



Vocabulary and expressive morpho-syntax in individuals with Down syndrome: Links to narration

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ABSTRACT

Background: Narrative ability is crucial for social participation in everyday and school life but involves different language abilities such as vocabulary and morpho-syntax. This is particularly difficult for individuals who display both language and cognitive impairments. Previous research has identified productive vocabulary as a possible key factor for narrative performance in individuals with Down syndrome. Considering a close connection between lexical and morpho-syntactic performance within language acquisition and the distinct impairments that individuals with Down syndrome display concerning their morpho-syntactic skills, the nature of a relation between vocabulary and narrative skills under the influence of grammatical deficits requires further investigation.

Methods: Narrations were obtained from 28 children and adolescents with Down syndrome (aged 10;0–20;1) using a non-verbal picture book. Narrative abilities were rated using the Narrative Scoring Scheme across seven narrative aspects (including macro- and microstructure). Vocabulary analyses and morpho-lexical context analyses including verb and conjunction enumerations, evaluation of verb position and MLU were conducted. Findings from the transcript analysis have been supplemented with data from standardized language measures evaluating expressive lexical and morpho-syntactic development. A multiple regression analysis was conducted to identify significant predictors for narrative outcome in the participants with Down syndrome.

Results: Lexical analyses revealed a high heterogeneity in production of subordinating conjunctions as a link between lexical and morpho-syntactic abilities. Comparisons of standardized and narrative data demonstrated differences in subordinate clause production depending on the elicitation setting. A multiple regression analysis identified the number of different verbs in the narrative task as the most significant predictor for narrative performance in individuals with Down syndrome.

Discussion and implications: The findings of this study contribute to the knowledge regarding factors that influence narrative performance in individuals with language impairment. A differentiated verb lexicon can be identified as the key ability for reaching advanced narrative skills in participants with Down syndrome. These findings are of clinical relevance for therapeutic and educational support and contribute to an understanding of the relation between strengths in vocabulary and morpho-syntactic weaknesses in individuals with Down syndrome within communicative participation.

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1. Introduction

Language is a complex interplay of different skills and levels. It is usually used in everyday life at the level of sentences and texts. Social interaction takes place through exchange, and it is impossible to imagine our everyday life without storytelling as a cultural technique. Narration is not a mere stringing together of words and sentences, but forms an independent language level. Narratives are structurally characterized by the macrostructure, i.e. the conventionalized structure of a story (e.g. introduction, initiating event (problem), attempt (problem solution), conclusion; cf. story grammar model according to [Stein & Glenn, 1979](#)). Second, in the linguistic realization of a narrative, the microstructure of a story is relevant, which includes, among others, concrete word choice, grammatical complexity, and referential devices (e.g., overview in [Govindarajan & Paradis, 2022](#)). References in stories are an important way for listeners to follow the action and understand the context (e.g. a protagonist grinds the pepper very small in the mortar because she bit into a big piece at the beginning of the story). In order to establish this inner logic of a story (cohesion), a narrator needs certain morpho-syntactic and lexical skills. When these skills are impaired, as they are in many clinical populations, storytelling - and therefore social interaction with others - can be significantly impaired.

Language proficiency is often challenging for individuals with language and cognitive impairments such as those with Down syndrome. Down syndrome is a genetic syndrome, which is caused by the trisomy (mostly free trisomy) of the 21st chromosome and manifests with mild to severe cognitive impairments and language disorders. Whereas language comprehension, communicative-pragmatic skills and vocabulary development are often described as relative strengths of individuals with Down syndrome (e.g., [Grieco et al., 2015](#); [Vicari et al., 2000](#)), morpho-syntactic impairments appear in a large number of persons with this syndrome ([Diez-Itza et al., 2007](#); [Martin et al., 2009](#); [Witecy et al., 2023](#)). Morpho-syntactic disorders are marked by missing function words ([Vicari et al., 2000](#)), an impaired production of complex sentences such as *wh*-questions ([Wimmer et al., 2020](#)) and a shortened sentence structure ([Channell et al., 2015](#)), which is not necessarily reflected by the participants' mean length of utterances (MLU). MLU is, however, influenced by other morpho-syntactic impairments such as sentence duplications or abortions and the occurrence of sentence fragments ([Neitzel and Penke, 2021](#)). Nevertheless, an impaired vocabulary performance and the existence of a developmental plateau – which is reached for language comprehension and lexical acquisition during the teenage years – have been described for individuals with Down syndrome ([Carr & Collins, 2014](#); [Carr, 2012](#); [Witecy & Penke, 2017, 2019](#); [Witecy et al., 2023](#)).

While language often remains impaired even after intensive speech and language therapy, one main goal of therapeutic and educational aids is the improvement in the social participation of persons with Down syndrome. Narrative skills, therefore, represent an important goal of individual support for many individuals with Down syndrome to enable the expression of needs and experiences to others ([Neitzel and Penke, 2022](#)). In order to gain a deeper understanding of the interplay between morpho-syntactic and lexical level and narrative skills, people with Down syndrome are a specifically interesting target group because of the impairments that are present. On the one hand, grammatical deficits are common in this group, as illustrated. On the other hand, although vocabulary is a general strength, there is usually some stagnation in lexical development. If we now look at the narrative abilities of these individuals, the question arises as to whether the difficulties lie on the narrative level itself or whether the narrative performance is decisively influenced by the abilities on other language levels. Of particular interest is the consideration of the microstructure of a narrative, which is strongly shaped by morpho-syntactic and lexical devices. This includes understanding what lexical and morpho-syntactic abilities individuals with Down syndrome exhibit at narrative level.

Important pioneers in vocabulary research on individuals with Down syndrome were [Hesketh and Chapman \(1998\)](#), who studied specifically verb production in 29 individuals with Down syndrome. The participants were on average 15 years old and had a mean mental age of just under 5 years (detailed characteristics per subgroup in [Hesketh & Chapman, 1998](#)). The authors analyzed the verb use of the participants with Down syndrome in narrative samples, controlling for MLU by using a group of typically developing children with matched MLU. Analyses were drawn from a variety of spontaneous speech and narrative procedures and spanned 12 min per participant. In their study, the authors distinguished between grammatical verbs (auxiliary verbs and forms of *do*, *have*, and *be*) and lexical verbs (other full verbs). The participants with Down syndrome were found to produce significantly more lexical verbs than MLU-matched controls. This is consistent with the hypothesis that participants with Down syndrome tend to have a strength in the area of vocabulary and have a higher vocabulary experience with increasing chronological age than their cognitive developmental level implies. In contrast, participants with Down syndrome produced significantly fewer grammatical verbs but significantly more utterances without a verb in this study. This is consistent with reports by [Neitzel and Penke \(2021\)](#), who described a high number of sentence fragments in the participants with Down syndrome, which were an expression of a morpho-syntactic impairment. It should be noted, however, that in the study by [Hesketh and Chapman \(1998\)](#) the investigator asked active questions. Due to the question wording, in some cases it was context-appropriate to answer with an utterance without a verb (see details in [Hesketh & Chapman, 1998](#)). For example, since ellipses are common in our everyday communicative life, a dialogical approach may be methodologically limiting. In conclusion, the study by ([Hesketh and Chapman, 1998](#)) over 20 years ago underscored the importance of verbs in spontaneous speech or narrative samples for assessing language performance in individuals with Down syndrome. However, the authors did not link vocabulary and narrative performance of the participants in this study, which is of clinical interest and a relevant extension of the considerations for everyday communication of this target group.

