

The effect of picture support on narrative retells in Swedish adolescents with ADHD

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ABSTRACT

ADHD is characterized by executive functioning (EF) deficits, which in turn may affect language, and therefore EF demands in language assessment tasks are important to consider. This study aims to inform clinical practice by 1) comparing and describing narrative retells in Swedish adolescents with and without ADHD, and 2) investigating the effects of picture support on narration in the two groups. Fifteen adolescents with ADHD and 31 with typical development (TD) participated. Two carefully matched narratives for retelling, one with and one without picture support were administered, transcribed, and analyzed regarding content and linguistic complexity (macro- and microlevel measures). The results showed that the ADHD group included less content than the TD group in both tasks, measured in fewer story grammar units and details. Both groups included more story grammar units in the task without picture support. The TD group had shorter retells with higher syntactic complexity in the task with picture support compared to the task without picture support. Compared to TD peers, retells without picture support from the ADHD group were significantly shorter and had a higher proportion of grammatical errors. These results show different strengths and weaknesses in the two groups and indicate that the narrative task without picture support, which places higher demands on EF, captured a linguistic vulnerability in the ADHD group. In conclusion, the choice of narrative task is important to consider in clinical practice to enable accurate descriptions of linguistic strengths and weaknesses in individuals with ADHD, and aid in differential diagnosis.

ARTICLE HISTORY

Received 16 June 2020
Revised 14 September 2020
Accepted 14 September 2020

KEYWORDS

ADHD; language; narrative; executive functioning; adolescents

Background

Attention deficit hyperactivity disorder (ADHD) is a common neuropsychiatric disorder in school-age children with an estimated prevalence of about 5–7% (Willcutt, 2012). Core symptoms include difficulties with attention, hyperactivity and impulsiveness (American Psychiatric Association [APA], 2013). It has been suggested that these symptoms follow a primary deficit in executive functioning, which refers to a set of cognitive processes including attentional control, inhibition, cognitive flexibility, working memory, and the ability to initiate and organize activities in an appropriate way (Green et al., 2014; Willcutt et al., 2005). Deficits in executive functioning may affect an individual's social and academic life (Green et al., 2014; Sciberras et al., 2014). Individuals with ADHD experience more

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academic difficulties than peers in middle school (Molina et al., 2009), and students with ADHD display lower grade point averages, are placed in more remedial classes and are more likely to fail classes in high school (Kent et al., 2011). Some of the difficulties to succeed academically could possibly be explained by deficits in executive functioning that in turn affect language, e.g., the ability to structure narratives and discourse, which is an important skill in many school subjects. For clinical speech-language pathologists the assessment of discourse skills is therefore a necessary part of language, reading and writing assessments in students with confirmed or suspected ADHD. There is a lack of standardized Swedish narrative tasks suitable for adolescents however, and no research has been published investigating how Swedish adolescents with ADHD perform in narrative tasks compared to peers with typical development (TD). This study aims to begin to fill these gaps.

Narrative ability can be affected by ADHD in several ways. Previous research has showed that children with ADHD have pragmatic difficulties which are often assumed to be a consequence of executive functioning deficits (Green et al., 2014); i.e. poor turn-taking, excessive talking, interruptions of others, and/or inadequate response to questions or instructions, which in turn can affect narrative performance. Planning, organizing and structuring a narrative in a coherent and cohesive way are also assumed to depend on executive functioning (Green et al., 2014; Kuijper et al., 2017; Purvis & Tannock, 1997).

Many narrative studies including children and adolescents with ADHD have focused on macrostructural measures (Lorch et al., 2010; Luo & Timler, 2008; Papaeliou et al., 2015; Tannock et al., 1993), including the overarching structural organization of story content, and sometimes also other aspects of story content (see e.g., Manolitsi & Botting, 2011). The overall structure of narrative content is often described in terms of Story grammar (Stein & Glenn, 1979) which outlines the main elements of a well-formed story, and includes sequential and causal relationships within stories (Fichman et al., 2017; Trabasso & Sperry, 1985). Story grammar consists of the general introduction (the setting) and the episode which includes initiating event, the character's internal response to this event, the character's plan, an attempt to solve the problem, the consequence produced by the attempt, and the character's reaction to the consequence (Hughes et al., 1997; Stein & Glenn, 1979). In a longitudinal study, Lorch et al. (2010) found that children with ADHD (4–6 or 7–9 years old) recalled fewer story events and showed less sensitivity to the thematic importance when viewing and retelling televised stories than a comparison group. When the procedure was repeated 21 months later with new stories, the comparison group showed an improvement, which was not seen in the retells from children with ADHD. In a story retell task without picture support, Papaeliou et al. (2015) showed that children with ADHD (mean age = 8.5) recalled less information and were less sensitive to the importance of the information they recalled compared to a control group. Several other studies including macrostructural measures have found that children with ADHD include less information (Tannock et al., 1993), fail to represent goals or other main aspects in their narratives (Renz et al., 2003; Rumpf et al., 2012), and have poorly organized narratives (Green et al., 2014; Kuijper et al., 2017; Rausch et al., 2017; Rumpf et al., 2012; Tannock et al., 1993). On the contrary, Luo and Timler (2008) found no group differences regarding overall narrative organization between children with ADHD and a control group (8–12 years old) on a single picture description task and a picture sequence task. They did find poorer content in the single picture description task in a group of children with ADHD and comorbid developmental language disorder (DLD) compared to

