University of Zagreb

Faculty of Education and Rehabilitation Sciences

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PRODUCTION OF PERSONAL NARRATIVES IN CHILDREN WITH DEVELOPMENTAL LANGUAGE DISORDER

DOCTORAL DISSERTATION

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Supervisors:

Jelena Kuvač Kraljević, PhD, Full Professor

Marleen F. Westerveld, PhD, Full Professor

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Sveučilište u Zagrebu

Edukacijsko-rehabilitacijski fakultet

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PROIZVODNJA OSOBNIH PRIČA U DJECE S RAZVOJNIM JEZIČNIM POREMEĆAJEM

DOKTORSKI RAD

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Zagreb, 2025

CONTENT

Throughout the development of this dissertation, I was fortunate to be supported by many people to whom I am deeply grateful.

I thank my supervisors for their unwavering support, insightful guidance, and dedicated reading of my work. Working with and learning from you has been both an honour and a pleasure.

I thank all the research participants for their time and commitment. I also thank my colleagues for their support in recruiting participants.

To my family and friends, thank you for your love, encouragement and belief in me. I am grateful to was able to share this journey with you and to have had you by my side.

BIOGRAFHY OF THE SUPERVISORS

Jelena Kuvač Kraljević, PhD, Full professor

Jelena Kuvač Kraljević graduated in speech-language pathology at the University of Zagreb Faculty of Education and Rehabilitation Sciences and obtained her master's and doctoral degrees in linguistics at the University of Zagreb Faculty of Humanities and Social Sciences. She has been employed at the University of Zagreb Department of Speech and Language Pathology since 2000. Her research interests include language development and processing as well as developmental and acquired language disorders.

She is head of the Postgraduate doctoral programme Speech, Language and Hearing Disorders; Croatian representative in the Child Language Committee of the International Association of Communication Sciences and Disorders (IALP); external evaluator for the University of Limerick, Ireland, and the University of Valletta, Malta; editor-in-chief of the Croatian Journal of Rehabilitation Research (from 2018 to 2024).

She has published over 100 articles in journals, proceedings and books. She is co-author of the book Methodology of Children's Language Research (published in Croatian in 2007) and editor of the book Recognition and Education of Children with Language Disabilities (published in Croatian in 2015). She has developed or adapted seven language tests in Croatian to assess the language, reading and writing skills of children and adults with language disorders, including TROG-2:HR and New Reynell Developmental Language Scale (NRDLS-HR). She has been the principal investigator on six scientific projects, most of which focused on knowledge and technology transfer, and the supervisor of four completed dissertations.

Jelena Kuvač Kraljević was awarded the State Prize for Science in 2016, the Prize for Scientific Productivity in 2016 and the Prize for the Best Scientist of the Faculty of Education and Rehabilitation Sciences in 2014. In addition, she was awarded two professional prizes: the Croatian Association of Speech-Language Pathologists Prize for combining science and practice in speech-language therapy in 2018 and the "Stjepan Cipek" Prize for improving teaching skills in higher education in 2020.

Marleen Westerveld, PhD, Full professor

Marleen Westerveld graduated in speech-language therapy at the HogeSchool van Amsterdam and obtained her Master's and Phd degrees in Speech-Language Therapy from the University of Canterbury (New Zealand). She was awarded a Top Achiever Doctoral Scholarship from the Foundation for Research Science and Technology (New Zealand Government) in 2003 and graduated with a Dean's List commendation for "*a PhD thesis of exceptional value*" in 2007. Her research focuses on children's spoken and written language skills that are needed to participate in everyday situations, at home, school, and in the community.

Marleen Westerveld joined the School of Health Sciences and Social Work at Griffith University (Australia) in 2011 and is currently the Speech Pathology Discipline Lead. She was the Higher Degree Research (HDR) Convenor in the School from 2018 – 2024, has supervised 9 HDR students to completion, and received the School's outstanding HDR Supervision award (2021). She is the Chair of the Child Language Committee of the International Association of Communication Sciences and Disorders (IALP); Board Member of IALP; executive committee member of the International Association for the Study of Child Language (IASCL); and Chair of the Global TALES Network. Marleen Westerveld has held prestigious editorial positions, including Editor for Language, Speech, and Hearing Services in Schools (2018-2020).

Marleen Westerveld has published 97 peer-reviewed journal articles, 8 book chapters, and 2 books. Over 30% of her publications are with international collaborators. Web of Science places 2 of her articles in the top 1% of the Essential Science Indicators academic fields Social Science, general and Psychiatry/Psychology, based on a highly cited threshold for the field and publication year. In 2021, she received Best in Field, The League of Scholars (The Australian) for her research contribution to Child and Adolescent Psychology. Her first-author text-book „Reading Success in the Primary Years" (2020) has been downloaded 124,000 times. To date, her research has attracted >3 million AUD in funding.

In 2021, Marleen Westerveld was awarded Fellowship of Speech Pathology Australia for her significant and sustained contribution to the profession. She was an invited Erskine Fellow at the Child Wellbeing Research Institute at the University of Canterbury (2024) and will be awarded an IALP Honoured Member Award (Aug 2025) for her outstanding leadership, contributions, and commitment to excellence.

ABSTRACT

Personal narrative production refers to the ability to talk about personally experienced past events that a person reconstructs from memory (Westby & Culatta, 2016), involving at least two temporally related actions (Peterson & McCabe, 1983). The production of personal narratives is a complex ability that relies on language skills at different discourse levels (e.g., vocabulary, grammar, coherence), cognitive skills (e.g., memory access), and socio-emotional aspects of functioning. The way in which children narrate about their past experiences not only provides insight into their language skills, it may also inform how individuals process pleasant and unpleasant experiences. To address the varying levels of discourse, this dissertation adopts the LUNA (Linguistic Underpinnings of Narrative in Aphasia) framework as its theoretical foundation (Dipper et al., 2021). The LUNA framework identifies four levels of discourse: (1) pragmatic, (2) macrostructure planning, (3) propositional, and (4) linguistic. This dissertation investigates whether the production of personal narratives differs in school-age children with developmental language disorder (DLD) compared to peers with typical language development (TLD) and which cognitive and socio-emotional factors contribute to these differences.

This dissertation is designed as the 'three papers' format. Each paper evaluates children's personal narrative skills, taking different LUNA levels into account. **The first aim** of this dissertation was to investigate the personal narrative production at the linguistic, propositional and macrostructure planning levels in children with DLD compared to children with TLD. **The second aim** was to investigate the effects of the emotional valence of events on the performance of personal narrative production. **The third aim** was to investigate the relationship between children's memory mechanisms and socio-emotional characteristics, as well as their contribution to the production of personal narratives.

Fifty Croatian-speaking children, aged 9 to 11 years, with a diagnosis of DLD and 50 age- and gender-matched peers with TLD narrated personal narratives in response to emotion-based prompts using the Global TALES protocol (Westerveld et al., 2022). Children's personal narratives were analysed at the linguistic (grammatical complexity and accuracy, lexical diversity, productivity), propositional (local coherence, incomplete utterances, fluency), macrostructure planning (context, chronology, theme), and pragmatic (theme) levels of the LUNA framework. Children were also assessed using measures of memory mechanisms, including episodic buffer, semantic access and fluency, as well as measures of socio-emotional functioning using the Beck Youth Inventory.

The children with TLD showed significantly better performance on all narrative measures, except lexical diversity, fluency and productivity. As hypothesised, when linguistic, macrostructure planning, and propositional measures were combined, 67% of the variance in personal narrative production was explained. The results showed that a combination of grammatical complexity and accuracy, and chronology measures predicted group (DLD/TLD) membership (93.8% sensitivity, 91.8% specificity). This confirmed the second hypothesis (Aim 1). The results also showed that children with DLD consistently demonstrated difficulties in both personal narratives about pleasant and unpleasant events, regardless of the type of event they were narrating (Aim 2). The emotional valence did not influence the production of personal narrative production differently in children with DLD than in children with TLD, which was in contrast to the third hypothesis. The fourth hypothesis, that children with DLD would produce a higher percentage of personal narratives involving unpleasant events than pleasant events, was also not confirmed.

No significant bivariate correlations were found between the children's memory mechanisms and socio-emotional characteristics and a composite measure of personal narrative production (hypothesis five was rejected). However, the episodic buffer uniquely predicted narrative production, and anxiety symptoms accounted for additional variance, with the final model explaining 46% of the variance (Aim 3). None of the other variables (semantic memory and other aspects of socio-emotional traits such as depression, anger, disruptive behaviour and self-concept), contributed to personal narrative production. The strength of this relationship was consistent regardless of group membership. This partially confirmed hypotheses six and seven that the episodic buffer, as opposed to other memory mechanisms, and anxiety (internalised behaviours), as opposed to externalised behaviours, make a greater contribution to explaining the production of personal narratives.

In conclusion, this dissertation advances research on discourse processing by evaluating the associations between linguistic, cognitive and socio-emotional aspects of personal narrative production. These findings on the predictive value of memory mechanisms and anxiety emphasise the importance of assessing both the memory processes underlying personal narrative production and the child's socio-emotional profile when evaluating personal narrative skills and planning targeted support for children with DLD.

Key words: personal narrative, developmental language disorder, emotional valence, memory mechanism, socio-emotional functioning

SAŽETAK

Proizvodnja osobnih priča odnosi se na sposobnost pričanja o osobno doživljenim prošlim događajima koje osoba rekonstruira iz sjećanja (Westby i Culatta, 2016), u najmanje dvije vremenski povezane radnje (Peterson i McCabe, 1983). Proizvodnja osobnih priča složena je sposobnost koja se oslanja na jezične vještine na različitim razinama diskursa (npr. rječnik, gramatiku, koherentnost), kognitivne vještine (npr. pristup pamćenju) i socio-emocionalne aspekte funkcioniranja. Način na koji djeca pripovijedaju o svojim prošlim iskustvima, ne samo da pruža uvid u njihove jezične vještine, već može i dati informacije o tome kako obrađuju ugodna i neugodna iskustva. Kako bi se istražile različite razine diskursa, ovaj se doktorski rad oslanja na LUNA (eng. *Linguistic Underpinnings of Narrative in Afasia*) okvir kao svoju teorijsku osnovu (Dipper i sur., 2021). LUNA okvir razlikuje četiri razine diskursa: (1) pragmatičku, (2) planiranje makrostrukture, (3) propozicijsku i (4) jezičnu razinu. Ovaj doktorski rad istražuje razlikuje li se proizvodnja osobnih priča u djece školske dobi s razvojnim jezičnim poremećajem (RJP) u usporedbi s vršnjacima urednog jezičnog razvoja (UJR) te koji kognitivni i socio-emocionalni čimbenici doprinose tim razlikama.

Ovaj doktorska disertacija izrađena je kao rad sastavljen od tri članka. Svaki članak procjenjuje vještine pričanja osobnih priča djece, uzimajući u obzir različite razine LUNA okvira. **Prvi cilj** ovog rada bio je istražiti proizvodnju osobnih priča na jezičnoj, propozicijskoj i razini planiranja makrostrukture kod djece s RJP-om u usporedbi s djecom s UJR-om. **Drugi cilj** bio je istražiti učinke emocionalne valentnosti događaja na izvedbu osobnih priča. **Treći cilj** bio je istražiti odnos između mehanizama pamćenja djece i socio-emocionalnih obilježja, kao i njihov doprinos proizvodnji osobnih priča.

Pedeset djece-govornika hrvatskog jezika, u dobi od 9 do 11 godina, s dijagnozom RJP-a i 50 vršnjaka s UJR-om, izjednačenih po dobi i spolu, ispričalo je osobne priče kao odgovor na poticaje temeljene na emocijama koristeći Global TALES protokol (Westerveld i sur., 2022). Dječje priče analizirane su na jezičnoj (gramatička složenost i točnost, leksička raznolikost, produktivnost), propozicijskoj (lokalna koherencija, nepotpuni iskazi, tečnost), na razini planiranja makrostrukture (kontekst, kronologija, tema) i na pragmatičkoj razini (tema) prema LUNA okviru. Djeca su također ispitana mjerama mehanizama pamćenja, uključujući epizodički međuspremnik, pristup semantičkom pamćenju i semantičku tečnost, kao i mjerama socio-emocionalnog funkcioniranja korištenjem Beckovih inventara za mlade.

Djeca s UJR-om pokazala su značajno bolje rezultate na svim pripovjednim mjerama, osim na leksičkoj raznolikosti, tečnosti i produktivnosti. Kao što je i pretpostavljeno, kada su kombinirane jezične, makrostrukturne i propozicijske mjere, objašnjeno je 67% varijance u proizvodnji osobnih priča. Rezultati su pokazali da kombinacija mjera gramatičke složenosti i točnosti te mjera kronologije predviđa pripadnost skupini (RJP/UJR) (s 93.8% osjetljivosti, 91.8% specifičnosti). To je potvrdilo drugu hipotezu (cilj 1). Rezultati su također pokazali da djeca s RJP-om dosljedno pokazuju poteškoće u osobnim pričama i o ugodnim i neugodnim događajima, bez obzira na vrstu događaja koji su ispričali (cilj 2). Emocionalna valentnost nije drugačije utjecala na proizvodnju osobnih priča u djece s RJP-om nego li u djece s UJR-om, što je bilo u suprotnosti s trećom hipotezom. Četvrta hipoteza, da će djeca s RJP-om proizvoditi veći postotak osobnih priča koje uključuju neugodne događaje u odnosu na ugodne događaje, također nije potvrđena.

Nisu pronađene značajne bivarijatne korelacije između dječjih mehanizama pamćenja i socio-emocionalnih obilježja te kompozitne mjere proizvodnje osobnih priča (peta hipoteza je odbačena). Međutim, epizodički međuspremnik pokazao je jedinstveni doprinos, dok su simptomi anksioznosti objasnili dodatnu varijancu u proizvodnji osobnih priča, pri čemu je konačni model objasnio 46% varijance (cilj 3). Nijedna druga varijabla (semantičko pamćenje i drugi aspekti socio-emocionalnih obilježja poput depresije, ljutnje, ometajućeg ponašanja i samopoimanja) nije doprinijela objašnjavanju proizvodnje osobnih priča. Snaga ovog odnosa bila je dosljedna bez obzira na pripadnost skupini (RJP/UJR). Time su djelomično potvrđene šesta i sedma hipoteza u dijelu da epizodički međuspremnik, za razliku od drugih mehanizama pamćenja, i anksioznost (internalizirana ponašanja), za razliku eksternaliziranih, imaju veći doprinos u objašnjavanju proizvodnje osobnih priča.

