The influence of students' linguistic condition, school level, and pedagogical input on analytical essay features

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Introduction: Analytical essays are a fundamental discourse practice within educational settings. These essays are topic-oriented texts that aim to inform readers about a specific matter while persuading them of the writer's perspective. This study investigates how students' linguistic condition (monolingual vs. bilingual) affects their ability to meet the social and discursive expectations of analytical essays. This is examined both over a broad developmental span, from elementary to higher education, and microdevelopmentally, through a sequence of genre-oriented classroom activities.

Methods: A corpus of 1,179 essays, written by Spanish monolingual and Catalan/Spanish bilingual students across elementary, secondary, and university levels, was analyzed. Participants were tasked with producing texts on both same and different topics. The analysis focused on lexical, syntactic-discursive and structural features identified as indicators of writing proficiency in the Developing Analytical Writing (DAW) model developed in previous studies. Pedagogical input was controlled by the researchers, and an external evaluation of text quality was performed by teachers from the different school levels.

Results: Results indicate that students' linguistic condition influenced most, but not all, the linguistic and structural indicators of writing proficiency but always in interaction with age/school level and pedagogical input. Improvements were observed across school levels and with pedagogical input. Additionally, teachers varied in their appreciation of different facets of writing performance as a function of the participants' age/school level and pedagogical input. However, the linguistic condition of students alone did not significantly impact external evaluations of text quality.

Discussion: Our findings reveal a complex interplay between factors such as writers' linguistic condition, their age/school level, and pedagogical input, which jointly shape the quality of analytical essays.

KEYWORDS

analytical writing, developmental changes, Catalan/Spanish bilinguals, Spanish monolinguals, text production, elementary to university level, text features

1 Introduction

Writing analytical texts is a common discourse practice in school contexts. By "discourse practice," we refer to the ways in which language is used in specific social and cultural contexts to convey meaning and meet particular communicative goals. Most texts that students are required to produce in academic settings—essays, research reports,

reviews—belong to analytical genres. Their purpose is to scrutinize and convey knowledge on a topic, aiming to persuade the reader—usually teachers—of the student's expertise, and/or the relevance and accuracy of their standpoint (Driver et al., 2002; Tolchinsky et al., 2017). However, the communicative goals of analytical texts, such as reflecting, explaining, describing, or arguing, might be differently weighted and distributed across texts (Schleppegrell, 2004). While some text types are primarily expository and focus on analyzing the topic, others are mainly argumentative, presenting multiple perspectives on the topic. A text is rarely entirely one type in rhetorical content. For instance, narratives may include thoughtful metalinguistic deliberations, especially in adults (Tolchinsky, 2014), and argumentative texts typically include narrative and expository elements (Deane et al., 2014). Analytical essays on controversial topics often include both an expository component, where the writer reflects on the topic and describes the presented evidence, and an argumentative component to assert and support the writer's standpoint (Vilar and Tolchinsky, 2021).

As readers, we are invariably impressed by the quality of a text. Research has been devoted to identifying the text features that support such impressions and function as indicators of text quality (Aparici et al., 2021). Researcher-based approaches for appreciating the quality of a text have been complemented in many studies by reader-based approaches, which involve external evaluations carried out by judges (McMaster and Espin, 2007). The purpose of both approaches is to turn subjective impressions into explicit and generally applicable indicators of quality.

This study examines the influence of students' linguistic condition (bilingual vs. monolingual) on linguistic and structural indicators of text writing proficiency in the essays produced by Spanish monolingual and Catalan/Spanish bilingual students on controversial topics (e.g., dress code, freedom of movement across countries). The use of text quality indicators is monitored both developmentally, across age/school levels from elementary to university level, and microdevelopmentally, across repeated text writing, controlling for pedagogical input. The influence of linguistic condition is thus examined concerning both developmental and microdevelopmental changes in different facets of writing performance, applying both a researcher-based analysis and a reader-based, external evaluation.

1.1 Discourse genre and development of text production

Genre, defined as text types intended to fulfill particular functions as defined by social-cultural norms and conventions (Tolchinsky and Rosado, 2005), compels writers' decisions concerning amount and structuring of information, and linguistic realizations (Alamargot and Chanquoy, 2001). Children's growing sensitivity to genres is part of their pragmatic development (Donovan and Smolkin, 2002), but proficiency is reached in some genres before others. While 9-year-old children have already mastered the structural and linguistic features of a narrative, mastery of analytical writing is a far more protracted achievement (Berman and Nir-Sagiv, 2007; Schleppegrell, 2004). It involves not only learning discourse conventions that result from experience

with written language but also a proficient use of later–acquired linguistic resources (Uccelli et al., 2012). Formal schooling offers an immersion in written discourse conventions in a variety of domains (Olson and Oatley, 2014). Individual's cognitive development interacts with schooling facilitating students to take advantage from their schooling experience with texts (Ravid and Tolchinsky, 2002).

The development of executive functions encompasses various cognitive processes. It involves enhanced memory processes that allow for the manipulation of information over short periods and the retention of larger amounts of information over longer spans. Additionally, it includes increasing cognitive flexibility and control, enabling individuals to think about multiple concepts simultaneously, switch between perspectives, and suppress inappropriate or unhelpful responses in a given context. This improved functioning facilitates better organization and integration of information (Limpo and Olive, 2021).

Concomitant to the development of cognitive control is the process of *decentering*, the metacognitive capacity "to shift experiential perspective from within one's subjective experience onto that experience" (Bernstein et al., 2015, p. 1), thus being able to understand an experience from different perspectives and consider multiple aspects of a situation. This capacity enhances audience awareness taking writers beyond asserting their own opinion, to adding explanations addressed to the reader. School instruction provides increasing experience with written language and builds on such maturation processes interactively improving cognitive control (Brod et al., 2017).

Experience with written language and cognitive development affects the process of text production. Young writers produce their texts in knowledge–telling manner, writing down ideas as they come to their minds, whereas more experienced writers develop knowledge–transforming means which involve considering the communicative purpose of their text, and setting goals that guide the generation and global structuring of content (Bereiter and Scardamalia, 1987). This progress affects, in turn, the quality of the written product.

1.2 Text features supporting analytical writing quality

The text–embedded features identified as indicators of quality range from the sheer amount of text produced through structural and linguistic features operating at different language levels.

Text length (TL) functions as a robust indicator of writing development across languages (Nelson and Van Meter, 2007). It correlates with other text features (Berman and Nir-Sagiv, 2007) and with external evaluation of quality, especially during elementary school (e.g., McMaster and Espin, 2007). A minimum amount of text is necessary for analyzing a topic, developing an argument or including relevant content in different genres.

The *density of discourse units* —the number of words or clauses included into higher level discourse units—is also considered an indicator of writing quality. Denser moves carry more and more condensed information increasing the informativeness of topic–oriented texts (Berman and Nir-Sagiv, 2010).

Indicators of quality at a syntactic–discursive level comprise several elements that mark relations between units of differing length signaling text transitions and indicating discourse organization explicitly (Snow and Uccelli, 2009). A proficient use of intrasentential (conjunctions in complex sentences) and intersentential *connectives* (discourse markers) impacts on the logical–semantic relationships between units as well as on the reliability of arguments and conclusions. Text connectivity constitutes a development that extends well beyond high school level (Uccelli et al., 2015).