Different investigations have reported that narrative abilities are impaired in individuals with Down syndrome (e.g. [Channell et al., 2015](#); [Finestack et al., 2012](#), [Neitzel and Penke, 2022](#); overview in [Segal & Pesco, 2015](#)). Time and again, a picture emerges of relative strength at the macrostructural level and relative weakness at the microstructural level in this population ([Ashby et al., 2017](#); [Channell et al., 2015](#); [Finestack et al., 2012](#)). A recent study provides insight into the relevance of vocabulary and morpho-syntax for narrative performance in individuals with Down syndrome: [Martoukou et al. \(2020\)](#) included 20 monolingual adults with Down syndrome

(native language: Greek) aged 18 to 46 years (chronological age: $M=28;2$ years, range 18;7–45;11 years) and compared the narrative ability of speakers with Down syndrome and two typically developing control groups. One group was matched for mental age ($n = 20$, chronological age: $M=4;2$ years, range 3;11–6;2 years, mental age: $M=4;3$ years; range <4;0–6;6 years). In addition, a second control group with typical development ($n = 20$) and parallel expressive vocabulary performance was included (chronological age: $M=5;10$ years, range 3;11–10;2 years, mental age: $M=5;8$ years, range: 3;9–9;8 years). The MLU in words and a sentence memory test were used to assess expressive morpho-syntax. All participants were asked to retell auditory narratives based on six illustrations (narrative material: stories baby dog and dog story from MAIN; Gargarina et al., 2012). The microstructural measures of the study were defined as the number of different content and function words, MLU in words and the type of subordinate clauses produced (counting adverbial, relative and verb complement clauses). In terms of microstructure, the speakers with Down syndrome performed significantly weaker than the children in the vocabulary-matched control group on almost all measures, but for the most part showed comparable performance to the children with matched cognition. This suggests that speakers with Down syndrome may show a microstructure appropriate to their cognitive level which might be masked by linguistic weaknesses. It is possible that microstructure was therefore often identified as a weakness of individuals with Down syndrome in narratives (Ashby et al., 2017; Channell et al., 2015; Finestack et al., 2012). It is interesting to note that the vocabulary in the narratives, despite often considered as a relative strength of the target group with Down syndrome, was a variable that could be used to distinguish them from typically developing speakers in the investigation (Martzoukou et al., 2020). The linguistic variables used in this study should be considered relevant to the assessment of microstructural abilities in individuals with Down syndrome. It is difficult, however, that the described study only makes a direct comparison with typically developing children, but does not analyze the individual influences of morpho-syntactic and vocabulary skills on narrative performance in individuals with Down syndrome. Such an analysis is not currently available in the literature. As individual language promotion and therapy for people with Down syndrome needs to take into account syndrome-specific characteristics, it is worthwhile to address this gap.

A recent, preliminary study has aimed to identify possible factors influencing narrative performance in children and adolescents with this syndrome. In their study, Neitzel and Penke (2022) included several variables, which might be associated with narrative abilities according to the literature (e.g. non-verbal mental age, Hogan-Brown et al., 2013; MLU, Channell et al., 2015). In contrast to previous findings, partial correlational analyses yielded performance on an overall vocabulary measure (AWST-R, see Section 2.3, which includes naming of nouns and verbs in hierarchical order) as the only significant factor for narrative performance across the group with Down syndrome ($p = .002$, Neitzel and Penke, 2022). Narrative abilities were measured by means of a point score, which is assigned in the Narrative Scoring Scheme (NSS; Heilmann et al., 2010). This instrument (cf. Section 2.2) offers the possibility of obtaining an overview of the narrative profile, whereby both macrostructural and microstructural aspects are included in the assessment (e.g. completeness of the description of conflicts and solutions as a macrostructural measure or references as a microstructural category). This is only a preliminary study in that within the analyses at that time, the authors' main goal was to describe the narrative skills of children with Down syndrome for speech and language pathologists. The analysis of possible influencing factors therefore only took place in a secondary and superficial way on the basis of correlation analyses (partial correlations). In terms of morpho-syntactic variables, neither performance on two standardized expressive morpho-syntax subtests nor a measure of MLU could be found as associated with narrative abilities. At the same time, both basic linguistics and current research literature (e.g. Martzoukou et al., 2020) repeatedly point out that vocabulary and morpho-syntax are difficult to distinguish from each other. It should be noted that the analyses carried out in the cited study by Neitzel and Penke (2022) had a different purpose and are only accessible to a very limited German-speaking audience. Since the analyses - as explained below - have raised many questions, this article presents new and comprehensive analyses that have not been published to date. The result of the preliminary analyses of the study by Neitzel and Penke (2022) seems questionable in that the variables used were not specifically selected to investigate the relationship between vocabulary, grammar and narrative, but rather represent skills that are typically used as clinical markers in Germany: results of well-known standardized tests. Thus, the results should be interpreted with caution, since, for example, it cannot be taken for granted from the literature that the morpho-syntactic performance of people with Down syndrome on a standardized measure (adapted, not created for this target group) corresponds to that in spontaneous speech. In addition, the total vocabulary measure used included both nouns and verbs, although nouns are less likely to be related to morpho-syntactic ability than verbs. It is possible that the analyses gave a completely different impression due to the differing research question of this preliminary study. However, given the existing research gap regarding a precise analysis of the effects of vocabulary and grammar performance on narrative in individuals with Down syndrome and the evidence from the preliminary study, it seems desirable to conduct more in-depth research at this point.

If one wants to investigate the relationship between vocabulary, morpho-syntactic skills, and narration in individuals with Down syndrome in more detail, the question arises as to which linguistic structures should be used to do so. On the one hand, it is common in the research community to use standardized tests of specific language skills to assess the performance of individuals with Down syndrome in terms of vocabulary and morpho-syntax. This seems reasonable because of the tailored material, but as described above, there is no guarantee that participants will perform on such a standardized measure in a way that is representative of their spontaneous language ability. Therefore, in a further analyses, it seems reasonable to include linguistic markers from the areas of vocabulary and morpho-syntax in the participants' text samples - in this case narratives based on a picture book. These were selected on the basis of literature research. In the following, verbs and conjunctions have been chosen as critical structures at the interface between lexicon and expressive morpho-syntax. Both linguistic structures convey (lexical) content, but at the same time fulfil functional (grammatical) tasks. Therefore, not only the knowledge of the words and word classes is assumed in a speaker (vocabulary), but also the syntactic structure of the sentence is influenced by the individual wording (morpho-syntax). This is especially true for German and can be confirmed a) for verbs, which differ in valence and thus also presuppose a different number of complements (e.g. subject + object), as well as b) for conjunctions, which introduce a subordinate clause (morpho-syntax), but also convey relevant content despite their

categorization as function words (e.g., contradiction: “*Er mochte mich, obwohl ich ihn manchmal nicht zurückrief.*”/ ‘He liked me, although I sometimes did not call him back.’).

Regarding the use of conjunctions by individuals with Down syndrome, there is no current research available. However, in the literature, due to the frequent absence of function words in individuals with Down syndrome, it is assumed that this also applies to conjunctions (Vicari et al., 2000; for German: Schaner-Wolles, 2000). Verbs, on the other hand, have already been addressed in the context of narratives. In a study by Channell et al. (2015), the authors reported a tendency for a lower number of verbs in the produced narrations to occur with narrative impairments in the 23 children and adolescents (aged 10 to 16 years) included. Recent work by Neitzel and Penke (2021) on verb production concerning a specific verb type—the occurrence of mental state verbs—described mental age-appropriate verbal performance with respect to mental state verbs in narrations. Although these findings pointed to a relatively high verbal performance by individuals with Down syndrome in a narrative task, mental state verbs are only a limited verb class strongly associated with Theory of Mind, which is impaired in many individuals with Down syndrome (Neitzel and Penke, 2021). The description of mental states in narrations is one element necessary for perspective taking in a narrative context. However, the findings for this verb class are not generalizable across all types of verbs.