Zaključno, ovaj doktorski rad unapređuje istraživanje obrade diskursa procjenjujući povezanosti između jezičnih, kognitivnih i socio-emocionalnih aspekata proizvodnje osobnih priča. Nalazi o prediktivnoj vrijednosti mehanizama pamćenja i anksioznosti naglašavaju važnost procjene i procesa pamćenja koji leže u osnovi proizvodnje osobnih priča te socio-emocionalnog profila djeteta pri ispitivanju vještina proizvodnje osobnih priča i planiranju ciljane podrške za djecu s RJP-om.

Ključne riječi: osobne priče, razvojni jezični poremećaj, emocionalna valentnost, mehanizmi pamćenja, socio-emocionalno funkcioniranje

1. INTRODUCTION

1.1. Defining Personal Narratives

Narrative is an integral part of structuring, explaining, and representing the human experience, whether through fictional or real events (Bruner, 1990). As children develop, they learn to create different types of narratives, such as scripts, fictional stories, or personal narratives (Hudson & Shapiro, 1991). Personal narratives, in particular, are among the earliest developing and most common forms of narrative in children (Preece, 1987), as they occur in everyday, natural situations, at home, at school, and in the community.

Personal narratives are defined as accounts of personally experienced events that a person reconstructs from their memory (Westby & Culatta, 2016). They allow sharing of one's own thoughts and feelings about pleasant and unpleasant experiences that consist of at least two temporally related actions (Peterson & McCabe, 1983). The way in which children narrate different emotionally valenced events provides insight into how they process different experiences (Bruner, 1990; Fivush et al., 2019). Constructing coherent narratives (i.e., that are well-structured and make sense to the listener) helps the narrator to process experiences in a way that allows them to connect objective events with subjective thoughts and feelings about those events (see Fivush et al., 2008; Westby & Culatta, 2016). The production of personal narratives is indeed a complex skill relying on language skills (vocabulary, grammar, and pragmatics) and cognitive skills (e.g., planning, memory access, social cognition) that work together to make a personal narrative discourse meaningful and coherent (Hudson & Shapiro, 1991; Johnston, 2008).

School-age children rely on personal narrative skills to build and maintain relationships with peers and others, and to participate in or express their opinions, both inside and outside the classroom (Westby & Culatta, 2016). Personal narrative skills are important for building social interactions and maintaining friendships making up more than half of children's daily conversations, which in turn positively impacts children's socio-emotional well-being and academic performance (see Reese et al., 2017; Westby & Culatta, 2016; Westerveld et al., 2022).

1.2. Children With DLD and the Importance of Examining (Personal) Narrative Skills

Developmental language disorder (DLD) is a neurodevelopmental condition characterised by significant and persistent difficulties in producing and/or understanding language, for example, in forming or understanding complex sentences or in acquiring and using new words, which

significantly impact on a child's daily functioning (Bishop et al., 2017). Research shows that DLD affects approximately 7.5% of preschool children (Norbury et al., 2016). There is no evidence that the language difficulties of individuals with DLD are related to any known aetiology, such as intellectual disability, neurological or hearing disorders, or that they are caused by emotional difficulties and/or limited exposure to language. Children and adults with DLD are a heterogeneous population with varying levels of ability in terms of strengths and needs in different language domains (i.e., morphology and syntax, semantics, pragmatics and phonology), and modalities (receptive and expressive spoken language, reading and writing) (Bishop et al., 2017). In late language development, children and adolescents with DLD can have significant difficulties in literacy-related skills due to challenges in understanding spoken language at the level of words (vocabulary), sentences (complex syntactic structures) and texts (abilities to form a well-organised and grammatically correct discourse) (Ziegenfusz et al., 2022). Children and young people with DLD not only have significant communication difficulties, but are also at increased risk of mental health problems (Yew & O'Kearney, 2013), and face many challenges in education (Ziegenfusz et al., 2022), and employment (Conti-Ramsden et al., 2018).

Children with DLD have difficulty constructing personal narratives. This can interfere with their ability to effectively convey the meanings they intend in their messages (Fivush et al., 2008; Tompkins et al., 2017). By examining the personal narrative discourse in children with DLD, researchers can thus gain valuable insights into how these children use language to convey information and connect ideas in meaningful ways, and also identify the specific skills with which they may struggle (Hill et al., 2021; Westby & Culatta, 2016). As the construction of personal narratives requires a combination of language skills, cognitive and interpersonal (socio-emotional) skills (Hudson & Shapiro, 1991; Johnston, 2008), understanding the interplay of these factors is crucial as it provides insight into whether children with DLD have the necessary skills for effective everyday communication and active participation in society.

2. Theoretical Framework for the Analysis of Personal Narrative Production – LUNA Framework

The language difficulties faced by children with DLD can strongly influence the structure and content of discourse, including personal narratives (Andreou & Lemoni, 2020; Blom & Boerma, 2016; Winters et al., 2022). Since the production of personal narratives is a complex skill and its realisation requires the coordination of multiple levels of discourse production, a

theoretical framework that reflects this complexity is required. The theoretical background of this study is based on the LUNA (Linguistic Underpinnings of Narrative in Aphasia) framework (Dipper et al., 2021) – a recently developed theoretical framework that applies metatheory principles to spoken discourse theory from aphasiology literature. Its aim is to summarize and organize existing theoretical frameworks and models in a structured manner. Thus, the strength of the LUNA framework is that it provides a good foundation for various aspects of discourse production based on well-known and widely accepted theories from the scientific fields of cognitive psychology and linguistics (e.g., Frederiksen et al., 1990; Sherratt, 2007). The framework extends these theories by linking their concepts and constructs and placing them in a discourse framework. The LUNA framework distinguishes four main levels of discourse production: 1) pragmatic level, 2) macrostructure planning, 3) propositional level, and 4) linguistic level, which interact with each other (Figure 1; Dipper et al., 2021). In this thesis, these levels are considered to determine whether the difficulties in forming the discourse of personal stories in children with DLD reflect only their linguistic difficulties, in the sense that they are the result of difficulties in lexical retrieval and morphosyntactic encoding, or whether there are also difficulties at other levels of discourse processing, such as social-pragmatic demands, memory and production planning, and the organisation of structural elements into a coherent whole.

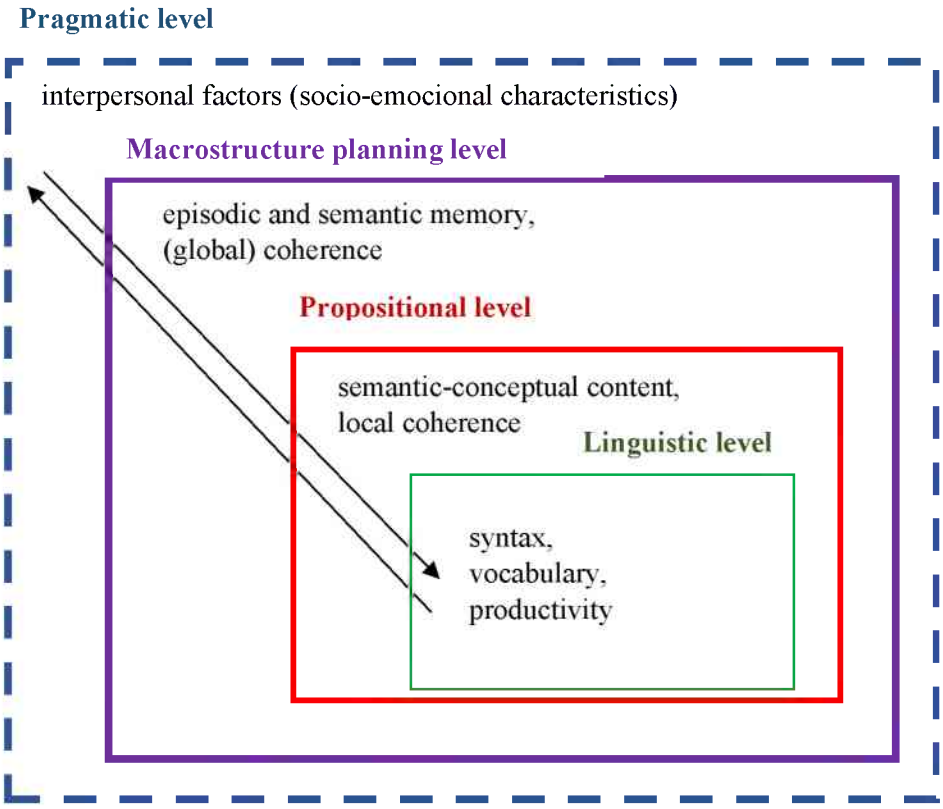

Figure 1. Concepts and Constructs Within the Different Discourse Processing Levels of the LUNA Framework (Dipper et al., 2021)

2.1. Discourse-Level Skills at Different Levels of Personal Narrative Production

The LUNA framework (Dipper et al., 2021) encompasses both language and cognitive processing within a multilevel framework reflecting the complex and multi-layered functioning of personal narrative production skills. According to the LUNA framework, the production of personal narratives begins at the pragmatic level, where the narrator decides which past personal event to depict based on environmental, interpersonal, and interactional factors. Environmental and interpersonal factors refer, for example, to the context in which the narrative is told, i.e., a familiar or formal setting, but also to the intrapersonal (socio-emotional) characteristics of the narrator, which may influence the way they convey personal experiences. Important here are the emotion regulation skills (in terms of levels of internalised and externalised behaviours and self-concept) that influence decisions about the content that the narrator will tell, which is reflected in the coherent content and language of the personal narrative.

The production of personal narratives continues at the level of macrostructure planning, where the narrator selects the organisational framework of the discourse based on familiar templates based on their memory of a personal event. The retrieval of episodic and semantic information from memory is not only important for macrostructure planning, but also for the overall organisation of the content and the linguistic shaping of the personal narrative discourse. At the macrostructure planning level, narrators include important elements such as contextual information and organise the structure chronologically and with resolutions, which contributes to the (global) coherence of the personal narrative.

The propositional level prepares semantic-conceptual content and utterances for linguistic processing. This level refers to the pre-linguistic organisational phase in which information is organised as propositions so that they are derived from each other and conceptual connections of ideas are realised at the local level. At this level, semantic connections are established between individual utterances, and the possible pauses and hesitations that occur in their realisation, as well as incomplete utterances, indicate that the establishment of semantic connections is complex.

At the linguistic level, the information organised at the previous levels is translated into language. Structural language skills are essential for this component in order to produce syntactically organised, grammatically complete sequences of selected lexical items and generally fluent and productive language. The processing of a personal narrative discourse can proceed ‘top-down’ as described, so that information from each level – from the pragmatic to the linguistic – contributes to the next. However, the skills underlying the processing levels can also work in the opposite ‘bottom up’ direction through revisions and reformulations of the personal narrative discourse (Figure 2).

Levels of the LUNA Framework and their Conceptualisation	Constructs and Skills
Pragmatic Level	
interpersonal factors	socio-emotional characteristics *description: emotion regulation skills – self-reporting on internalising and externalising behaviour and self-concept*
Macrostructure Planning Level	
episodic memory access	episodic buffer functioning
semantic memory access	an access to semantic memory *skills: retrieving and using semantic-syntactic information from the long-term memory in working memory; retrieving lexical-semantic and phonological items; accessing semantic memory - knowledge of connections between words*
coherence	coherence (context, chronology, and theme) *discourse skills: production of linguistic items (words, sentences) related to a global theme and their chronological arrangement*
Propositional Level	
conceptualisation	semantic-conceptual content, local coherence *discourse skills: production of linguistic items (words, sentences) that denote connected ideas at the local level; production of sentences that relate to each other*
Linguistic Level	syntax, vocabulary, productivity
language	*discourse skills: production of linguistic items with the correct form, and production of fluent, complex, accurate, and productive language*

Figure 2. The LUNA Framework: Associated Constructs and Skills

2.1.1. *Production of Personal Narratives at Different Levels of Discourse in Children with DLD*

Previous research has shown that children with DLD exhibit significant difficulties in producing personal narratives. At the linguistic level of the LUNA framework, the personal narratives of children with DLD are less grammatically complex and accurate, with shorter and often syntactically less complex utterances, and errors of a morphosyntactic and lexical nature that persist well into adolescence (Miranda et al., 1998; Wetherell et al., 2007). Available studies investigating the personal narrative skills of children with DLD have included a relatively small number of participants and a small number of measures to evaluate personal narrative skills. Some studies focus only on productivity, which primarily refers to the length of the narrative, but reveals less about the specific difficulties that children with DLD may face in producing it (Bliss & Pierre, 1997; McCabe et al., 2008; McCabe & Bliss, 2004). Investigating specific difficulties in personal narrative narration is important. For example, the study by Miranda et al. (1998) showed that 8-to-9-year-old children with DLD produced personal narratives with significantly lower grammatical complexity and accuracy than typically developing peers, but with similar lexical diversity. However, the sample size was small (n = 10) and consisted of middle-class Caucasian boys, so it is difficult to generalise the results. In a study by Wetherell et al. (2007), adolescents aged 13-15 (n = 19) produced personal narratives of relatively similar syntactic complexity and lexical diversity to children with typical language development (TLD), but made significantly more grammatical and lexical errors. These errors differed in distribution from those of children with TLD, indicating specific difficulties and grammatical weaknesses in the group of adolescents with DLD.

At the propositional level, many studies have used measures that measure ability at multiple levels of the LUNA framework (using composite measures), but few have documented how children with DLD function specifically at the propositional level. For example, a number of studies using the Narrative Assessment Profile procedure, developed by Peterson and McCabe (1983), have shown that children with DLD perform more poorly than their typically developing peers on aspects of topic maintenance, conjunctive cohesion, and referencing that tap into the propositional level of narrative production (Goldman, 2008; McCabe et al., 2008; Miranda et al., 1998).

At the macrostructure planning level, previous research using high-point analysis has shown that children with DLD tend to create a less complex personal narrative structure (Bliss &

Pierre, 1997; McCabe et al., 2008; Miranda et al., 1998). Children with DLD showed difficulty organising their narratives in a chronological (and logical) sequence of events, and produced 'jumpy' narratives in which relevant events are omitted, and the sequence of events is confusing (McCabe et al., 2008; Miranda et al., 1998). In addition, compared to typically developing peers, children with DLD omitted constitutive narrative elements such as orienting elements that situate the personal narrative in place and time, and mentioned fewer actions, complications, and resolutions (Goldman, 2008; McCabe & Bliss, 2004). In terms of maintaining a coherent, topic-centred macrostructure, results are inconsistent and may be due to the different schemes used to assess coherence, the dimensions they capture and the scoring procedures. Some studies have shown that the personal narratives of children with DLD are characterised by a relatively intact global coherence, comparable to that of children with TLD (Bliss & McCabe, 2009; Goldman, 2008). However, other research supports the idea that children with DLD show poor or limited theme development (McCabe et al., 2008; Miranda et al., 1998). This could also be related to the socio-emotional well-being of children with DLD (see Beck et al., 2012), who have difficulties at a pragmatic level to select the experiences they want to share and to process them, which can lead to less thematic coherence.