In line with approaches to text connectivity that consider formal as well as functional criteria (Gras et al., 2021), in Rosado et al. (2021) we provided a comprehensive picture of Catalan high school and university students' use of connectives. We found a decrease between age/school level groups in the use of syntactic conjunctions, whereas the predisposition to use modal markers, indicating speaker–writers' stance, increased with the participants' school level.

At a lexical level, *Word length* is diagnostic of higher register and literacy level since word length and frequency of use are inversely related in many languages (the longer a word, the less common it will be), particularly in morphologically complex languages like Spanish and Catalan (Llauradó and Tolchinsky, 2013).

Also, *Lexical diversity*, assessed by TTR (type–token ratio) or D (diversity) measures (Malvern et al., 2004), serves as an estimate of vocabulary richness, and typically increases as a function of age (Berman and Nir-Sagiv, 2010). Word length and lexical diversity are affected by discourse genre, with expository texts including longer words and higher lexical diversity than narratives (Berman and Ravid, 2009; Johansson, 2008).

In Aparici et al. (2021) we traced the development of indicators of quality at the syntactic–discursive and lexical level in the same sample of Spanish monolinguals included in this study. We also examined the microdevelopmental changes along a set of classroom activities aimed to raise students' awareness about the features of analytical essays. We tracked the development of text length, density of rhetorical moves, use of intersentential markers (DMs), word length, lexical diversity, use of adjectives, and nominalizations.

We found an increase in text length until the end of high school across texts. This agrees with results of Limpo and Alves (2014) in an intervention study on argumentative writing but contrasts with Malpique and Simão (2019) and Luna et al. (2020) who did not find such increase. Both at a syntactic–discursive level (density of rhetorical moves, discourse markers), and for lexical choices, our results yield significant developmental changes: more experienced writers produced more informative and better-connected units of discourse displaying increased clausal complexity, and more morphologically complex and diverse words. However, despite exhibiting similar developmental improvement, these indicators showed a different sensitivity to instruction.

Text structure is also assumed as an indicator of writing performance (Berman, 2008). Proficient writers' decisions go top-down controlled by a writing schema (genre and stylistic knowledge) stored in long-term memory affecting syntactic and lexical choices (Vande Kopple, 1998). In contrast, novice writers' decisions depend more on their previous local decisions than on

a central writing schema. Text structure is realized into spans of discourse that fulfill different communicative functions, such as rhetorical moves (Upton and Cohen, 2009) or other discourse units (Taboada and Zabala, 2008). The integration of different moves to fulfill the communicative goals of a genre is an indicator of writing performance (Allen et al., 2019).

In Vilar and Tolchinsky (2021) we examined the development of text structure in Spanish monolinguals essays across school levels. We found that it was not until high school and university that completeness of text structure —i.e., integrating argumentative and expository components—is attained in most texts. Moreover, the distribution of the different structures according to school level pointed to a developmental transition from assertion–based texts, where writers focus only on their standpoint, to exposition–based texts, where provision of evidence become more dominant.

In this study, we examine the influence of students' linguistic condition (monolingual vs. bilingual) on text features that improved with school level in the monolingual sample (Aparici et al., 2021; Vilar and Tolchinsky, 2021). Below are the reasons that justify the interest in this comparison.

1.3 Effects of linguistic condition

Studies comparing monolinguals and bilinguals' performance on cognitive and linguistic tasks (Bialystok and Feng, 2009; Kerrigan et al., 2017) draw contrasting conclusions regarding advantages and disadvantages of bilingualism.[1] van den Noort et al. (2019) found that bilinguals exhibit enhanced executive control in nonverbal tasks requiring inhibiting conflicting information. However, Dick et al. (2019) found no significant differences between monolingual and bilingual children and adults in tasks requiring inhibitory skills (see Planckaert et al., 2023; for a systematic review). On the other hand, bilinguals were shown to have smaller vocabularies, weaker access to lexical items (Ivanova and Costa, 2008) and lower verbal fluency (Sandoval et al., 2010). But these bilinguals' disadvantages have been disputed using alternative measures of vocabulary size or methods of assessment (Bialystok, 2018; Hoff et al., 2012).

These somehow contradictory results on cognitive and linguistic effects of bilingualism are related, among other factors, to the heterogeneous nature of multilingual profiles, calling for multidimensional approaches to the study and understanding of multilingualism, as well as for the conceptualization of multilingualism like a continuum rather than as a categorical phenomenon (Marian and Hayakawa, 2021; Rothman et al., 2023). The use of appropriate tools to assess language profiles, which move away from dichotomous labeling of language profiles and allowed characterizing individual's linguistic profile along a continuum from monolingualism to active multilingualism, would help clarifying research results (Aparici et al., 2024).

Benefits of bilingualism, though, seem to be preserved for some literacy–related domains. A greater metalinguistic awareness (Adesope et al., 2010; Le Pichon Vorstman et al., 2009),

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1 The terms *multilingual* and *bilingual* will be used here interchangeably, irrespective of the number of languages used by the speakers.

and enhanced reading skills (Marian et al., 2013) have been attested in bilingual children. Hsin and Snow (2017) found that bilingual students matched or surpassed English—only students on perspective acknowledgment and perspective articulation in academic writing. Bilinguals' enhanced theory of mind and improved metalinguistic awareness might support the crafting of arguments, where explicit consideration of multiple points of view would serve to strengthen their claims.

Positive effects of bilingualism on literacy are mediated by educational programs (van den Bosch et al., 2018), participants socioeconomic status (De Cat, 2021), and typological distance between languages (Ng, 2013). However, the enhanced executive functions in speakers that operate in a dual–language context may enable better control of text structure than monolinguals (Green and Abutalebi, 2013). We carried an initial exploration of this hypothesis with a sample of Catalan/Spanish bilinguals tracing developmental and microdevelopmental changes in text length and text structure (Tolchinsky et al., 2022). In contrast to what was observed for monolinguals' by Vilar and Tolchinsky (2021) applying the same scoring of texts, bilinguals showed both a more precocious adjustment to analytical text structure, and an earlier divergence from canonicity than their monolingual counterparts. Bilingual elementary students' texts already included assertive, argumentative, and expository moves whereas older students' texts contained mostly assertive and expository moves, diverging from the expected canonical structure. A similar divergence was found in the narrative and expository texts produced by English monolingual students as they grow older (Berman and Nir-Sagiv, 2007).

We also found a delayed (only beyond high school) significant increment in text length as compared with own studies on analytical texts in monolingual Spanish (Aparici et al., 2021), and other studies examining narrative and expository texts (Nelson and Van Meter, 2007). These findings suggest a possible challenging effect of Catalan orthography (less transparent than Spanish) that might only be resolved by university level, and also confirm the more demanding nature of analytical writing compared to other types of texts.

To sum up, bilinguals outperform monolinguals in text structure but not in text length. However, we are ignorant of the influence of linguistic condition on other linguistic indicators of text quality, a limitation that the present study aims to overcome.

1.4 Study goals and expectations

Our primary goal was to determine the influence of students' linguistic condition (monolingual vs. bilingual) on the development, microdevelopment, and external evaluation of analytical text writing proficiency. We assessed changes in structural and linguistic text features identified in previous studies as indicators of writing performance. These changes were monitored across different age/school levels and through repeated text-writing during a sequence of genre-oriented classroom activities. These activities were designed to provide uniform pedagogical input to the participants in the study and enhance their awareness of analytical essay features (for details, see Tolchinsky

et al., 2024). The researcher-based assessment of text features was supplemented by external evaluation by teachers. We examined the direct effects of age/school level, timing of text writing (before, immediately after, and 1 month after classroom activities), and students' linguistic condition (monolingual vs. bilingual) on both the assessed text features and the external evaluation of text quality. Additionally, we checked for interactions between the three factors that might explain observed changes in text features: (1) Text by Linguistic Condition, (2) Text by School Level, and (3) Linguistic Condition by School Level. Finally, we explored which text features best explained the external evaluation by teachers. The combined effects of these three factors were explored through a three-way interaction: Text by Linguistic Condition by School Level.