a control group, however, and the authors stressed the importance of identifying comorbid DLD and describing how different tasks place different demands on executive functioning.

More recent studies have emphasized the need to include microstructural measures (e.g., measures related to story length, syntax and semantics) when analyzing narratives from children with ADHD (Kuijper et al., 2017). Rumpf et al. (2012) found that children with ADHD (8–12 years old) produced shorter narratives in a wordless picture book task than a comparison group but found no group differences regarding syntactic complexity. In contrast, Kuijper et al. (2017) found reduced syntactic complexity and a larger number of morphosyntactic errors in an ADHD group compared to a control group (6–12 years old) in a wordless picture book task. Similarly, Miranda et al. (2013) found that young adults with ADHD (18–24 years old) showed lower syntactic complexity compared to a control group in a writing task, and discussed that deficits in executive functioning could be an explanation since attention, working memory and planning skills are required to produce long and complex sentences.

One way to relate narrative performance to executive functioning is provided by the dual coding theory (Sadoski et al., 2012). In order to retell a story, a listener needs to create mental representations to understand, remember, and connect details in a story. According to the dual coding theory, language skills help create these mental representations (while listening), and the mental representations, in turn, support and enable language (for retelling). Since ADHD involves underlying difficulties with sustained attention, memory, and planning, individuals with ADHD might not be able to create these representations as effectively as peers and this might, in turn, affect their ability to retell negatively as shown in both macro- and micro-structural measures.

Finally, Rausch et al. (2017) found that improved attention and concentration following medication had a positive effect on macrostructural but not microstructural narrative measures in children with ADHD and comorbid DLD (7–13 years old). They found no effects on story length, lexical diversity, and syntactic complexity. This might indicate that macrostructural deficits are more related to executive functioning skills, and microstructural measures more related to linguistic skills. More research is needed, however.

Type of eliciting task is important to consider and can in part explain the varying results presented above. To the authors' knowledge, the effects of picture support on retells have not previously been investigated in children or adolescents with ADHD. A few international studies have compared the effect of picture support on narratives including other groups of children. Masterson and Kamhi (1992) found that TD children (6–9 years old) included more descriptive information in an expository task without picture support, but more complex syntax in retells with picture support. Similar findings from children with DLD were reported by Schneider (1996): they included more story grammar units in retells without picture support compared to narration to a picture sequence. Westerveld and Heilmann (2012) found a somewhat different result, where TD children (6–8 years old) produced longer retells with picture support compared without picture support, and there were no differences regarding sentence length between the two tasks. Finally, Colozzo et al. (2011) found that school-age children with DLD (7–10 years old) increased their grammatical errors in a single picture task compared to a sequential picture task.

Some authors mentioned above have discussed the task effects in terms of different demands on executive functioning and divided attention, even though they have not included participants with ADHD (Colozzo et al., 2011; Schneider, 1996). Schneider (1996) argued that their results could be a consequence of the divided attention between

the pictures and the retell: the pictures may interfere with the planning and organizing of the story. Colozzo et al. (2011) suggested that the higher demands on executive functioning and planning in the single picture task compared to the picture sequence task affected the children's grammatical production.

To summarize, deficits in executive functioning are suggested to affect not only pragmatic ability but also macro- and microstructural aspects of narration. Previous narrative research indicates that eliciting and analyzing oral narratives may be a suitable way to capture difficulties with both executive functioning and linguistic skills in clinical practice. Previous research also shows that type of narrative task is important to consider when interpreting narrative results, and for individuals with ADHD the demands placed on executive functioning are particularly important to take into account.

Aims

The aims of the present study are to 1) compare and describe narrative retells in Swedish adolescents with and without ADHD in terms of both micro- and macro-structural measures (the latter also including story content), and 2) investigate the effects of picture support on narration in two carefully matched retelling tasks, one with and one without picture support.

The study was guided by the following research questions:

For macrostructural measures

- (1) Are there differences in number of included story grammar units and the amount of information included in the retells in adolescents with ADHD and age-matched peers with typical development (TD) in the two retelling tasks?
- (2) Will the presence or lack of picture support affect the macrostructural measures, and are these effects the same across the two groups?