In summary, despite mixed results from previous studies, there is ample evidence that the personal narratives of school-age children with DLD differ from those of their typically developing peers in terms of individual linguistic, propositional, and macrostructure planning skills. However, previous studies into the personal narrative skills of children with DLD included only a small number of measures that could not capture overall performance in personal narrative production across the LUNA levels (Bliss & Pierre, 1997; Goldman, 2008; McCabe et al., 2008; Wetherell et al., 2007), to better understand where the breakdown is. It is important to investigate this because a comprehensive assessment across all levels of the LUNA framework can provide a more informed understanding of the specific areas where children with DLD struggle to produce personal narratives and which skills may cumulatively contribute to whether a narrative is well-formed and coherent.

In addition, some previous studies did not include comparisons with typically developing peers, but instead compared performance across different genres (Bliss & McCabe, 2009; McCabe et al., 2008). These studies shed light on the cognitive demands each narrative type imposes on children with DLD but do not clarify how their narrative production compares to that of their peers. Furthermore, personal narrative assessment procedures relied on model stories using a conversation map procedure (Bliss & Pierre, 1997; McCabe & Bliss, 2004; Miranda et al.,

1998) or offered less flexible topics (Goldman, 2008; Wetherell et al., 2007). While these procedures yielded valuable insights, they limited the children's authentic production by limiting the spontaneity and personal relevance of the elicited narratives.

Apart from primarily linguistic skills at the discourse level, where children with DLD have been shown to perform worse, other (non-linguistic) factors contributing to the formation of personal narratives have not yet been investigated. Consequently, relatively little is known about how retrieving episodic and semantic information from the macrostructure planning level and socio-emotional functioning from the pragmatic level of the LUNA framework contribute to well-formed personal narrative discourse and how they interact with linguistic and propositional levels (Figure 2). Although stronger language skills can lead to linguistically well-formed, complete and coherent narratives, there are gaps in the data on whether school-age children with DLD can effectively utilise their more limited linguistic resources to elaborate descriptions of events and provide a complete, well-structured and meaningful narrative about events of both positive and negative emotional valence.

2.1.2. Emotional Valence of Personal Narratives

Emotional valence refers to the affective content signalled by linguistic means and determines how pleasant the emotions are that an event described in a personal narrative can evoke (Bestgen, 1994; Davidson & Welliver, 2021). The emotional valence of stories can influence, for example, the choice of lexical items and the complexity of syntactic structures, the connection of ideas conveyed from utterance to utterance, but also the organisation of the macrostructure planning level.

At the linguistic level, studies have shown that there is no difference in syntactic complexity and verbal productivity between narratives about positive and negative events in children with TLD. Habermas et al. (2009) found this in a study with 5- and 7- to 8-year-olds in which they asked them to tell narratives about happy, sad and scary events. In their study, there was no significant difference in the syntactic complexity and amount of language produced in positive and negative personal narratives. A similar study was conducted in a more recent cross-sectional study by Kuvač Kraljević et al. (2023), who examined children with an average age of 7, 10 and 12 years and used the Global TALES protocol. In this study, there was no influence of emotional valence on the production of personal narratives in terms of syntactic complexity, but lexical diversity varied as a function of emotional valence. The children's personal

narratives elicited by positive prompts (happiness, pride) were lexically earlier than those elicited by negative (anger, worry) and neutral (problem, important event) prompts.

At the propositional level, there are few studies that have measured specific skills that inform how children integrate ideas into personal narratives, elaborate by connecting actions, and evaluate personal narratives. Fivush et al. (2003) found that typically developing children between the ages of 5 and 12 reported conceptual ideas for both types of narratives, both positive and negative, but used more descriptions in positive narratives. Another study by Fivush et al. (2012) showed that children did not differ in their elaboration of events in positive and negative narratives. In a more recent study by Westerveld et al. (2023), using the Global TALES protocol, 10-year-old children with TLD were found to use evaluations, including linguistic expressions of causality, hypotheses and judgements for all types of narratives. However, when analysing the types of evaluation, no specific pattern of repetition of types of evaluation devices for narratives with different emotional valence was found.

At the macrostructure planning level, according to some authors, narratives with negative emotional valence place greater demands on the speaker to structure these events and connect them into a coherent whole than pleasant or positive experiences (Bohanek & Fivush, 2010; Fivush et al., 2008). Studies examining the effects of emotional valence on macrostructure planning level used the Narrative Coherence Coding Scheme (NCCS) developed by Reese et al. (2011), which views coherence as a multidimensional construct consisting of context, chronology and theme. Studies have shown that negative narratives have a better chronological order and thus a more coherent macrostructure than positive narratives (Fivush et al., 2003; Fivush et al., 2008; Kuvač Kraljević et al., 2023). However, contradictory results have been obtained with regard to the provision of orienting information about the time and place of the event. A study by Kuvač Kraljević et al. (2023) found that typically developing children incorporate more contextual information about time and place in positive narratives. In contrast, Fivush et al. (2008) showed that positive and negative narratives do not differ in terms of the orienting information embedded in personal narratives.

In summary, by analysing different levels of linguistic processing in the personal narratives of typically developing children, research has shown that the emotional valence of events can influence certain aspects of personal narrative production. While syntactic complexity and verbal productivity remain relatively stable regardless of the positive or negative valence of the event, lexical diversity has been shown to be greater in narratives with positive valence. At the

propositional level, children provide a similar amount of conceptual information in both types of narratives, but positive events often lead to richer descriptions. In terms of macrostructure, negative narratives require more complex organisation and coherence and are often better structured chronologically. However, results regarding the provision of orienting information about the time and place of events remain inconsistent, suggesting that further research is needed in this area and should be extended to children with DLD. This is important because children with DLD are at higher risk of developing socio-emotional difficulties and personal narratives may play a protective role by enabling children to verbalise their emotional states and experiences. At the same time, the difficulties that children with DLD face, whether in the linguistic domain or in the way they process the emotional content of their experiences, may be reflected in the formation of personal narratives.

2.2. Macrostructure Planning Level: Memory Mechanisms

To tell personal stories, children need to recall relevant events from memory and constantly update their content as they form a series of coherent sentences. For this process to be successful, constant interaction between the episodic buffer of working memory and long-term memory is crucial. The episodic buffer of working memory integrates information about the time, place and actions of events (Fivush, 2011) with linguistic (semantic and syntactic) information, while semantic memory enriches the narrative by adding schemas, facts and details encoded in words and sentences, such as place names or specific details about the event (Westby & Culatta, 2016). These memory mechanisms play a key role in the construction of personal narratives, from macrostructure planning to the linguistic level according to the LUNA framework. The effective use and rapid access to episodic and semantic information contribute to narrative coherence by providing schemas that guide the organisation of specific events and their logical sequencing, helping to connect different parts of the story by creating cause-effect relationships, thus not only enriching the content of personal narratives but also supporting their macrostructure arrangement.

According to Baddeley's model of working memory, the episodic buffer has the task of communicating with long-term memory and integrating information from the other two components of working memory – phonological loop and/or visual-spatial sketchpad – and storing it in the short term (Baddeley, 2000; Baddeley, 2012). In verbal tasks, the episodic buffer enables the integration of syntactic and semantic information from long-term memory with information from working memory by combining them into a single episodic

representation. This increases processing capacity and explains the ability to repeat larger sequences of related meaning units than the phonological loop can process (Baddeley et al., 2009). This memory mechanism thus provides a general understanding of the role of knowledge in long-term memory in supporting working memory performance (Baddeley, 2012; Baddeley et al., 2009).

Semantic memory mechanisms, on the other hand, provide access to the storage of general knowledge and facts as well as the information contained in words and sentences (Tulving, 1972; Tulving, 2002). This is another area of research on verbal memory that looks at the speed and accuracy of accessing lexical-semantic and phonological knowledge necessary to form a meaningful, connected and coherent narrative (Hall et al., 2017).

2.2.1. The Relationship Between Narrative Skills and Memory Mechanisms in Children With DLD

Several studies have investigated the relationship between narrative skills and memory mechanisms in children with DLD, and these have focused on working memory. Dodwell and Bavin (2008) investigated this relationship using verbal working memory tasks and the ability to tell fictional stories. They found that the ability to narrate (retelling and generating) was associated with measures of verbal working memory in 6- to 7-year-old children with DLD. Although memory mechanisms were associated with narrative skills, the episodic buffer, measured using a sentence retrieval task, played a unique role in predicting variance in story comprehension and recall. In contrast, measures of phonological working memory, as measured by digit and word counting tasks did not explain any additional variance in children's narrative skills. A similar study was conducted by Duinmeijer et al. (2012), who investigated the relationships between verbal working memory, measured using a phonological memory task, and (fictional) narrative ability in 6- to 9-year-old children with DLD. It was found that differences in verbal working memory significantly affect the ability of students with DLD to recall structural elements when creating and retelling stories. These results suggest that the mechanisms of verbal working memory, particularly the episodic buffer, are important for the recall and creation of narratives in children with DLD.

2.3. Pragmatic Level: Socio-Emotional Functioning

According to the pragmatic level of the LUNA model, the speaker makes a decision about what information to communicate in a given situation. Some interpersonal factors – such as intentions, (mental) states and socio-emotional characteristics – come to the fore when the

speaker uses them to convey the message or the overall meaning of the discourse in a particular communication situation (Dipper et al., 2021). Research involving children with DLD shows that their emotional self-regulation skills and how well they understand emotional descriptions linguistically are related to their language skills, particularly pragmatic skills (Beck et al., 2012; Conti-Ramsden et al., 2019; Fujiki et al., 2004). In this sense, higher levels of emotional (self-)regulation are often conceptualised in research as less internalised and externalised behaviours (Beck et al., 2012). Some research suggests that emotional difficulties in children with DLD are not always the result of limited communication experiences, but may also be part of their specific neurodevelopmental trajectory (Botting et al., 2016; Conti-Ramsden & Botting, 2008; Conti-Ramsden et al., 2019).

2.3.1. The Relationship Between Personal Narrative Skills and Socio-Emotional Characteristics in Children

A few studies have examined personal narrative skills in relation to children's socio-emotional functioning, but only in typically developing adolescents; there is no data on these relationships in children with DLD. These studies have used a broader – and more diverse – range of measures of socio-emotional traits, making comparisons difficult and leading to inconsistent results, making it difficult to draw clear conclusions. Previous studies also indicate gender differences in the ability to tell a personal narrative related to the socio-emotional functioning of male and female narrators, but the investigation of gender differences was not the focus of these theses.

For example, Bohanek and Fivush (2010) studied typically developing adolescents aged 13 to 16 years and analysed their narratives based on internal states, which included evaluative devices related to emotional states and cognitive processes. The study found that while female adolescents used more emotional and cognitive words in their stories, the language of internal states was associated with higher emotional well-being (less internalising and externalising behaviours) in male adolescents, whereas this relationship was not significant in female adolescents. Chen et al. (2012) investigated the relationship between narrative coherence and socio-emotional functioning in adolescents with TLD aged 12 to 21 years. The relationship between personal narrative coherence and socio-emotional functioning was again found in male subjects, with higher levels of narrative coherence associated with lower levels of socio-emotional functioning. In addition, higher levels of coherence were associated with prosocial behaviour in older adolescents. Waters and Fivush (2015) investigated the relationship between

personal narrative coherence and socio-emotional traits related to self-concept. They showed that the construction of coherent personal narratives was positively associated with various aspects of self-concept.

2.3.2. Summary

The LUNA framework allows for the investigation of the possible influence of linguistic and non-linguistic skills on discourse formation in children with DLD. In children with DLD, difficulties are most prevalent on the linguistic level. Within this level, difficulties with linguistic skills such as word finding or sentence processing can limit the complexity and completeness of spoken utterances. Therefore, difficulties with linguistic or propositional processing can affect the realisation of the macrostructure and thus the coherence of personal narratives. Conversely, it is also possible that difficulties in accessing and organising familiar schemas affect linguistic realisation. In either case, the linking of multiple levels within the LUNA framework raises the question of whether difficulties in the language performance of a child with DLD interact with difficulties at other levels of discourse, such as macrostructure planning or pragmatic demands. DLD can lead to difficulties in the skills required to prepare a message for production (planning, retrieval), resulting in the production of linguistically incomplete or inaccurate utterances (known in the literature as 'spiral of impairment'; Black & Chiat, 2000). Difficulties at the discourse level can also arise from difficulties in recalling personal events and experiences. On the other hand, it is possible that the decisions made at the pragmatic level about what a child will narrate are conditioned by the child's socio-emotional functioning in the sense that they determine what the child will produce. The interconnectedness of the framework means that difficulties at one level can affect production at other levels and the overall production of the personal narrative. By examining skills at each level in this thesis, the aim is to find out the extent to which skills at different levels of discourse processing influence the production of personal narratives. In addition, difficulties in children with DLD may also affect the way children process their past experiences. For example, due to the different ways in which they process pleasant or unpleasant experiences, the personal narratives of children with positive or negative emotional valence may be characterised by different complexity and diversity in terms of syntactic structures and lexical units, but also by different organisation of structural elements and coherence. It has been shown that the narratives of proficient and less proficient narrators differ in terms of the emotional valence of events, even when the developmental aspect is excluded (e.g., by observing the personal narratives of adults, for whom stability in linguistic and macrostructural complexity is

expected) (Fivush et al., 2019). The use of the complex LUNA model allows for the observation of difficulties and generally allows the consideration of skills required at the levels of propositional, macrostructural planning and pragmatic processing as well as linguistic skills, and can determine their mutual influence.

3. AIMS AND HYPOTHESES OF THE STUDY

The first aim of this study is to investigate production of personal narratives at the linguistic, propositional and macrostructure planning levels in children with DLD compared to children with TLD. The second aim is to investigate the effects of the emotional valence on the performance at the linguistic, propositional and macrostructure planning levels of personal narrative in children with DLD and TLD. For this purpose, the Global TALES protocol is used, which contains six emotion-based prompts: narratives about a time children *felt happy or excited, worried or confused, annoyed or angry, proud, having a problem and experiencing something important* (Westerveld et al., 2022). The third aim of this study is to investigate the associations between children's memory mechanisms and socio-emotional characteristics, as well as their contributions to the production of personal narratives.

