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The reading process in bilingual and monolingual children: fluency as a mediating mechanism in a morphologically complex and transparent language

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Abstract
This study examines how native language status shapes the reading process in a morphologically rich and orthographically transparent language, focusing on reading fluency as a mediating mechanism linking bilingualism to reading comprehension. Participants were 330 primary school children in Grades 2 and 4 from low socioeconomic backgrounds, including 164 monolingual Turkish-speaking children and 166 Kurdish–Turkish bilingual children. Reading performance was assessed using grade-appropriate narrative and expository texts from the reading skills assessment tool (RSAT). Reading fluency was indexed by text reading time, total correct words, and correct words per minute, while comprehension was measured through responses to comprehension questions. Results indicated that bilingual children demonstrated lower reading fluency and comprehension than monolingual peers across text types. Fluency indicators were associated with comprehension outcomes among bilingual readers but not among monolinguals. Hierarchical regression analyses further showed that reading fluency partially mediated the relationship between native language status and reading comprehension. These findings suggest that in morphologically complex yet orthographically transparent languages such as Turkish, bilingual reading difficulties may primarily reflect reduced processing efficiency during text reading rather than fundamental decoding deficits.

Keywords Bilingual reading · Reading fluency · Reading comprehension · Morphology · Transparent orthography

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Introduction

Reading is a complex cognitive process that emerges from the coordinated interaction of multiple component skills rather than a single, unitary ability. Contemporary theories of reading development emphasize that successful comprehension depends not only on accurate word recognition but also on the efficiency with which written text is processed and integrated into coherent mental representations over time (Duke & Cartwright, 2021). From this perspective, reading is best understood as an online process requiring coordination of lower- and higher-level processes during text reading rather than a static outcome reflected solely in accuracy or comprehension scores (Hessel & Schroeder, 2019).

Within this theoretical framework, the Simple View of Reading (SVR) has played a central role by conceptualizing reading comprehension as the product of decoding and linguistic comprehension (Nordström et al., 2025). While adequate performance in both components is necessary for successful comprehension, the SVR also implies that reading difficulties may arise from inefficiencies in how decoding and linguistic comprehension are coordinated during real-time text processing. Accordingly, recent research has increasingly adopted process-oriented interpretations of reading development that seek to explain how these components interact dynamically during continuous text reading rather than merely whether they are present (Makaure & Wilsenach, 2024; Tong & Deacon, 2025).

While the Simple View of Reading provides a foundational framework for understanding the relationship between decoding and linguistic comprehension, more recent theoretical perspectives have emphasized the dynamic and interactive nature of reading processes. Models such as the active view of reading (Duke & Cartwright, 2021) and the direct and indirect effects model of reading (DIER; Kim, 2020) extend the SVR by incorporating a broader set of linguistic, cognitive, and motivational components that contribute to reading development. These models highlight that successful reading comprehension emerges not only from the presence of decoding and language comprehension skills, but also from the efficiency with which these processes are coordinated during real-time text processing. Within these expanded perspectives, reading fluency is often conceptualized as a critical intermediary mechanism linking word recognition processes to higher-level comprehension. Fluent reading reflects the degree to which lower-level processes such as decoding and morphological parsing become automated, allowing readers to allocate cognitive resources to syntactic integration, inferencing, and meaning construction (Duke & Cartwright, 2021; Kim, 2020).

Reading fluency is increasingly conceptualized as a functional bridge between decoding and comprehension (e.g., Hsu et al., 2023; Makaure & Wilsenach, 2024; Marinelli et al., 2025; Tong & Deacon, 2025). It reflects the automatization of word recognition processes that enables readers to allocate cognitive resources to higher-level processes such as syntactic integration, inferencing, and comprehension monitoring (Kim, 2020). Fluency is typically indexed by indicators such as reading time, accuracy in connected text, and correct words per minute, capturing processing efficiency rather than accuracy alone. Empirical evidence indicates that reduced fluency increases cognitive load during text processing and constrains comprehension per-

formance (Kim, 2020; Kim et al., 2021; Makebo et al., 2022). Recent studies further show that fluency functions as a mediating mechanism linking word-level skills to reading comprehension, particularly during the early and middle stages of reading development (Cadime et al., 2025; De Jong & Molenaar, 2025; Makaure & Wilsenach, 2024; Meggiato et al., 2025).

In addition to reader-related characteristics, properties of the text itself may also influence reading performance. One such factor is text genre. Research has shown that narrative and expository texts impose different cognitive and linguistic demands on readers (McNamara et al., 2017). Narrative texts typically present events within familiar story structures and provide contextual cues that support meaning construction, whereas expository texts often contain denser informational structures, unfamiliar vocabulary, and less predictable organizational patterns that increase processing demands (Diakidoy et al., 2005). Consequently, readers often demonstrate higher comprehension when reading narrative texts than expository texts (Yıldırım et al., 2010). Similar patterns have been documented among struggling readers and in studies with Turkish students, where text genre influences comprehension performance and response patterns (Alatlı et al., 2023; Ceylan & Baydık, 2018). Accordingly, this study includes text genre (narrative vs. expository) as a factor in the analyses to account for potential variation in reading fluency and comprehension across text types.