For microstructural measures

- (1) Are there differences in total number of words, grammatical errors and syntactic complexity in adolescents with ADHD and age-matched peers with typical development (TD) in the two retelling tasks?
- (2) Will the presence or lack of picture support affect the retells regarding the microstructural measures, and are these effects the same across the two groups?

Methods

This study is part of the project EXPLORE-SA: Expository language and oral retelling in Swedish Adolescents (PI: AE. Hallin), which is approved by the Stockholm Regional Ethical Review Board (#2017/49-31/4). Before participation, oral consent was obtained from each adolescent, and their legal guardians signed a written informed consent.

Participants

Forty-six participants were recruited for this study: 31 with typical development (TD) and 15 with Attention-Deficit Hyperactivity Disorder (ADHD). The participants in the TD

group (21 girls and 10 boys) attended Swedish grades 6–9 (ages 11;8 to 15;6) and were recruited from mainstream middle-class schools in the greater Stockholm area. During recruitment, one researcher gave a brief (5-minute) presentation of the project in the classroom and handed out invitation letters/flyers. Interested students signed up on a web-page online or texted the researcher for more information, who then sent a written consent and the parental questionnaires via e-mail. According to the parental questionnaire no participants had a history of special education support, reading and writing difficulties, or neurodevelopmental difficulties. They were all native speakers of Swedish, i.e., they had been exposed to Swedish from birth, were born in Sweden and had at least one Swedish-speaking parent. Two participants were exposed to one additional language at home (simultaneous bilinguals), but both reported Swedish as their strongest language. All participants reported normal hearing (hearing is routinely checked in Swedish schools).

The participants in the ADHD group (8 girls and 7 boys) attended Swedish grades 6–9 (ages: 11;6 to 16;1). One participant with ADHD had repeated one school year, another two school years. The participants were recruited from speech and language clinics and schools in Stockholm area and through a clinical center specializing in ADHD. Invitation letters/flyers were handed out after a brief presentation of the project in classrooms, ADHD parent groups and meetings with speech-language pathologists. They had all received an ADHD diagnosis following an evaluation by a team of specialists in the area of neurodevelopmental disorders. The team, which included an SLP, had excluded any additional diagnoses of autism spectrum disorder, intellectual disability ($IQ < 70$), and developmental language disorder (DLD). Two participants had an additional diagnosis of developmental dyslexia but since dyslexia affects written but not oral language (and DLD was excluded), these participants were included in the final sample. According to parental background questionnaires, all had reported normal hearing and were native speakers of Swedish (see definition above). Seven participants were simultaneous bilinguals and exposed to an additional language at home, and all reported Swedish as their strongest language, except one participant, who reported that both languages were equally strong. Two of the participants were medicating for ADHD.

To enable a comparison between groups on selected standardized measures of language and working memory, all participants were given TROG-2 (Test for Reception of Grammar 2, Swedish version; Holmberg & Lundälv, 2002), Recalling sentences, and Digit repetition from CELF-4 (Semel et al., 2003, Swedish version; Miniscalco & Frylmark, 2013). TROG-2 was administered and scored during the session, and the subtests from CELF-4 were recorded during administration for later scoring. Since the Swedish version of CELF-4 does not have norms for children above 12:11, raw scores are reported for these tests. For the two participants with dyslexia their results on the standardized tasks were obtained from their records with consent from the guardians (the assessments were done within a year from participating in the study).

Results from independent two-tailed t-tests showed significant group differences on TROG-2 and on CELF-4 Recalling sentences. In the TD group, all participants except one scored within 1 SD from the mean on TROG-2. In the ADHD group, five participants scored 1 SD below the mean or lower on TROG-2 of which two were exposed to an additional language at home. On the CELF-4 Digit repetition task, group differences were not significant, see [Table 1](#).

Table 1. Descriptive data for the participants included in the study.

Measure	ADHD (N = 15)		TD (N = 31)		*Group diff.
	Mean (SD)	Range	Mean (SD)	Range	
Age (months)	163.87 (15.91)	140–194	164.90 (14.42)	142–188	$p = .833$
Guardians' average education in years after compulsory school (ADHD $n = 14$, TD $n = 28$)	4.32 (1.91)	1–7	4.98 (1.61)	2–8	$p = .244$
TROG 2, Swedish version (percentile)	29.07 (20.64)	6–73	46.97 (19.62)	12–82	$p = .009$
CELF-4 Recalling sentences (raw score, max 54)	34.79 (6.44)	24–45	42.45 (7.31)	25–51	$p = .001$
CELF-4 Digit repetition (raw score, max 30)	12.41 (1.98)	9–17	13.39 (2.42)	10–19	$p = .188$
SDQ; Total scale (raw score, max 40) (ADHD $n = 11$, TD $n = 17$)	13.73 (3.26)	10–21	6.29 (4.47)	1–15	$p < .001$
SDQ; Hyperactivity/Inattention scale (raw score, max 10) (ADHD $n = 11$, TD $n = 17$)	6.91 (1.22)	5–8	2.88 (2.06)	0–7	$p < .001$

* Groups compared with an independent, two-tailed t-test (equal variances not assumed). Bolded p -values indicate significant group differences.