In line with previous research on discourse production at different discourse processing levels in children with DLD (Blom & Boerma, 2016; Colozzo et al., 2011; Duinmeijer et al., 2012; Reese et al., 2011) and considering the different emotional valence of narratives (Habermas et al., 2009; Reese et al., 2011), the specific aims and research questions are as follows:

1. Research question: Does language disorder affect overall performance in forming personal narratives defined by various linguistic, propositional and macrostructure planning measures for all six story prompts combined?

Hypothesis 1: There are effects of group on linguistic, propositional and macrostructure planning measures, in that children with developmental language disorder have lower scores than children with typical language development.

2. Research question: To what extent do different linguistic and macrostructure planning measures predict which group of children they belong to – developmental language disorder/typical language development?

Hypothesis 2: Lower scores on the linguistic and macrostructure planning measures will predict belonging to the group of children with developmental language disorder.

3. Research question: For children with developmental language disorder and for children with typical language development, does the emotional valence influence their production of personal narratives at the linguistic, propositional and macrostructure planning level?

Hypothesis 3: The emotional valence will influence personal narrative production in such a way that the narratives of children with developmental language disorders elicited through negative prompts will be more complex at the linguistic and macrostructure planning level than those elicited by positive prompts.

4. Research question: Are there differences in the emotional valence of themes of personal narratives in children with developmental language disorder and typical language development?

Hypothesis 4: There will be differences in the emotional valence of themes between the two groups, with children with developmental language disorder producing a higher percentage of narratives reflecting unpleasant and less pleasant emotions.

5. Research question: Are there differences in the relationship between linguistic and macrostructure planning measures with memory mechanisms and socio-emotional characteristics between children with developmental language disorder and children with typical language development?

Hypothesis 5: The episodic buffer mechanism and the semantic lexicon will be more strongly related to the production of personal narratives than semantic memory access and socio-emotional characteristics, and this relationship will be stronger for the group of children with typical language development than in the group of children with developmental language disorder.

6. Research question: To what extent do the memory mechanisms of the episodic buffer and semantic memory contribute to predicting the production of personal narratives from the linguistic to the macrostructure planning level in children with developmental language disorder and typical language development?

Hypothesis 6: The episodic buffer and the semantic lexicon mechanism will make a relatively greater contribution to explaining the production of personal narratives than semantic memory access.

7. Research question: To what extent do internalised and externalised behaviours and self-concept in children with developmental language disorder and typical language development contribute to predicting the production of personal narratives from the linguistic to the macrostructure planning level?

Hypothesis 7: Internalised behaviours in children with developmental language disorder will contribute more strongly than externalised behaviours to predicting children's personal production skills from the linguistic to the macrostructure planning level.

4. INTEGRATED DISCUSSION

The doctoral thesis was prepared as a 3-articles dissertation in which three peer-reviewed scientific papers were published in international journals. Each paper addresses specific aims and research questions and tests corresponding hypotheses. As all three papers involve the same participants and use the same methods (tasks, measures) and procedures; in the next sections the sample of participants is described and the test procedure explained, before the results are presented and discussed in relation to the current literature.

4.1. Participants

The study included 50 children with a confirmed diagnosis of DLD (age range = 9.08 – 11.11 years, *M* = 10.08, *SD* = .49) and 50 children with TLD (age range = 9.06 – 11.03 years, M = 10.02, *SD* = .35) matched by gender, with 31 males and 19 females in each group. All participants were Croatian-speaking monolingual children attending the fourth grade of primary school.

As defined by Bishop et al. (2017), children with DLD were included if they had received a clinically established diagnosis, made by their assigned speech-language pathologist, characterised by significant and persistent difficulties in producing and/or understanding language, and if they did not have an intellectual disability, hearing impairment, neurological disorder or other neurodevelopmental condition such as autism spectrum disorder (ASD). Two children in the DLD sample had comorbid attention deficit hyperactivity disorder (ADHD) and were included in the study. None of the participants had a history of clinically identified emotional difficulties. Information on formal diagnoses was provided by the parents and confirmed by health or school records from the institutions where the children were recruited, namely the Polyclinic for Hearing and Speech Rehabilitation SUVAG in Zagreb and the urban public schools in Croatia. Children with DLD were either receiving education through an individualised programme or were in the process of obtaining one and were referred for speech-language therapy.

Additional assessments using standardised language and non-verbal cognitive tests were administered for descriptive purposes. First, the Croatian version of the Test for Reception of Grammar, TROG:2-HR (Bishop et al., 2014) was used as a receptive grammar test, that assesses the understanding of Croatian grammar in terms of inflection, function words, word order and syntactic complexity. The test manual states that the test has a split-half reliability of .76 and a high internal consistency of .96. Second, the Croatian version of the Peabody Picture

Vocabulary Test, PPVT-III-HR (Dunn et al., 2009) was used as a receptive vocabulary test. The test manual reports a high internal consistency of .83 to .99 using Cronbach's alpha. Third, the Raven's Standard Progressive Matrices (Raven et al., 2000) were used to measure children's nonverbal IQ (NVIQ) abilities, such as perceptual and analytical abilities. The test manual states a test–retest reliability of .83 to .93 and an internal consistency of over .90. Based on the results of these language and non-verbal cognitive tests, no children were excluded as a formal DLD diagnosis had already been made. In the TLD group all children scored within age expectations (*SS* > 85) on the TROG:2-HR, the PPVT-III-HR and the Raven's Standard Progressive Matrices. In addition, all children met the inclusion criterion for the NVIQ (i.e., *SS* > 70). As shown in Table 1, the two groups differed significantly in comprehension of syntactic structures (t = -16.51, p < .01, d = .33) and receptive vocabulary (t = -8.92, p < .01, d = .18) as well as NVIQ (t = -7.70, p < .01, d = .15), with children with TLD outperforming the DLD group.

Table 1. Performance on Standardised Tests

	DLD group (*n* = 50)	**TLD group (*n* = 50)**	
	M (SD) *(range)*	*M (SD)* *(range)*	*p*
TROG-2:HR	71.88 (10.97) (55 – 86)	104.60 (8.72) (92 – 123)	< .001
PPVT-III-HR	83.53 (14.64) (55 – 110)	105.84 (9.29) (91 – 131)	< .001
Non-verbal IQ	98.10 (9.95) (81 – 125)	113.50 (10.04) (90 – 125)	< .001

Note. TROG-2:HR = the Croatian version of the Test for Reception of Grammar (Bishop et al., 2014); PPVT-III-HR = the Croatian version of the Peabody Picture Vocabulary Test (Dunn et al., 2009); NVIQ = non-verbal IQ as assessed by the Raven's Standard Progressive Matrices (Raven et al., 2000).

A parent questionnaire was used to collect demographic data, including relative monthly family income and parents' educational level, which served as indicators of socioeconomic status (SES). According to census statistics (Croatian Bureau of Statistics, 2024), families with a relative monthly income of less than €800 were classified as low-income, those earning between €801 and €1,600 as middle-income, and those earning more than €1,600 as high-income. In terms of family income, 16% of families in the DLD group had a low socioeconomic status, compared with 8% of families with children with TLD. The majority of families had a middle family income, namely 52% in the group of children with DLD and 46% in the group of children with TLD. High income was reported by 22% of families with DLD and 36% with TLD (10% were not reported for both groups). The chi-square test was applied to examine group differences in SES. There were no significant group differences in relative monthly income, $\chi^2(2) = 2.80$, $p = .247$, Cramer's $V = .176$.

In terms of paternal education, 6% of fathers in the DLD group and 4% in the TLD group had completed primary school. Most fathers had completed secondary education, 68% in the DLD group and 56% in the TLD group. Higher education was distributed such that 14% of fathers in the DLD group had a bachelor's degree, 2% had a master's degree and 4% had a PhD; 22% had a bachelor's degree, 16% had a master's degree and there were no fathers (0%) with a PhD in the TLD group (6% unreported in the DLD group and 2% in the TLD group). Regarding maternal education, 10% of mothers in the DLD group had completed primary school and none (0%) in the TLD group. In addition, 58% of mothers in the DLD group and 26% in the TLD group had completed secondary school. The distribution of higher education was such that 16% of mothers in the DLD group had a bachelor's degree, 12% had a master's degree, and none (0%) had a PhD; 26% had a bachelor's degree, 28% had a master's degree, and none (0%) had a PhD in the TLD group (only 4% were not reported in the DLD group). Results showed statistically significant differences (with a moderate effect size) between the DLD and TLD groups in terms of maternal education, $\chi^2(3) = 10.05$, $p = .018$, Cramer's $V = .320$, with the mothers in the TLD group reporting higher levels of education. In contrast, no significant group differences were found in paternal education, $\chi^2(4) = 6.23$, $p = .183$, Cramer's $V = .255$.

4.2. Materials and Procedure

4.2.1. Personal Narratives: Global TALES Protocol

All children were asked to produce personal narratives in response to six prompts specified in the Global TALES protocol (Westerveld et al., 2022) in the following way: "Tell me a story about a time..." (1) when you felt excited or really happy; (2) when you felt worried or confused; (3) when you were really annoyed or angry; (4) when you felt proud of yourself; (5) when you had a problem and had to fix it; (6) when something important happened to you. If the child did not respond or answered with a shorter utterance, the narrative was prompted with a scripted example or by asking if the child could tell more. Neutral prompts were used when needed throughout the session to encourage the child to continue speaking and to give them a sense of natural context.

Transcription. All narrative samples were audio-recorded and subsequently transcribed for analysis. Transcripts were checked to ensure they met the criteria for personal narratives, defined as containing at least two temporally related narrative clauses referring to past events (Labov, 1972). Transcription followed the standard conventions of the Systematic Analysis of Language Transcripts (SALT) (Miller et al., 2024). Children's utterances were segmented into communication units (C-units), defined as main clauses with their attached subordinate clauses (Loban, 1976). The analysis was carried out both manually and using SALT or Excel: The segmentation of the C-units was performed manually, while all linguistic and propositional-level measures were computed using SALT and coherence measures using Excel. Only complete and intelligible utterances were included in the analysis, unless otherwise specified for a particular measure. False starts, personal comments, unintelligible words or segments, as well as repetitions and rephrasing (marked in brackets in SALT), were excluded. Transcription reliability was verified by an independent rater who reviewed 10% of the transcripts, yielding a transcription accuracy of 98%.

Coding the emotional valence of events. The six emotion-based prompts used to elicit narratives can be categorised into three types: 1) positive (a personal narrative about happiness/excitement and pride), 2) negative (a narrative about worry/confusion and annoyance/anger) and 3) neutral, which the child themselves assigns to the event they are telling about (a narrative about a problem and an important event). To measure the emotional valence of the narratives, an approach was developed in which the data was read and the content of the narratives was interpreted to determine whether the event in the narrative evoked a

pleasant (positive) or unpleasant (negative) emotion. The term event was defined as what the children described as happening or as the topic of the story that could be summarised in a short sentence (e.g., “school trip” for a pleasant event or "an argument with a friend" for an unpleasant event). The distribution of the narratives can be found in Table 2 or in a related article (Gabaj et al., 2025). The inter-rater agreement in the coding of the events between the author and the supervisor (JKK) was tested and was 97%.

Table 2 shows that positive prompts elicited predominantly pleasant events, negative unpleasant events and neutral both pleasant and unpleasant events. Overall, it was found that children with DLD recalled a similar proportion of positive events (34.0%) as children with TLD (38.7%). Similarly, children with DLD told the similar proportion of negative narratives (48.3%) as children with TLD (46.3%).

Table 2. Distribution of the Emotional Valence of Events

	DLD group (*n* = 48)			**TLD group (*n* = 48)**		
Prompts	pleasant event	unpleasant event	no personal narrative	pleasant event	unpleasant event	no personal narrative
Positive	82	8	10	83	2	15
Negative	1	74	25	2	83	15
Neutral	19	63	18	31	54	15
Total	102 (34.0%)	145 (48.3%)	53 (17.7%)	116 (38.7%)	139 (46.3%)	45 (15.0%)

Note. Two children in the DLD group and one in the TLD group did not provide at least two analysable personal narratives on both pleasant and unpleasant events, so their data were excluded from this part of the analysis (n = 48).

4.2.2. Narrative Measures

The following narrative measures were selected from the linguistic (verbal productivity, lexical diversity, grammatical complexity and accuracy), propositional (mazing behaviour, incomplete utterances, local coherence, theme), macrostructure planning (context, chronology, theme) and pragmatic (theme) levels.

Linguistic Measures

Verbal Productivity. Verbal productivity, which measures the amount of language produced, was measured by the total number of utterances produced (TNU) in C-units and the total number of words produced (TNW).

Lexical Diversity. Lexical diversity, as a vocabulary measure of the diversity of words used, was measured by the moving average type-token ratio (MATTR). This measure calculates the average type-token ratio (TTR: number of different words divided by the total number of words), based on a predefined window that moves through the sample (e.g., from words 1 – 50, then 2 – 51, and so on to the end of the sample). For the analysis, moving windows of 50 words were defined for study 1, in which all narratives of each child were included, and 30 words for study 2, in which the narratives were categorised according to the emotional valence of the event.

Syntactic Complexity. Two measures were used to assess syntactic complexity: (1) mean length of utterance in words (MLUw), which reflects complexity at the utterance level and is calculated by dividing the total number of words by the total number of utterances; and (2) clausal density (CD), which captures subordination (i.e., considers subordinate clauses) and is determined by dividing the total number of clauses by the total number of utterances.

Grammatical Accuracy. The percentage of grammatical utterances (PGU) was used as a measure of grammatical (morphosyntactic, including lexical) accuracy. PGU was expressed by dividing the total number of correct utterances by the total number of utterances. If a C-unit contained at least one error, it was marked as ungrammatical. Each utterance received 1 point if it was grammatically correct and 0 points if it was ungrammatical. In this case, the utterance had to contain at least a verb. In addition, all utterances that marked the end of the story (e.g., 'That's it') were excluded from the analysis.

Propositional Measures

Mazing Behaviour. The maze behaviour as a measure of verbal fluency was assessed by dividing all mazes (i.e., repetitions, reformulations) by the total number of words. Only complete words were included in the analysis of maze behaviour, while part words and filler words (e.g., uhm, ah) were not recorded.

Incomplete Utterances. Incomplete utterances were expressed as utterances that were interrupted or abandoned before all complete information was conveyed. The proportion of incomplete utterances in relation to complete utterances was calculated.