We expected a positive effect of age/school level and pedagogical input on the linguistic indicators. Based on Aparici et al. (2021), we expected that texts will become longer, informatively denser, more explicitly connected, and will deploy more sophisticated and diverse vocabulary, especially after the classroom activities. Examining these features in a text production task will enable us to elucidate to what extent monolinguals' performance differs from that of bilinguals on every indicator.

As for the structural indicators, we assumed that students' texts will include differentiated structural components fulfilling the rhetorical goals of analytical writing. Informed by Vilar and Tolchinsky (2021), we also expected that the presence of the expository component, including provision of evidence to support writer's standpoint, will increase with school level and along the classroom activities and will be positively impacted by bilingualism.

2 Methods

2.1 Participants

A total of 393 students participated in the study. The bilingual Catalan/Spanish sample was integrated by 53 (22 female) elementary school students ($M = 11.52$ years, $SD = 0.25$), 72 (34 female) high school students ($M = 15.85$ years, $SD = 0.58$), and 56 (43 female) university students ($M = 20.08$ years, $SD = 1.0$) from the province of Barcelona, who had Catalan as the language of instruction and produce the texts in Catalan. The monolingual Spanish sample was comprised of 65 (34 female) elementary school students ($M = 11.62$ years, $SD = 0.28$), 78 (45 female) high school students ($M = 15.86$ years, $SD = 0.67$), and 69 (42 female) university students ($M = 20.87$ years, $SD = 2.31$), from Ciudad Real and León, who had Spanish as the language of instruction and produce the texts in Spanish. The corpus analyzed for this study comprised 1,179 texts (three per participant).

Whereas Ciudad Real and León are part of Spanish monolingual regions, Catalonia has high levels of bilingualism. Catalan and Spanish are co-official languages and Catalan is the language of schooling, but there is a widespread use of both languages, with virtually no monolingual Catalan population (Tolchinsky et al., 2022). Spanish and Catalan are structurally very close and share multiple lexical, morphosyntactic, and rhetorical features. The two languages are not simply juxtaposed but are structurally and rhetorically intertwined; this involves the use of

a highly similar and integrated linguistic repertoire by Catalan bilingual speakers (Rosado et al., 2014; Schulte, 2021).

Participants' linguistic condition was established based on the sociolinguistic characteristics of each region and ensured by a sociolinguistic questionnaire (MUAQ, Aparici et al., 2024) that also provided information of sociodemographic variables relevant to literacy achievements (Bialystok, 2018). Responses to the questionnaire confirmed that students in the monolingual sample speak, write, understand, and read only in Spanish, and reported they did not know any other language, while those in the bilingual sample claimed to speak, write, understand, and read in Spanish and Catalan, and to use Catalan in other contexts than school. In particular, 86% of the bilingual sample demonstrated balanced to high proficiency in speaking both languages, 88.3% in oral comprehension, 87.1% in reading, and 70.1% in writing. For questionnaire details (see Aparici et al., 2024).

Parental education was scored 1 (elementary school), 2 (high school), and 3 (university). In the bilingual group, most parents from elementary school students were either high school or university graduates with the highest scores, while mean score for high school and university students was similar (see Table 1). Most parents were high school graduates. A similar pattern was found in the Spanish group. Parents from elementary school students got the highest scores and university participants the lowest ones. Single–factor ANOVAs with school level and linguistic condition as between–subjects factors showed that parental education differed significantly across school level [$F_{(2,362)} = 22.55, p < 0.001$] but not between linguistic conditions [$F_{(1,362)} = 2.46, p = 0.118$].

Parental occupation was scaled on the Spanish National Classification of Occupation (CNO-11, 2010) based on training requirements and socioeconomic status (SES) factors. Higher values correspond to lower training requirements and SES. Most parents' jobs were classified below the mean (better job than the average), with significant differences between school levels [$F_{(2,350)} = 7.46, p = 0.001$]. Parents of elementary school students present lower scores than the two other groups. No significant differences were found between linguistic conditions [$F_{(2,350)} = 0.82, p = 0.366$].

2.2 Tasks and procedures

To control for topic and pedagogical input, we asked participants for repeated text writing on same and different topics during seven sessions within the context of an identical set of classroom activities aimed to raise participants' awareness of the main features of the target genre. Each participant produced five texts on debatable topics, prior to and along the set of classroom activities: Text 1 on dress code, texts 2, 3, and 4 on freedom of movement between countries, and text 5 on rewards and punishments in education. In this study, we examined three texts, each on a different topic, and produced at different moments: Text 1 (T1) produced *before* the onset of the classroom activities, Text 4 (T4) *immediately after*, and Text 5 (T5) 1 month *later*. The set of activities was implemented during regular lessons led by the students' teachers, who had received

specific training. For more detail on the classroom activities (see Tolchinsky et al., 2024).

Texts were written in the language of schooling in all cases. All texts were transcribed and coded using CHAT format (CHILDES project; MacWhinney, 2000), and data were analyzed using CLAN programs. The texts were segmented into clauses, which was the basic unit of analysis, following Berman and Slobin (1994).

Several measures served for assessing linguistic and structural features and text quality:

Text length (TL): Computed by number of words and clauses. Analyses were conducted on number of words due to high intercorrelation ($r = 0.86$).

Word length (WL): Calculated by the mean number of letters of content words—words tagged as (common) nouns, (main) verbs, adjectives, and adverbs. The measure was obtained using the morphological analyzer of CLAN (MacWhinney, 2000) plus manual disambiguation.

Lexical diversity (LD): Estimated by the D measure, implemented in CLAN as VOCD, because it is unaffected by the text's length (Malvern et al., 2004).

Discourse markers: Manually coded as structural or modal. *Structural markers* (SDM) guide readers on discursive progress; for instance, openings or closings (e.g., *para empezar,* "to start with"), continuation of themes or arguments (e.g., *de forma similar,* "similarly"). *Modal markers* (MDM) add a subjective overlay of meaning to the discourse guidance provided by structural markers; for instance, doubt (e.g., *posiblemente,* "possibly"), personal view (e.g., *en mi opinion,* "in my opinion"). DMs were computed with and without controlling for text length.

Discourse density (DD): Computed by mean number of words per rhetorical move as an indicator of the amount of information packed within a discourse unit.

Text structure (TS): Each text was segmented into rhetorical moves, defined by changes in the communicative goal and/or topics, punctuation, switch from affirmative to negative modality, and/or presence of discourse markers. Three main types of moves were distinguished based on the communicative goals of analytical writing:

- *Assertive moves:* Contain a claim expressing the writer's standpoint on the issue raised in the prompt, but without supporting evidence within the same move.
- *Expository moves:* Contain no claims, only examples, descriptions of facts, that serve as evidence for a claim. They can also contain reflections on the topic or definition of terms that not always serve as evidence for a claim.
- *Argumentative moves:* Contain both the writer's standpoint on the issue raised in the prompt and the evidence supporting it within the same move.