To obtain an estimation of group differences regarding core symptoms in ADHD and deficits with executive functioning, the Strength and Difficulties Questionnaire (SDQ; Goodman, 1997) was included. SDQ is a screening instrument used to identify mental health and hyperactivity/inattention in children and adolescents. The SDQ consists of 25 items pertaining to social, emotional, and behavioral functioning of children and adolescents across five subscales: Conduct problems, Inattention-Hyperactivity, Emotional symptoms, Peer problems, and Prosocial behavior. In this study, The Total scale (total sum of all scales except Prosocial behavior) and the Inattention-Hyperactivity subscale were used to compare the groups, where low numbers indicate a relative strength. Results from an independent two-tailed t-test showed significant differences between the ADHD group ($n = 11$) and TD group ($n = 17$) on the Total scale and Hyperactivity/Inattention scale, see Table 1.

As an estimate of socio-economic status, the guardians' mean number of years of education after Swedish compulsory school (grades 0–9) was calculated, see Table 1. A comparison between the groups with an independent two-tailed t-test showed no significant differences between the ADHD group and the TD group.

Narrative tasks

The two retelling tasks were constructed for the larger research project and consisted of two different recorded stories, one always presented with and one always presented without picture support. Each story was about an everyday event with an equal number of named characters. The task with picture support was about a girl getting ready to have her picture taken in school in the morning, when her brother spills milk on her favorite jeans and her dad disappoints her. The task without picture support was about a girl meeting a friend in a mall, but running out of cellphone battery and trying to hide from her upset mom. The intention was that both stories would be relatable for adolescents living in Sweden regardless of age and cultural background. The stories were constructed to be engaging but complex enough also for typical speakers in this age group, and were carefully matched

on both micro- and macrostructural aspects: number of words (487), speaking pace (length of each recording: 4 minutes), mean length of C-unit (11.88), average number of clauses per C-unit (SI: 1.66/1.68) number and frequency of terms related to emotions (9), number of episodes (3), story grammar units (21), and number of details (76). The following story grammar units were included and scored in each episode 1) Setting 2) Initiating event, 3) Plan, 4) Action, 5) Problem, 6) Plan again and 7) Action/Landing. To get one point only actions (not reactions) need to be mentioned in the retell.

Episode overview for the story with picture support (episode 1/3). To get one Story Grammar point at least one underlined phrase (or a synonymous phrase) had to be included.

Setting:	A winter <u>morning</u> , in a messy <u>room</u> .
Initiating event:	A <u>mobile phone</u> is <u>ringing</u> , Sara <u>wakes up</u> .
Plan:	<u>Decides</u> to put on her <u>jeans</u> and the <u>blue sweater</u> .
Action:	<u>Starts to look</u> for her clothes.
Problem:	<u>Can't find her jeans</u> .
Plan again:	Decides <u>to look</u> for her jeans <u>under the bed</u> .
Action/Landing:	<u>Finds her jeans!</u>

Each story had 76 “details” which were defined as the information-carrying nouns, verbs, adjectives, and adverbs, e.g., ‘It was a **dark morning** in a **messy room**’ was scored with four points, and ‘**Sara woke up**’ and ‘**Sara went up**’ was scored equally with two points each.

For the task with picture support, one picture sequence of three pictures was constructed for each episode. The pictures showed the central characters and content of the story, and there was a total of nine pictures. The stories were recorded by a female speech language pathologist in a studio with the software Phog (2.500.1003; Neovius Data and Signal System AB, Lidingö, Sweden) onto a recorder at a sampling rate of 16500 Hz, normalized to 65 dB.

Procedure

All participants met once individually with an examiner who was either a certified speech language pathologist or a trained speech language pathology student. All examiners followed the same written instructions for the sessions and tasks with instructions on preparations, prompts, and feedback both before and during the tasks. The session lasted for 60–80 minutes and took place in a quiet room at the participant’s school, home, or in the clinician’s office. After a consent procedure and a brief introduction, the tasks were given in the following order 1) Retelling task with picture support, 2) Standardized language tasks (including two brief tasks not analyzed in the current study) 3) Retelling task without picture support. The last 10–15 minutes of the session contained an oral expository task, not analyzed in this study. Thus, the tasks analyzed in this study took between 45 and 70 minutes, including any breaks that the participant needed. The two retelling tasks (with/without picture support) were always presented in the order mentioned above.