In bilingual populations, constraints in reading often emerge not as decoding failure but as reduced processing efficiency, making reading fluency a sensitive indicator of bilingual differences. Bilingual children typically read more slowly and achieve lower correct-words-per-minute scores than monolingual peers, even when accuracy is comparable (Bonifacci et al., 2020; Papastefanou et al., 2021). These fluency differences may mediate the relationship between bilingual status and reading comprehension by reflecting efficiency-based coordination between decoding and linguistic comprehension (Makaure & Wilsenach, 2024). Accordingly, research increasingly adopts a component-based perspective, emphasizing heterogeneous reading profiles shaped by language exposure and proficiency (Bialystok et al., 2025; Bonifacci et al., 2020; Dosi, 2025; Gunnerud et al., 2022; Papastefanou et al., 2021). Within this framework, linguistic comprehension has emerged as a particularly vulnerable domain for many bilingual readers. Evidence shows that reading comprehension is strongly predicted by oral-language proficiency, including vocabulary depth, morphosyntactic knowledge, and discourse-level skills, even when decoding accuracy is comparable to that of monolingual peers (Dosi, 2025; Gunnerud et al., 2021; Papastefanou et al., 2021). Limited exposure to the language of instruction may constrain lexical and syntactic representations, reducing inferencing and comprehension monitoring, and leading to difficulties in constructing coherent mental representations during reading.

Several mechanisms have been proposed to explain why bilingual readers may experience reduced fluency and comprehension efficiency. First, reduced quantity and quality of exposure to the school language may weaken lexical quality, slowing lexical access and increasing processing time during connected-text reading (Dosi, 2025). Second, less developed morphosyntactic representations may hinder the rapid integration of words into sentence-level structures, increasing cognitive load during

comprehension (Guldenoglu et al., 2024, 2025). Third, bilingual readers may experience cross-linguistic interference or competition between linguistic systems, further taxing processing resources during reading (Gunnerud et al., 2022). Finally, bilingual readers may rely more heavily on executive control processes to compensate for limited linguistic resources, a strategy that may preserve accuracy while slowing overall processing speed (Marinelli et al., 2025).

The manifestation of these mechanisms is shaped by the orthographic and morphological characteristics of the language being read. Cross-linguistic research consistently shows that orthographic depth plays a central role in the development of reading processes across languages. In opaque orthographies such as English, inconsistent grapheme–phoneme correspondences slow the acquisition of accurate decoding and fluent word recognition. In contrast, transparent orthographies typically support earlier decoding accuracy but may still present challenges for reading fluency depending on the linguistic structure of the language (Leachman et al., 2025; Seymour et al., 2003).

Much of the bilingual reading literature has been derived from studies conducted in opaque orthographies, particularly English, where irregular grapheme–phoneme correspondences prolong decoding development. In such contexts, decoding difficulties and fluency-related inefficiencies are often intertwined, making it difficult to isolate the specific pathways through which bilingualism influences reading processes. Consequently, findings from opaque orthographies may obscure important process-level distinctions relevant to bilingual reading development.

In contrast, orthographically transparent and morphologically rich languages, such as Turkish, offer a theoretically informative context for examining bilingual reading processes. Turkish is characterized by highly consistent one-to-one mappings between graphemes and phonemes, enabling children to acquire decoding accuracy relatively early in reading development (Guldenoglu et al., 2024, 2025). However, this transparency coexists with extensive agglutinative morphology, allowing the formation of long and structurally complex word forms through the systematic attachment of multiple suffixes (e.g., *ev→evlerinizdenmişsiniz*) (Miller et al., 2019). Such morphologically complex words impose demands on morphological parsing, lexical access, and syntactic integration during text reading.

Recent research conducted in Turkish has demonstrated that reading difficulties often manifest not as persistent decoding errors, but as reduced fluency, longer reading times, and inefficiencies in processing morphologically complex word forms during continuous text reading (Guldenoglu et al., 2024; Kargın et al., 2024). Empirical research conducted with Turkish students similarly highlights the strong association between reading fluency and reading comprehension. For example, studies with elementary school students in Turkey have shown that key components of reading fluency, such as word recognition accuracy, reading speed, and prosody, are significant predictors of comprehension outcomes (Yıldız & Çetinkaya, 2017; Yıldız et al., 2014). Other research examining Turkish readers has also reported meaningful relationships between reading fluency, attention, and comprehension performance, suggesting that efficient text processing plays an important role in successful reading development in Turkish (Kanık Uysal & Bilge, 2019). Even when readers decode words accurately, the cumulative processing demands imposed by long, suffixed

structures may hinder the automatization of word recognition processes, limiting the cognitive resources available for comprehension. These difficulties are most likely to emerge at the interface between decoding and linguistic comprehension, that is, at the level of reading fluency (Makaure & Wilsenach, 2024; Marinelli et al., 2025; Papastefanou et al., 2021).

This linguistic profile is particularly consequential for bilingual children learning to read in Turkish. Although bilingual readers may benefit from the transparent orthography and achieve adequate decoding accuracy, reduced exposure to complex Turkish morphosyntax and derived word forms may slow the development of fluent reading. As a result, bilingual readers may experience comprehension difficulties not because they cannot decode text correctly, but because they cannot process text efficiently enough to sustain meaning construction. This pattern underscores the importance of examining reading fluency as a mediating mechanism linking bilingual status to comprehension outcomes in morphologically rich and transparent languages (Dosi, 2025; Makaure & Wilsenach, 2024; Papastefanou et al., 2021).

Despite the theoretical relevance of these issues, process-oriented research examining how bilingualism interacts with reading fluency and comprehension in languages such as Turkish remains limited. Few studies have simultaneously examined reading time, accuracy-based fluency indicators, and comprehension performance within a unified SVR-informed framework. Consequently, the mechanisms through which native language status shapes the reading process, rather than merely reading outcomes, remain insufficiently understood. This study addresses this gap by examining the reading process in bilingual and monolingual children, with a specific focus on reading fluency as a mediating mechanism between native language status and reading comprehension in Turkish, a morphologically rich and orthographically transparent language. It integrates multiple indicators of reading efficiency (reading time, total correct words, and correct words per minute) with comprehension outcomes to examine how bilingualism reshapes the coordination of decoding and linguistic comprehension during text reading. By positioning Turkish as a theoretically informative linguistic context rather than merely a local case, the study contributes to contemporary models of reading development and provides evidence relevant to educational practice in linguistically diverse settings. Reading fluency and comprehension were measured using behavioral indicators derived from the RSAT assessment battery, while constructs such as processing efficiency and coordination between decoding and linguistic comprehension are interpreted theoretically based on the observed fluency indicators.