Moves not fitting these categories were coded as unrelated. Inter-rater agreement between one of the authors and an independent rater on 100 texts was 0.89 for the number of moves and 0.94 for move type, with a Cohen's κ of 0.92 (see Vilar and Tolchinsky, 2021).

For each main move type, subtypes were further identified based on their differential qualities. These subtypes are not considered here but see Tolchinsky et al. (2024).

TABLE 1 Percentage of parents by educational level and mean score (SD) of type of occupation by age/school level group.

	Catalan/Spanish bilingual participants					
School level	Elementary school *n* = 53		Secondary school *n* = 72		University *n* = 56	
Parental education	Father	Mother	Father	Mother	Father	Mother
Elementary	11.5	1.9	12.7	7.0	25.9	16.7
High school	32.7	25.0	54.9	35.2	25.9	31.5
University	44.2	65.4	11.3	33.8	37.0	37.0
Other	11.5	7.7	21.1	23.9	11.1	14.8
Occupation* Min/Max: 13–98	50.42 (24.28)	37.31 (21.05)	60.55 (23.71)	51.67 (26.91)	52.6 (21.95)	51.67 (26.91)
	Spanish monolingual participants					
	Elementary school *n* = 65		Secondary school *n* = 78		University *n* = 69	
Elementary	3.1	3.1	17.9	9	22.4	10.4
High school	10.8	12.3	43.6	44.9	34.3	38.8
University	72.3	75.4	26.9	39.7	23.9	32.8
Other	13.8	9.2	11.5	6.4	19.4	17.9
Occupation* Min/Max: 13–98	34.71 (19.65)	37.06 (24.2)	57.13 (27.58)	58.2 (27.6)	52.42 (25.69)	65.6 (28.2)

*Parental occupation was scaled on the Spanish National Classification of Occupation (CON-11., 2010) based on occupational training requirements and SES factors, with higher values corresponding to lower training requirements and SES.

TABLE 2 Scoring of the rhetorical structure.

Rhetorical structure	Score
• The text contains the three main types of rhetorical moves: Assertive, expository, and argumentative moves.	4
• The text contains two main types of rhetorical moves: Expository and argumentative moves.	3
• The text contains assertive and expository moves or assertive and argumentative moves or only argumentative moves	2
• The text does not contain argumentative moves only assertive or expository moves.	1

TABLE 3 Scoring of the presence of the expository component.

Percentage of the expository component	Score
0	0
1–25	1
26–45	2
46–55	3
56–75	4
76–99	5
100	6

The realization of these three main types indicates the text's internal differentiation in terms of argumentative components (presenting a standpoint and claiming for or against) and expository components (supporting claims with reasons, reflections, or evidence). It also indicates the completeness of the text structure, or the extent to which different components are presented in the text. Accordingly, the resulting rhetorical structures were scored for each text from 1 to 4, based on internal differentiation and structural completeness (see Table 2). For detailed scoring criteria (see Vilar and Tolchinsky, 2021). Examples of each scoring level are provided in the Supplementary material.

Presence of *Expository component* (EC): Refers to the proportion of reasons, reflections, or evidence occurring as either separate expository moves or as part of argumentative moves. Texts received 0 points for each assertive move, 100 points for

each expository move, and 50 points for each argumentative move, as they contain both assertion and evidence. The resulting score was divided by the total number of moves in the text to yield a percentage. This percentage was then transformed into an ordinal measure (see Table 3). We considered EC as an additional measure of analytical texts structure.

Text quality (TQ): Rated by four experienced teachers from the different school levels and from the same communities in which the texts were gathered. Teachers based in Ciudad Real or León evaluated the texts produced in Ciudad Real and León and teachers based in Catalonia evaluated the texts produced in Catalonia, both using an analytic rubric that included an assessment of overall quality. For the present study, raters produced an overall score for 758 texts after consensus was reached (inter–rater agreement Cronbach alpha 0.85 on 3.6% of the corpus).

3 Results

We aimed to explain changes in the linguistic and structural text features that served as indicators of analytical texts writing proficiency by three factors: School level (Elementary, High School, University); Text (T1, T4, T5); and Linguistic Condition (Bilingual, Monolingual). We considered the interactions of School Level × Text, School Level × Linguistic Condition, and Text × Linguistic Condition on each assessed feature.

3.1 Analytic strategy

We used a Generalized Estimating Equations (GEE) model for non-normal distribution and repeatedly measured texts (Hardin and Hilbe, 2013). Text Length (TL) in number of words is not a continuous variable; thus, we fitted a finer Poisson model with overdispersion correction (negative binomial distribution) (Hilbe, 2017), and similar corrections were applied to the number of structural and modal discourse markers. Other variables showed a normal distribution and were repeatedly measured. The GEE framework was used to assess the main effects and interactions between the three factors considered in the study on the observed changes in linguistic and structural text features and external text evaluation. We also aimed to identify which factors and text features better explain the external evaluation of TQ.

3.2 Indicators of writing proficiency

Tables 4A, B display performance in five linguistic and three structural features assessed by researchers plus scores of the overall external assessment. Each feature was analyzed in response to three factors: school level (SL), linguistic condition (LC), and the repeated text timing (Text). These aspects were then tested with three two-way interactions followed by one three-way interaction analysis which combined all three factors together.

The first column in Table 4A displays the model fitted to each variable according to its distribution: negative binomial distribution (NB) for counts, i.e., Text length (TL), number of Structural (SDM) and Modal discourse markers (MDM), and linear for the other variables. The last two counts were controlled by Text length (TL). Other columns show the effect of SL, Text and LC indicated by the Wald's Chi–Square Test followed by pairwise comparisons for marginal mean ranking. For each cell (e.g., Text length in elementary school) we present mean and Standard Error (SE) in brackets. The means were ranked from lowest to highest using statistical methods and labeled with Latin superscripts. The letter [a] represents the smallest sub-mean, with subsequent letters ("b", "c") indicating increasingly higher sub-means. If two letters appear, it means that this sub-mean did not differ from either the lower or upper sub-mean. The GEE procedure treated the repeatedly measured texts T1, T4, and T5. In Table 4B the last four columns display the interaction effects: Text by LC, Text by SL, and LC by SL and the three-way interaction, Text by LC by SL on the target features and the External evaluation (EE) of text quality. Supplementary Figures 1.1 to 1.20 show the decompositions of

the interaction effects into their sources, that is, the significant subgroup mean differences across all possible interaction pairs.

3.3 Linguistic features

For Text Length (TL), there were main effects of SL and Text, as expected. Elementary-school texts were significantly shorter than high-school texts, which were, in turn, shorter than university texts. No main effect of LC was found. However, all three two-ways and one three-ways interactions were found to affect the length of the texts. There were significant interactions of Text by LC (see Supplementary Figure 1.1) and Text by SL (Supplementary Figure 1.2) due to T4, which varied across LC and SL. T4, produced immediately after instructional activities, was the longest in both LCs and at all three SLs, with TL increasing with SL. Bilingual students produced longer (but not significantly so) texts. University students were more productive across all texts compared to elementary school students. Among bilinguals and across texts, university students were the most productive, while elementary- and high-school students performed similarly. Among monolinguals, elementary-school students produced the shortest texts, and university students produced the longest texts (Supplementary Figure 1.3).

A complementary three-way interaction analysis was performed and is presented in Table 5.