The retelling tasks were presented in Microsoft Power Point© on a laptop computer with headphones. Before starting the presentation for the task with picture support, the participants were instructed that they would 1) choose one of three stories by clicking on a number

on the screen (without showing the experimenter which one), 2) independently look at the pictures to become familiar with the story 3) then listen to the story while looking at the same picture sequences again, and finally, 4) to retell the story while looking at the picture sequences a third time, with as much details as possible but with their own words. For the task without picture support the same procedure was followed but omitting step 2 and the screen was blank throughout. Unknown to the participant, there was only one story in each retelling task, but the purpose of making the participant choose between three stories was to make the experimenter a naïve listener, and thus encourage the participant to include as much as possible of the story (see also Fey et al., 2004, for a similar procedure). After the oral instructions, the experimenter moved away from the screen, and the participant used the mouse to move to the next step, short written instructions/reminders were presented on the screen. The retells were recorded with a portable digital recorder (Tascam DR-07MK2).

Transcription and analyses

The recordings were orthographically transcribed, segmented into C-units (a main clause with all joined subordinate clauses) and coded for microstructural measures according to the SALT manual (Miller et al., 2011) by the two authors, and coded for macrostructural measures (including content) by the first author. The macrostructural measures were 1) total number of included story grammar units with a maximum score of 21 for each story (i.e., a maximum score of 7 for each episode out of three) and 2) total number of included details with a maximum score of 76 details per story. The total number of story grammar units included was interpreted as the participant's overall ability to structure and retell the central parts of a story, while the total number of included details was interpreted as amount of content or information retold. The coding manuals for the macrostructural measures were developed by the first author.

The microstructural measures were 1) Total number of words, 2) Percent C-units with grammatical errors (omissions, overgeneralization errors, word-level errors, extraneous words, and utterance-level errors), 3) Subordination Index (the proportion of complete clauses per C-unit), and 4) Mean length of C-unit (MLCU). These variables were calculated automatically from the coded transcripts in the SALT software.

The second author re-transcribed and re-coded approximately 10% of the recordings (two retells from each of four randomly selected participants) on all macro- and micro-structural measures. Agreement between the first author and the second author was calculated as mean percentage of agreement across each variable for each participant and task, and those percentages were then averaged. A value of 0.70 or above was used to judge adequacy of agreement (Bowers & Courtright, 1984), and all variables reached above this threshold both by participant and when averaging participants, see [Table 2](#).

Results

All statistical analyses were made using the SPSS 24 statistical package. Two-way repeated measures ANOVAs were conducted to compare the effect of group and picture support on micro- and macrostructural measures. Before analyses, assumptions for ANOVA were controlled, and when necessary appropriate nonparametric tests were used instead. All results for both groups and conditions are presented in [Table 3](#).

Table 2. Interrater reliability for four participants. W = task with picture support, and WO = task without picture support.

Measure	Task	Mean % agreement
Story grammar	W	93% 94%
	WO	
Number of details	W	95%
	WO	97%
	W	98%
	WO	98%
% C-units w. errors	W	81%
	WO	81%
Subordination index (SI)	W	98%
	WO	98%
Mean length of C-unit (MLCU)	W	97%
	WO	97%

Table 3. Descriptive data and summary of significant effects for the task with picture support (W) and without picture support (WO) for the macro- and microlevel measures for the two groups.

Measure	Task	ADHD (N = 15)			TD (N = 31)			Sign. Effects?
		M (SD)	Mdn	Range	M (SD)	Mdn	Range	
Story grammar units (max 21)	W	14.2 (3.0)	15	9–18	15.3 (2.1)	15	11–20	ADHD < TD
	WO	15.0 (4.1)	16	4–21	17.5 (1.9)	18	14–21	W < WO
Number of details (max 76)	W	36.2 (8.4)	39	21–48	40.3 (6.9)	41	24–53	ADHD < TD
	WO	33.1 (10.8)	34	8–48	41.3 (7.2)	40	29–57	
	W	261.3 (76.9)	285	99–374	292.2 (68.0)^a	286	173–502	ADHD < TD
	WO	244.3 (81.0)^a	254	75–359	310.7 (65.2)^b	311	209–510	+interaction
% C-units w. errors	W	18.1 (13.4)	14.6	0–41.2	13.0 (10.5)	10.7	0–43.8	WO: ADHD > TD
	WO	20.9 (14.0)	20.8	0–50.0	9.4 (7.9)	8.3	0–30.4	
Subordination index (SI)	W	1.5 (0.2)	1.5	1.1–2.0	1.7 (0.2)	1.6	1.4–2.3	W: ADHD < TD
	WO	1.5 (0.2)	1.5	1.2–1.7	1.6 (0.1)	1.5	1.3–1.9	TD: W > WO
Mean length of C-unit (MLCU)	W	10.4 (2.5)	10.2	5.8–15.4	12.1 (2.4)	11.4	8.8–18.9	W: ADHD < TD
	WO	9.6 (1.5)	9.7	7.2–12.5	10.2 (1.6)	9.7	8.2–14.9	TD: W > WO