Research questions and hypotheses

Grounded in the SVR and recent process-oriented frameworks of reading development, including the active view of reading (Duke & Cartwright, 2021) and the direct and indirect effects model of reading (Kim, 2020), this study adopts a theory-driven approach to examine how native language status shapes the reading process in a morphologically rich and orthographically transparent language. In such linguistic contexts, decoding accuracy is typically acquired early, making efficiency-related aspects of text reading particularly important for understanding individual differences

in comprehension. Accordingly, the present hypotheses focus on reading fluency as a central mechanism through which bilingualism may influence reading outcomes.

First, given that fluent reading requires the automatization of word recognition and the efficient processing of morphologically complex word forms, reduced exposure to the language of instruction and limited familiarity with complex morphological structures are expected to constrain processing efficiency in bilingual readers. Hypothesis 1 posits that bilingual children will demonstrate lower reading fluency than monolingual children, as reflected by longer text reading times, fewer total correct words, and lower rates of correct words per minute during text reading. Research Question 1 asks whether bilingual and monolingual children differ in reading fluency during text reading in Turkish.

Building on these expected fluency differences, limitations in processing efficiency are hypothesized to constrain higher-level comprehension processes by increasing cognitive load and reducing the resources available for meaning construction. Hypothesis 2 therefore proposes that bilingual children will exhibit lower reading comprehension than monolingual children, as indicated by fewer correct responses and more incorrect responses on reading comprehension measures. Research Question 2 examines whether bilingual and monolingual children differ in reading comprehension during text reading in Turkish.

Beyond group-level differences, process-oriented models of reading predict that individual differences in fluency should be systematically related to comprehension outcomes across readers. When text reading is slow or effortful, comprehension monitoring and integration are expected to be compromised regardless of native language status. Hypothesis 3 states that indicators of reading fluency (reading time, total correct words, and correct words per minute) will be associated with reading comprehension, such that higher fluency will correspond to better comprehension accuracy and fewer comprehension errors. Research Question 3 addresses the extent to which reading fluency indicators are associated with reading comprehension in bilingual and monolingual children.

Finally, integrating these predictions within an SVR-informed framework, bilingualism is expected to influence reading comprehension primarily through its impact on processing efficiency rather than through direct effects on decoding accuracy. Reduced automatization of word recognition and increased processing demands during text reading are thus hypothesized to function as indirect pathways linking native language status to comprehension outcomes. Hypothesis 4 proposes that reading fluency will mediate the relationship between native language status and reading comprehension, such that differences in comprehension between bilingual and monolingual children will be partially or fully accounted for by differences in reading fluency. Research Question 4 investigates whether reading fluency mediates the relationship between native language status and reading comprehension during text reading in Turkish.

Method

Design

This study employed a cross-sectional comparative design to examine how native language status shapes the reading process in Turkish. Native language status (monolingual vs. bilingual) was treated as a between-subjects factor, whereas text type (narrative vs. expository) was treated as a within-subjects factor because all participants read both text types. This design allowed the examination of group differences in reading fluency and comprehension as well as the role of text characteristics in reading performance.

Reading fluency was operationalized using multiple indicators derived from connected-text reading, including text reading time, total correct words, and correct words per minute (WCPM), capturing processing efficiency rather than accuracy alone. Reading comprehension was assessed through responses to comprehension questions administered after reading, with both correct and incorrect responses analyzed to provide a differentiated representation of comprehension outcomes.

Participants

The final sample consisted of 330 primary school children (198 girls, 132 boys) enrolled in Grade 2 ($n = 164$) and Grade 4 ($n = 166$). Data were collected in Van, Türkiye, from four public primary schools operating under the supervision of the Turkish Ministry of National Education. All children attended public schools and received literacy instruction in Turkish under the same national curriculum. The selected schools served neighborhoods characterized by low socioeconomic status (SES) and were highly comparable in terms of student demographics, instructional resources, and educational conditions.

The sample was nearly evenly divided with respect to language background, comprising 164 monolingual Turkish-speaking children and 166 bilingual children. In Grade 2, 80 children were classified as monolingual and 84 as bilingual, whereas in Grade 4, 84 children were monolingual and 82 were bilingual. Importantly, monolingual and bilingual participants were drawn from the same schools and classrooms, thereby controlling for potential confounding effects related to school context, instructional quality, and peer learning environments.

All bilingual children were identified as having Kurdish as their first-acquired language, which they reported learning naturally in the home environment prior to exposure to Turkish. According to child reports, Kurdish was the primary language used for communication with parents and siblings, whereas Turkish was acquired subsequently and served as the language of schooling and formal literacy instruction. At the time of data collection, bilingual children reported using both Kurdish and Turkish for everyday communication, with Turkish functioning as the dominant language in academic contexts.

Prior to inclusion in the study, bilingual children participated in an individual prescreening interview conducted in Kurdish by a researcher proficient in the language. These interviews verified that children could express themselves comfortably and

coherently in their first language, thereby confirming functional proficiency in Kurdish and supporting their classification as early sequential bilinguals. Notably, during these interviews, it was observed that when children attempted to produce sentences in Turkish, their utterances frequently included Kurdish lexical or structural elements, whereas their expressive fluency and ease of communication were more evident when speaking Kurdish. This qualitative observation further corroborated the classification of these children as bilinguals with Kurdish-dominant early language experience.