Text lengths are ranked within text timing (T1, T4, and T5) by capital letters for differences due to students' LC across school levels (left: bilinguals; right: monolinguals), and by small letters for differences due to LC within each school level and each text. Before participating in the classroom activities, monolingual university students produced longer texts, but similar texts were produced in the two lower school levels. Bilingual university and high-school students performed similarly and better than elementary-school students. A look within each school level and each text (small letters) shows that in high school, bilingual students outperformed monolingual students.

For Word Length (WL), there were main effects of SL, Text, and LC, as well as two two-way significant interactions: Text by LC (Supplementary Figure 1.4)—monolingual students wrote longer words than bilinguals, especially in T4—and LC by SL (Supplementary Figure 1.5)—in all texts, university students included longer words than high- and elementary-school students, but monolingual students outperformed bilingual ones. The three-way interaction did not affect WL.

Similarly, for Lexical Diversity (LD), there were main effects of SL, Text, and LC, and significant interactions of Text by LC, Text by SL and LC by SL. Bilingual speakers showed greater LD than monolingual speakers in their T4 texts but LD remained similar at T1 and T5 (Supplementary Figure 1.6); all texts showed to have greater LD at university and high school than at elementary school, except for T4, in which differences blurred (Supplementary Figure 1.7). Subgroup means of LD were ranked by school levels from university to elementary at each LC, but the only exceptionally higher LD level was found among the university bilingual students (Supplementary Figure 1.8). The three-way interaction did not affect LD.

TABLE 4A School level, text, and linguistic condition effects.

Model		Ln Words	School level				Text				Linguistic condition		
			Wald	Element.	High	Univ.	Wald	T1	T4	T5	Wald	Billing.	Monoling.
NB	Text length	-	185.36***	152.20[a] (6.83)	206.44[b] (6.96)	306.76[c] (9.23)	334.27***	171.37[a] (4.24)	248.74[c] (5.69)	226.10[b] (5.23)	0.50	215.94 (5.75)	209.73 (6.73)
Linear	Word length	-	487.07***	5.43[a] (0.02)	5.81[b] (0.03)	6.17[c] (0.02)	175.57***	5.72[a] (0.02)	5.97[b] (0.02)	5.72[a] (0.02)	300.80***	5.56[a] (0.02)	6.05[b] (0.02)
Linear	Lexical diversity	-	107.38***	71.25[a] (1.34)	83.88[b] (1.16)	88.49[c] (1.00)	119.51***	74.82[a] (1.06)	88.63[c] (0.96)	80.17[b] (0.89)	11.01**	83.45[b] (1.01)	78.96[a] (0.91)
NB	Structural discourse markers	39.06***	54.92***	0.83[a] (0.06)	1.49[b] (0.07)	1.88[c] (0.13)	42.32***	1.15[a] (0.06)	1.25[a] (0.06)	1.62[b] (0.07)	0.40	1.30 (0.06)	1.35 (0.06)
NB	Modal discourse markers	25.20***	21.47***	2.04[a] (0.12)	2.19[a] (0.09)	2.86[b] (0.15)	14.55**	2.12[a] (0.08)	2.37[ab] (0.10)	2.54[b] (0.09)	1.78	2.26 (0.09)	2.42 (0.08)
Linear	Discourse density	-	349.93***	3.19[a] (0.02)	3.42[b] (0.02)	3.66[c] (0.02)	70.38***	3.33[a] (0.02)	3.47[b] (0.01)	3.47[b] (0.01)	0.19	3.42 (0.01)	3.43 (0.01)
Linear	Complete ness of moves	-	11.42**	2.63[a] (0.07)	2.87[b] (0.06)	2.93[b] (0.06)	66.55***	2.59[a] (0.06)	2.70[a] (0.06)	3.13[b] (0.05)	2.67	2.75 (0.05)	2.87 (0.05)
Linear	Expository component	-	118.96***	3.23[a] (0.08)	4.01[b] (0.07)	4.31[c] (0.05)	100.96***	3.73[a] (0.07)	4.25[b] (0.06)	3.56[a] (0.06)	23.47***	4.05[b] (0.06)	3.65[a] (0.06)
Linear	External evaluation	-	66.54***	3.26[a] (0.07)	3.77[b] (0.05)	3.94[b] (0.05)	76.61***	3.38[a] (0.05)	3.74[b] (0.05)	3.85[b] (0.04)	1.30	3.69 (0.04)	3.62 (0.05)

GEE result. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$; Standard errors in parentheses; Latin letters (a–c) for sub-group mean ranking, "a" for the lowest mean. Ln. Without control for number of words.

TABLE 4B Interactions on text-embedded linguistic and structural features, and external assessment.

Text embedded features and external evaluation		Ln Words	Text × Linguistic condition	Text × School level	Linguistic condition × School level	Text × Linguistic condition × School level
Model		Ln Words				
NB	Text length	-	15.70**	92.71***	18.90***	14.25***
Linear	Word length	-	21.44***	6.57	19.88***	6.37
Linear	Lexical diversity	-	14.41**	42.53***	14.80***	3.42
NB	Structural discourse markers	39.06***	0.18	8.08	13.39**	11.75*
NB	Modal discourse markers	25.20***	1.07	34.59***	20.04***	22.14***
Linear	Discourse density	-	0.59	0.69	8.63*	6.93
Linear	Completeness of structure	-	11.26**	20.13***	24.53***	10.72*
Linear	Expository component	-	9.11*	6.35	5.96*	12.58*
Linear	External evaluation	-	6.50*	15.27**	13.43**	15.80**

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

TABLE 5 Three-way interactions on text-embedded linguistic and structural features, and external assessment.

Text	School level	Linguistic condition	Text length	Structural discourse markers	Modal discourse markers	Completeness of moves	Expository component	External evaluation
T1	1 Elementary	1 Monolingual	116.83[aA]	0.61[aA]	1.55[aA]	2.36[aA]	3.26[aA]	2.96[aA]
		2 Bilingual	[A]112.5[a]	[A]0.76[a]	[A]1.62[a]	[A]2.35[a]	[A]2.86[a]	[A]2.92[a]
	2 High school	1 Monolingual	139.75[aA]	1.25[aB]	1.70[aA]	2.64[aA]	3.86[aAB]	3.47[aB]
		2 Bilingual	[B]194.96[b]	[B]1.10[a]	[A]1.89[a]	[B]2.90[a]	[B]3.88[a]	[B]3.70[a]
	3 University	1 Monolingual	286.25[aB]	1.74[aB]	3.25[aB]	2.63[aA]	4.21[aB]	3.60[aB]
		2 Bilingual	[B]233.52[a]	[C]1.89[a]	[B]2.99[a]	[AB]2.64[a]	[B]4.25[a]	[B]3.61[a]
T4	1 Elementary	1 Monolingual	221.04[aA]	1.02[aA]	2.86[aB]	2.89[aA]	4.02[aA]	3.41[aA]
		2 Bilingual	[A]177.40[a]	[A]0.60[a]	[A]1.94[a]	[A]2.46[a]	[A]3.49[a]	[A]3.27[a]
	2 High school	1 Monolingual	230.69[aA]	1.38[aA]	1.80[aA]	2.40[aA]	4.71[bB]	3.73[aA]
		2 Bilingual	[B]243.29[a]	[B]1.67[a]	[B]2.99[b]	[B]3.13[b]	[B]4.17[a]	[B]4.02[a]
	3 University	1 Monolingual	358.84[bB]	1.36[aA]	2.47[aB]	2.34[aA]	4.84[bB]	4.39[bB]
		2 Bilingual	[C]304.59[a]	[B]1.80[a]	[AB]2.29[a]	[AB]2.97[b]	[B]4.33[a]	[AB]3.64[a]
T5	1 Elementary	1 Monolingual	159.87[aA]	1.39[bA]	2.56[bA]	3.34[bA]	3.49[bA]	3.46[aA]
		2 Bilingual	[A]140.69[a]	[A]0.69[a]	[A]1.79[a]	[A]2.51[a]	[A]2.34[a]	[A]3.52[a]
	2 High school	1 Monolingual	204.92[aB]	1.63[aA]	2.07[aA]	2.97[aA]	3.69[aA]	3.87[aB]
		2 Bilingual	[B]232.22[a]	[B]2.04[a]	[B]2.82[a]	[B]3.17[a]	[B]3.71[a]	[AB]3.76[a]
	3 University	1 Monolingual	373.18[aC]	1.94[aA]	2.71[aA]	3.38[aA]	4.48[bB]	4.58[bC]
		2 Bilingual	[C]328.90[a]	[B]2.54[a]	[B]3.55[a]	[B]3.57[a]	[B]3.77[a]	[B]3.98[a]