Notes: Bolded means indicate that parametric tests (ANOVA) were used, and bolded medians that nonparametric tests (Mann-Whitney/Wilcoxon Signed Rank) were used. Different superscripts on mean values indicate significant follow-up pairwise comparisons after a significant interaction.

Story grammar units

The assumption of normality for the ADHD group was not met in the task without picture support due to one outlier. After excluding the outlier, all assumptions were met. Since the conclusions from the ANOVA did not change with the outlier excluded, the results reported below include all participants.

There was a significant main effect of group, $F(1,44) = 6.335$, $p = .016$, $\eta^2 = 0.126$, where the ADHD group ($M = 14.6$, $SD = 3.55$) on average included significantly fewer story grammar units than the TD group ($M = 16.4$, $SD = 2.0$). Additionally, there was a significant main effect of picture support, $F(1,44) = 13.330$, $p < .001$, $\eta^2 = 0.233$, where there were fewer story grammar units in the task with picture support ($M = 14.8$, $SD = 2.54$) than in the task without picture support ($M = 16.2$, $SD = 3.02$). The interaction between group and picture support was not significant, $F(1,44) = 2.817$, $p = .100$.

Included details

Analyses showed that there was a significant main effect of group, $F(1,44) = 7.287$, $p = .010$, $\eta^2 = 0.142$ where the ADHD group ($M = 34.7$, $SD = 9.59$) included fewer details than the

TD group ($M = 40.8$, $SD = 7.0$). There was no significant main effect of picture support, $F(1,44) = 0.891$, $p = .350$, and no significant interaction between group and picture support $F(1,44) = 3.617$, $p = .064$.

Total number of words

There was a significant main effect of group $F(1,44) = 5.417$, $p = .025$, $\eta^2 = 0.110$, but no significant main effect of picture support, $F(1,44) = 0.010$, $p = .921$. Additionally, there was a significant interaction between group and picture support $F(1,44) = 5.284$, $p = .026$, $\eta^2 = 0.107$. Post-hoc tests (Fishers LSD) with Bonferroni corrections showed for the task with picture support, there was no significant difference in number of total words between the ADHD group ($M = 261$, $SD = 76.9$) and the TD group ($M = 292$, $SD = 68.1$), $p = .174$. In contrast, in the task without picture support, the ADHD group ($M = 244$, $SD = 81.0$) had significantly shorter narratives than the TD group ($M = 310$, $SD = 65.2$), with a large effect size, $p = .005$, $d = 0.89$. Within the ADHD group there was no significant difference in story length between the two conditions ($p = .174$, $d = 0.22$), but within the TD group, narratives without picture support were significantly longer than narratives with picture support on average, with a small effect size ($p = .041$, $d = 0.28$).

Percent C-units with grammatical errors

A Mann-Whitney U test indicated that in the task with picture support, there was no significant difference between the ADHD group and the TD group, $U = 185.5$, $p = .270$. In contrast, in the task without picture support, there was a significantly higher proportion of C-units with grammatical errors in the ADHD group, $U = 112.5$, $p = .005$. Within groups, Wilcoxon Signed Ranks Test showed no significant differences between tasks in the ADHD group ($p = .572$) or the TD group ($p = .099$).

Subordination index (SI)

A Mann-Whitney U test indicated that in the task with picture support, the mean SI from the ADHD group was significantly lower than in the TD group, $U = 139.5$, $p = .029$. There were no significant differences in the task without picture support between the ADHD group and the TD, $U = 152.5$, $p = .061$. Wilcoxon Signed Ranks Test showed no significant difference within the ADHD group between the tasks ($p = .256$), but a significant difference within the TD group where the task with picture support had a significantly higher SI than the task without picture support ($z = 2.5$, $p = .011$).

Mean length of C-unit (MLCU)

A Mann-Whitney U test indicated that in the task with picture support, the ADHD group had a significantly shorter MLCU than the TD group, $U = 145.0$, $p = .040$. In the task without picture support, there was no significant difference between the ADHD group and the TD group, $U = 196.5$, $p = .398$. Wilcoxon Signed Ranks Test showed no significant difference between the tasks within the ADHD group ($p = .147$), but a significant difference within the TD group where the task with picture support had a significantly higher MLCU than the task without picture support, $z = 4.3$, $p < .001$.