The aim of the current study was to investigate the relation between morpho-lexical development and narrative abilities in individuals with Down syndrome. The focus of the analyses was to verify or confute an association between vocabulary and narrative skills, while controlling for morpho-syntactic impairments, in the 28 participants with Down syndrome. Although preliminary analyses yielded performance in an overall vocabulary measure as decisive for narrative abilities in this group, it seems likely that specific parts of vocabulary skills such as verb production might be the actually decisive for narrative outcome. Therefore, in the current study, a specific predictor analysis is sought. Furthermore and prior to data analysis, the author presumed the existence of a linking structure between lexical and morpho-syntactic performance relevant for narrative performance, such as finite verb production or production of conjunctions as a marker of subsequent subordinate clauses (which is part of complex syntax in German). If verb use or more specific aspects concerning the verbal lexicon were decisive for narrative abilities, the author assumed that a deeper vocabulary analysis in the narrations would reveal this relation. There are several investigative steps that need to be taken before the predictive analysis can be carried out.

Therefore, the first aim of the present study is (A) to analyze the occurrence of verbs and conjunctions in terms of number (tokens) and differentiation (types) in the narratives of children and adolescents with Down syndrome and to relate them to the quantitative and qualitative results of a standardized vocabulary test. Because of the close link between vocabulary and morpho-syntax, which can be assumed especially for verbs, the morpho-syntactic context of verbs must also be taken into account. The morpho-syntactic performance with respect to verb position in different sentence types of German is therefore analyzed as the second subgoal (B) in the present study. In addition, the production of complex syntactic structures as a marker of advanced or delayed morpho-syntax in individuals with Down syndrome might depend on the context of elicitation. To address this question, this study compares the production of subordinate clauses and finite verbs in various (complex) sentence structures across different diagnostic contexts (C): production in picture-based narrations vs. production within a standardized expressive morpho-syntax measure. Subgoals (A) to (C) are necessary to first understand the vocabulary and grammar skills of the studied sample with Down syndrome before (D) testing the influence of vocabulary and grammar skills on narrative performance as the main research question of the present study. The previously operationalized variables on vocabulary, morpho-syntax and their interface will be included as possible influencing factors in a multiple regression analysis.

2. Methods

Data regarding performance on a narrative task as well as on a battery of standardized language measures were obtained from children and adolescents with Down syndrome over approximately three sessions of 45 to 60 min (see details in Section 2.4). The research project involving the data presented here was approved by the Ethics Committee of the Medical Department of the University of Cologne, Germany (number of approval 18–121). As described in the introduction, the participants’ scores on narration and standardized language measures presented in this paper were already used in a preliminary German study by Neitzel and Penke (2022) with a focus on clinical implications of narrative impairments. The data and analyses presented in this article are independent of this and the article by Neitzel and Penke (2022) should be understood exclusively as scientific preliminary work.

2.1. Participants

Participants in the current study were 28 individuals with Down syndrome (free trisomy: $n = 26$; mosaic trisomy: $n = 1$; type of trisomy unknown: $n = 1$). The participants were recruited with the aid of parent associations as well as institutions such as schools for children with learning difficulties and inclusive sports clubs. Inclusion criteria, as described below, were verified using information from caregivers and own testings in the first session. Inclusion criteria were met by all children and adolescents with Down syndrome presented here and were the following: [i] attendance of an inclusive or special education school, [ii] monolingual German speaker, [iii] calculated mental age $\geq 3;6$ years (in y:mm) (measured using the non-verbal cognition measure SON-R 2 ½–7; see Section 2.3), [iv] usage of spoken language at least in two-word-utterances (evaluation in spontaneous speech at the first appointment), [v] cooperation during the test sessions. From the originally recruited sample of 32 individuals with Down syndrome, four participants were excluded after the first of three planned testing sessions because of a calculated mental age $< 3;6$ years ($n = 3$) or a lack of cooperation ($n = 1$). Exclusion criteria for the current study were multilingualism or an additional psychiatric diagnosis such as Autism spectrum disorder, which was the case for none of the contacted participants. Visual and hearing abilities were sufficient in all

participants (mild hearing loss < 30 dB in $n = 9$ individuals). With respect to their language comprehension abilities, all participants were able to understand the instructions for the measures used.

Chronological age of the participants is displayed in Table 1 ($M=14;05$ years;months). In general, chronological age is not informative for individuals with Down syndrome in terms of their development and abilities. Children from the age of 10 were sought to increase the likelihood of familiarity with the educational setting and concentration on a task. In Germany, children with special education due to intellectual impairments usually first attend an orientation level, in which, for example, concentration behavior is promoted. At around 10 years of age, most children have completed this orientation stage and attend the lower level of a special education school (no strict age criterion). Children attending inclusive schools have at this point gone through the first years of elementary school, which aims to promote similar goals. Therefore, this rough cut-off was chosen as an orienting, lower age limit for recruitment. The age of the participants was limited upwards by defining school attendance as an inclusion criterion, as experience has shown that the support or therapy situation of children with cognitive impairment can differ after leaving school, and thus changes in language skills could occur.

2.2. Narrative measures

Oral narratives were elicited from the children and adolescents based on a common non-verbal picture book ('Frog, where are you?'; Mayer, 2003). The so-called *Frog story* is widely used in narrative research in different clinical groups (for a methodical overview see Reilly et al., 2004) and appropriate for the children's cognitive level. The story consists of 24 black and white pictures of a boy and his dog searching for his escaped pet frog. The main characters (boy, dog, frog) are supplemented by a number of animal side characters. Knowledge of the key nouns for picture-based narration of the story (e.g., names of animals and setting elements) was assured using a short naming task before the narrative task. For this purpose, the participants saw a PowerPoint presentation with individual illustrations of the objects or settings and characters needed to convey the core content of the story. The respective correct nouns were named by the experimenter if the child showed uncertainties during the naming task (e.g., 'flies' instead of 'bees'). At the end of the brief review, the child should name these items again. This clarification procedure allowed the core vocabulary of the narrative to be produced in advance by all participants. Afterwards, no further aids were provided during the narrative task.

All narratives were audio-recorded and transcribed using ELAN 5.3 (Max Planck Institute for Psycholinguistics, The Language Archive, 2018). A second rater, who was a trained speech and language pathology student, reviewed transcripts and narrative scorings. The transcripts of children and adolescents with Down syndrome are now available as a complete data set on the CHILDES database (Neitzel, 2023). Narrative scoring was conducted using the Narrative Scoring Scheme (NSS; Heilmann et al., 2010). The NSS scoring procedure is widely used in international narrative research, e.g., including different clinical populations (for Down syndrome: Finestack et al., 2012; for autism spectrum disorder (ASD): Rollins, 2014; for unilateral cleft lip and palate: Andersson & Klintö, 2020), for cross-language comparisons (Bitetti et al., 2020) and in longitudinal investigations (Bitetti & Hammer, 2016; Orizaba et al., 2020). The NSS instrument consists of seven categories: character development and referencing with microstructural and introduction, mental/ emotional states, conflict/ resolution, cohesion and conclusion with macrostructural focus. The analysis yields a total score of max. 35 points (0–5 points per category). NSS scores of one point per category point to an immature narrative ability while three points are defined as a developing and five points as a mature narrative performance. Examples for the scorings in different categories are displayed in the supplementary material (Table S1). A manual was used for evaluation in this study, which shows the respective point scores from 0 to 5 points per category for the Frog story. This is an extended translation into German (Neitzel and Meier, 2024) of the original specifications for the Frog story by Miller et al. (2003) for English. The German manual was evaluated in a study on the transcripts of 89 children with typical development and achieved very good interrater reliability (0.93; 95 % CI: 0.77 - 0.98; Authors, 2023). It should be noted that these were not the same coders, but they were instructed by the author according to the same guidelines. The participants' narrative performance, which was assessed using the NSS, has a mean score of 13.07 points (see details in Table 1). Please note that in the NSS, a score of one point per category is considered minimal narrative ability and a score of three points per category is considered developing narrative ability. The displayed mean score of the participants should be considered very low, with an average score of 1.87 points per category.

Narrative performance – defined by the NSS total scores for each participant here – is the dependent variable of a multiple regression analysis included in this paper.