Local Coherence. Local coherence (LC) was assessed by determining the extent to which each utterance was meaningfully related to the immediately preceding utterance (Van Leer & Turkstra, 1999). All complete and/or incomplete utterances that were eligible for analysis, except the first utterance, were rated on a scale of 1 (lowest score) to 5 (highest score). A score of 1 was awarded if the current utterance was unrelated to the previous utterance or was completely incomprehensible in the context of the discourse. A score of 2 was awarded if the utterance contained multiple sentences, one of which possibly referred to the content of the previous utterance, but the other sentences did not. A score of 3 was awarded if the topic of the utterance related to the content of the previous utterance but the focus was different from the subject or activity, or if the utterance was unclear in terms of the reference and had to be inferred. A score of 4 was awarded if the utterance contained several sentences, one of which was certainly related to the content of the previous utterance, but the other sentences may not have been. A score of 5 was awarded if the current utterance was fully and clearly connected to the content of the previous utterance. An average score for local coherence was calculated for each narrative, with higher scores indicating better preservation of local coherence.

Macrostructure Planning Measures

Global Coherence. Global coherence was assessed using the Narrative Coherence Coding Scheme (NCCS) (Reese et al., 2011), which was refined in the first study to increase inter-rater coding reliability (Gabaj et al., 2024). Please visit https://osf.io/ztqg6/ to download a copy of the Refined NCCS. Coherence was assessed across three dimensions: (1) context (ability to place the narrative in time and place), (2) chronology (chronological order of actions), and (3) theme (ability to create a meaningful narrative). It is important to note that the thematic dimension extends across the macrostructure planning, propositional, and pragmatic levels of discourse processing. A score of 0 (the lowest) was awarded for context if there was no

reference to time or place, and for chronology if no temporal sequence was established, and for theme if the topic was unclear. A score of 3 (the highest) was awarded for context if both the time and place of the event were specified; for chronology if the clauses were arranged chronologically without causing confusion; and for theme if the narrative was detailed and elaborated and contained a clear resolution. For each narrative, an average score was calculated for each dimension, with higher scores indicating better coherence.

Coding Reliability. For all measures that were manually or semi-automatically analysed and summed, inter-rater agreement was calculated using Krippendorff's alpha. Inter-rater agreement between the author and the supervisor (JKK) was calculated for all narrative samples for the segmentation of C-units and clauses required to calculate the linguistic and propositional measures. It was .97 for C-units and .99 for clauses. For local coherence, the inter-rater agreement between the author and the supervisor (JKK) was calculated for 20% of the transcripts. For the global coherence dimensions, the inter-rater agreement between the author and the supervisor (MW) was calculated for 10% of the randomly selected translated transcripts. Krippendorff's alpha coefficient was .83 for local coherence, .95 for context, .84 for chronology and .80 for theme.

4.2.3. Memory Mechanism Tasks

Episodic Buffer Task. To assess the function of the episodic buffer, the constrained sentence span task (Baddeley et al., 2009) was used, which was adapted for Croatian and successfully tested before being used in this study (Gabaj & Kuvač Kraljević, 2022). This task examines how working memory utilises long-term knowledge of words and the linguistic constraints on their order in sentences. This task involves the repetition of sentences with nouns, adjectives and verbs repeated in a series of sentences to create proactive interference with long-term encoding of the same material. Repetition of the numbers 1-2-3-4 during sentence repetition was also used to disrupt the phonological loop.

Semantic Access Task. To assess the ability to access semantic memory, the *Pyramids and palms* task was used, which was adapted from the CAT-HR test (Swinburn et al., 2020) for this study. In this task, children are asked to match pictures that are semantically related, either taxonomically or thematically, in the presence of distractor pictures.

Semantic Fluency. The semantic fluency task, which measures the accuracy and speed of accessing semantic information, was applied by asking children to name as many words from the categories of *animals* and *food* as possible within one minute. Semantic fluency was

expressed by counting the total number of correct words, excluding repetitions of the same words or errors.

Coding Reliability. Inter-rater agreement between the author and the supervisor (JKK) was assessed for the episodic buffer in 20% of the responses, while it was assessed for the semantic fluency in 30% of the responses. Krippendorff's alpha yielded values of .83 for the episodic buffer and .99 for semantic fluency, indicating high reliability.

4.2.4. Socio-Emotional Functioning: Beck Inventories

Beck's inventories (BYI) (Beck et al., 2011) were used to assess children's tendencies to internalise and externalise feelings and behaviours as well as their self-concept. The BYI consists of five self-report inventories that measure the risk of developing anxiety symptoms (BAI-Y), depression (BDI-Y), anger (BANI-Y), conduct disorder (BDBI-Y), and self-concept (BSCI-Y) in children and adolescents aged 7 to 18 years. Children rated on a scale from 0 (never) to 3 (always) how often each of the 20 statements in each inventory applied to them. The test manual states an internal consistency of .86 to .96.

4.3. Procedure

The study took place in 2023. All children attended 4th grade, but were enrolled in two separate academic years (2022-2023, 2023-2024). Children were assessed individually, face-to-face, in a quiet place, either on the school premises or in the speech-language pathologist's office. The full assessment of the children was conducted in two to three sessions, each lasting up to 45 minutes and adjusted to the individual needs of the child. Initially, all children were assessed in one or two sessions using standardised language tests (PPVT-III-HR and TROG:2-HR) and measurements of the NVIQ (Raven's Standard Progressive Matrices). Personal narratives using Global TALES protocol, measures of memory mechanisms and socio-emotional functioning (Beck Inventories) were then collected in the second and/or third session. Comprehensive demographic questionnaires were sent to the parents for completion. The author conducted the entire study, with the exception of the NVIQ assessments, which were administered by a qualified psychologist. To account for possible reading difficulties, the examiner (author) read all written tasks aloud to the children with DLD. The personal narrative task, the episodic buffer task and the semantic fluency task were audio-recorded for later transcription and analysis.

4.4. Ethical Approval

This study was approved by the Ethics Committee of the Faculty of Education and Rehabilitation Sciences, University of Zagreb (No. 251-74/22-01/2; 6 March 2023). All parents gave their consent for their children to participate in the study prior to scheduling. The children also gave their written consent at the beginning of the session after the purpose of the study and their rights had been explained to them verbally.

4.5. Results and Discussion

This section provides a summary and interpretation of the findings, organised by aims and research questions, placing them in the context of the existing literature and suggesting directions for future research.

Aim 1 (study 1 and 2): To investigate the production of personal narratives at the linguistic, propositional and macrostructure planning levels in children with DLD compared to children with TLD

Research Question 1: Does language disorder affect overall performance in forming personal narratives defined by various linguistic, propositional and macrostructure planning measures for all six story prompts combined?

Data Analysis

To answer the first research question about group differences between children with DLD and children with TLD, the children's responses to the six prompts of the Global TALES protocol were combined to calculate their performance on the linguistic measures, including verbal productivity, lexical diversity, syntactic complexity, and grammatical accuracy. In contrast, only the two longest narratives, as measured by the children's verbal productivity using the TNU, were selected to analyse their performance on the macrostructure planning level (coherence across the three dimensions of context, chronology and theme). A multivariate analysis of covariance (MANCOVA) was conducted to determine whether the groups differed on a combination of measures describing performance at the linguistic and macrostructure planning levels, controlling for the NVIQ, which showed group differences. A significant MANCOVA was followed by individual *t*-tests with Bonferroni correction for multiple comparisons to determine which measure best differentiated the groups. Group differences between children with DLD and TLD were also examined in the second study, in which performance on the linguistic measures (lexical diversity, syntactic complexity and

grammatical accuracy) and two of the macrostructure planning measures (context and chronology) were added to performance on the propositional measures (mazes, incomplete utterances and local coherence). Effect sizes were evaluated using the partial eta squared (ηp^2) and interpreted as follows: $\eta p^2 = .01$ (small), $\eta p^2 = .06$ (medium), and $\eta p^2 = .14$ (large).

Hypothesis 1: There are effects of group on linguistic, propositional and macrostructure planning measures, in that children with DLD have lower scores than children with TLD.

This hypothesis was partially confirmed.

Results showed significant group differences in personal narrative performance when combining linguistic and macrostructure planning (context and chronology) measures, explaining 55% of the variance, even when controlling for the NVIQ (study 1). In addition, NVIQ was found to have no significant effect on the outcome of the model. In study 2, in addition to the combination of linguistic and macrostructure planning measures, group differences in propositional measures were also tested (with the NVIQ not included as a covariate) and yielded similar results, explaining 67% of the variance. Overall, the significant group effect observed in both study 1 and study 2 indicates that the differences in narrative production between children with DLD and children with TLD are largely accounted for by the combined measures used to assess personal narrative production. However, subsequent analyses revealed that children with DLD did not perform lower in all aspects of personal narrative production compared to their peers with TLD. This finding partially supports the hypothesis: while children with DLD obtained lower scores on most linguistic and macrostructure planning measures, there were notable exceptions. For example, children with DLD produced personal narratives of similar length (productivity), used the same variety of words (vocabulary), and did not differ in fluency (mazes) compared to their typically developing peers. However, compared to their TLD peers, children with DLD continued to show significant difficulty (all with large effect sizes) in forming syntactically complex and grammatically accurate personal narratives, in conveying ideas completely and coherently at local level from one utterance to the next, organizing actions chronologically and elaborating on themes, and also had difficulty in orienting narratives to place and time (with small effect size) (see Table 3).

Table 3. Personal Narrative Performance Overall and in Relation to Emotional Valence of Events in Children With DLD and TLD (Data From the Second Study)

	Overall				**Positive**		**Negative**	
	DLD	**TLD**			**DLD**	**TLD**	**DLD**	**TLD**
	M (SD)	*M (SD)*			*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Measures	*(range)*	*(range)*	*p*	np^2	*(range)*	*(range)*	*(range)*	*(range)*
MATTR	.795 (.041)	.791 (.038)	.326	.010	.788 (.055)	.792 (.054)	.802 (.041)	.791 (.044)
	(.71 – .92)	(.69 – .86)			(.65 – .93)	(.68 – .89)	(.72 – .91)	(.63 – .88)
MLUw	7.314 (1.140)	8.840 (1.172)	<.001	.309	7.388 (1.375)	8.972 (1.488)	7.241 (1.210)	8.708 (1.471)
	(5.37 – 10.25)	(6.77 – 11.04)			(5.23 – 12.34)	(6.35 – 11.92)	(4.68 – 10.04)	(5.14 – 11.25)
PGU	.708 (.153)	.885 (.070)	<.001	.362	.718 (.189)	.875 (.103)	.697 (.161)	.894 (.078)
	(.29 – 0.94)	(.71 – 1.00)			(.26 – 1.00)	(.64 – 1.00)	(.25 – 1.00)	(.67 – 1.00)
Mazes	.037 (.027)	.032 (.025)	.292	.012	.038 (.032)	.029 (.024)	.037 (.031)	.034 (.032)
	(.00 – .10)	(.00 – .10)			(.00 – .11)	(.00 – .09)	(.00 – .12)	(.00 – .14)
IU	.072 (.060)	.025 (.038)	<.001	.182	.068 (.086)	.025 (.055)	.076 (.067)	.025 (.047)

	(.00 – .22)	(.00 – .17)			(.00 – .33)	(.00 – .25)	(.00 – .25)	(.00 – .22)
LC	4.231 (.388)	4.754 (.181)	<.001	.432	4.272 (.450)	4.753 (.232)	4.190 (.524)	4.755 (.246)
	(3.14 – 4.87)	(4.27 – 5.00)			(3.02 – 5.00)	(4.01 – 5.00)	(2.50 – 5.00)	(4.06 – 5.00)
Context	.902 (.511)	1.119 (.525)	.043	.043	.941 (.612)	1.188 (.690)	.862 (.634)	1.050 (.638)
	(.00 – 2.33)	(.25 – 2.17)			(.00 – 2.67)	(.00 – 2.50)	(.00 – 3.00)	(.00 – 2.50)
Chronology	1.538 (.649)	2.227 (.604)	<.001	.234	1.462 (.863)	1.984 (.904)	1.614 (.663)	2.469 (.580)
	(.00 – 3.00)	(.83 – 3.00)			(.00 – 3.00)	(.00 – 3.00)	(.00 – 3.00)	(1.00 – 3.00)

Note. MATTR = moving average type-token ratio; MLUw = mean length of utterances in words; PGU = percentage of grammatical utterances; IU = percentage of incomplete utterances; LC = local coherence.

Discussion RQ1: Group Differences in Personal Narrative Performance

Linguistic Level

As predicted, there were significant group differences on the linguistic measure of syntactic complexity (MLUw) and grammatical accuracy (morphosyntactic/lexical errors; PGU), with the TLD group outperforming the DLD group. These findings reveal that school-age children with DLD continue to have difficulties with grammatical skills that are important for formulating their thoughts. Results from this study clearly show that children with DLD struggle forming grammatically accurate complex sentences. Compared to children with TLD they produce shorter utterances that contain a higher percentage of morphosyntactic and lexical errors. Our findings are consistent with the results of a study by Miranda et al. (1998), which showed that 8-year-old children with DLD produce personal narratives of lower grammatical complexity and accuracy. In contrast, there were no group differences in lexical diversity (MATTR). Again this is consistent with the findings from Miranda et al. (1998), who found no differences in lexical diversity between children with DLD and their typically developing peers matched by chronological age or younger TLD children matched by language proficiency.

Furthermore, our findings are partially consistent with those of Wetherell et al. (2007), who showed that adolescents with DLD produce narratives that contain more morphosyntactic and lexical errors than typically developing peers. However, in contrast to our results, the adolescents in their study produced personal narratives of comparable syntactic complexity to typically developing children. The contrasting results of their study and ours in terms of syntactic complexity may be explained by within-subject differences, such as the ages of the children who participated in the study. First, their study focused on an older age group, 13 – 15 years, in contrast to our study, which could indicate that older children (adolescents) can catch up with their peers in syntactic development. Second, the differences could be due to the methodological way in which the personal narratives were collected. In their study, a single-prompt spontaneous narrative protocol was used in which participants were asked to tell a story about the most annoying person in the third person singular, which raises the question of the extent to which such a methodology promotes diversity in the complexity of syntactic structures used in both DLD and typical populations. In contrast, our study used a protocol containing six emotion-based prompts, that gave children more opportunities to narrate their own experiences. This approach may have elicited a wider range of syntactic structures and increased the variability of responses, thereby better emphasising the differences between the

groups that we were able to capture in the analysis. In addition, the Global TALES protocol asked children to produce past-tense narratives which may have been more difficult for children with DLD. Third, although Wetherell et al. (2007) measured the total number of syntactic units and complex sentences without considering proportions, this approach only partially controls for narrative length when language productivity is similar between groups. Finally, it is possible that the Croatian language, as a highly inflected language spoken by the respondents in this study, contributes to the higher proportions of morphosyntactic and lexical errors they make in the context of telling a personal narrative. In summary, this research suggests that grammatical structures should be considered in the context of the type of (personal) narrative discourse they are signalling. Similarly, the inherent structure of personal narrative discourse may place higher processing demands on discourse production at multiple levels, resulting in lower grammatical complexity and accuracy in individuals who are already prone to language (grammatical) difficulties, such as children with DLD.