Discussion

The aims of the present study were to 1) compare and describe narrative retells in Swedish adolescents with and without ADHD, and 2) investigate the effects of picture support on narration.

Macrostructural analyses showed that participants with ADHD on average included significantly fewer story grammar units and fewer details than the participants with TD in both tasks. There was also a main effect of picture support, showing that both groups included more story grammar units in the task without picture support compared to the task with picture support. The microstructural analyses indicated that picture support affected the two groups differently, however. The TD group showed a significant effect of picture support on syntactic complexity with fewer total number of words, longer MLCU and higher SI in the task with picture support. This was not seen in the ADHD group which led to group differences regarding syntactic complexity in the task with picture support only. In the task without picture support, the ADHD group had significantly fewer words and a higher proportion of grammatical errors compared to the TD group, and these differences were not seen in the task with picture support.

The group differences in terms of macrostructure measures (narrative organization and content) were in line with previous research, showing that the retells from participants with ADHD had poorer content and included less information compared to TD comparison groups (Green et al., 2014; Kuijper et al., 2017; Papaeliou et al., 2015; Purvis & Tannock, 1997). These results suggest that the deficits in executive functioning following ADHD may not only affect pragmatics, but also the content and structure of narratives (Green et al., 2014; Kuijper et al., 2017; Papaeliou et al., 2015; Rumpf et al., 2012; Tannock et al., 1993). According to Lorch et al. (2010), deficits in narrative macrostructure in children with ADHD seem to persist over time for younger children (between the ages of 4 to 9). The present study which included Swedish 12- to 16-year-olds, showed that these deficits may continue through adolescence. The difficulties could be explained by the dual coding theory (Sadoski et al., 2012) where underlying deficits in sustained attention and executive functioning in children with ADHD affect the ability to memorize and create a mental representation of the heard story, with fewer included story grammar units and details as a consequence.

In terms of the effect of picture support on our macrostructural measures, the present study found similar effects in both groups (ADHD/TD), with a larger number of story grammar units included in the task without picture support. The results are in line with earlier studies including younger children with DLD and TD (Masterson & Kamhi, 1992; Schneider, 1996) and suggest that for all participants, divided attention (story/pictures) might interfere with the processing and the reformulation of a heard story. Previous studies have discussed and emphasized that different elicitation tasks might affect narrative ability (Colozzo et al., 2011; Luo & Timler, 2008; Schneider, 1996; Westerveld & Heilmann, 2012), and this is important to be aware of when using narrative tasks in clinical assessment. The present study confirms that we can learn more about similarities and differences in narrative retells between groups using more than one narrative task with different levels of support, which also has implications for clinical practice. The presence of picture support did not increase macrostructural scores in either group, although the group with ADHD recalled more details on average (but not to a significant level) in the task with picture support.

For the microstructural measures, the TD group had a greater number of words on average in the task without picture support compared to the task with picture support. In contrast, the ADHD group somewhat decreased story length (and a decreased number of details recalled) in the task without picture support, although not to a statistically significant level. An opposite effect was seen regarding syntactic complexity: the TD group produced significantly higher subordination index (SI) and significantly longer C-units (MLCU) in the task with picture support compared to the ADHD group, and this effect was not seen in the task without picture support. Previous research regarding syntactic complexity in children and adolescents with ADHD is limited and results are varied. Rumpf et al. (2012) for example, found no group differences (ADHD/TD) in MLCU in a picture description task, while Kuijper et al. (2017) found lower syntactic complexity in an ADHD group compared to a TD group in a wordless picture book task. In the present study, the TD group increased sentence length and complexity (MLCU/SI) in narratives when they could attend to pictures, and this effect was not seen in the ADHD group. Miranda et al. (2013) argue that lack of complex syntax might support the idea of a 'syntactic immaturity' in children with ADHD, possibly due to underlying executive functioning skills and/or vulnerable underlying linguistic skills in the ADHD group, which will be further discussed below.

The groups also showed different task effects regarding grammatical errors. The ADHD group produced a significantly higher proportion of C-units with grammatical errors in the task without picture support compared to the TD group, but there were no differences between the groups in the task with picture support. This is in line with a previous study, showing that grammatical errors increased in a group children with DLD in a more executive functioning demanding single picture task than a picture sequence task (Colozzo et al., 2011). Similarly, Kuijper et al. (2017) found that children with ADHD had more grammatical errors in a wordless picture book task compared to a control group. The adolescents with ADHD in the present study might have put larger effort in recalling and planning the retellings in the task without picture support, with a larger number of grammatical errors as consequence.

