tolchinsky, L. (2002). Developing linguistic literacy: A comprehensive model. *Journal of Child Language*, 29, 419-448.
- Ravid, D., van Hell, J., Rosado, E., & Zamora, A. (2002). Subject NP patterning in the development of text production: Speech and writing. *Written Language and Literacy*, 5, 69-94.
- Ravid, D. & S. Zilberbuch. (2003). The development of complex nominals in expert and non-expert writing: A comparative study. *Pragmatics and Cognition*, 11(2), 267-297.
- Ray, M. N., & Meyer, B. J. (2011). Individual differences in children's knowledge of expository text structures: A review of literature. *International Electronic Journal of Elementary Education*, 4(1), 67-82.
- Salas, N., & Caravolas, M. (2019). Dimensionality of Early Writing in English and Spanish. *Journal of Literacy Research*, 51(3), 272-292.
- Sanders, T.J.M. & Schiperoord, J. (2006). Text structure as a window on the cognition of writing: How text analysis provides insights in writing products and writing processes. In: MacArthur, C.H., Graham, S. & Fitzgerald, J. (Eds.), *Handbook of Writing Research* (pp. 386-402). NY: The Guilford Press.
- Schmid, H. J. (2012). English abstract nouns as conceptual shells. In *English Abstract nouns as conceptual shells*. De Gruyter Mouton.
- Schleppegrell, M.J. (2001). Linguistic features of the language of schooling. *Linguistics and Education*, 12, 431-459.
- Schuele, C.M., & Dykes, J.C. (2005). Complex syntax acquisition: a longitudinal case study of a child with specific language impairment. *Clinical Linguistics & Phonetics*, 19(4), 295-318.
- Scott, C.M. & Balthazar, C.H. (2010). The grammar of information: Challenges for older students with language impairments. *Topics in Language Disorders*, 30, 288-307.
- Scott, C.M. & Windsor, J. (2000). Measures in spoken and written narrative and expository discourse of school aged children with language learning disabilities. *Journal of Speech Language and Hearing Research*, 43, 324-339.
- Silliman, E. R., & Berninger, V. W. (2011). Cross-disciplinary dialogue about the nature of oral and written language problems in the context of developmental, academic, and phenotypic profiles. *Topics in Language Disorders*, 31(1), 6-23.
- Simmonds, D.J., Hallquist, M.N., Asato, M., Luna, B., (2014). Developmental stages and sex differences of white matter and behavioral development through adolescence: a longitudinal diffusion tensor imaging (DTI) study. *NeuroImage*, 92, 356-368.
- Snow, C. E., & Uccelli, P. (2009). The challenge of academic language. *The Cambridge handbook of literacy* (pp. 112 - 133).
- Staples, S., Egbert, J., Biber, D., & Gray, B. (2016). Academic writing development at the university level: Phrasal and clausal complexity across level of study, discipline, and genre. *Written Communication*, 33(2), 149-183.
- Tibi, S., Tock, J. L., & Kirby, J. R. (2019). The development of a measure of root awareness to account for reading performance in the Arabic language: A development and valida-

- tion study. *Applied Psycholinguistics*, 40(2), 303-322.
- Tolchinsky, L. (2019). Evolving structure of descriptive texts and learners' abilities. *Journal of Literacy Research*, 51(3), 293-314.
- Tower, C. (2003). Genre development and elementary students' informational writing: A review of the literature. *Literacy Research and Instruction*, 42(4), 14-39.
- van Rijk, Y., de Mey, L., de Haan, D., van Oers, B., & Volman, M. (2017). Reading for meaning: the effects of developmental education on motivation and achievement in reading informative texts in primary school. *ReseaRch PaPeRs in education*, 32(3), 333-352.
- van Rijt, J. H., van den Broek, B., & De Maeyer, S. (2021). Syntactic predictors for text quality in Dutch upper-secondary school students' L1 argumentative writing. *Reading and Writing*, 34(2), 449-465.
- Vulchanova, M., Milburn, E., Vulchanov, V., & Baggio, G. (2019). Boon or burden? The role of compositional meaning in figurative language processing and acquisition. *Journal of Logic, Language and Information*, 28(2), 359-387.
- Watson, R. (1985). Towards a theory of definition. *Journal of child language*, 12(1), 181-197.

Appendix A. GEE models of text size

(i) Number of Words – GEE Modeling Results, Main Effects and Interactions

Model Type: NBD		
Outcome Variable: Number of Words		
Step 1: Main Effects	Exp(B)	Coefficient
Intercept	66.77	4.20*** (.05)
Grade Effect		Wald $\chi^2 = 295.2, p < .001$
G4 vs. Adults	.51	-.68*** (.08)
G7 vs. Adults	.75	-.29*** (.07)
G11 vs. Adults	1.65	.50*** (.07)
Genre Effect		Wald $\chi^2 = .72, p = .40$
Informative vs. Narrative	1.02	.02 (.02)
Step 2: Interaction		Wald $\chi^2 = 12.13, p = .007$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