Table 1
Participant characteristics ($n = 28$) and performance in terms of narration analysis.

	Age and mental equivalents in yy:mm		Narrative performance (max. 35 p.)
	Chronological age	Mental age (SON-R)	NSS total score
Mean	14;05	5;03	13.07
SD	2;06	1;02	5.90
Range	10;00–20;01	3;05–8;00	1–26

Note: SON-R version: 2 ½– 7; NSS: Narrative scoring scheme.

2.3. Standardized measures

2.3.1. Non-verbal cognition measure

Non-verbal mental age was calculated using a cognition measure in the current study. Calculations were based on the results of the Reasoning scale of the Snijders-Oomen Nonverbal Intelligence Test (SON-R 2 ½–7; Tellegen et al., 2007). The authors report a high reliability for the reasoning scale (.83). The Reasoning Scale consists of three subtests. In the Categories subtest, the child has to choose from a series of options which item belongs to the given category (e.g. types of fruit). The items become increasingly complex and less frequent. The selection is made by dragging small picture cards onto the test picture or by pointing to the picture (feedback is possible even in the case of fine motor impairment). In the Analogies subtest, the patient has to reproduce patterns of shapes that follow a logical sequence (e.g. a small circle is always followed by a large circle of the same color). Again, the sequences become increasingly complex. The selection is made by placing or pointing (tapping) plastic tiles (e.g. a large blue circle). In the final subtest, Situations, the participant has to decide which picture from a selection set fits into a presented picture. This might be a picture of a boy on a tree with a small piece missing (similar to a jigsaw puzzle piece). In this picture, for example, a small square showing the saw that the boy is using to cut off the branch. It is important for the correct performance of the test that the picture fits the situation not only visually but also inferentially - e.g. there is a puzzle piece where the boy is sawing off the piece he is sitting on, which cannot be selected.

An overview of the participants' characteristics and the narrative data as partially described in the clinical paper by Neitzel and Penke (2022) is given in Table 1. While the participants are on average 14;05 years old, their mean (non-verbal) mental age is 5;03 years, which corresponds to a preschool-aged child.

2.3.2. Vocabulary measure

Language performance in the individuals with Down syndrome was evaluated using two standardized measures for expressive lexical and morpho-syntactic language abilities. The vocabulary measure was the AWST-R (*Aktiver Wortschatztest für 3- bis 5-jährige Kinder*; Kiese-Himmel, 2005) which consists of 75 colorful photographs picturing 51 nouns and 24 verbs of increasing difficulty. Normative data (t-values) is provided for children aged 3;0 to 5;5 years. The internal consistency of the AWST-R is $\alpha = .88$ (Kiese-Himmel, 2005). Although the AWST-R is only normed for a narrow age window, it has been shown to be readily adaptable in practice with individuals with Down syndrome (Neitzel and Dittmann, 2021). An important advantage of the procedure is that the items are presented as photographs. This is usually more explicit than drawn items/situations. In addition, the items are arranged hierarchically, becoming increasingly difficult and less frequent. Thus, in case of a child's frustration or lack of cooperation, at least some of the items can still be used. A final advantage is that the test also asks for verbs of low frequency that are still visually recognizable. The AWST-R allows both quantitative (raw score) and qualitative analysis. The latter, following the manual (Kiese-Himmel, 2005), distinguishes between five types of error, which are described as follows:

[a] Nonverbal/ other reactions: includes e.g., silence up to 10 s after picture presentation, nonverbal answer (such as a gesture), 'I don't know'; Example: child imitates a scissor with her fingers to describe the verb 'schneiden' / 'cut'.

[b] Taxonomic errors: includes e.g., using an alternative word from the same semantic field; Example: 'tauchen' / 'dive' instead of 'schwimmen' / 'swim'.

[c] Thematic errors: includes e.g., associations, functional paraphrasing, naming of material or color characteristics; Example: 'Feuer' / 'fire' instead of 'rauchen' / 'smoking'.

[d] Rule-based errors: includes derivations and composition of neologisms; Example: 'Eierhuhn' / 'egg chicken' instead of 'Küken' (sg.) / 'chick'.

[e] Non-categorizable errors: includes all other answers/ errors; Example: unintelligible utterances.

As part of the qualitative analysis (research aim A), the participants' errors were evaluated according to the above error types [a] to [e] to investigate whether the errors that occurred in the individual participants might limit the communication of narrative content. The number of correct verbs per participant is also used as a factor variable in the multiple regression analysis.

2.3.3. Morpho-syntactic measure

Participants' expressive morpho-syntactic abilities were measured using subtest 1 and 2 of the ESGRAF 4–8 (Motsch & Rietz, 2016), a standardized test occurring within the context of a circus game. The test elicits specific grammatical structures (subtest 1: verb second position including *wh*-questions and subject-verb-agreement, subtest 2: verb final position) and yields normative data (percentile ranks) for children aged 4 to 8 years of age (Table 1). Subtest 1 checks verb-verb agreement and correct subject-verb congruence. For this purpose, a guessing game is played with the child, in which the child is asked to ask questions to a hidden animal in a box (e.g. "Wo wohnst du?" / 'Where do you live?'). Both correct verb agreement and subject-verb congruence are scored with one raw point per correct item. In the second subtest, the verb ending position is tested, which occurs in German in the subordinate clause. For this purpose, the child has to repeat various magic rules (e.g., "Übe den Trick mehrfach, bevor du ihn vorführst." / 'Practice the trick several times before you perform it.') and make a phone call to a fictitious circus director to order equipment for the performance (e.g., "Der Zauberer braucht einen neuen Tisch, weil der alte kaputt ist." / 'The magician needs a new table because the old one is broken.'). In order to elicit the target grammatical structures from the children, specific aids are applicable for each subtest (e.g. usage of prescribed gapped sentences). Medium test/ re-test reliability ($r = .046^*$) and a high split-half-reliability ($r = .73$) as well as Crombachs α ($=.79$) are reported by the authors in Motsch and Rietz (2016). The results of the standardized grammar test are used to compare performance in terms of verb position in a standardized procedure and in the participants' narrative samples (subgoal C).

2.4. Procedure

All participants participated in a comprehensive battery of narrative, cognition and language tasks and attended three testing sessions of 45 to 60 min each, including small talk and sufficient breaks. The testing sessions were scheduled in a short time distance and took place in the children's home or in a speech and language pathology ambulance in Cologne, Germany. Nonverbal cognition and expressive vocabulary were assessed in the first session, especially to ensure the inclusion criteria without overstraining the participants. Expressive grammar (ESGRAF 4–8) and another short narrative instrument, which is not addressed in this paper, were conducted in the second session. The Frog story narratives were obtained in the third session following the procedure described in Section 2.2. Frog story narratives of the participants with Down syndrome took about 10 to 25 min of narration time. Furthermore, the caregivers of all children and adolescents in the study completed an anamnestic questionnaire for their child.

2.5. Data analysis

The analyses carried out to explore subgoals A to C and main goal D in the present investigation were the following:

Subgoal A) To analyze the vocabulary skills of the participants with Down syndrome, raw scores were calculated according to the AWST-R manual. In addition to the quantitative analysis, a qualitative analysis including the participant's error types was conducted. This qualitative analysis is given in the vocabulary measure AWST-R and was applied according to the manual (see error types in Section 2.3). A comprehensive qualitative evaluation form was used for each participant, which relates the errors per error type to the total errors. This results in a proportion score that is based on the participant's individual performance and not on the total number of items, which could distort the result. The lexical performance of the children and adolescents in their narratives was assessed by enumerating the verbs and conjunctions that occurred (number of different words (types) and total number (tokens)). A type-token-ratio was computed by dividing the types by the tokens. The closer the obtained decimal value is to 1, the higher is the lexical richness with respect to verbs or conjunctions in the participants' narrative. The number of different verbs and different conjunctions in the Frog story narratives were included as factor variables in the multiple regression analysis.