Formal standardized language or reading assessments were not administered, as no validated standardized language assessment is currently available for Kurdish that would be appropriate for the age range and educational context of the participants. Instead, participant classification relied on a multi-source screening procedure. In addition, school guidance counselors provided contextual information regarding children's family backgrounds and the language(s) used in the home environment, which corroborated reports concerning native language status and language exposure. Monolingual children were identified as students demonstrating typical classroom reading performance and with no history of identified reading or learning difficulties. This criterion was applied to ensure that the monolingual comparison group represented typical classroom reading performance and did not include children with identified reading difficulties.

Monolingual children were defined as those who had been exposed exclusively to Turkish from birth and who reported using Turkish as their sole language of communication both at home and at school. Individual interviews confirmed that monolingual participants did not regularly use or prefer another language for communication.

Across both language groups, children with identified intellectual disabilities, uncorrected sensory impairments, or known neurological conditions were excluded from participation. Parental consent and child assent were obtained for all participants, and all procedures were conducted in accordance with ethical guidelines for research involving human participants. This multi-source screening procedure was used to increase the reliability of participant classification and to minimize potential misclassification of language status.

Instrument

Participants' reading performance was measured using the Reading Skills Assessment Tool (RSAT) (Alatlı et al., 2022), a standardized, norm-referenced assessment battery developed for Turkish-speaking students in Grades 2, 4, 6, and 8.

The psychometric adequacy of the RSAT has been documented in previous studies (Alatlı et al., 2022). Content validity was established through expert review conducted by primary school teachers and university-level instructors of Turkish. Reliability analyses have demonstrated strong internal consistency for the fluent reading component, with a Cronbach's alpha coefficient of 0.95 based on correct words per minute. For the comprehension component, test–retest reliability coefficients were reported as 0.80 for Grade 2 and 0.70 for Grade 4 students. Each text included a limited number of comprehension items designed to capture different comprehension processes (e.g., literal understanding, inference, and evaluation). Because of the

relatively small number of items per text, reliability estimates at the text level should be interpreted with caution. Overall, these findings indicate that the RSAT provides a reliable framework for assessing reading fluency and comprehension among Turkish-speaking students.

In this study, participants were administered two grade-appropriate texts from the RSAT battery, including one narrative and one expository text. Each text was followed by comprehension questions designed to assess multiple comprehension processes. Items represent five question types widely cited in reading research: literal (2 items), reorganization (1 item), inference (1 item), prediction (1 item), and evaluation (1 item). The second-grade version includes three response options per item, whereas the fourth-grade version includes four options, reflecting developmental progression in metacognitive and inferential demands. All reading fluency indicators (e.g., reading time, number of correctly read words, correct words per minute) and reading comprehension measures were derived from participants' performance on these texts, ensuring that fluency and comprehension were assessed within comparable and ecologically valid reading contexts.

Procedure

Prior to data collection, written informed consent from parents and assent from students were obtained after participants were informed about the voluntary nature of the study and their right to withdraw at any time. Data collection was conducted individually in quiet, designated locations within the schools (e.g., unused classrooms, guidance counseling rooms, or library reading areas) to minimize external distractions and ensure consistent testing conditions across participants. Each participant read both a narrative and an expository text aloud. The order of administration followed the standard RSAT testing procedure, with oral reading used to derive reading fluency indicators for both texts.

Each assessment session began with a brief rapport-building interaction (e.g., discussion of hobbies, favorite games, or movies) aimed at reducing anxiety and increasing comfort with the examiner. In addition, for bilingual participants, a short approximately 5-min preliminary conversation conducted in Kurdish was included prior to the reading tasks. This brief interaction served to verify that students could communicate comfortably in their first-acquired language and to ensure that they were at ease before proceeding with the Turkish reading assessments. No formal scoring or evaluation was conducted during this preliminary conversation.

Following this introduction, all students were provided with standardized instructions and asked to read a grade-appropriate narrative text from the RSAT battery aloud. Oral reading performances were audio-recorded to allow for subsequent analyses of decoding accuracy, error patterns, and fluency indicators.

Immediately after the oral reading task, students completed the reading comprehension assessment associated with the text. To minimize potential order and text-type effects, the order of narrative and expository texts was systematically varied across participants so that the sequence of text types was balanced. Each assessment session lasted approximately 12 min in total. At the conclusion of the session, par-

ticipants were offered a small stationery item (e.g., a pencil, eraser, or sharpener) as a token of appreciation for their participation.

Data analysis

All analyses were conducted using IBM SPSS Statistics. Prior to the main analyses, the dataset was screened to ensure data quality. Missing values, outliers, and data entry errors were examined across all variables. No systematic patterns of missing data were observed, and cases with incomplete data on key variables were excluded from relevant analyses. Assumptions of normality, linearity, and homoscedasticity were evaluated, and the distributions of the primary outcome variables were deemed acceptable for the planned parametric analyses.

To address the research questions, a series of descriptive and inferential statistical analyses were conducted. Group differences in reading fluency and comprehension were examined using multivariate analyses of variance (MANOVA) including native language status as a between-subjects factor and text type as a within-subjects factor. Associations between reading fluency indicators and reading comprehension were evaluated using correlational analyses, conducted separately for bilingual and monolingual groups to capture potential group-specific patterns. Although participants were drawn from two grade levels (Grades 2 and 4), preliminary analyses indicated that the overall pattern of group differences was comparable across grades. Therefore, grade was not included as a covariate in the main analyses in order to maintain model parsimony and to focus on the primary research questions concerning language status, text type, and reading fluency.

To examine the hypothesized role of reading fluency as a process-level mechanism, hierarchical regression analyses were conducted to test whether reading fluency accounted for variance in reading comprehension beyond native language status. Changes in standardized regression coefficients across models were used to evaluate evidence for partial mediation, consistent with an SVR-informed analytical framework. Statistical significance was evaluated using an alpha level of 0.05 for all analyses. Although item-level or mixed-effects models can provide an alternative approach for analyzing repeated-measures data, this study employed MANOVA and hierarchical regression analyses in line with common analytic practices in reading research examining group differences and process-level associations. Because the comprehension items were designed to function as components of a standardized assessment rather than independent analytical units, analyses were conducted at the text level. This approach is consistent with common practices in reading research examining group differences in fluency and comprehension using standardized reading assessments. Formal mediation analyses based on bootstrapped indirect effects represent an alternative analytic strategy and may provide additional precision in estimating indirect pathways; however, this study focused on hierarchical regression to evaluate mediation patterns within an SVR-informed framework.

