



Vocabulary, metacognitive knowledge and task orientation as predictors of narrative picture book comprehension: from preschool to grade 3

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Abstract

This is a study of early picture book comprehension, its determinants and later development through primary school. More specifically, picture book comprehension was analyzed longitudinally from age 5 to age 9, delineating the unique contributions of vocabulary, metacognitive knowledge and task orientation to the initial level as well as to the growth of comprehension. A total of 90 Finnish-speaking children participated in the study. The children's narrative picture book comprehension was assessed at age 5, age 6 and age 9. Vocabulary, metacognitive knowledge and task orientation were evaluated at age 5. Latent growth curve modeling showed a pattern of decreasing achievement gaps in narrative picture book comprehension. Vocabulary and metacognitive knowledge uniquely contributed to the concurrent level of narrative picture book comprehension. The results further showed that metacognitive knowledge and task orientation were positive and statistically significant predictors of the growth of picture book comprehension over and above the initial level of narrative picture book comprehension. These findings add to our knowledge about the development of inter-individual differences in narrative picture book comprehension and the roles of vocabulary, metacognitive knowledge and task orientation in it. They also suggest a novel way to assess the narrative comprehension potential among students with compromised working memory or decoding ability.

Keywords Narrative picture book comprehension · Vocabulary · Metacognitive knowledge · Task orientation · Children · Latent growth curve modeling · Longitudinal study

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Introduction

Picture books are an essential part of the textual environment in the home as well as in preschool. Many picture books have a narrative structure that is, they incorporate a particular setting and characters involved in goal-directed actions. Pictorial stories provide opportunities for children to practice their comprehension skills independent of decoding. Consequently, children learn to encode the individual events of the narrative and make inferences regarding those events that are connected to each other. These abilities develop through early childhood and are related to later reading comprehension (Kendeou, van den Broek, White, & Lynch, 2009; Lepola, Lynch, Kiuru, Laakkonen, & Niemi, 2016; Oakhill & Cain, 2012).

In the present study, we examine the development of prereaders' narrative picture book comprehension through a wordless picture book task. The task required the children to view a series of pictures by themselves, not being narrated by an adult, and to construct a meaning-based representation of the story. We ask a hitherto unexplored question that is, if individual growth in narrative picture book comprehension can be predicted by variables that have been found valid in predicting reading comprehension, namely vocabulary (e.g., Perfetti & Stafura, 2014), metacognitive knowledge (Annevirta, Laakkonen, Kinnunen, & Vauras, 2007; Pressley & Gaskins, 2006) and task-oriented behavior (Hirvonen, Georgiou, Lerkkanen, Aunola, & Nurmi, 2010; Lehtinen, Vauras, Salonen, Olkinuora, & Kinnunen, 1995; Lepola et al. 2016). Drawing on the theoretical considerations of Paris and Paris (2003) and text comprehension models (Perfetti, Landi & Oakhill, 2005; Verhoeven & Perfetti, 2008), we maintain that regardless of medium, similar comprehension processes are deployed when children study a pictorial narrative independently, listen to a narrative or, at later age, read one (Kendeou, Bohn-Gettler, White, & van den Broek, 2008; Kim, 2016a).

Narrative picture book comprehension

Like text comprehension, comprehension of a wordless picture book is theorized to take place on different levels that is, surface (picture), text (narrative) and situation model (e.g., Kintsch & Rawson, 2005). Because the meaning of these narratives is carried by visual images only, children must actively encode and elaborate the meanings of individual pictures. This may involve identifying and naming individual objects, characters and actions represented in the picture. On the other hand, to achieve a narrative representation, the child has to construct and integrate meanings across pictures by focusing on relevant as well as suppressing irrelevant information. In other words, they must "read" pictures strategically (Paris & Paris, 2003). The child's ability to use story grammar categories (e.g., initiating event, problem, outcome) is essential to building and later recalling narrative representations. Moreover, narrative comprehension requires inference making to understand explicit and implicit information in the story as well as other higher-level cognitive skills such as monitoring ongoing comprehension (Florit, Roch, & Levorato, 2011; Silva & Cain, 2015; Tompkins, Guo, & Justice, 2013).