Subgoal B) The sentence types produced were analyzed according to verb position, which is different for main and subordinate clauses as well as for questions in German: whereas main sentences and *wh*-questions require a verb second position ("Wo *gehst* du hin?" / 'Where *are* you going?'), the finite verb is placed in final position in a subordinate clause ("...weil ich Zitronen *mag*." / '...because I *like* lemons.') and in first position in questions ("Kaufst du das Buch?" / 'Are you buying the book?'). The number of finite verbs in the narratives was included as a factor variable in the multiple regression analysis.

Subgoal C) The results of the participants in the standardized grammar measure ESGRAF 4–8 were calculated according to the manual (raw scores). Additionally, the percentages of correct items per subscale were computed for each participant. Production of subordinate clauses as an indicator of advanced syntax development was compared in two conditions using cross tables and the Fisher exact test: a) performance in the standardized measure ESGRAF 4–8 and b) in the narrations. As an additional morpho-syntactic measure, the participant's mean length of utterances (MLU) was calculated (in words, which is common for German). The individual MLU scores were included as a factor variable in the multiple regression analysis.

Main Aim D) In order to examine the influence of morpho-syntactic and lexical performance on narrative performance, a multiple regression analysis was conducted including five variables: 1) the number of verbs correct in the standardized measure AWST-R, 2) the number of different verbs in the narrative, 3) the number of different conjunctions, 4) the number of finite verbs in the narrative and 5) the participant's MLU. As explained earlier, MLU is considered here as a morpho-syntactic measure. The lexical measures, with the exception of the AWST-R raw score for verbs, are analyzed in the frog story narratives and are expected to serve as a link between lexical and morpho-syntactic abilities.

The statistical analyses were computed using SPSS 26 (IBM, 2019) for subgoal A to C and using R Statistical Software (v4.1.3; R Core Team, 2021) with additional packages 'haven', 'nnet', 'lme4' and 'car' for regression analyses concerning main goal D. Apart from the presentation of the quantitative vocabulary evaluation, raw scores and frequency values were used exclusively in order to

Table 2

Expressive vocabulary performance for individuals with DS (n = 28) on the standardized measure AWST-R: Overview of quantitative and qualitative findings including proportion of different error types.

Quantitative analyses					
	<i>n</i> verbs correct (max. 24)	Raw points (max. 75)	T-value for mental age		
Mean	16.50	49.71	52.06		
<i>SD</i>	5.04	13.44	15.09		
Range	4-23	12-64	22-75		
Qualitative analyses					
Proportions of error types	[a] Nonverbal/ other reactions	[b] Taxonomic errors	[c] Thematic errors	[d] Rule-based errors	[e] Non-categorizable errors
Mean	0.07	0.21	0.68	0.02	0.02
<i>SD</i>	0.12	0.17	0.24	0.00	0.06
Range	0.00-0.38	0.00-0.63	0.00-1.00	0.00-0.13	0.00-0.29

Note: Normative data for AWST-R is given for individuals aged 3;0-5;5 years. According to their computed mental age, t-values can be calculated for n = 17 participants with DS. Proportion of error types was computed following the AWST-R manual

prevent distortions caused by norms not intended for this target group.

3. Results

3.1. Vocabulary analyses

The analyses of the participants' lexical abilities presented below serve to classify them with respect to subgoal A. Table 2 displays the findings from verb analyses using the standardized German vocabulary measure AWST-R including the proportion of various error types (see examples in Section 2.3). The highest proportion of errors across the group were thematic errors, whereas rule-based errors hardly occurred. As shown in the examples in the method section, thematic errors often slightly change the semantic meaning of an utterance but do not prevent a successful transport of narrative content. A quantitative analysis of the individuals' performance on the vocabulary task revealed advanced vocabulary skills (mean t -value: 52.06, range 22–75) in a substantial number of individuals with Down syndrome. On average, two thirds of verbs (16.50/24) were produced correctly according to the standardized measure.

Table 3 shows relevant enumerations of verbs and conjunctions in the narrations – given for types (number of different verbs, number of different subordinating conjunctions) and tokens (number of verbs and number of subordinating conjunctions) – as a link between vocabulary skills and morpho-syntactic development. Concerning the number of words, a high heterogeneity can be noted (range for verbs: 5–122, range for conjunctions: 0–16). The number of different subordinating conjunctions remains low across the group (mean 1.82, range 0–5). The type-token-ratio for the verbs is below 50 % (0.41), indicating that a high proportion of the verbs were used more than once. The lexical richness is lower for verbs than for conjunctions. Although conjunctions occur to a small extent overall, the mean type-token-ratio of the participants for this word type is somewhat higher (0.55).

3.2. Morpho-lexical context analyses

The production of finite verbs (including correct subject-verb-agreement) requires a link between verb production and morpho-syntactic abilities. To evaluate the occurrence of finite words in syntactic structures of differing complexity (morpho-syntactic performance, subgoal B), Table 4 shows an enumeration of different verb positions. In German, the production of subordinate clauses (verb in final position) and questions (verb in first position) is classified as a part of complex syntax. There are also some complex structures involving a verb in the second position, especially *wh*-questions. A high number of finite verbs in these complex syntactic contexts would indicate advanced morpho-syntactic skills. In contrast, the number of inflected verbs in sentence fragments (e.g., subject omitted) reveals the presence of morpho-syntactic impairments which often occur in individuals with Down syndrome. As displayed in Table 4, the number of finite verbs in verb final position was distinctly lower (mean 3.00, range 0–17) than the number of verbs in sentence fragments (mean 14.29, range 0–38), which indicates impaired morpho-syntax in several individuals with Down syndrome (see Neitzel and Penke, 2021 for further analyses). This finding is underlined by the results of another measure of morpho-syntactic skills in the narrative task: MLU. Please note that the high value of MLU (in words) of 7.00 (range 1.57–13.28) does not indicate advanced syntactic performance in the participants with Down syndrome but is a result of the distinct number of sentence duplications and other syntactic symptoms (e.g., '*Wir wissen noch nicht was sind die beiden was meint.*' / '*We do not know yet what the two are what means.*', Authors, 2021a, p. 8).

With regard to the participants' morpho-syntactic performance, the results of the standardized grammar test ESGRAF 4–8 are presented in Table 5. For the respective subtests or subscales test, both the raw scores in points and the proportion of correct answers (Mean, SD , range) are given. The range illustrates a great heterogeneity that is evident in the morpho-syntactic performance of the participants. In all subscales, the participants reach correctness percentages $M > 60$ % with comparable standard deviation, but on average they do not exceed the 90 % mark (acquisition criterion).

To detect possible differences in the production of subordinate clauses depending on the elicitation context (subgoal C), the occurrence of this structure was compared across the Frog story-narrations and the standardized morpho-syntax measure. While a Fisher exact test yielded no significant differences ($p = .222$), a cross table (as displayed in Table 6) could identify individuals who showed associations and dissociations between the two diagnostic contexts. The shaded cells indicate an association between the occurrence of subordinate clauses in both tasks ($n = 16$ individuals). The white cells display a dissociation between the two tasks. This dissociation appears in 11 individuals who produced subordinate clauses in the standardized elicitation task but did not produce the structure during their narrations.

Table 3

Enumeration of verbs and conjunctions as well as type-token-ratio (TTR) in narrations of individuals with DS ($n = 28$).

	n verbs (token)	n different verbs (types)	TTR for verbs	n subordinating conjunctions	n different subordinating conjunctions	TTR for conjunctions
Mean	69.07	28.25	0.41	3.32	1.82	0.55
SD	30.57	10.65	–	4.03	1.44	–
Range	5–122	4–48	–	0–16	0–5	–

Table 4

Morpho-lexical context analyses including number of finite verbs, finite/ inflected verbs in V2 (verb second position), VF (verb final position), V1 (verb first position) and sentence fragments as well as MLU (in words) for individuals with DS (n = 28).