Propositional Level

At the propositional level, the results showed that children with DLD do not exhibit higher maze behaviour than children with TLD, indicating that they do not more frequently repeat or rephrase words, phrases, or sentences. However, they do produce a significantly higher number of incomplete utterances, and when going beyond the level of individual utterances, they demonstrate a lower degree of conceptual connection between utterances, resulting in lower coherence at the local level, all with a large effect size. These results may indicate that the children with DLD have problems with remembering and/or retrieving specific ideas that coalesce into a whole, and/or that they are unsure of how to translate the idea into language (e.g., Colozzo et al., 2011; Duinmeijer et al., 2012; Miranda et al., 1998). Previous studies examining personal narrative skills at the propositional level employed different measures (topic maintenance, conjunctive cohesion, referencing) to assess the connections between utterances, which makes direct comparisons across studies challenging. Nevertheless, previous studies including propositional measures (often as part of a composite scheme such as 'high point analysis') – such as topic maintenance, conjunctive cohesion between utterances, referencing, fluency and evaluation (Goldman, 2008; McCabe et al., 2008; Miranda et al., 1998), also showed that children with DLD obtained lower scores than children with TLD.

Macrostructure Planning Level

At macrostructure planning level, for research question 1, three aspects of global coherence were considered: context, chronology and theme. Regarding context, children with DLD did not differ from children with TLD in orienting the information in the narrative. It seems that the provision of contextualising information about the time and place of events in personal narratives is still developing in both groups of children. This study showed that, at group level, both groups of children provided only one of the orienting pieces of information, either when (time) or where (place) the event happened. An explanation for these results was also provided by Reese et al. (2011), who noted that consistent, high-level performance on this coherence dimension is typically seen only in middle childhood. At this stage, children begin to regularly include information about time and place in their narratives, which coincides with their growing awareness of time conventions (e.g., days, weeks, calendar months, seasons). Before middle childhood, such individual orienting elements appear only sporadically.

As far as chronology is concerned, on average, children with DLD organised less than half of their actions chronologically. In contrast, children with TLD organised on average most of their actions chronologically. Results from this study are consistent with previous research with younger children that has shown, using high-point analysis, that children with DLD exhibit "leap-frogging" patterns characterised by disrupted chronology and less logical sequencing of events (Bliss & Pierre, 1997; McCabe et al., 2008; Miranda et al., 1998). It is important to point out, however, that previous studies involved children up to the age of 9 years and analysed the macro-structural complexity of personal narratives (using high-point analysis), whereas research after this age more often shifted the focus from assessing structural complexity to assessing coherence (see Westby & Culatta, 2016). As this study has shown that 10-year-old children with DLD struggle to form chronologically coherent narratives, this is concerning as chronology is important in conveying meaning to the listener, which may ultimately impact on communication in various everyday situations, whether with peers or with authorities. However, it remains to be investigated whether the difficulties that children with DLD have in constructing a coherent, chronologically connected macrostructure are something specific to children with DLD, consistent with the general structural language difficulties observed in DLD, or whether they are a consequence of the competing cognitive demands that multi-level narrative production places on children who are already struggling with the grammatical aspect of production (Andreou & Lemoni, 2020).

The macrostructure planning level analysis also included the thematic dimension of coherence, which, together with context and chronology, provides information on global coherence, but also extends to the pragmatic and propositional levels. In terms of thematic coherence, our results suggest that although children with DLD defined a theme, they were less likely to develop it significantly through elaborations, evaluations and providing resolutions, resulting in lower scores compared to children with TLD. Our findings are consistent with studies reporting weaker development of the theme and its organisation, with a low number of utterances relating to the topic (McCabe et al., 2008; McCabe & Bliss, 2004; Miranda et al., 1998), but inconsistent with studies indicating well-developed thematic coherence in children with DLD (Bliss & McCabe, 2009; Goldman, 2008). These discrepancies can most likely be explained by differences in assessment methods. Previous studies used unidimensional schemes (Goldman, 2008; Miranda et al., 1998) or multidimensional schemes with different criteria that capture constructs outside of coherence itself (Bliss & McCabe, 2009; McCabe et al., 2008), in contrast to the NCCS scheme used in this study (Reese et al., 2011), which was developed to include structural elements that reflect their coherent thematic organisation.

Research Question 2: To what extent do different linguistic and macrostructure planning measures predict which group of children they belong to – DLD/TLD?

Data Analysis

Prior to the main analysis, Pearson correlations were calculated to determine the relationship between the linguistic and macrostructure planning measures for both groups. To answer research question 2, a binary logistic regression analysis was performed with the subset of measures that showed significance in the between-group *t*-tests to determine their predictive value in determining group membership (DLD vs. TLD group).

Hypothesis 2: Lower scores on the linguistic and macrostructure planning measures will predict belonging to the group of children with DLD.

This hypothesis was confirmed.

The Relationship Between Linguistic and Macrostructure Planning Measures of Personal Narrative Production

Before analysing the prediction of group membership, correlations between the measures of linguistic (i.e., TNW, MATTR, MLUw, PGU) and macrostructure (i.e., context, chronology, theme) of narrative production were analysed. The association between the skills at the

different levels was mild to moderate, ranging from -.366 to .486, but nevertheless provides insight into the interplay of linguistic and macrostructure planning features. Productivity (TNW) was found to be mildly to moderately related to global coherence (i.e., chronology and theme) in children with TLD, but not in the group with DLD. This suggests that typically developing children who use more words to tell their personal narrative are able to pack information into their narratives that enables them to elaborate and interpret, evaluate or reflect on actions in a chronologically correct order, clearly conveying the meaning of the event to the listener and eventually provide a resolution to the story. Or conversely, these results indicate that the cognitive schema of a well-structured chronological narrative that typically developing children possess enables them to produce longer narratives. The findings are consistent with those of Reese et al. (2011). In their broader age groups, which included children with TLD with an average age of 8 and 11 years, narrative length was also related to chronology or theme. This suggests that children with DLD have more difficulty in providing a chronologically and thematically coherent narrative, regardless of their linguistic productivity or the length of their narrative.

Results showed that lexical diversity in the DLD group was positively associated with better chronological organisation, suggesting that a broader vocabulary may help children to express the sequence of actions more clearly. It is possible that children with TLD used more temporal markers to explain actions and chronological events, and it is also possible that both skills (productivity and chronological ordering) can be explained by better oral language ability in the TLD group. Syntactic complexity showed a mild to moderate positive correlation with theme in both groups, suggesting that children with better developed syntactic skills can more easily elaborate on the theme by using causal connections, interpretations, evaluations and/or resolution, which contributes to the coherence of the personal narrative. In both groups, the narratives with a more coherent chronological structure also tended to show greater thematic elaboration. This observation is consistent with Reese et al. (2011), who reported mild to moderate correlations between chronology and theme across several groups.

Discussion RQ2: Prediction of Group Membership

The study 1 also investigated whether the production of personal narratives could predict group membership (DLD vs. TLD) using all linguistic and macrostructure planning level measures. The hypothesis that lower scores on linguistic and macrostructure planning measures predict membership of the group of children with DLD was confirmed. The final model, which

included linguistic measures of grammatical complexity (MLUw) and accuracy (PGU) as well as the chronological dimension of coherence, predicted group membership over and above the NVIQ, with the model demonstrating high sensitivity (93.8%) and specificity (91.8%), correctly classifying 92.8% of children. It is noteworthy that three variables remained significant in the final model: NVIQ, MLUw, and PGU. An increase in grammatical complexity and accuracy was associated with a higher probability of belonging to the TLD group. More specifically, the odds of belonging to the TLD group increased by 8.13 for each one-unit increase in MLUw and by 98.84 for each one-unit increase in PGU. This result is significant in that it suggests that by assessing personal narrative skills at the linguistic and macrostructure planning levels, we can not only identify the specific discourse-level challenges of children with DLD, but we can also predict difficulties associated with the possibility of language impairment in children in general based on personal narrative performance. This research suggests that the assessment of personal narrative skills may complement other (standardised) measures to explain and describe difficulties children with DLD experience in everyday communicative interactions.

Aim 2 (study 2): To investigate differences in the production of personal narratives at the linguistic, propositional, and macrostructure planning levels in children with DLD compared to children with TLD in relation to the emotional valence of the events

Research Question 3: For children with DLD and for children with TLD, does the emotional valence influence their production of personal narratives at the linguistic, propositional and macrostructure planning level?

Data Analysis

To answer the second research question, whether the emotional valence of evoked events affects the production of personal narratives differently in children with DLD compared to children with TLD at the linguistic, propositional and macrostructure planning levels, measures were selected that conceptually measure skills at one of the levels without much overlap with the other levels. The analysis therefore included the following measures at the linguistic level (lexical diversity, and grammatical complexity and accuracy), the propositional level (mazes, incomplete utterances, and local coherence), and the macrostructure planning level (context and chronology) as dependent variables. For each measure, the children's performance on pleasant (positive, i.e., a child's response that is categorised as an event that evokes pleasant emotions) and unpleasant (negative, i.e., a child's response that is categorised as an event that

evokes unpleasant emotions) emotional valence was tallied separately and the scores were averaged. Thus, for example, a story prompt to which the child responded with an event such as a birthday party was categorised as a pleasant emotion and poor academic performance was categorised as an unpleasant emotion. Prior to the main analysis, a multivariate analysis of variance (MANOVA) was performed on the group differences in the combination of measures to eliminate the risk of type I error. Subsequently, in the main analysis, separate 2 x 2 analyses of variance (ANOVAs) were conducted for each individual narrative measure (dependent variable), examining two groups of children (DLD and TLD) who had reported two types of events (positive and negative emotional valence events).

Hypothesis 3: The emotional valence will influence personal narrative production in such a way that the narratives of children with DLD elicited through negative prompts will be more complex at the linguistic and macrostructure planning level than those elicited by positive prompts.

This hypothesis was partially confirmed.

The second study focused on the question of how the emotional valence of experiences affects personal narrative ability. Specifically, it aimed to determine at which levels of the LUNA framework and with which specific skills children with DLD experience difficulties and whether personal storytelling affects their performance differently depending on emotional experience and language difficulties. When children recount personal experiences, they convey the pleasant or unpleasant feelings associated with these events recalled from episodic memory, resulting in narratives with positive or negative valence. The way they talk about these experiences may reflect how they process their emotions (see Westby & Culatta, 2016). Differences in emotional processing may influence the construction of narratives at the linguistic, propositional, and macrostructure planning levels. Understanding these differences may shed light on how children process emotionally charged events at the discourse level and potentially provide recommendations for evaluating narratives with different emotional valence. This study involved 48 children with DLD and 48 typically developing peers, each of whom recounted personal event narratives with both positive and negative emotional valence. Only children who provided narratives for both a positive and a negative event were included in the analysis; consequently, narratives from two children in each group were excluded.

Discussion RQ3: The Effects of the Emotional Valence of Events on Personal Narrative Production

At the linguistic level, the results showed that syntactic complexity (MLUw), grammatical accuracy (PGU) and lexical diversity (MATTR) were not influenced by the emotional valence of the recalled event. This is in contrast to the hypothesis for the group of children with DLD, who were expected to produce linguistically less complex personal narratives in response to positive versus negative prompts. However, these results are partially consistent with previous studies of children with TLD, which also found that the grammatical aspects of their narrative production did not differ depending on whether the children were narrating pleasant or unpleasant emotional events (Habermas et al., 2009; Kuvač Kraljević et al., 2023). At the propositional level, the results from study 2 showed that the skills required to prepare the message for linguistic realisation are also not influenced by the emotional valence of the event. In particular, the results showed that positive narratives do not differ from negative ones in terms of the proportion of incomplete utterances, mazes, and the maintenance of meaning and sense from utterance to utterance (local coherence). There are several possible explanations for these results. First, given that personal narratives are among the earliest and most common forms of discourse (Preece, 1987), children are often exposed to and rehearse narrative structures for both positive and negative events. Pleasant and unpleasant experiences tend to be repeated (birthdays, conflicts, achievements), so that children have comparable exposure. This familiarity may facilitate cognitive and emotional processing involved in constructing personal narratives, so that the linguistic and conceptual linking of ideas at the propositional level about unpleasant events is as effective as that about pleasant events. Second, using the same protocol prompts ('Tell me a story about a time when...') and sub-prompting strategies may ensure that children engage in similar cognitive and linguistic efforts regardless of emotional content. Third, not all negative events are inherently more complex or associated with higher arousal than positive events (e.g., anger as opposed to distressing events or trauma). The specific content and personal significance of the event play a key role in determining the cognitive effort required to recount it (see also Chen et al., 2012; Fivush et al., 2008). Thus, some negative events may not be more demanding to process than positive events.

At the macrostructure planning level, results from this study show that the provision of orienting information about time and place (i.e., 'context') is not influenced by the emotional valence of the event regardless of group, which is consistent with previous studies with 5- to 12-year-old children with TLD reporting the same results (Fivush et al., 2003; Fivush et al.,

2008). However, these results contrast with those reported in a study by Kuvač Kraljević et al. (2023), which showed that typically developing children aged 7 to 13 years provide more information about time and place by contextualising the narration of positive events compared to negative ones. It is possible that these inconsistencies in results are due to methodological differences in the coding of the narratives. In the present study, the narratives were analysed for their content and not for the emotion-based prompt used to elicit the narratives. In contrast, the results from this study are consistent with previous studies that have shown that negative narratives are more chronologically organised than positive narratives (Fivush et al., 2003; Fivush et al., 2008; Kuvač Kraljević et al., 2023), and extend these previous findings to children with DLD. It is possible that the inherent structure of negative narratives more often follows a flow from problem to resolution and that children therefore rely more on these familiar schemas to organise the narrative, resulting in a better chronological order of actions than in narratives with positive valence, which may focus more on details and situational descriptions (Fivush et al., 2019; Hudson et al., 1992). Thus, it appears that unpleasant events rely more than pleasant events on storytelling focused on a problem to be solved and provide children with opportunities to express and regulate the thoughts and emotions (emotional processing) they incorporate into a coherent narrative—an essential aspect of meaning-making (see also Chen et al., 2012; Fivush et al., 2008).