To construct a situation model on the basis of a pictorial narrative, the child must make further inferences to their background knowledge as well as engage in higher-level processes such as discerning a theme of the story. What is more, extracting meaning from pictures without any verbal cues requires focus on the task and effortful engagement (Arizpe, 2013; Chaparro-Moreno, Reali, & Maldonado-Carreño, 2017). The ability to find words for explicit and implicit information in pictures taxes vocabulary (Silva & Cain, 2015). Forming a mental model on the basis of a wordless picture book is certainly complex and may well require active metacognitive knowledge of how various cognitive skills such as memory, learning and understanding affect comprehension of stories. The perspective outlined here is in line with the findings of Strasser and del Rio (2013) showing that a broad set of cognitive skills, including attention, vocabulary, inferences and comprehension monitoring play a role in narrative picture book comprehension.

Furthermore, as Feldman, Bruner, Renderer and Spitzer (1990) have argued, narrative story comprehension can be viewed as the ability to integrate information from two landscapes within a story. The landscape of action refers to the elements of story grammar, whereas the landscape of consciousness reflects what characters know, think or feel (Bruner, 1986). Cross-sectional evidence suggests that memory for story events is likely to precede the ability to make inferences about characters' motives and feelings (Khan, Gugiu, Justice, Bowles, Skibbe, & Piasta, 2016; Paris and Paris, 2003, Table 12). With age, children also improve at identifying implicit information in the story (e.g., describing the character's goals and motives), connecting events in the story, and using their background knowledge to interpret story events that is, making inferences (Florit et al., 2011; Kendeou et al., 2008; Tompkins et al., 2013). These improvements have been observed by using different media, such as viewing a picture book (Lepola et al., 2016; Paris & Paris, 2003) or listening to a story from an iPad (Filiatrault-Veilleux, Bouchard, Trudeau, & Desmarais, 2016). Interestingly, despite the ubiquitous presence of picture books and their pivotal role in the development of preschoolers' narrative comprehension skills (Paris & Paris, 2007; Zevenbergen & Whitehurst, 2003), there is a lack of longitudinal studies of narrative picture book comprehension.

Evaluation of the development of narrative comprehension skills

Prereaders' narrative comprehension skills can be evaluated with three types of material: wordless picture books, picture books combined with listening, or listening only. Several studies have utilized a pictorial story with listening to an adult or an audiovisual story (Filiatrault-Veilleux et al., 2016; Kendeou et al., 2009; Khan et al., 2016; Lynch, van den Broek, Kremer, Kendeou, White, & Lorch, 2008; Storch & Whitehurst, 2002). There is also abundant research on narrative listening comprehension in which the children hear either a live or audio-recorded story and then their comprehension is evaluated (Annevirta et al., 2007; Dufva, Niemi, & Voeten, 2001; Florit, Roch, Altoé, & Levorato, 2009; Florit, Roch, & Levorato, 2014; Kim, 2016a, b; LARRC, 2017; Torppa, Georgiou, Lerkkanen, Niemi, Poikkeus, & Nurmi, 2016). Most of these studies also include a developmental aspect.

In contrast, only a handful of studies have relied on picture books in which words are absent and the story is not read to the child (Lepola et al., 2012; Paris & Paris, 2003; Silva & Cain, 2015; Silva, Strasser, & Cain, 2014; Strasser & del Rio, 2013; Tompkins et al., 2013). Interestingly, of these relevant studies, only that of Paris and Paris (2003) asked how components of picture book comprehension improved over time. The authors deployed two samples, one from Grade 1 to Grade 2 and the other from Grade 2 to Grade 3. Significant progress was found in children's literal and inferential comprehension skills as well as their ability to retell the main story elements. However, the cross-sectional design of Paris and Paris (2003) did not allow them to study whether the initial achievement gaps increased, decreased or remained stable over the years (for more detail, see Pfost, Hattie, Dörfler, & Artelt, 2014). Moreover, previous studies have not examined the role of other resources, such as vocabulary, metacognitive knowledge and task orientation in the growth of children's narrative picture book comprehension.

Predicting the development of narrative picture book comprehension: vocabulary, metacognitive knowledge and task orientation

Regarding the role of vocabulary, evidence suggests that knowledge of word meanings facilitates not only listening comprehension of beginning readers (Florit, Roch, Altoé, and Levorato, 2009; Potocki, Magnan, & Ecalles, 2013), but it also plays a role in their literal and inferential picture book comprehension (Silva & Cain, 2015; Strasser & del Rio, 2013). Although vocabulary plays an important role in word-to-text integration in reading (Perfetti & Stafura, 2014), less is known about the contribution of vocabulary to the initial status and the growth of prereaders' narrative picture book comprehension.