	<i>n</i> finite verbs	<i>n</i> finite verbs in V2	<i>n</i> finite verbs in VF	<i>n</i> finite verbs in V1	<i>n</i> inflected verbs in sentence fragment	MLU (in words)
Mean	49.25	31.57	3.00	0.46	14.29	7.00
SD	23.95	19.28	3.89	0.74	7.93	2.94
Range	1-88	0-63	0-17	0-3	0-38	1.57-13.28

Table 5

Participant's performance (n = 28) in the standardized morpho-syntax measure ESGRAF 4–8.

Standardized morpho-syntax measure ESGRAF 4-8 raw scores (% correct)			
	Subtest 1: V2 (max. 45 p.)	Subtest 1: SVA (max. 42 p.)	Subtest 2: VF (max. 20 p.)
Mean	30.26 (0.79)	31.00 (0.74)	12.56 (0.63)
SD	12.37 (0.27)	10.41 (0.25)	5.48 (0.27)
Range	4-44 (0.60-0.97)	5-41 (0.12-0.98)	0-19 (0-0.95)

Note: V2: verb second position, SVA: subject-verb-agreement, VF: verb final position. Raw scores for subtest 2 (VF) of ESGRAF 4-8 are given for n = 27 participants

Table 6

Associations and dissociations in the production of subordinate clauses within the standardized morpho-syntax measure and the Frog story-narration (frequencies of occurrence) for individuals with Down syndrome (n = 28).

Production of subordinate clauses in narration	Production of subordinate clauses in standardized measure ESGRAF 4-8	
	No	Yes
No	2	11
Yes	0	14

Note: information concerning performance in the standardized measure is given for n = 27 participants regarding the production of subordinate clauses (subtest 2: verb final position)

3.3. Relations to narrative abilities

Several word types such as conjunctions as well as the occurrence of finite verbs serve as a link between lexical and morpho-syntactic skills. In a preliminary study of Neitzel and Penke (2022), partial correlation analyses revealed performance on the overall vocabulary measure AWST-R as decisive for narrative abilities (rated using the NSS total score) in individuals with Down syndrome. To allow a more detailed analysis of the influence of morpho-syntactic and lexical performance on the narration of the participants (main goal D), a multiple regression analysis was computed including both lexical and morpho-syntactic variables as possible key factors for narrative performance. Correlations between the predictor variables are displayed in the [supplementary material](#) (Table S2).

A QQ plot was used to check the normal distribution of the residuals. This was available. As a result, it was identified that the residuals scatter with a discernible pattern. Since this is an indication of heteroskedasticity, this was tested and proven using the Breusch-Pagan test ($p = .071$). Heteroscedasticity leads to a bias in the standard errors of the independent variables. In the following, the data was therefore first checked for multicollinearity, which was not present ($VIF < 10$ for all variables). To solve the problem of heteroskedasticity, robust standard errors were calculated using the estimation procedure HC3. The resulting model (overview in Table 7) provided a significant explanatory contribution ($0.05 > 9.605e - 07 = p\text{-value}$). The multiple R^2 is 0.7868, explaining almost 79 % of the variance of the dependent variable. Thus, the null hypothesis, that the independent variable has no influence on the dependent variable, can be rejected. The predictors number of correctly named verbs in the standardized procedure ($p = 0.049$) and the total number of different verbs in the Frog Story ($p = 0.025$) have a significant influence on the NSS score, which represents the

Table 7

Results of regression model (adjusted $R^2 = .787$) with coefficients B for 95 %-confidence interval (95 %-CI), the standard error, standardized regression coefficient Beta and p-values p .

	B (95 %-CI)	Std. Error	Beta	p
Constant	-3.55 [- 8.13, 1.04]	2.21		.123
<i>n</i> verbs correct in AWST-R	.422 [.001,.84]	0.20	0.360	.049 *
<i>n</i> different verbs in Frog story	.308 [.04,.57]	0.13	0.557	.025 *
<i>n</i> different conjunctions in Frog story	.377 [- .97, 1.72]	0.38	0.092	.665
<i>n</i> finite verbs in Frog story	-.021 [- .15,.11]	-0.02	-0.087	.568
MLU (in words)	.188 [- .70, 1.08]	0.43	0.093	.738

Note: *p-value is significant for $p < .05$.

dependent variable. To identify the predictor with the greatest influence, the standardized coefficients were considered in the final step. Of the two significant variables, the predictor number of different verbs in the Frog Story has the greatest influence, since the coefficient of 5.565e-01 is greater than that of number of correct verbs in the naming test with 3.601e-01.

4. Discussion

This study aimed to shed light on the importance of morpho-lexical skills for narrative abilities in the context of language impairments often described in individuals with Down syndrome. Lexical and morpho-syntactic performance were therefore evaluated with respect to their possible impact on narrative skills in 28 children and adolescents with Down syndrome. The findings of the investigation support the importance of vocabulary competencies for narrative outcomes and are of clinical relevance for therapeutic and educational support.

4.1. Morpho-lexical performance

In preparation for the search for factors holding significance for narrative abilities in individuals with Down syndrome, a deeper analysis of both lexical and morpho-syntactic skills was conducted using narrative transcripts in addition to the standardized language measures. T-values from a standardized naming procedure including nouns and verbs yielded mental age-appropriate performance across the group on average, whereas scores on a standardized expressive grammar measure displayed impaired performance by most individuals with Down syndrome. The mean percentages of correct items between 63 % and 79 % in the individual subtests show that subject verb agreement, verb second position, and verb final position in the subordinate clause have not yet been acquired by most participants (acquisition criterion 90 %). These findings of an impaired morpho-syntax going along with (mental) age-appropriate vocabulary skills are well in line with the literature: Different studies have characterized vocabulary skills as a relative strength in individuals with Down syndrome (e.g., Grieco et al., 2015; Vicari et al., 2000), whereas morpho-syntactic impairments have been widely described in the field (e.g., Abbeduto et al., 2007; Diez-Itza and Miranda, 2007; Wimmer et al., 2020; Witecy et al., 2023). Understanding this strengths and weaknesses profile of the present sample is important to allow conclusions to be drawn below about the impact of each on narrative performance.

Verbs were chosen as a key word type in the standardized measure because of their linking function between lexical and morpho-syntactic skills. The focus of the analyses for subgoal A was to address the occurrence of verbs and conjunctions in terms of number (tokens) and diversity (types) in the narratives of children and adolescents with Down syndrome and to relate them to the quantitative and qualitative results of a standardized vocabulary test. The results of the Frog Story for different verbs ($M=28.25$, range 4–48) and the number of different subordinating conjunctions per participant ($M=1.82$, range 0–5) are, however, difficult to interpret alone, as no comparison group was included in the present study. In addition, concrete comparison data from the literature are sparse, especially for conjunctions. The concrete numbers of different verbs are unfortunately not comparable with the data of the participants of Hesketh and Chapman (1998), because they differentiated into grammatical and lexical verbs, which was not done in the present study. In addition, the authors report the respective values for three subgroups of participants (assigned by MLU in morphemes), which is not congruently transferable to the present data. More informative in this context is the type-token ratio, which demonstrates the proportion of different verbs or conjunctions in the total number of verbs/conjunctions uttered. Accordingly, this value is a relational measure in which a higher value (closer to 1) indicates greater lexical richness, although a value of 1 is not the target. Some word reuse is natural in fluency, but this should be limited primarily to function words and single important content words. The mean type-token ratio for verbs in the present sample is 0.41 and the mean type-token ratio for conjunctions is 0.55. It is striking that the value for verbs is below 50 %, which indicates that at least half the lexicon used consists of repetitions. A type-token ratio for verbs is also available from the study by Hesketh and Chapman (1998). This averaged 0.59 – higher than that in the present study – although the participants were also adolescents (mean age between 14 and 15 years in the two studies) and the group showed a mean mental age at preschool level. Thus, it is possible that this difference is again a reflection of the high heterogeneity in participants with Down syndrome. However, since the range for the type-token-ratio is not reported in Hesketh and Chapman (1998), this cannot be specifically reconciled. Alternatively, it is possible that the presenting sample showed a weaker average lexical richness than the participants of (Hesketh and Chapman, 1998). Despite the differences, however, the values do not differ to such an extent that the interpretation of the data presented here would be called into question.