Group Differences in Personal Narrative Performance as a Function of Emotional Valence

Our study also investigated whether the emotional valence of events influences the production of personal narratives differently in children with DLD compared to children with TLD; however, no interaction effects were found. The lack of an interaction effect suggests that emotional valence influences the formation of narratives in children in a similar way, regardless of their DLD diagnosis. This finding suggests that the inherent structure of narratives is shaped by the experiences that children recount, which, in turn, affects how they construct their personal narratives linguistically and coherently. Negative narratives, for example, often follow an arc from problem to resolution (Fivush et al., 2019; Hudson et al., 1992), which can naturally encourage a more chronological sequence of actions.

However, this study found that children with DLD consistently demonstrate difficulties with both positive and negative narratives, regardless of the type of events and experiences they recount. Children with DLD encounter challenges in forming narratives within and between utterances, resulting in personal narratives with less linguistic and structural complexity and

coherence. More specifically, at the linguistic level, children with DLD produce narratives with less grammatical complexity and accuracy. At the propositional level, children with DLD produce a greater number of incomplete utterances. In addition to individual utterances, children with DLD show less continuity between utterances, resulting in less local coherence. At the macrostructural level, they provide significantly less information about the temporal and spatial context of events, although these effects are milder in terms of effect sizes compared to the pronounced impairments in narrative chronology.

The difficulties with the linguistic aspects of production are consistent with the results of the standardised tests (TROG-2:HR, PPVT-III-HR), particularly in the processing of utterance sequences (Gabaj et al., 2025). These difficulties may be due to difficulties in word retrieval or syntactic processing, leading to limitations in grammatical complexity, accuracy and completeness. Apart from individual utterances, children with DLD also have difficulty constructing personal narratives. They often have difficulty explaining events in more detail, linking actions together and connecting ideas conceptually between sentences (local coherence). They also often find it difficult to place their narratives in a specific time and place and to keep to the chronological sequence of events (global coherence). According to the LUNA framework (Dipper et al., 2021), these problems can result from 'bottom-up' processing problems in which linguistic difficulties influence the overall coherence of the narrative. Conversely, 'top-down' problems may also play a role, where the formation of a coherent macrostructure is hindered by the less efficient activation of known organisational schemas. In line with the findings of other studies (e.g. Fivush et al., 2019; Fivush et al., 2003), this could mean that children with DLD, at the group level, are generally less able to process the emotional content of personal experiences.

Research Question 4: Are there differences in the emotional valence of themes of personal narratives in children with DLD and TLD?

Data Analysis

Each child's response to a positive (happiness, pride), negative (worry, anger) and neutral (problem, important event) prompt was categorised according to whether the event evoked pleasant (positive) or unpleasant (negative) emotions, as previously described. All personal narratives about pleasant and unpleasant events were tallied and expressed numerically and in proportions (i.e., percentages) (Table 2). It was compared whether children with DLD told

greater proportion of narratives about themes that reflect unpleasant emotions compared to pleasant emotions than children with TLD.

Hypothesis 4: There will be differences in the emotional valence of themes between the two groups, with children with DLD producing a higher percentage of narratives reflecting unpleasant and less pleasant emotions.

This hypothesis was not confirmed.

Discussion RQ4: Group Differences in The Emotional Valence of Themes

In contrast to our expectations that children with DLD would tell personal narratives that reflect negative emotions to a greater extent, this was not confirmed. As shown in Table 2, the proportion of pleasant (positive) to unpleasant (negative) events recounted by the children was similar in both groups. While children with DLD reported positive events in 34.0% of narratives, children with TLD did so in 38.7% of cases. In both groups, there were more negative than positive narratives, namely 48.3% in the DLD group and 46.3% in the TLD group. Interestingly, in the neutral prompt condition, both groups of children more often chose to tell a narrative about unpleasant event. Our initial hypothesis was that children with DLD would produce a higher proportion of narratives reflecting unpleasant or less pleasant emotions, as there is evidence indicating that children with DLD often experience more socio-emotional difficulties than their typically developing peers (e.g., Burnley et al., 2023; Levickis et al., 2018; Yew & O'Kearney, 2013). Such challenges may be reflected at the pragmatic level of the LUNA model and may lead these children to select unpleasant negative events more frequently than pleasant ones, as they are more frequently confronted with such experiences in their social interactions and personal lives (see also Reese et al., 2017). However, our results showed that both children with DLD and TLD produced an equal number of positive and negative narratives. This result may be attributed to the design of the Global TALES protocol, which contains a balanced set of prompts (two positive, two negative and two neutral). This likely encouraged children from both groups to share a wide range of experiences, resulting in an even distribution of emotional valence of themes. Another plausible explanation is that children with DLD are equally willing to recount both pleasant and unpleasant events, despite their socio-emotional functioning. This willingness could be due to the fact that they are exposed to a variety of experiences and have the desire to share events that they find meaningful, regardless of their emotional valence.

Aim 3 (study 3): To investigate the relationship and contribution of memory mechanisms at the macrostructure planning level and children's socio-emotional characteristics at the pragmatic level of the LUNA framework to the production of personal narratives

Research Question 5: Are there differences in the relationship between linguistic and macrostructure planning measures with memory mechanisms and socio-emotional characteristics between children with DLD and children with TLD?

Data Analysis

Before answering the research questions, a 'personal narrative ability' composite was calculated, consisting of measures that showed a high level of internal consistency, as measured by Cronbach's alpha, of .799. The selected measures were linguistic (grammatical complexity and accuracy), propositional (local coherence, theme), macrostructure planning (context, chronology, theme) and pragmatic (theme) measures. Their values were converted into *z*-scores and averaged before a composite score was created. To answer research question 5 about the relationship between personal narrative ability, memory mechanisms and socio-emotional functioning, Pearson correlations were performed separately for each group (DLD and TLD).

Hypothesis 5: The episodic buffer mechanism and the semantic lexicon will be more strongly related to the production of personal narratives than semantic memory access and socio-emotional characteristics, and this relationship will be stronger for the group of children with TLD than in the group of children with DLD.

This hypothesis was rejected.

Discussion RQ5: Group Differences in The Relationship Between Memory Mechanisms, Socio-Emotional Functioning and Personal Narrative Ability

To answer the research question of whether there were group differences in the associations between memory mechanisms and socio-emotional functioning and personal narrative ability, separate correlation analyses were carried out for each group. To correct for family-wise error due to multiple comparisons, a p-value < 0.01 was considered significant. The production of personal narratives was not significantly correlated with any of the memory mechanism variables or with the children's socio-emotional characteristics in any group of children (DLD/TLD) (Table 4). These results was in contrast to our hypothesis that children with TLD would show stronger correlations between memory mechanisms and the production of personal narratives, which was based on the theoretical assumption that children with DLD have

difficulties with memory mechanisms in general (cf. Archibald & Joanisse, 2009; Hall et al., 2017; Larson & Ellis Weismer, 2022; Lum et al., 2012; Vugs et al., 2017) and specifically in relation to the ability to storytelling (Dodwell & Bavin, 2008; Duinmeijer et al., 2012) and therefore utilise them less. Further results are interpreted and discussed in the context of the findings obtained through regression analysis and the prediction of the factors for the production of personal narratives.

Table 4. Correlations Between Personal Narrative Production, Memory Mechanisms and Socio-Emotional Characteristics

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. PN production	-	TLD: .196	TLD: .158	TLD: .003	TLD: .049	TLD: -.284	TLD: -.105	TLD: .159	TLD: .030
2. Episodic buffer	DLD: .320	-	TLD: .313	TLD: -.022	TLD: .190	TLD: -.372**	TLD: -.183	TLD: -.007	TLD: -.096
3. Semantic fluency	DLD: -.110	DLD: .104	-	TLD: -.065	TLD: .009	TLD: -.133	TLD: -.051	TLD: -.024	TLD: -.060
4. Semantic access	DLD: -.004	DLD: .066	DLD: .168	-	TLD: -.098	TLD: .156	TLD: .230	TLD: .291	TLD: .129
5. Self-concept	DLD: -.017	DLD: -.012	DLD: -.136	DLD: .031	-	TLD: -.441**	TLD: -.637**	TLD: -.556**	TLD: -.564**
6. Anxiety	DLD: -.299	DLD: -.166	DLD: -.029	DLD: .187	DLD: .076	-	TLD: .728**	TLD: .430**	TLD: .382**
7. Depression	DLD: -.196	DLD: -.139	DLD: -.008	DLD: .071	DLD: -.374**	DLD: .576**	-	TLD: .737**	TLD: .591**
8. Anger	DLD: -.096	DLD: .008	DLD: -.019	DLD: .184	DLD: -.345	DLD: .456**	DLD: .802**	-	TLD: .759**
9. Disruptive behavior	DLD: -.041	DLD: .225	DLD: .081	DLD: .150	DLD: -.344	DLD: .384**	DLD: .695**	DLD: .787**	-

Note. PN production = personal narrative production (calculated as composite score containing MLUw, PGU, LC, context, chronology and theme). Only p-values < .001*** and p < .01** were considered significant.

Research Question 6: To what extent do the memory mechanisms of the episodic buffer and semantic memory contribute to predicting the production of personal narratives from the linguistic to the macrostructure planning level in children with DLD and TLD?

Research Question 7: To what extent do internalised and externalised behaviours and self-concept in children with DLD and TLD contribute to predicting the production of personal narratives from the linguistic to the macrostructure planning level?

Data Analysis

To answer the research question of how concurrent factors of memory mechanisms and children's socio-emotional characteristics predict performance in personal narrative production, a multiple regression analysis (stepwise method) was conducted to identify concurrent predictors of 'personal narrative ability' composite score. Based on the two previous studies, in which personal narratives were analysed at different levels of the LUNA framework, a composite variable 'personal narrative ability' was created for study 3 to describe the performance of children's personal narratives. The measurements were taken at the linguistic (grammatical complexity and accuracy), propositional (local coherence, theme), macrostructure planning (context, chronology and theme) and pragmatic (theme) levels (Table 5). Using experimental tasks targeting the episodic buffer of working memory and semantic memory, and a standardised instrument to assess socio-emotional functioning, the associations and contribution of memory mechanisms and socio-emotional traits to children's personal narrative production were examined. Predictors included memory mechanisms (episodic buffer and semantic memory, measured by semantic access and fluency) and socio-emotional characteristics (anxiety, depression, anger, disruptive behaviour and self-concept). In addition, this study investigated whether group membership (DLD vs. TLD) moderates the differences in the 'personal narrative ability'. The 'personal narrative ability' (outcome) was predicted by each predictor variable, the moderator (DLD/TLD group), and their interaction (Table 6). Hypotheses 6 and 7 will be discussed together.

Hypothesis 6: The episodic buffer and the semantic lexicon mechanism will make a relatively greater contribution to explaining the production of personal narratives than semantic memory access.

This hypothesis is partially confirmed.

Hypothesis 7: Internalised behaviours in children with DLD will contribute more strongly than externalised behaviours to predicting children's personal production skills from the linguistic to the macrostructure planning level.

This hypothesis is partially confirmed.

Discussion RQ6: Predicting the Personal Narrative Ability Based on Memory Mechanisms

This study complements studies 1 and 2 by investigating how concurrent factors such as episodic buffer and semantic memory, as well as children's socio-emotional functioning, are interrelated and contribute to their personal narrative production. One of the main findings of this study is that episodic buffer and anxiety symptoms predicted personal narrative ability, incorporating measures from the linguistic (MLUw and PGU), propositional (local coherence and theme), macrostructure planning (context, chronology and theme) and pragmatic (theme) levels of the LUNA framework, explaining 46% of the variance. The episodic buffer was found to make the largest contribution of all memory mechanisms (more than the semantic memory access and semantic fluency) in explaining personal narrative ability in both groups of children, which is partially consistent with the hypothesis 6.

Our findings are similar to those of Dodwell and Bavin (2008), who showed that the episodic buffer plays a unique role in predicting (fictional) narratives compared to other (working) memory mechanisms in 6- to 7-year-old children with DLD. Interestingly, however, group membership (DLD vs. TLD) did not moderate this variance. This suggests that differences in the episodic buffer within an individual child are more important than group status in predicting personal narrative production. Additionally, the differences between the two groups might be more related to language processing or pragmatic abilities that are not directly linked to working memory problems. This is also confirmed by the fact that group membership played a predictive role in the production of personal narratives without moderating them.

Contrary to the hypothesis, the semantic lexicon affecting the speed and accuracy of semantic information retrieval did not predict personal narrative ability. However, our hypothesis was based on the theoretical assumption that retrieval from semantic and episodic memory is essential for the production of personal narratives (see Fivush, 2011; Westby & Culatta, 2016). Overall, these findings suggest that episodic information is more important for personal narratives when children recall events they want to talk about, especially information about when and where what happened emerges when they recount their own autobiographical experiences. Semantic memory may play a greater role when it comes to inventing a (fictional)

story or retelling it through a series of pictures, as this type of storytelling relies more heavily on semantic information as well as knowledge of goal-directed schemas (Hudson & Shapiro, 1991).

Discussion RQ7: Predicting the Personal Narrative Ability Based on Socio-Emotional Characteristics

Of the socio-emotional characteristics, only anxiety symptoms showed a predictive value for personal narrative ability. Anxiety symptoms explained additional variance beyond the episodic buffer in narrative production – variance that was not explained by other predictors (internalising and externalising behaviours, self-concept, and semantic memory mechanisms), partially supporting hypothesis 7. In addition, our findings suggest that children who experience higher levels of anxiety have lower performance in personal narrative production. The results of previous studies are inconsistent (e.g., Bohanek & Fivush, 2010; Chen et al., 2012; Waters & Fivush, 2015), but our results are partially in line with a study by Bohanek and Fivush (2010) who examined adolescents with TLD aged 13-16 years and found a negative relationship between internalising behaviours, including anxiety, and personal narrative skills in male participants. In contrast, Chen et al. (2019) found no association between internalising behaviours and personal narrative production in typically developing adolescents aged 12-21 years. In contrast to this current study, a study by Waters and Fivush (2015) found correlations between some aspects of self-concept and personal narratives in typically developing adults aged 18-28 years. It is possible that the age of the respondents, the measures used to examine socio-emotional functioning, or other factors such as coping or resilience mechanisms, or other internal or external supports and situational factors related to personal storytelling may have contributed to the differences between the findings of other studies and this study.