(ii) Number of Clauses – GEE Modeling Results, Main Effects and Interaction

Model Type: NBD		
Outcome Variable: Number of Clauses		
Step 1: Main Effects	Exp(B)	Coefficient
Intercept	12.57	2.53*** (.05)
Grade Effect		Wald $\chi^2 = 191.20, p < .01$
G4 vs. Adults	.78	-.25*** (.07)
G7 vs. Adults	.88	-.01*** (.07)
G11 vs. Adults	1.89	.64*** (.07)
Genre Effect		Wald $\chi^2 = 48.35, p < .001$
	0.83	-.19 (.03)
Step 2: Interaction		Wald $\chi^2 = 12.13, p = .007$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

(iii) Mean Clause Length – GEE Modeling Results, Main Effects and Interaction

Model Type: Gamma	
Outcome Variable: Mean Clause Length	
Step 1: Main Effects	Coefficient
Intercept	5.57*** (.12)
Grade Effect	Wald $\chi^2 = 192.99, p < .0001$
G4 vs. Adults	-2.01*** (.15)
G7 vs. Adults	-1.20*** (.18)
G11 vs. Adults	-.77*** (.13)
Genre Effect	Wald $\chi^2 = 71.52, p < .001$
	.86*** (.10)
Step 2: Interaction	Wald $\chi^2 = 20.45, p < .001$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Appendix B. GEE models of Lexical measures

(i) Abstract noun tokens over Words– GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear	
Outcome Variable: Abstract noun tokens over Words	
Step 1: Main Effects	Coefficient
Intercept	-1.48*** (.083)
Grade Effect	Wald $\chi^2 = 57.83, p < .001$
G4 vs. Adults	-.30*** (.05)
G7 vs. Adults	-.26*** (.04)
G11 vs. Adults	-.15** (.32)
Genre Effect	Wald $\chi^2 = 271.05, p < .001$
Informative vs. Narrative	-.67*** (.001)
Step 2: Interaction	Wald $\chi^2 = 7.71, p = .052$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Abstract noun tokens in compounds over words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear	
Outcome Variable: Abstract noun tokens in compounds over words	
Step 1: Main Effects	Coefficient
Intercept	-2.52*** (.051)
Grade Effect	Wald $\chi^2 = 252.752, p < .001$
G4 vs. Adults	-.30*** (.11)
G7 vs. Adults	-.26*** (.09)
G11 vs. Adults	-.15** (.06)
Genre Effect	Wald $\chi^2 = 46.56, p < .001$
Informative vs. Narrative	.19*** (.0013)
Step 2: Interaction	Wald $\chi^2 = 2.49, p = .478$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Abstract noun types over Words – GEE Modeling Results, Main Effects and Interactions
 Abstract noun types over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
 Outcome Variable: Abstract noun types over Words

Step 1: Main Effects	Coefficient
Intercept	-1.80*** (.03)
Grade Effect	Wald $\chi^2 = 65.11, p < .001$
G4 vs. Adults	-.30*** (.05)
G7 vs. Adults	-.26*** (.05)
G11 vs. Adults	-.26** (.04)
Genre Effect	Wald $\chi^2 = 37.15, p < .001$
Informative vs. Narrative	-.21*** (.003)
Step 2: Interaction	Wald $\chi^2 = 25.09, p < .001$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Abstract noun types in compounds over words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
 Outcome Variable: Abstract noun types in compounds over words

Step 1: Main Effects	Coefficient
Intercept	-1.99*** (.03)
Grade Effect	Wald $\chi^2 = 284.77, p < .001$
G4 vs. Adults	-1.52*** (.11)
G7 vs. Adults	-1.08*** (.09)
G11 vs. Adults	-.45*** (.07)
Genre Effect	Wald $\chi^2 = 54.17, p < .001$
Informative vs. Narrative	-.027*** (.000)
Step 2: Interaction	Wald $\chi^2 = 17.97, p < .001$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

(ii) Attributive adjective tokens over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
Outcome Variable: Attributive adjective tokens over Words

Step 1: Main Effects	Coefficient
Intercept	-3.20*** (.05)
Grade Effect	Wald $\chi^2 = 35.09, p < .001$
G4 vs. Adults	-.39*** (.08)
G7 vs. Adults	-.35*** (.07)
G11 vs. Adults	-.18** (.06)
Genre Effect	Wald $\chi^2 = 47.89, p < .001$
Informative vs. Narrative	.013*** (.002)
Step 2: Interaction	Wald $\chi^2 = 5.66, p = .13$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Attributive adjective types over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
Outcome Variable: Attributive adjective tokens over Words

Step 1: Main Effects	Coefficient
Intercept	-3.31*** (.05)
Grade Effect	Wald $\chi^2 = 45.07, p < .001$
G4 vs. Adults	-.43*** (.08)
G7 vs. Adults	-.38*** (.07)
G11 vs. Adults	-.22*** (.05)
Genre Effect	Wald $\chi^2 = 49.78, p < .001$
Informative vs. Narrative	.011*** (.002)
Step 2: Interaction	Wald $\chi^2 = 1.41, p = .70$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Denominal attributive adjective tokens over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
Outcome Variable: Denominal attributive adjective tokens over Words