As a further look at the comparison between verbs and conjunctions in the present study shows, the type-token ratio for verbs is lower than that for conjunctions. Although there is a lack of literature on the production of conjunctions in individuals with Down syndrome, content words (here: verbs) are often described as strength compared to function words (conjunctions, even if they also carry lexical information) (Vicari et al., 2000; for German: Schaner-Wolles, 2000). Therefore, it might have been expected that the lexical richness of verbs would be higher than that of conjunctions. Finally, the interpretation of the data is also complicated by the overall low number of conjunctions uttered in the narrative samples. This may explain why the production of conjunctions in people with Down syndrome has been so little studied: they are difficult to elicit specifically and do not necessarily occur in clusters even in the spontaneous speech of unimpaired speakers. Therefore, the present data can only provide a first insight, but encourage further research and surveys with picture materials specifically designed to elicit conjunctions in participants. With regard to subgoal A, the most relevant question is whether any lexical weaknesses might limit the communication of narrative content. The performance of correctly and incorrectly named verbs in the standardized naming procedure was therefore examined qualitatively. While two thirds of verbs were produced correctly on average by the participants with Down syndrome, a number of error types was apparent for the incorrect items. Although an error rate of one third is non-negligible, most errors were thematic (e.g., naming of associations) or

taxonomic (e.g., naming of another verb from the same semantic field). These error types might limit narrative production less than other error types, e.g., a high proportion of “I don’t know”-utterances (‘nonverbal/ other reactions’). It seems likely that participants with a high proportion of thematic and taxonomic errors might still be able to convey a sufficient amount of narrative information to ensure the interlocutor’s orientation in the story. Nevertheless, a conclusion regarding the production of conjunctions is not possible here because the standardized vocabulary measure did not cover this word type. With regard to subgoal A, it can thus be concluded that lexical weaknesses can be identified and the verb richness of the participants could be limited, but that the nature of the failures may be less limiting to the successful communication of narrative content than might be expected. It is therefore necessary to examine how the interaction of vocabulary and morpho-syntactic skills succeeds in the participants.

The production of finite verbs represents an intersection between vocabulary (choice of verb) and grammar (inflection and word position in the sentence). A deeper analysis of finite verb productions (subgoal B) underlined morpho-syntactic deficits across the group with Down syndrome, since a high number of inflected verbs occurred in sentence fragments (e.g., with an omitted subject; $M=14.29$, range 0–38). Although MLU is often used as a morpho-syntactic measure in the literature, this finding of this study once again shows that MLU is prone to failure, e.g., in the context of sentence fragments or paragrammatical utterances (see [Neitzel and Penke, 2021](#), for a broader discussion). In contrast, the number of finite verbs in verb final position – indicating the production of a German subordinate clause – was lower ($M=3.00$, range 0–17), which is in line with the findings from the standardized morpho-syntax measure concerning verb final production in subordinate clauses ($M=0.63$ correct). While [Hesketh and Chapman \(1998\)](#) found no difference between syntactic complexity and structures used in the adolescents with Down syndrome and the control group (MLU-matched) they studied, the picture here contradicts this result. On the one hand, the MLU of the participants with Down syndrome in the present study is very high, which, however, is not due to high sentence complexity, but to multiple sentence entanglements and paragrammatic structures ([Neitzel and Penke, 2021](#)). On the other hand, the verb phrase in the subordinate clause, which is an important part of complex syntax in German, cannot be assessed as acquired on the basis of the percentage of correct items in the standardized measure. The agreement between the morpho-syntactic analysis and the standardized measure is distinctly informative in that. This finding leads over to subgoal C, which concerns alignment with standardized measures regarding morpho-syntax.

The results presented here have identified deficits in the production of complex structures in individuals with Down syndrome, which is according to the literature on morpho-syntactic skills in this clinical population. Nevertheless, the appearance of these structures, e.g., the production of subordinate clauses, might also depend on the diagnostic context. As standardised measures can be applied to individuals with Down syndrome – although no normative data are provided for this clinical group (see [Neitzel, 2021](#), for clinical notes) – clinicians can rely on their results when planning therapeutic interventions, and the results of standardized procedures are often used as valid benchmarks, including in the preliminary study for the present comprehensive analysis. Subgoal C aimed at critically questioning the correspondence between a standardized measure and the narratively expressed structures. Importantly, the current study reveals distinct differences regarding the production of subordinate clauses in a standardized elicitation measure (25/27 participants produce subordinate clauses) and the narration task (14/27 participants produce subordinate clauses). This finding implies a highly expedient elicitation in the standardized task but little informative value of this performance for spontaneous speech competencies and questions the use of elicitation measures in research regarding individuals with Down syndrome, since the syntactic complexity displayed in such tests is not necessarily representative of spontaneous speech. Additionally, this might be of critical clinical relevance for therapists or educators working with children with Down syndrome: If complex syntax is not yet produced by a client in spontaneous speech or a narrative task but can be elicited in a standardized task, speech and language therapists might use this knowledge as a starting point for transfer exercises.

4.2. Impact on narrative abilities

The current study aimed to verify or refute the findings of a preliminary investigation by [Neitzel and Penke \(2022\)](#), which yielded performance on an overall vocabulary measure as a significant factor for narrative performance in individuals with Down syndrome. Although this finding is of clinical relevance, an overall vocabulary measure does not allow enough differentiation between the varied lexical abilities involved in a narrative task. The main goal of this study (main goal D) is to address whether vocabulary performance indeed has a major influence on narrative outcome or whether variables at the interface of vocabulary and morpho-syntax are more important. Given the distinct morpho-syntactic difficulties in individuals with Down syndrome, the current study specifically addresses verbs and conjunctions because these word types build a bridge between lexical and morpho-syntactic development. While a bare count of the verbs and conjunctions in a narration does not provide information about the participants’ vocabulary skill (tokens; duplications of words are not considered in this context), the number of different verbs and conjunctions (types) seems more informative as a possible factor. The performance on the overall vocabulary measure included by [Neitzel and Penke \(2022\)](#) involved both nouns and verbs but nouns are of limited significance for a relation between lexical and morpho-syntactic skills. For this reason, the number of verbs correct on a standardized vocabulary measure was chosen as a more specific (but standardized) variable in the current study. Choosing one additional variable that functions as a link between vocabulary and morpho-syntax (the number of finite verbs in the narrative tasks) and one measure which is more associated with morpho-syntax (MLU), five variables in total were included in a multiple regression analysis as possible key factors for narrative performance in individuals with Down syndrome. This analysis yielded the number of different verbs in the narrative task as the only significant factor for narrative performance (as measured by the NSS) within the current study ($p = .025$). That said, the number of verbs correct on the standardized vocabulary measure was also another main predictor in the present regression ($p = .049$). Given the results of the analyses from subgoal C regarding the dissociation between spontaneous speech and (standardized) test performance in the area of morpho-syntax in the participants with Down syndrome, it can be said, however, that this association of the two verb measures is not self-evident. The results thus also indicate a better

generalizability of standardized diagnostic results in the area of vocabulary than for the area of grammar in participants with Down syndrome. Furthermore, this finding underlines the importance of lexical skills for narrative performance in individuals with Down syndrome. Given the high importance of vocabulary skills for conveying narrative content, e.g., by naming the characters and describing the plot, a differentiated lexicon might compensate for at least some morpho-syntactic deficits in individuals with Down syndrome. Consequently, this finding is of clinical relevance and supports the importance of vocabulary work in therapeutic and educational contexts. Speech and language therapists should attach importance to supporting the differentiation of the verbal lexicon in their work with individuals with Down syndrome, since narrative abilities are highly relevant for everyday social participation. Furthermore, clinicians are often limited in the time available to them for evaluating spontaneous speech samples and could therefore use the children's verbal performance (number of verbs correct) on a standardized vocabulary measure as an orienting indicator for lexical skills with narrative relevance for individuals with Down syndrome.