Taken together, the results of the present study imply that the narrative task that demanded more of executive functioning skills (retelling without picture support) affected groups differently on various aspects of language, indicating a linguistic vulnerability in the ADHD group, possible due to their deficits in executive functioning skills. In addition, the ADHD group included fewer story grammar units and details in both tasks, which again could be a consequence of difficulties with sustained attention. There were no obvious group differences regarding parents' level of education, thus socio-economic factors are unlikely to be driving these results.

One might argue that the group differences seen were due to the higher proportion of bilingual speakers in the ADHD group compared to the TD group, but we believe this is unlikely. All bilingual participants were born in Sweden with one Swedish-speaking parent, thus having had Swedish exposure from birth. Furthermore, the participants considered Swedish as their strongest language (apart from one who reported that their languages were equally strong). They went to schools in middle-class areas with a clear majority-language norm with Swedish as the language of instruction as well as the language of socialization and peer interactions. Based on this information, the bilingual speakers are expected to have native competency of Swedish (see e.g., Thordardottir, 2015).

The uneven proportion of boys vs. girls could also possibly have given an advantage to the TD group since there is some evidence that girls have stronger narrative skills than boys (see e.g., Fey et al., 2004). Fey et al. (2004) only found significant gender differences on story length and global story quality rating in their 4th grade sample, however, and given that our participants are older, and that the story length differences seen in this study were interacting with task, makes gender an unlikely driving factor. This should be investigated in further studies with a larger and more balanced sample, however.

An alternative explanation to the group differences in the present study that we find more plausible, however, is subclinical language difficulties in the ADHD group. No adolescents included in the study had an additional diagnosis of developmental language disorder (DLD) (Bishop et al. 2016), but the results on sentence repetition scores (CELF-4) differed significantly between the groups, which might indicate language processing deficits in the ADHD group (see also Kim & Kaiser, 2000; Purvis & Tannock, 1997). There was also a significant difference between groups regarding grammatical comprehension (TROG-2). It is possible that deficits in sustained attention have affected the results on TROG-2, however, and further analyzes of the responses revealed an uneven performance. According to the TROG-2 manual, the participant is only given one point when four out of four items testing the same structure are matched to the correct picture. If instead, one point is given when three out of four similar items are correct, the significant group differences in this study disappear. This might indicate that the participants with ADHD in the present study might not have a primary lack of grammatical knowledge, but rather make random single errors as a consequence of not being able to sustain attention continuously through the whole 15–20-min task.

Finally, we want to highlight some additional limitations to the present study. The low number of participants in the ADHD group contributed to the fact that in some cases statistical tests with a lower power had to be used, which might have increased the risk of type two errors. In addition, the fact that 2/15 participants with ADHD medicated for their symptoms makes the ADHD group heterogeneous and the results less generalizable. According to Rausch et al. (2017) ADHD medication may affect the performance on macrostructural measures but not microstructural measures, thus, two of the participants in the present study might have presented different results on the macrostructural measures without medication. Our initial plan was to avoid effects of medication by only recruiting participants that did not medicate, but it turned out to be challenging to recruit adolescents with newly diagnosed and/or non-medicated ADHD. The severity of the ADHD symptoms of the adolescents included in this study is unknown, and it is also possible that a non-medicated ADHD indicates less severe ADHD in some participants. That we did find group differences on narrative measures despite this, however, indicates that narrative performance might be sensitive to deficits in executive functioning, which has also been suggested previously.

Lastly, it is possible that the order or the content of the two narrative retelling tasks affected the results: the tasks were carefully matched regarding structure and amount of information as described in the method section, but they were naturally not exactly matched regarding story content. In addition, even though the adolescents with ADHD participated in all tasks without showing obvious signs of excessive tiredness, it is possible that deficits in attention affected their performance in the second half of the session which included the narrative task without picture support. Both groups included more, not less story grammar units in this last task, however. A previous study has also ruled out order/practice effects for these tasks and measures (Hällström & Myr, 2019).

Conclusions

To summarize, the adolescents with ADHD in this study showed subtle language difficulties compared to the TD group, which was seen in both standardized tests and in the two narrative tasks. The group differences were especially evident in the task without picture support and are assumed to depend on deficits in executive functioning in the ADHD group. This knowledge can aid the assessment planning and analysis of narrative skills in children with suspected and confirmed ADHD. In clinical practice, the symptoms of ADHD and developmental language disorder (DLD) are sometimes difficult to disentangle. The present study adds to the knowledge base about language in adolescents with ADHD without comorbid DLD. Further studies should include larger samples of adolescents with an equal number of boys and girls, and compare results from adolescents with ADHD to adolescents with diagnosed DLD, to be able to closely examine the impact of linguistic ability and executive functioning on narrative skills.

Declaration of interest

The authors report no conflict of interests.

Funding

This study was partly supported by the Aina Börjeson Foundation for Speech Language Pathology Research and Treatment.

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