Step 1: Main Effects	Coefficient
Intercept	-4.06*** (.08)
Grade Effect	Wald $\chi^2 = 232.18, p < .001$
G4 vs. Adults	-1.77*** (.15)
G7 vs. Adults	-1.09*** (.09)
G11 vs. Adults	-.54** (.08)
Genre Effect	Wald $\chi^2 = 366.32, p < .001$
Informative vs. Narrative	.022*** (.001)
Step 2: Interaction	Wald $\chi^2 = 5.66, p = .13$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Denominal attributive adjective types over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
Outcome Variable: Denominal attributive adjective types over Words

Step 1: Main Effects	Coefficient
Intercept	-4.06*** (.09)
Grade Effect	Wald $\chi^2 = 271.09, p < .001$
G4 vs. Adults	-1.78*** (.15)
G7 vs. Adults	-1.16*** (.09)
G11 vs. Adults	-.70*** (.08)
Genre Effect	Wald $\chi^2 = 242.92, p < .001$
Informative vs. Narrative	.014*** (.001)
Step 2: Interaction	Wald $\chi^2 = 26.82, p < .001$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

(iii) Adjacency compound tokens over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
Outcome Variable: Adjacency compound tokens over Words

Step 1: Main Effects	Coefficient
Intercept	-3.15*** (.05)
Grade Effect	Wald $\chi^2 = 133.06, p < .001$
G4 vs. Adults	-.99*** (.10)
G7 vs. Adults	-.64*** (.10)
G11 vs. Adults	-.18** (.06)
Genre Effect	Wald $\chi^2 = 97.12, p < .001$
Informative vs. Narrative	.19*** (.002)
Step 2: Interaction	Wald $\chi^2 = 5.17, p = .16$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Free compound tokens over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear
Outcome Variable: Free compound tokens over words

Step 1: Main Effects	Coefficient
Intercept	-4.62*** (.1)
Grade Effect	Wald $\chi^2 = 29.84, p < .001$
G4 vs. Adults	-.79*** (.15)
G7 vs. Adults	-.54*** (.10)
G11 vs. Adults	-.03 (.13)
Genre Effect	Wald $\chi^2 = .17, p < .001$
Informative vs. Narrative	.00 (.00)
Step 2: Interaction	Wald $\chi^2 = 9.9, p < .05$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Chained compound tokens over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear	
Outcome Variable: Chained compound tokens over Words	
Step 1: Main Effects	Coefficient
Intercept	-4.83*** (.17)
Grade Effect	Wald $\chi^2 = 47.33, p < .001$
G4 vs. Adults	-1.34*** (.28)
G7 vs. Adults	-1.36*** (.27)
G11 vs. Adults	-.62*** (.15)
Genre Effect	Wald $\chi^2 = 32.52, p < .001$
Informative vs. Narrative	.005*** (.001)
Step 2: Interaction	Wald $\chi^2 = 5.10, p = .17$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Appendix C. GEE models of Demarcation variables

(i) Conjoining lexicon over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear	
Outcome Variable: Conjoining lexicon to- kens over Words	
Step 1: Main Effects	Coefficient
Intercept	-3.73*** (.03)
Grade Effect	Wald $\chi^2 = 19.94, p < .001$
G4 vs. Adults	.20* (.10)
G7 vs. Adults	.27** (.09)
G11 vs. Adults	-.08 (.08)
Genre Effect	Wald $\chi^2 = 22.76, p < .001$
Informative vs. Narrative	.01*** (.00)
Step 2: Interaction	Wald $\chi^2 = 2.60, p = .46$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Commas over words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear	
Outcome Variable: Commas over Words	
Step 1: Main Effects	Coefficient
Intercept	-2.90*** (.09)
Grade Effect	Wald $\chi^2 = 50.18, p < .001$
G4 vs. Adults	-1.23*** (.10)
G7 vs. Adults	-.26* (.12)
G11 vs. Adults	-.04 (.09)
Genre Effect	Wald $\chi^2 = 5.84, p < .05$
Informative vs. Narrative	.006** (.00)
Step 2: Interaction	Wald $\chi^2 = 2.94, p = .40$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.

Full stops over Words – GEE Modeling Results, Main Effects and Interactions

Model Type: Transformed Linear	
Outcome Variable: Full stops over Words	
Step 1: Main Effects	Coefficient
Intercept	-2.75*** (.03)
Grade Effect	Wald $\chi^2 = 19.15, p < .001$
G4 vs. Adults	-.33*** (.08)
G7 vs. Adults	-.16* (.06)
G11 vs. Adults	-.06 (.05)
Genre Effect	Wald $\chi^2 = .28, p = .59$
Informative vs. Narrative	.006** (.00)
Step 2: Interaction	Wald $\chi^2 = 6.37, p = .10$

*** $p < .001$, ** $p < .01$, * $p < .05$; Standard errors in parentheses.