Table 1 Descriptive statistics for reading fluency and comprehension by grade level

Variable	Grade	*n*	M	SD
Reading fluency (WCPM)	Grade 2	164	53.97	16.76
	Grade 4	166	81.86	21.57
Reading comprehension	Grade 2	164	3.71	1.21
	Grade 4	166	3.89	1.60

Table 2 Descriptive statistics for reading fluency measures by language status and text type

Measure	Language status	Expository text M (SD)	Narrative text M (SD)	Total M (SD)
Text reading time (s)	Monolingual	139.90 (41.46)	148.51 (47.36)	144.21 (44.58)
	Bilingual	167.63 (72.71)	182.02 (85.84)	174.83 (79.63)
Total correct words	Monolingual	178.66 (70.22)	199.41 (91.14)	189.04 (81.77)
	Bilingual	154.10 (66.80)	171.94 (85.77)	163.02 (77.16)
Correct words per minute (WCPM)	Monolingual	76.23 (19.03)	78.91 (22.24)	77.57 (20.68)
	Bilingual	57.94 (22.07)	59.13 (23.98)	58.54 (22.98)

Higher scores on WCPM and total correct words indicate better reading fluency, whereas lower scores on text reading time indicate greater fluency

Results

Preliminary analyses were conducted to examine whether Grade 2 and Grade 4 students differed in reading fluency and reading comprehension (Table 1). Results indicated that Grade 4 students demonstrated significantly higher reading fluency scores ($M=81.86$, $SD=21.57$) compared to Grade 2 students ($M=53.97$, $SD=16.76$), $t(\approx 320)=-13.12$, $p<0.001$. In contrast, no statistically significant difference was found between Grade 2 ($M=3.71$, $SD=1.21$) and Grade 4 students ($M=3.89$, $SD=1.60$) in reading comprehension, $t(\approx 320)=-1.10$, $p=0.271$. Although a significant difference was observed in reading fluency, grade level was not central to the research questions. Therefore, subsequent analyses were conducted on the combined sample, while these developmental differences are reported for transparency.

To test Hypothesis 1, which predicted that bilingual children would demonstrate lower reading fluency than monolingual children, a MANOVA was conducted. Reading fluency was operationalized using three indicators: text reading time, total number of correctly read words, and correct words per minute (WCPM). Native language status (monolingual vs. bilingual) was treated as a between-subjects factor, whereas text type (expository vs. narrative) was treated as a within-subjects factor because all participants read both text types. Results are presented in Table 2.

The multivariate analysis revealed a significant main effect of language status on reading fluency, *Pillai's trace* $=0.18$, $F(3, 324)=25.13$, $p<0.001$, partial $\eta^2=0.18$, indicating that monolingual and bilingual children differed across the combined fluency measures. The multivariate main effect of text type was not statistically significant, *Pillai's Trace* $=0.02$, $F(3, 324)=2.24$, $p=0.080$, partial $\eta^2=0.02$, nor was

the interaction between language status and text type, *Pillai's trace* = 0.00, $F(3, 324) = 0.19$, $p = 0.902$, partial $\eta^2 = 0.00$.

Follow-up univariate analyses showed that language status had a significant effect on all three fluency indicators. Monolingual children read texts faster than bilingual children, $F(1, 326) = 18.56$, $p < 0.001$, partial $\eta^2 = 0.05$. They also read a greater number of words correctly, $F(1, 326) = 8.92$, $p = 0.003$, partial $\eta^2 = 0.02$, and achieved higher correct words per minute scores, $F(1, 326) = 62.26$, $p < 0.001$, partial $\eta^2 = 0.16$.

In contrast, the main effect of text type was limited. Text type did not influence text reading time or WCPM; however, a small but significant effect was observed for total correct words, $F(1, 326) = 4.91$, $p = 0.027$, partial $\eta^2 = 0.01$, with higher accuracy observed for narrative texts. Importantly, the interaction between language status and text type was not significant for any of the fluency measures (all $ps > 0.68$), indicating that the fluency advantage of monolingual children was consistent across expository and narrative texts.

Overall, these findings support Hypothesis 1, demonstrating that bilingual children exhibit reduced reading fluency relative to monolingual peers across multiple indicators of processing efficiency, independent of text type.

Having established that bilingual children exhibit reduced reading fluency across multiple indicators of processing efficiency, the next step was to examine whether these fluency differences are reflected in higher-level reading comprehension outcomes.

To test Hypothesis 2, which predicted that bilingual children would demonstrate lower reading comprehension than monolingual children, a MANOVA was run. Reading comprehension was operationalized using the number of correct comprehension responses. Native language status (monolingual vs. bilingual) was treated as a between-subjects factor, whereas text type (expository vs. narrative) was treated as a within-subjects factor because all participants read both text types. A summary of the results is presented in Table 3.

The multivariate analysis revealed a main effect of language status on reading comprehension, *Pillai's Trace* = 0.13, $F(2, 325) = 26.10$, $p < 0.001$, partial $\eta^2 = 0.13$, indicating that monolingual and bilingual children differed in comprehension performance. A main effect of text type was also observed, *Pillai's Trace* = 0.16, $F(2, 325) = 30.88$, $p < 0.001$, partial $\eta^2 = 0.16$, reflecting differences in comprehension performance between expository and narrative texts. The interaction between language status and text type was not observed, *Pillai's Trace* = 0.00, $F(2, 325) = 0.61$, $p = 0.54$, partial $\eta^2 = 0.00$.