Results from this study are significant because they could indicate that children may have difficulties in emotional processing related to linguistic organization, as other research has shown (e.g. Beck et al., 2012; Conti-Ramsden et al., 2019). This is particularly relevant for the linguistic production of personal narratives, which involve reflection on emotional experiences and their integration into a coherent narrative (see Bohanek & Fivush, 2010; Westby & Culatta, 2016). It could also be that children with heightened anxiety have difficulty communicating experiences in less familiar situations, which could be reflected in their production of personal narratives. This explanation arises from the pragmatic requirements defined in the LUNA framework. In relation to the LUNA framework, it is also possible that situational external

factors such as the emotional-based prompts used in this study encouraged the children to talk more about emotional experiences whose linguistic framing was related to their socio-emotional characteristics. Finally, the lack of a moderation effect may suggest that the group of children with DLD in our current study did not experience higher levels of anxiety at the group level due to their language difficulties and communication experiences. Instead, anxiety levels in both populations may be explained by other genetic, environmental or internal child factors (Conti-Ramsden & Botting, 2008; Conti-Ramsden et al., 2019).

Table 5. Regression Analysis

	b	*SE b*	*ß*	*P*
Step 1				
(Constant)	-2.809	.348		$p < .001$
Episodic_buffer	.067	.008	.642	$p < .001$
Step 2				
(Constant)	-1.970	.440		$p < .001$
Episodic_buffer	.055	.009	.528	$p < .001$
Anxiety	-.017	.006	-.250	$p = .004$

Table 6. Moderation Analysis: Linear Model of Predictors of Personal Narrative Ability

	b	*SE b*	*t*	*p*
Predictor: Episodic buffer				
Episodic buffer (centered)	.026	.011	2.379	$p = .019$
Group	.777	.139	5.582	$p < .001$
Episodic buffer x Group	-.010	.022	-.463	$p = .644$
Predictor: Semantic fluency				
Semantic fluency (centered)	-.001	.006	-.020	$p = .984$
Group	1.023	.114	8.938	$p < .001$
Semantic fluency x Group	.015	.012	1.247	$p = .216$
Predictor: Semantic access				
Semantic access (centered)	.000	.059	-.001	$p = .999$
Group	1.020	.104	9.838	$p < .001$
Semantic access x Group	.003	.118	.028	$p = .978$

Predictor: Self-concept				
Self-concept (centered)	.001	.008	.111	$p = .912$
Group	1.017	.104	9.753	$p < .001$
Self-concept x Group	.005	.015	.294	$p = .770$
Predictor: Anxiety				
Anxiety (centered)	-.015	.005	-2.863	$p = .005$
Group	.889	.106	8.378	$p < .001$
Anxiety x Group	.004	.010	.339	$p = .735$
Predictor: Depression				
Depression (centered)	-.008	.006	-1.358	$p = .178$
Group	.975	.104	9.353	$p < .001$
Depression x Group	.004	.012	.365	$p = .716$
Predictor: Anger				
Anger (centered)	.002	.005	.355	$p = .723$
Group	1.029	.103	9.965	$p < .001$
Anger x Group	.012	.012	1.167	$p = .246$
Predictor: Disruptive behavior				
Disruptive behavior (centered)	.000	.011	.021	$p = .983$
Group	1.020	.102	9.964	$p < .001$
Disruptive behavior x Group	.006	.022	.288	$p = .774$

5. LIMITATIONS AND FUTURE DIRECTIONS

This study, which employed a wide range of narrative measures to capture personal narrative skills at different levels of the LUNA framework, as well as measures of children's memory mechanisms and socio-emotional functioning to test their contribution, is the first study to provide a comprehensive picture of 10-year-old children's personal narrative performance. However, some limitations of the study should not go unmentioned.

This study attempted to control for the contribution of NVIQ and family-wise errors. However, it revealed group differences in NVIQ and maternal education, with children with DLD showing lower NVIQ scores than TLD children and mothers in the DLD group reporting lower levels of education than mothers of children with TLD. Although these represent genuine data points, a certain inhomogeneity of the sample must be acknowledged. It is known that DLD is

associated with some environmental risk factors (e.g., lower family socioeconomic status), which may have resulted in a relatively lower socioeconomic status in the DLD sample. Moreover, children with DLD, are known to demonstrate a relatively lower average NVIQ at the group level (Bishop et al., 2017). It is also possible that parents of typically developing children whose mothers have a higher level of education were more willing to consent to their child's participation in the study. This study only recruited 10-year-old children attending fourth grade and it is not clear whether the results are generalisable to other age groups. Future studies should include a wider age range of children to account for the changing developmental trajectory of children's personal narratives, memory mechanisms and socio-emotional characteristics. Furthermore, future research should consider whether these data can be generalised to children from other cultures and speakers of other and additional languages, as it is known that there are cultural differences in the amount of information that children from different cultures and languages report in their narratives (Bliss & McCabe, 2008). Furthermore, all children were assessed by the same examiner (author), who was not blinded to the groups either during the examination or when analysing the personal narratives. Although an attempt was made to fully standardise the assessment process through the use of a procedural protocol and to fully objectify the analysis by establishing clear criteria for each measure and its scoring and by checking the reliability through inter-rater agreement, this does not rule out the possibility of being completely impartial in the examination and analysis of the data.

The second study used measures that largely capture skills that tap into specific levels within the LUNA model, e.g., only skills from the linguistic level, without overlap with other levels, e.g., the propositional, macrostructural and/or pragmatic level. However, when going beyond the linguistic level, it is challenging to select metrics that measure theoretical constructs and discourse-level skills that reflect functioning at a particular level of the LUNA framework, as the metrics overlap multiple levels. For example, the thematic coherence dimension using the NCCS measures skills at the propositional (Reese et al., 2011), macrostructure planning and pragmatic levels and also relies heavily on linguistic skills in its implementation. In addition, there are often multiple ways to measure a particular skill, e.g., syntactic complexity (with MLUw and CD), which makes it difficult to use multiple measures due to multicollinearity, with each measure providing specific information about aspects of (syntactic) functioning. These challenges were also mentioned in the original LUNA framework paper (Dipper et al., 2021). Nonetheless, investigating different measures and combining them can provide

information for specifying levels and interactions between levels, which was attempted in this study, but further research that goes in the direction of specifying levels is needed. The third study, in which the measures were combined and a composite measure of narrative production was created, provided partial information about which measures reflect the relationship, but defining the dimensions of personal narrative production is only possible with a larger sample of respondents. To ensure that the study was sufficiently powered, a limited range of measures representing different levels of the LUNA framework were selected. Future work should recruit a larger group of children and use a wider range of measures to determine which best reflect the production of personal narratives.

There are few validated measures that measure memory mechanisms, i.e., there are several studies that have used measures of the episodic buffer and semantic memory (see Hall et al., 2017; Henry & Botting, 2017; Nobre et al., 2013). The lack of validated measures has constrained their application choices. For this study, we selected measures that measured the constructs of interest (episodic buffer, semantic memory access) while controlling for the contribution of other skills, particularly linguistic skills. Thus, the task measuring the episodic buffer (constrained span task), which was carefully developed to control for the effects of linguistic skills and other components of working memory (phonological loop) (Baddeley et al., 2009), was adapted to the Croatian language and tested prior to its use in this study (Gabaj & Kuvač Kraljević, 2022). However, both the episodic buffer task and the semantic fluency task, are verbal, so it cannot be argued that they are not entirely based on language knowledge (Polišenská et al., 2015), which could influence the performance of children with DLD on these tasks.

In the third study, we investigated the predictive value of children's socio-emotional characteristics on a composite measure of 'personal narrative ability' and found that anxiety symptoms can predict overall personal narrative performance. Although beyond the scope of this study, a more fine-grained analysis of our data could explore how socio-emotional characteristics predict personal narrative performance depending on whether children recounted pleasant (positive) or unpleasant (negative) experiences. This is important because the analysis could reveal specific patterns in the way anxiety symptoms contribute to the structuring and content of personal narratives, depending on the emotional valence of the experiences described by the children. It would also provide answers to the question of whether anxiety is more predictive of the way children shape negative narratives than positive

narratives. This would give a deeper insight into the way children express and process their experiences.

6. SCIENTIFIC CONTRIBUTION

Based on the fact that more than half of everyday conversations consist of personal narratives, this study sheds light on how children with DLD manage this complex pragmatic skill in a natural setting. By drawing on the LUNA framework to study how school-age children tell personal narratives, this study moved beyond the idea that storytelling is *just* a basic or typical language skill. Instead, the framework helped show that storytelling involves more complex, multi-dimensional skills (such as memory access, social-emotional functioning, planning skills, etc.). Therefore, this study advances discourse processing research by linking linguistic, cognitive, and socio-emotional domains to provide a holistic view of the factors that influence personal narrative production. By systematically examining constructs from all four components of the LUNA framework – the pragmatic, macrostructure planning, propositional, and linguistic levels — this work has highlighted the interconnectedness of these levels of discourse processing. This further contributes to the refinement of the LUNA framework by empirically validating the interplay between its levels and providing a nuanced model for discourse evaluation and intervention. This, in turn, improves our understanding of how difficulties in one domain can affect the overall discourse production of children with DLD.

This study contributes to the existing knowledge about the difficulties in the formation of personal narratives in children with DLD in a way that does not limit it to the linguistic level alone. Instead, the challenges extend to macrostructure planning and pragmatic levels, suggesting that the impairments in personal narrative ability are not only due to language-specific deficits, but to broader discourse processing problems. The study emphasises the important role of cognitive skills, in particular the episodic buffer, a component of working memory responsible for integrating episodic information about the temporal and spatial context of events with linguistic skills. In addition, socio-emotional characteristics, especially anxiety, influence children's ability to express and process personal experiences and thus affect the linguistic organisation and coherence of the narrative. The relationship between episodic buffer, anxiety and narrative performance is consistent in both groups, DLD and TLD, and, more importantly, independent of group membership.

7. CONCLUSION

This doctoral dissertation fills a gap in the research on personal narrative skills in a large sample of ten-year-old children with DLD and TLD. Our results clearly show that children with DLD have difficulties at all four discourse levels of the LUNA framework: linguistic, propositional, macrostructure planning, and pragmatic (Dipper et al., 2021). In addition, children with DLD consistently demonstrate difficulties across positive and negative narratives, regardless of the type of events and experiences they narrate. Difficulties with the linguistic aspects of production are consistent with those found using standardised tests. However, they inform us that the difficulties of children with DLD in natural settings, such as in the production of personal narrative discourse requiring multi-level processing, extend to difficulties in processing sequences of utterances, either due to difficulties in word finding or syntactic processing, which may limit grammatical complexity, accuracy and completeness. Difficulties with forming personal narratives in children with DLD also extend beyond the level of the individual utterance, leading to difficulties in elaboration, linking actions and conceptually connecting ideas from utterance to utterance (local coherence), but also in orienting the narrative in place and time and in the chronological ordering of events (global coherence). In line with models of discourse processing (e.g. Dipper et al., 2021; Sherratt, 2007), these difficulties may be the result of 'bottom-up' processing. Here, challenges at the linguistic level (e.g., forming a grammatically correct, syntactically complex discourse) and at the propositional level (e.g., interrupting utterances or inconsistently conveying meaning from utterance to utterance) affect the overall coherence of personal narratives. At the same time, however, these difficulties can also arise from 'top-down' problems in which difficulties in building a coherent macrostructure result from a less efficient activation of known organisational frames. In line with the findings of other studies (e.g. Fivush et al., 2019; Fivush et al., 2008), this could mean that children with DLD at the group level, are less able to process the emotional content of personal experiences.

This doctoral dissertation advances the understanding of how non-linguistic factors predict personal narrative ability. It was shown that the episodic buffer memory mechanism and anxiety symptoms have a greater predictive value for personal narrative production than other memory mechanisms, such as semantic memory, and other socio-emotional characteristics. These findings suggest that memory mechanisms from the macrostructure planning level, as well as interpersonal factors (socio-emotional characteristics) from the pragmatic level of the LUNA framework, play a significant role in the formation of personal narratives. An increase

in episodic buffer ability is associated with better personal narrative performance. Conversely, our study showed that mechanisms involved in accessing semantic information do not play a predictive role in personal narratives. These results emphasise the importance of the episodic buffer, which integrates information about where, when, and what happened with linguistic structures (syntactic and semantic) that are important for the coherent construction of personal narratives

In addition, our study revealed that of the socio-emotional traits, only anxiety symptoms predicted personal narrative performance, with elevated levels of anxiety associated with poorer narrative performance. This may indicate that children experiencing anxiety face challenges in emotionally processing their experiences, which affects their ability to produce coherent narratives. Finally, we investigated whether group membership (DLD/TLD) moderated these relationships and found no moderating effect. This suggests that the strength of the relationship between episodic buffer and anxiety with personal narrative performance is consistent, regardless of whether the children belong to the DLD or TLD group.

Finally, this study confirms the complexity of shaping personal narratives, which goes beyond the use of language skills alone. It requires the careful integration of different linguistic, cognitive and socio-emotional elements, and future studies analysing personal narratives should take this complex interplay of skills into account.

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CURRICULUM VITAE

Mateja Gabaj was born on 13 May 1994 in Koprivnica. After graduating from the Dr Ivan Kranjčev High School in Đurđevac, she enrolled in the Speech-Language Pathology Programme at the Faculty of Education and Rehabilitation Sciences at the University of Zagreb. She completed her undergraduate studies and graduate studies in speech-language pathology and graduated with honours (magna cum laude) in 2018. In 2020, she enrolled in the Postgraduate Doctoral Study Programme in Speech, Language and Hearing Disorders at the Faculty of Education and Rehabilitation Sciences at the University of Zagreb. She passed the professional exam in 2020 and is currently employed at the Centre for Education and Rehabilitation in Koprivnica, where she works clinically as a speech-language therapist.

Her main scientific interest is language development and processing in children with developmental language disorder and in the typical population, as well as research into narrative skills. She has actively presented and disseminated the results of her doctoral research at international conferences and participated in several international and national workshops. She is involved in the activities of an international group of researchers within the Global TALES Network. From March to June 2024, she spent a short-term study visit at Griffith University on the Gold Coast in Australia. In 2025, she became a member of the Child Language Committee of the International Association of Communication Sciences and Disorders (IALP) and is a member of the Croatian Logopaedics Association. She is (co-)author of 8 articles published in international peer-reviewed journals and proceedings and has been invited to co-author papers: (1) *Investigating coherence of personal narratives across cultures and languages*, and (2) *A tutorial on personal narrative assessment to guide clinical practices in the assessment and support of children with developmental language disorder* for a special issue of the journal Language, Speech, and Hearing Services in Schools.

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