Latin letters for marginal mean ranking from the lowest to the highest: Small letters for differences due to student's Linguistic condition within each school level and each text and capital letters for differences due to Linguistic condition across school levels (left: bilinguals; right: monolinguals) and by each text.

The use of Structural discourse markers (SDM) was directly affected by SL and Text, but not by LC. However, there was an interaction of LC by SL. As illustrated in Supplementary Figure 1.9, there was a steady increase among both monolinguals and bilinguals in the use of SDMs across school levels, but it was more pronounced among monolinguals. The difference between high-schoolers and university students was not significant among bilinguals but was so among monolinguals. Additionally, there was a three-way interaction effect on the use of SDMs. For displaying the interaction effects (Table 5) the use of SDMs is ranked within

TABLE 6 External evaluation by age/school level and text.

	All	Level 1 Elementary	Level 2 High School	Level 3 University
Text - Wald's χ^2	26.72***	17.45***	0.40	20.36***
Effect of Text 1 vs. Text 5	−0.29***	−0.36***	−0.05	−0.47***
Effect of Text 4 vs. Text 5	−0.23***	−0.40***	−0.06	−0.18~
School level - Wald's χ^2	15.20**	-	-	-
Level 1 vs. Level 3	−0.07	-	-	-
Level 2 vs. Level 3	0.17*	-	-	-
Other effects				
Linguistic condition	0.02	−0.18	0.02	0.23~
Text length	0.64***	0.75***	0.51***	0.64***
Completeness of moves	0.02	−0.01	0.05	0.03
Presence of expository component	−0.01	−0.01	−0.06	0.11*
Word length	0.05	−0.04	0.24**	−0.16
Lexical diversity	0.002	0.001	0.01*	−0.003
Structural discourse markers	−0.003	−0.04	−0.01	0.03
Modal discourse markers	−0.01	−0.01	0.01	0.003
Discourse density	−0.005	0.11	−0.06	−0.25

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, ~$p < 0.10$; Outcome variable is the global evaluation.

text timing, indicated by capital letters for LC differences across school levels and by small letters within each SL and Text. In Text 1, the use of SDMs increased with SL in both LCs, however, bilinguals performed better in comparison to monolinguals at university level. In Text 4, the increase in the use of SDMs was noted from elementary to high school, with no difference at the university level. The effect of LC appeared in high school and was maintained at the university level, with bilinguals outperforming monolinguals. For Text 5, monolingual students produced more SDMs than bilinguals in elementary school, but bilinguals outperformed monolingual students in high school and university.

Finally, the use of Modal discourse markers (MDM) was directly influenced by SL and Text, but not by linguistic condition (LC). Unlike other text features that showed a steady increase across the three school levels, the use of MDM increased significantly only at the university level, with no significant increase between elementary and high school. However, in interaction with Text, an increase in MDMs was already noted in high school in Text 5, which was produced 1 month after the school activities (Supplementary Figure 1.10). Regarding LC, we found no interaction of Text by LC, but there was an interaction between LC and SL (Supplementary Figure 1.11). A steady increase among both linguistic conditions is also observed in the use of MDMs, once more, more pronounced among monolinguals.

Additionally, there was a three-way interaction effect on the use of MDMs. As displayed in Table 6, the use of MDMs is ranked within text timing, indicated by capital letters for LC differences across levels and by small letters within each SL and Text. Before classroom activities, the use of MDMs was more frequent among monolinguals at the university level. In Text 4,

produced immediately after the classroom activities, monolinguals outperformed bilinguals only in elementary school. However, in high school, bilinguals outperformed monolinguals, while the differences by LC blurred at the university level. In Text 5, produced 1 month after the implementation of classroom activities, no difference by LC was detected in elementary school, but bilingual speakers outperformed monolinguals in the use of MDMs at both high-school and university levels.

3.4 Structural features

Discourse density of rhetorical moves (DD) was directly influenced by SL and Text. Moves became significantly denser at higher school levels and later text writing, i.e., T4 and T5. There was not a direct effect of LC but an interaction between LC by SL was found. The interaction results showed that pairs of LC and SL differed among monolinguals and bilinguals (Supplementary Figure 1.12). The difference in DD between elementary and high school levels was more pronounced in monolinguals than the difference between high school and university students. Bilinguals showed a reversed pattern, the difference between higher school levels was more pronounced than the difference between lower school levels. The three-way interaction did not affect DD.

Text Structure (TS), assessed through the diversity of rhetorical moves and the completeness of text structure, revealed a significant main effect of SL and Text, but not of LC. Compared to elementary school students, high school students produced significantly

better structured texts; however, no significant difference was observed between the texts produced by high school and university students. Among the different texts, T5 exhibited a more complete structure compared to T1 and T4. Three two-way interactions were identified: Text by LC, Text by SL and LC by SL. Only in T4 did monolingual students display a better text structure (Supplementary Figure 1.13). No significant effects of LC were found on the structure of T1 and T5. Furthermore, significant differences in TS by SL were only evident in T5 (Supplementary Figure 1.14). Elementary-school texts were significantly less well-structured than those produced at higher school levels, but this finding applied only to monolingual students (Supplementary Figure 1.15).

A three-way interaction analysis indicated that prior to classroom activities (T1) there were no significant differences in the completeness of structure between bilingual and monolingual students in elementary school. In high school, however, bilingual students produced texts with better structure compared to their monolingual counterparts, although this difference diminished in university-level texts. After classroom activities, T4 demonstrated similar completeness of structure in texts produced by both monolingual and bilingual students in elementary school. Conversely, bilingual students exhibited better structure in high school, whereas monolingual students outperformed bilinguals in university. In T5, produced 1 month after classroom activities, a more complete structure was observed in bilinguals compared to monolinguals in elementary school, whereas the opposite difference was found among high school and university students, that is, monolinguals performed better than bilinguals. Overall, texts from elementary school exhibited less completeness in structure than those from higher school levels among monolingual students, but this was not the case for bilingual students.

The other measure of text structure, presence of an Expository component containing mainly evidence (EC), was directly influenced by SL, Text and LC, demonstrating significant interactions between Text by LC and LC by SL.

There was a consistent increase in EC as SL advanced. Texts at T4 and T5 showed a stronger expository component compared to T1. Interaction of Text by LC showed that bilingual students' texts contained a higher EC in T4, while EC was lower in T5, yet remained above T1 (Supplementary Figure 1.16), while interaction of LC by SL revealed that bilingual students' texts had a stronger EC than monolingual students' in elementary and university levels, but not in high school (Supplementary Figure 1.17).