Follow-up univariate analyses showed that language status affected comprehension performance. Monolingual children produced more correct responses than

Table 3 Descriptive statistics for reading comprehension measures by language status and text type

Measure	Language status	Expository text M (SD)	Narrative text M (SD)	Total M (SD)
Correct comprehension responses	Monolingual	3.79 (1.20)	4.78 (1.08)	4.29 (1.24)
	Bilingual	2.76 (1.35)	3.88 (1.28)	3.32 (1.43)

bilingual children, $F(1, 326) = 50.79$, $p < 0.001$, partial $\eta^2 = 0.13$, indicating a comprehension advantage for monolingual children across text types.

Text type also exerted an effect on comprehension performance. Both monolingual and bilingual children produced higher comprehension scores when reading narrative texts compared to expository texts, $Fs(1, 326) \geq 60.31$, $ps < 0.001$, partial $\eta^2 s \geq 0.15$. The absence of a language status × text type interaction indicates that the observed differences between bilingual and monolingual children were consistent across expository and narrative texts.

Overall, these findings support Hypothesis 2, demonstrating that bilingual children showed lower reading comprehension than monolingual peers, as reflected in differences in correct comprehension responses across text types.

Having demonstrated that bilingual and monolingual children differ both in reading fluency and in reading comprehension, the next step was to examine whether individual differences in reading fluency are systematically associated with comprehension outcomes across readers.

To test Hypothesis 3, which predicted that reading fluency indicators would be associated with reading comprehension, a two-step analytic approach was adopted. First, Pearson correlation analyses were conducted separately for monolingual and bilingual children to examine the bivariate associations between reading fluency indicators (text reading time, total correct words, and correct words per minute) and reading comprehension (number of correct comprehension responses) (Table 4). Second, a multiple regression analysis was performed on the full sample to examine the unique contribution of fluency indicators to reading comprehension while controlling for native language status and text type.

Correlation analyses revealed different patterns of association between reading fluency and comprehension across language groups. Among monolingual children, none of the fluency indicators were associated with correct comprehension responses (all $ps > 0.14$), suggesting that variability in comprehension performance within this group was not linked to differences in reading efficiency.

In contrast, among bilingual children, associations were observed between fluency and comprehension performance. Specifically, the total number of correctly read words was associated with correct comprehension responses ($r = -0.51$, $p < 0.001$). Similarly, correct words per minute was positively related to correct comprehension responses ($r = 0.45$, $p = 0.003$). Text reading time showed no statistically significant association with comprehension outcomes within either group.

To further examine whether reading fluency contributes uniquely to comprehension performance beyond group membership and text type, a multiple regression analysis was conducted with number of correct comprehension responses as the dependent

Table 4 Correlations between reading fluency indicators and reading comprehension by language status

Group	Fluency indicator	Correct responses
Monolingual	Text reading time	−0.23
	Total correct words	0.05
	Correct words per minute	0.19
Bilingual	Text reading time	−0.15
	Total correct words	0.51*
	Correct words per minute	0.45

Correlations are Pearson's *r*. $p < 0.01$**

variable. The overall model was significant, $F(5, 324) = 29.07$, $p < 0.001$, accounting for approximately 31% of the variance in reading comprehension ($R^2 = 0.31$, adjusted $R^2 = 0.30$). Within this model, native language status ($\beta = -0.24$, $p < 0.001$) and text type ($\beta = 0.36$, $p < 0.001$) emerged as predictors of comprehension performance. When entered simultaneously with these variables, individual fluency indicators did not account for additional unique variance in comprehension (all $ps > 0.17$).

Taken together, these findings partially support Hypothesis 3. While reading fluency indicators were associated with comprehension outcomes among bilingual children at the bivariate level, these associations were attenuated when native language status and text type were considered. This pattern suggests that the relationship between fluency and comprehension may differ across language groups and highlights the importance of examining reading fluency as a mechanism linking bilingual status to comprehension.

Having shown that bilingual and monolingual children differ in both reading fluency and reading comprehension, and that fluency is systematically associated with comprehension, particularly among bilingual readers, the final step was to examine whether reading fluency accounts for the relationship between native language status and reading comprehension.

To test Hypothesis 4, a hierarchical multiple regression analysis was conducted to examine whether reading fluency (correct words per minute) mediates the relationship between native language status and reading comprehension. In the first step, language status and text type were entered as predictors of comprehension to estimate the total effect. In the second step, reading fluency was added to the model to assess whether the effect of language status on comprehension was reduced when fluency was taken into account. Detailed results of the analyses are presented in Table 5.

In the first step of the hierarchical regression analysis, language status and text type jointly accounted for a significant proportion of variance in reading comprehension, $R^2 = 0.25$, $F(2, 327) = 55.70$, $p < 0.001$. Language status emerged as a significant predictor, with bilingual children demonstrating lower comprehension performance than monolingual children ($\beta = -0.34$, $p < 0.001$), while text type also showed a significant effect favoring narrative texts ($\beta = 0.37$, $p < 0.001$).