The results of the current study point to a high importance of verb production and a small(er) influence of morpho-syntactic deficits on narrative performance in individuals with Down syndrome. These findings are well in line with previous investigations, which found significant impacts of vocabulary skills on narrative abilities in children with typical language development (Korecky-Kröll et al., 2019; Lengning et al., 2012). Nevertheless, findings from a study by Channell et al. (2015) point to a connection between a smaller number of verbs produced and narrative deficits in individuals with Down syndrome. Similarly, the older study by Hesketh and Chapman (1998) identified a smaller number of lexical and grammatical verbs in English speaking individuals with Down syndrome in comparison to a group of typically developing children matched on MLU. In contrast to these outcomes regarding vocabulary skill, morpho-syntactic deficits seem to be of limited relevance for narrative performance in individuals with Down syndrome. Please note that this conclusion is based on a limited sample size and the finding contradicts suggestions from the literature that syntactic impairments might limit participants with Down syndrome in their narrative realization (Martzoukou et al., 2020; Segal & Pesco, 2015). However, a simple but expedient syntax might be sufficient – in combination with a varied and context-adequate vocabulary – for individuals with Down syndrome to convey narrative content.

4.3. Clinical implications

The results of the present study indicate a clear relationship between linguistic performance and narrative skills in children and adolescents with Down syndrome. The relationship between semantic-lexical and narrative skills, which has been discussed in different studies, was analysed in depth and demonstrated once more. Still open and of high clinical relevance, however, is the question whether the improvement of these language-systematic areas, e.g. vocabulary performance, can also positively influence narrative ability. Intervention studies involving people with Down syndrome are urgently needed to explore this relationship in detail. Nevertheless, with the knowledge of the relation of the corresponding language areas (especially vocabulary and narration), it is already recommended to include narrative exercises in speech therapy and to support the transfer of already acquired language structures on a narrative level (therapy suggestions for German in Neitzel, 2022; Neitzel, 2021).

The present study underlines the high relevance of verbs for the production of narratives. In different therapy concepts, for example in the approach for developmental language disorders by Siegmüller and Kauschke (2013), which is widely used by speech-language pathologists in German-speaking countries, the expansion of verb vocabulary plays a central role. On the one hand, a high information value can be conveyed through the use of specific verbs, on the other hand, verbs – especially in German – also determine the syntactic structure with their valence (e.g. "sehen"/ 'see' requires two elements: subject and acc-object, while "schenken"/ 'gift' additionally requires a dat-object). Since vocabulary work is a central field of therapeutical and educational support in individuals with Down syndrome and these individuals often show expressive semantic-lexical impairments (Næss et al., 2011), the relevance of an intervention is supported by the present results. Due to the complex contexts that are usually expressed in narratives, as well as the partially abstract content of individual verbs, the word material in therapy should be chosen appropriately low-level and hierarchically increasing to ensure the participants' comprehension.

The narrative ability represents an important area of competence in the context of participation orientation, especially for children and adolescents. Due to the described impairments that may exist in the concerning narrative abilities in individuals with Down syndrome, it is highly recommended to consider the narrative level in therapy planning for adolescents with Down syndrome.

4.4. Limitations

Although the findings of the current study shed light on the importance of lexical skills for narrative performance in individuals with Down syndrome, this investigation underlies some limitations. First of all, the use of a particular narrative material always implies thematic and methodological limitations. These restrict the free narrative situation and can be more or less suitable for different participants in different ways due to previous experience or habits. In the case of the Frog Story, there is a danger of overstraining individual participants, especially for participants with Down syndrome, because the story is very extensive with 24 pictures. Even if none of the participants asked to stop the task or similar, this length could have been a challenge, especially for participants with distinct narrative or language impairments. With regard to the execution of the test, it must be pointed out that the tasks were carried out in the same order for all participants. Therefore, possible sequence effects cannot be ruled out completely. It would be better to randomize or counterbalance the tasks in future studies.

Another limitation is that although conjunctions were prioritized as a possible interface variable between vocabulary and grammar in the present study, there is very little available evidence on this in the literature regarding individuals with Down syndrome. Concerning the production of conjunctions, the findings from the narrative analysis cannot be compared to the results from a

standardized vocabulary task since the AWST-R only includes nouns and verbs. Given that the individuals with Down syndrome are the only clinical population in this study, the enumerations of word types and finite verbs in different positions can only be compared with each other but not between different clinical groups. To supplement the findings provided here, data of participants from other clinical populations (e.g., developmental language disorder, ASD or Williams syndrome) or children with typical development (see Neitzel and Penke, 2022; Meier and Neitzel, 2023) should be collected.

Methodically, narrative performance was measured using only the NSS in this study. Although this instrument is widely used in international narrative research including different clinical groups (for Down syndrome: Finestack et al., 2012), the subcategories of the NSS address macrostructural rather than microstructural abilities (five vs. two categories). The narrative abilities of individuals with Down syndrome were evaluated by two independent raters in the current investigation and for all scores a consensus of both raters was shown, yet the NSS scores are awarded not fully objective. The reason for this is that the scoring recommendations for the NSS by Heilmann et al. (2010) only provide examples for orienting scores of one (immature narrative ability), three (developing) and five (mature) points. The intermediate scores of two and four points are therefore not clearly defined, but have been supplemented and successfully evaluated (Meier and Neitzel, 2023) in the German translation (Neitzel and Meier, 2024). The inclusion of further narrative measures such as an additional narrative task (e.g., MAIN, (Gagarina et al., 2019)) or additional narrative evaluations (e.g., number of propositions) would be desirable in future investigations. With regard to the narrative task, it should be noted that both the MLU as a factor variable and the NSS total score as a dependent variable were both calculated using the Frog story narratives. This represents a methodological limitation and should be avoided by analyzing at least one additional (narrative) task.

Finally, it must be pointed out that at the age of the participants studied, written language resources also exist in some persons with Down syndrome. It would have been desirable at this point to include knowledge about the literacy skills of the participants studied and to enable the inclusion of written language, if necessary, even as a narrative resource. This could be a relevant factor because of the close connection between grammatical development and literacy skills. Future research might fill this gap in the current investigation.

5. Conclusion and future research

The findings of the current study support a key role of the verbal lexicon in the narrative performance of individuals with Down syndrome, which has already been described in the literature for typically developing children (Korecky-Kröll et al., 2019; Lengning et al., 2012). Individuals with Down syndrome might need to rely on a differentiated verbal lexicon to balance existing morpho-syntactic deficits in a narration task. Although lexical and morpho-syntactic skills are difficult to distinguish in individuals with Down syndrome (Martzoukou et al., 2020), no variables related to morpho-syntax could be identified as decisive for narrative performance in this population. This represents an interesting single result, but does not imply with certainty that morpho-syntax is of little or no importance for narration in individuals with Down syndrome due to the difficult differentiation described. Simultaneously, it remains unclear whether an improvement of verb production, in this case defined as an increased number of different verbs, would also improve narrative outcomes in individuals with Down syndrome. To address this research gap, further work should especially include intervention studies. Given the importance of narrative for children and young people's everyday social participation as part of our society, and given the language difficulties that are particularly present in people with Down syndrome, narrative and related language skills should be supported by therapeutic and educational aids.

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CRediT authorship contribution statement

Isabel Neitzel: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

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

Data availability

The full transcripts are available on the CHILDES database following this link: <https://childes.talkbank.org/access/Frogs/German-Neitzel.html>.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ridd.2024.104781](https://doi.org/10.1016/j.ridd.2024.104781).

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