Additionally, there was a three-way interaction effect on EC. Before classroom activities, no significant difference due to LC was observed at the elementary level. At high-school and university levels, bilinguals' texts had a stronger EC than monolinguals' texts. In T4 and T5, the pattern showed no differences at elementary level, but a lower presence of the expository component in monolingual texts at the two higher school levels.

3.5 External evaluation of text quality

Teachers' evaluations were directly influenced by SL, with a significant increase in scores observed only between elementary

and high school, but not between high school and university. These evaluations were also directly influenced by Text (with T4 and T5 receiving the highest scores), but not by the students' LC, except when interacting with Text.

The influence of SL interacted with that of Text (Supplementary Figure 1.18) and the influence of Text with that of LC (Supplementary Figure 1.19). Elementary-school students received lower scores compared to higher school levels, particularly in T1 compared to T4 and T5 (Supplementary Figure 1.18). The effect of LC on teachers' scoring was evident in T4 and T5 but not in T1 (Supplementary Figure 1.19). SL also interacted with LC (Supplementary Figure 1.20). Specifically, among bilinguals, university students received higher scores than younger students, whereas among monolinguals, both university and high school students received higher scores compared to elementary students.

There was also a three-way interaction showing that for the texts produced before classroom activities, teachers' scoring was higher for texts produced by high school and university students, but similar for monolingual and bilingual students. In contrast, for T4, produced immediately after classroom activities, monolingual and bilingual students received similar scores in elementary school but lower than the scores for texts produced by bilinguals in high school and monolinguals in university. For T5, 1 month after classroom activities, scoring was similar for texts produced by monolingual and bilingual students in elementary school but lower than for texts produced by their high-school and university counterparts. At the university level, however, texts by monolingual students were scored higher.

Next, we regressed the external evaluation of TQ on text features within the GEE framework for each feature separately to identify the features that better explain TQ. We ran these models over all participants and by school levels (see Table 6).

The GEE framework enabled to identify the text features that better explain the external evaluation of text quality: TL was the most successful across all participants and at every school level. Lexical measures (WL and LD) explained high school students' evaluations, and the presence of an EC did so for the texts produced by university students.

3.6 Summary of findings

All the targeted indicators of analytical writing proficiency were significantly influenced by the interaction of three factors: students' linguistic condition, school level, and text timing in different combinations.

Students produced longer texts across SL and LC, especially after classroom activities. Bilingual high schoolers produced longer texts than their monolingual counterparts. Regarding Structural discourse markers, there was a consistent increase with SL, particularly among monolingual students. However, bilingual students outperformed monolinguals across all texts, notably at high school and university levels.

Regarding Modal discourse markers, bilinguals excelled, particularly in high school and university texts, with the most significant differences observed in texts produced 1 month after pedagogical scaffolding (T5). Bilingual students demonstrated

greater Lexical Diversity in their texts, particularly after classroom activities. Additionally, bilinguals' texts also exhibited a higher expository component compared to monolingual texts, especially following classroom activities at higher educational levels. In contrast, LC had fewer clear-cut effects on the completeness of TS, which fluctuates at different school levels. The density of rhetorical moves increased with each school level, but this increase was more pronounced between elementary and high school for monolingual students, while it was more noticeable between higher school levels for bilingual students. Notably, monolingual students tended to use longer words than bilingual students, particularly in texts produced after classroom activities.

Overall, the findings highlight the complex interplay of linguistic condition, educational level, and text timing on various aspects of writing, demonstrating consistent improvement in text length, word length, lexical diversity, and structural elements at higher-education levels and after instructional activities, with bilingual students exhibiting advantages in most indicators of quality.

Finally, teachers' evaluations of text quality were significantly influenced by school level, with notable differences in scores between elementary and high school, and less variation between high school and university. Text plays a role in the evaluations, particularly favoring T4 and T5, while the students' linguistic condition does not have a consistent impact.

Text Length was the text feature that best explained teachers' evaluation of TQ at every school level, whereas lexical measures (Word Length and Lexical Diversity) explained high-school students' evaluation, and the presence of an expository component did so at university level.

4 Discussion

Our primary goal was to determine the influence of writers' linguistic condition (monolingualism vs. bilingualism) on analytical writing proficiency, both in the larger developmental window, from elementary to higher education, and microdevelopmentally, along a sequence of classroom activities that lasted 2 weeks.

Our results indicate a selective impact of students' linguistic condition on analytical writing proficiency. It influences most, but not all, linguistic and structural indicators of writing proficiency targeted in this study. However, the linguistic condition of students never impacted writing proficiency alone, but always interacted in different combinations with the other factors considered: school level and text timing along pedagogical scaffolding.

Bilingualism, in interaction with school level and text timing, positively affected the use of modal discourse markers (MDM) and, in interaction with school level, positively influenced the use of structural discourse markers (SDM). Moreover, bilingualism in interaction with text timing positively impacted lexical diversity, while in interaction with school level, it led to a stronger presence of an expository component in bilingual students' texts. In contrast, monolingualism positively impacted word length.

Regarding the density of rhetorical moves, linguistic condition influenced developmental differences. Among bilinguals, the

progression from elementary to secondary school showed a smaller difference than the progression from secondary to university levels, while monolinguals displayed the opposite pattern.

Texts produced by children operating in dual-language contexts showed a greater use of stance-marking markers than monolingual students, particularly in the texts produced 1 month after pedagogical scaffolding, and most notably in high school and university. The use of structural markers increased with school level, particularly among monolingual students. However, bilingual students outperformed their monolingual counterparts at high school and university levels. Although both the use of modal and structural markers increased with school level, a significant increment was found in modal markers, only between high school and university, while in structural markers the increment was steady throughout school levels. Thus, the expression of the writer attitude toward the conveyed information by means of modal discourse markers appeared as a later attainment than the ability to explicitly structure spans of discourse (Tolchinsky and Rosado, 2005; Rosado et al., 2021). However, modal markers are only one of the many rhetorical options speakers–writers have for conveying subjective attitudes since "… modality can be said to ramify across the whole lexico–grammatical architecture of the language" (Gonzálvez García, 2000, p. 119). Further research is needed to identify which other resources (e.g., modal verbs, pronouns), if any, are employed by younger writers to express their involvement.

Texts produced by bilingual students were longer than those produced by monolingual students, though only at high school. Their texts exhibit greater lexical diversity at all levels of schooling, particularly when written after classroom activities and. Older bilingual students display a richer vocabulary compared to monolinguals. This result sheds new light on contrasting findings regarding size of both productive and receptive vocabulary in bilinguals compared to monolinguals. Some studies indicate that bilinguals lag behind monolinguals at earlier (Hoff et al., 2012) and later ages (Bialystok et al., 2010), while others show that when bilinguals' total vocabulary knowledge is considered they do not (Poulin-Dubois et al., 2013).