In the second step, reading fluency (correct words per minute) was added to the model. The inclusion of fluency improved model fit, $\Delta R^2 = 0.05$, $\Delta F(1, 326) = 24.21$, $p < 0.001$, indicating that fluency explained additional variance in comprehension

Table 5 Hierarchical regression analyses predicting reading comprehension (correct responses)

Predictor	Model 1 β	Model 2 β
Language status (Native vs. Bilingual)	−0.34***	−0.24***
Text type (Expository vs. Narrative)	0.37***	0.36***
Reading fluency (WCPM)	–	0.24***
R^2	0.25	0.30
ΔR^2	–	0.05***

Model 1 includes language status and text type as predictors of reading comprehension. Model 2 includes language status, text type, and reading fluency (correct words per minute) as predictors. Standardized regression coefficients (β) are reported. ***$p < 0.001$. The dash (—) indicates that the predictor was not included in that model

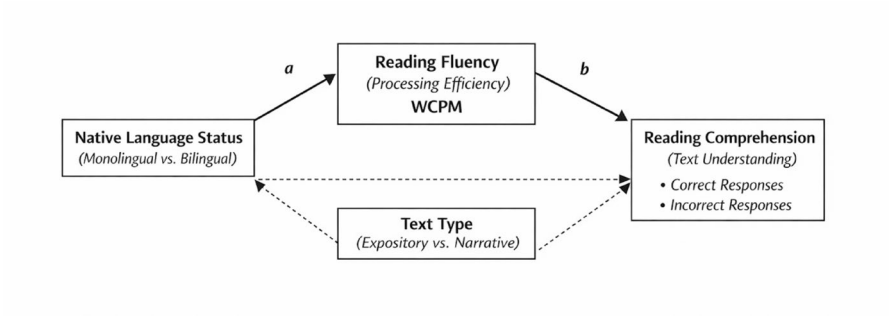


Fig. 1 Conceptual mediation model illustrating the role of reading fluency in the relationship between native language status and reading comprehension. WCPM, words correct per minute

beyond language status and text type. Importantly, reading fluency emerged as a significant positive predictor of comprehension ($\beta = 0.24$, $p < 0.001$).

Crucially, the standardized regression coefficient for language status decreased in magnitude from $\beta = -0.34$ to $\beta = -0.24$ after the inclusion of reading fluency, while remaining statistically significant ($p < 0.001$). This reduction indicates that reading fluency partially mediates the relationship between native language status and reading comprehension. The pattern of results remained stable when examining unstandardized coefficients and their 95% confidence intervals. In other words, a notable portion of the comprehension disadvantage observed among bilingual children can be explained by reduced processing efficiency during text reading. To facilitate the interpretation of this mediation pattern and to illustrate the hypothesized pathways linking native language status, reading fluency, and reading comprehension, a conceptual model of the tested relationships is presented in Fig. 1.

Figure 1 depicts the conceptual mediation model underlying Hypothesis 4, illustrating reading fluency as a central processing mechanism through which native language status influences reading comprehension. In this model, bilingualism is associated with reduced reading fluency, operationalized as WCPM, which in turn predicts lower comprehension performance, reflected in both correct and incorrect response patterns. Text type (expository vs. narrative) is included as a covariate to account for genre-related differences in linguistic and processing demands.

Overall, these findings support Hypothesis 4, demonstrating that reading fluency functions as a meaningful mediating mechanism linking bilingualism to reading comprehension outcomes in Turkish.

Discussion

The present study set out to examine how native language status shapes the reading process in a morphologically rich and orthographically transparent language, with a particular focus on reading fluency as a mechanism linking bilingualism to reading comprehension. Taken together, the findings provide converging evidence that bilingual–monolingual differences in reading outcomes cannot be adequately explained by surface-level decoding accuracy alone. Rather, the results point to processing

efficiency during continuous text reading as a key locus of difficulty for bilingual readers, with important consequences for comprehension. Bilingual children demonstrated lower levels of reading fluency and comprehension than their monolingual peers, and these differences were meaningfully connected through a partial mediation pattern in which reading fluency accounted for a portion of the relationship between native language status and comprehension. Interpreted within contemporary models of reading development, these findings highlight reading fluency not merely as a byproduct of decoding development but as a dynamic interface through which word recognition processes are coordinated with higher-level linguistic operations during real-time text processing. This interpretation is particularly relevant in morphologically complex languages such as Turkish, where long and structurally dense word forms may impose sustained processing demands that challenge the automatization of word recognition. Importantly, these findings should not be interpreted as indicating an inherent deficit associated with bilingualism. Rather, they reflect differences in language exposure and processing experience in the language of instruction, which shape the efficiency with which decoding and linguistic comprehension processes are coordinated during reading.

A closer examination of the observed fluency differences suggests that the bilingual disadvantage identified in this study is best understood in terms of reduced processing efficiency rather than fundamental decoding failure (Bialystok et al., 2025; Bonifacci et al., 2020; Dosi, 2025; Gunnerud et al., 2021; Papastefanou et al., 2021). Although Turkish offers highly consistent grapheme–phoneme correspondences that support early acquisition of decoding accuracy, fluent text reading requires the rapid coordination of word recognition with the processing of complex morphological structures (Guldenoglu et al., 2024; Miller et al., 2019). For bilingual children, reduced exposure to the instructional language and limited automatization of morphologically complex word forms may slow the transition from effortful decoding to automatic word recognition. In morphologically rich languages such as Turkish, where words often consist of long strings of inflectional and derivational morphemes, this lack of automatization can increase processing demands during continuous text reading (Guldenoglu et al., 2024, 2025). As a result, bilingual readers may read more slowly and less efficiently even when accuracy is relatively preserved, a pattern that aligns with recent evidence emphasizing fluency as a sensitive marker of processing limitations in bilingual literacy development (Bonifacci et al., 2020; Papastefanou et al., 2021).

The observed differences in reading comprehension further underscore the importance of efficiency-based processes in bilingual reading development. Even in transparent orthographies, successful comprehension requires more than accurate word decoding; it depends on the reader's ability to integrate lexical, morphosyntactic, and semantic information while monitoring meaning across the text (Guldenoglu et al., 2024; Hessel & Schroeder, 2019). For bilingual children, limitations in lexical depth and morphosyntactic proficiency in the language of instruction may place additional strain on these integrative processes, particularly when reading extended texts (Dosi, 2025; Gunnerud et al., 2022; Marinelli et al., 2025). When combined with reduced fluency, such linguistic constraints can lead to increased cognitive load, leaving fewer resources available for higher-level comprehension operations such as inferencing,

coherence building, and comprehension monitoring (Kim, 2020). The finding that narrative texts were generally better comprehended than expository texts across both groups is consistent with this interpretation, as narrative structures provide richer contextual and schematic support that may partially compensate for processing inefficiencies. However, the persistence of the differences in comprehension across text types suggests that genre-related support alone is insufficient to offset the underlying efficiency-related challenges faced by bilingual readers.

The differential strength of the association between reading fluency and comprehension across language groups provides further insight into the mechanisms underlying bilingual reading development (Dosi, 2025; Gunnerud et al., 2022; Makaure & Wilsenach, 2024; Marinelli et al., 2025). Among bilingual children, fluency emerged as a correlate of comprehension, suggesting that processing efficiency plays a critical role in determining how successfully textual information is integrated and understood. When word recognition and morphological parsing are not fully automatized, bilingual readers may need to allocate disproportionate cognitive resources to lower-level processes, thereby constraining higher-level comprehension operations (Dosi, 2025). In contrast, for monolingual children, whose word recognition processes are likely to be more automatized, variability in fluency may fall below a functional threshold that meaningfully constrains comprehension. As a result, comprehension performance in monolingual readers may be driven more by higher-level linguistic and cognitive factors than by efficiency-related constraints. This pattern is consistent with threshold and bottleneck accounts of reading, which posit that fluency becomes a limiting factor for comprehension primarily when processing demands exceed available cognitive resources, a condition more likely to characterize bilingual readers in morphologically complex languages.

The mediation analysis provides critical evidence that reading fluency functions as a key explanatory mechanism linking bilingualism to reading comprehension outcomes, rather than merely co-occurring with them. As illustrated in Fig. 1, bilingual status was associated with reduced processing efficiency during text reading, which in turn accounted for a portion of the observed differences in comprehension (Cadime et al., 2025; Makaure & Wilsenach, 2024). Importantly, the persistence of a direct effect of language status after accounting for fluency suggests a partial rather than complete mediation, indicating that while fluency plays a central role, additional linguistic and cognitive factors may also contribute to bilingual readers' comprehension performance. From the perspective of the SVR, these findings extend traditional formulations by highlighting fluency as a dynamic interface between decoding and linguistic comprehension, particularly in contexts where morphological complexity places sustained demands on real-time processing (Duke & Cartwright, 2021; Kim, 2020). In this sense, the present model moves beyond a binary distinction between decoding and comprehension and instead emphasizes the efficiency with which these components are coordinated during continuous text reading.

The present findings also underscore the importance of considering language-specific properties when examining bilingual reading development. Turkish represents a particularly informative case due to its combination of orthographic transparency and high morphological complexity, a profile that is underrepresented in the predominantly English-centric reading literature. While transparent orthographies facilitate

early decoding accuracy, the extensive use of inflectional and derivational morphology in Turkish requires readers to process long, morphologically dense word forms in real time (Guldenoglu et al., 2024; Miller et al., 2019). For bilingual children, limited exposure to such complex morphological structures may delay the automatization of morphological parsing, thereby amplifying processing demands during continuous text reading. The present results suggest that in languages like Turkish, bilingual reading difficulties may manifest less in overt decoding errors and more in reduced processing efficiency, a pattern that may not be fully captured by models derived primarily from morphologically simpler languages. As such, the study contributes to a growing body of evidence indicating that the mechanisms underlying bilingual reading development are shaped not only by language experience but also by the structural characteristics of the language being learned (Makaure & Wilsenach, 2024; Marinelli et al., 2025; Papastefanou et al., 2021).

Beyond their theoretical significance, the present findings carry important educational implications for supporting bilingual readers in school settings. Identifying reading fluency as a central mechanism underlying comprehension difficulty suggests that assessments relying solely on decoding accuracy may underestimate the challenges faced by bilingual children, particularly in morphologically rich languages. Fluency-based indicators, such as correct words per minute during connected-text reading, may therefore provide more sensitive markers of reading risk and should be incorporated into early screening and progress-monitoring frameworks. From an instructional perspective, interventions targeting the automatization of word recognition and morphological processing may help reduce processing demands and support comprehension. In addition, the advantage observed for narrative texts suggests that instructional materials may be strategically sequenced, using narrative texts as an initial scaffold before introducing more linguistically demanding expository texts. Together, these implications highlight the need for process-oriented assessment and instruction responsive to bilingual language experience and the structural characteristics of the language of instruction.

Despite its contributions, this study has several limitations that should be considered when interpreting the findings and that suggest directions for future research. First, the cross-sectional design precludes conclusions about developmental trajectories and causal relations among language status, reading fluency, and comprehension. Longitudinal studies following bilingual and monolingual readers over time would help clarify the directionality of these processes and the stability of fluency as a mediating mechanism. Second, the absence of standardized measures of Kurdish language proficiency represents an additional limitation. As a result, bilingual classification relied on interview-based and contextual indicators rather than formal language assessments. Future research incorporating direct measures of oral-language proficiency would allow a more precise examination of how language proficiency interacts with reading fluency and comprehension. Third, reading processes were assessed using behavioral indicators derived from connected-text reading. Although these measures capture ecologically valid aspects of reading, they do not provide fine-grained information about online processing. Process-level methodologies, such as eye-tracking or reaction-time paradigms, could help identify more precisely where processing bottlenecks arise. Finally, the study focused on Turkish as a single lan-

guage context. Comparative research across languages differing in morphological complexity would help clarify the extent to which the observed mediation pattern generalizes across linguistic systems.

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Data availability The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request, in accordance with institutional and ethical guidelines.

Declarations

Conflict of interest The authors declare no competing interests.

Ethical approval This study was conducted in full compliance with the ethical standards.

Informed consent Informed consent was obtained from all participants prior to the commencement of the study.

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