We measured lexical diversity only in the language of instruction. Thus, bilinguals' outperformance may not emerge from their knowledge of both languages, but rather from the type of task. We used a text-production task in contrast to other studies applying structured psycholinguistic (Ivanova and Costa, 2008) or psychometric (Roberts et al., 2002) measures. Participants were constrained by a prompt but not by a selection of words or time, and they could choose what words to use. A similar beneficial effect of unconstrained word selection on performance was found when comparing the spelling of dictated words against the spelling of words in a text production task (Tolchinsky, 2021). L2 studies also illustrate how lack of time constraints derived in deliberate avoidance of grammatical and/or structures learners perceived as difficult (Hubert, 2015). Nevertheless, more research is needed to explain why the effect of linguistic condition on lexical diversity is confined to university level. In other linguistic domains, such as complex syntactic structures, it has been reported that bilinguals may need more time to learn low-frequency structures because they receive a smaller amount of input in one language than their monolingual peers and these structures occur only occasionally in the input (Gathercole, 2007).

Finally, students raised and schooled in a dual-language context produced texts that were better supported in their claims as the expository component contained empirical evidence and justifying reasons. To the extent that justifying one's own position implies a concern for potential or empirical addressees, this finding relates to Hsin and Snow (2017) conclusion about how bilinguals' enhanced metalinguistic awareness becomes a facilitating factor for writers to incorporate reasons to strengthen a claim. Bilingualism appears to influence the process of decentering (Bernstein et al., 2015), which enhances writers' awareness of how adding reasons and reflections can facilitate understanding and acceptance of their claims. This increased awareness allows bilingual writers to better appreciate the importance of providing supporting evidence ultimately leading to more persuasive arguments.

In contrast to the positive effects of bilingualism on text connectivity, length, and lexical diversity, monolinguals outperformed bilinguals in word length. This indicator is a proxy of vocabulary sophistication given the inverse relationship between word length and word frequency. However, we believe this result may stem from structural differences between Spanish and Catalan rather than from different levels of vocabulary sophistication. Corpus as well as variation studies (e.g., Heggarty et al., 2005) inform of a significantly shorter word length in Catalan than in Spanish: while in Catalan is 4.01(SD 2.36) letters, in Spanish, the average word length is of 4.34 (SD 2.42) (see Huang et al., 2024). Presumably then, at a similar level of sophistication, words in Catalan might be shorter than Spanish words. Unfortunately, to the best of our knowledge, there are no comparative analyses of word length at equivalent frequencies in Catalan vs. Spanish.

On top of the selective and interactive influence of linguistic condition, we have found a steady development of the assessed features across schooling, with the exception of text structure. Overall, more experienced writers produced longer texts favoring elongated reflections on the topic and provision of evidence. With time, texts display a denser packing of information, more sophisticated and diverse vocabulary, and an increased use of cohesive devices (discourse markers). In contrast, the basic structure of analytical texts, embracing assertive, expository, and argumentative moves, was already attained at high school and did not improve further. As reported above, only the presence of the expository component continued to grow significantly up to university. These findings are consistent with documented development in argumentative writing pointing to a shift from a writer's unsupported opinion to a backed argumentation (Coirier et al., 1999; Felton and Kuhn, 2001). Such shift might be related to the development of decentering skills (Bernstein et al., 2015) that contributes to consider the addressee's perspective and consequently to provide more example and expand evidence and reasoned support. Features reflecting general writing improvement, such as cohesiveness, lexical diversity, and richness of expression, steadily improve throughout schooling and genre-oriented instruction. However, while completeness of text structure was already attained at high school, the more specific adjustment to analytical text constraints indicated by the presence of an expository component had a more protracted improvement, advancing up until the university level.

The overall improvement with genre-oriented input in the assessed indicators points to their malleability in the narrow time span of 2 weeks, during which students were reading, writing, and discussing the nature of analytical texts. Improvements in text length, provision of evidence and reasons, lexical sophistication, and diversity were most pronounced in texts produced immediately after instruction. In contrast, more significant improvements in text structure and the use of modal markers were observed in texts produced 1 month later. As this text was on a different topic (rewards and punishment in education), this finding hints at a facilitating effect of topic on text structuring and stance marking, warranting further investigation.

Finally, our study found that school level and the timing of text writing significantly influenced teachers' evaluations. Students in lower grades received lower scores compared to those in higher grades. Additionally, texts written before pedagogical scaffolding were scored lower than those produced immediately after classroom activities. However, students' linguistic condition did not consistently affect assessments: bilingual students' texts received higher scores after pedagogical input in high school and university settings, but not in elementary school.

The only text feature that affected teachers' scoring across the board was text length. This finding aligns with previous studies pointing at text length as the most sensitive measure of developing writing quality and pedagogical effectiveness (Nelson and Van Meter, 2007; McMaster and Espin, 2007). Interestingly, lexical features influenced the scoring of high school students' texts, while the presence of an expository component explained the scoring of university students' texts. Evaluators appreciate different facets of writing performance as a function of school level, likely reflecting the greater experience of students with written language (Olson and Oatley, 2014). In line with Salas et al. (2016), at advanced school levels, teachers appreciate adequate vocabulary, whereas at university level, they place more value on a well-reasoned and evidence-based stance.

These findings lead to two conclusions. First, bilingualism alone does not directly impact writing assessment; instead, its effects are mediated by school level and pedagogical input. And second, there is a discrepancy between researchers' and teachers' evaluations of such proficiency, with researchers focusing on lexical, syntactic, and structural features, while teachers primarily value more extensive arguments.

4.1 Implications and future research

The findings of this study highlight the complex interplay between linguistic condition (bilingualism vs. monolingualism) and the various factors that influence the development of text production proficiency. The selective influence of linguistic condition on specific linguistic features, with some favored by bilingualism, others by monolingualism, and some unaffected, underscores the need for a multifaceted approach to understanding this phenomenon.

The study identified several factors that impact the influence of linguistic condition on text production proficiency, including

experience with written language provided by schooling, exposure to genre-oriented input, the topic to be debated, and language characteristics. To fully grasp the effect of linguistic condition, further research is needed to explore the complex interaction between these factors and their relative influence on writing proficiency.

One of the study's findings highlighted the need for more contrastive research to clarify the source of observed differences between bilingual and monolingual populations. For example, the study found that the vocabulary of Spanish monolingual students may either be of a higher register or reflect structural differences between Spanish and Catalan languages. Additional research is necessary to determine the precise nature of these differences and their implications for writing proficiency.

Findings also suggested that targeted, genre-oriented instruction can lead to significant improvements in writing proficiency in a relatively short time span. This highlights the importance of fitted-in, individual educational interventions which specifically consider the students' age and/or school level. However, more research is needed to understand the specific roles played by repeated text production, type of instruction, and topic on the quality of analytical essays.

The importance of considering both researcher and teacher perspectives when assessing text quality is also underscored. While researchers focus on identifying nuances in lexical, syntactic, and structural features, teacher ratings appear to be primarily influenced by the length of the text. This discrepancy suggests the need for a more comprehensive and aligned approach to text quality assessment, incorporating both research expert and practitioner viewpoints.

In conclusion, this study provides valuable insights into the complex factors influencing the development of text production proficiency in bilingual and monolingual students. However, further research is needed to fully understand the interplay between linguistic condition, pedagogical interventions, and assessment approaches. By addressing these areas, researchers and educators can work together toward improving writing proficiency and supporting students' success in academic and professional settings.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements at the time of data collection. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

Author contributions

MA: Conceptualization, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing. ER: Investigation, Methodology, Supervision, Validation, Writing – review & editing. HV: Data curation, Formal analysis, Investigation, Writing – review & editing. RC: Data curation, Investigation, Validation, Writing – review & editing. LT: Conceptualization, Formal analysis, Funding acquisition, Investigation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/flang.2024.1480422/full#supplementary-material

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