According to the conceptualization by Flavell (1979), metacognitive knowledge refers to "knowledge or beliefs about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises. There are three major categories of these factors or variables—*person*, *task*, and *strategy* (p. 907)." In other words, metacognitive knowledge reflects the extent to which the child possess knowledge about person (i.e., age, experience), task (i.e., number of items, external distractor) and strategy (i.e., categorization, explanation, practicing) factors in cognitive processing. More concretely, awareness of these factors have been measured in tasks where the child is asked, first, to rate what is the best way to remember, understand and learn things, and then to explain his or her rating (Annevirta et al., 2007; Wellman, 1977). Metacognitive knowledge has shown to be associated with 6- to 10-year-old students' text comprehension evaluated through listening and reading (Annevirta et al., 2007; Leppänen, Aunola, Niemi, & Nurmi, 2008; van Kraayenoord, Beinicke, Schlagmuller, & Schneider, 2012), and the facilitating role of metacognitive knowledge among proficient readers is clear (Pressley & Gaskins, 2006). Annevirta and Vauras (2001) as well as Marulis, Palincsar, Berhenke, and Whitebread (2016) have shown that preschool-aged children and kindergartners already have metacognitive knowledge (for a review of recent studies, see Marulis, Baker, & Whitebread, 2020). Empirical findings also suggest that a high level of

metacognitive knowledge from kindergarten to Grade 2 is linked to better self-regulatory skills such as self-guided speech and comprehension monitoring (Annevirta & Vauras, 2006). Moreover, comprehension monitoring has been found to predict picture book comprehension among prereaders (Strasser & del Rio, 2013). Thus, it is plausible that children's metacognitive knowledge can be reliably assessed already at age 5, and this early metacognitive knowledge is a potent predictor of the development of narrative picture book comprehension.

Individual differences in children's task-focusing behaviors are related to the acquisition of word reading skills (Manolitsis, Georgiou, Stephenson, & Parrila, 2009; Morgan, & Fuchs, 2007) and reading comprehension (Georgiou, Manolitsis, Zhang, Parrila, & Nurmi, 2013; Hirvonen et al., 2010). In the present study, task orientation refers to the child's intrinsically motivated tendency to accept and engage in challenging aspects of a learning task given by the teacher. This kind of motivational and social tuning into the task is observed as approaching, exploring, and mastering behaviors. The present conceptualization of task orientation draws on older depictions of children's and adults' problem- and emotion-focused coping strategies (Lazarus, 1991), the nature of intrinsic motivation (Harter, 1981) and the distinction between mastery and helplessness orientations (Diener & Dweck, 1978). Our approach to task orientation also includes aspects of executive skills such as attention control and planning (Conners, 2009; Sesma, Mahone, Levine, Eason, & Cutting, 2009).

A recent longitudinal study by Lepola et al. (2016) showed that teacher-rated task orientation and children's oral language comprehension including vocabulary, listening comprehension and inference-making about a pictorial story were reciprocally related from age 4 to age 9. In addition, Strasser and del Rio (2013) found that 4- to 7-year-old children's attention to a pictorial story (based on an examiner's evaluation of the participants' focus on instructions, on-task behavior and cooperation) was a unique predictor of wordless picture book comprehension. Like reading comprehension, pictorial comprehension demands resources to initiate, maintain and coordinate automatic and effortful processes. Therefore, it is important to study the relevance of task-oriented behaviors in the development of narrative picture book comprehension.

Aims and hypotheses

In the present study, we examined the development of children's narrative picture book comprehension (hereafter picture book comprehension) from the age of 5 through the age 6 to the age of 9 years. The study had three aims. First, by using Latent Growth Curve (LGM) modeling, we investigated individual variation in the level of picture book comprehension, its growth rate (e.g., linear), and the association between its initial level and growth factor (Annevirta et al., 2007; Aunola, Leskinen, Arvilommi, & Nurmi, 2002; Muthén & Khoo, 1998). Second, we used the LGM approach to examine the extent to which vocabulary, metacognitive knowledge and task-oriented behavior at age 5 (preschool) contributed to the children's initial level of picture book comprehension at age 5. Third, and most important, we

asked whether vocabulary, metacognitive knowledge and task-oriented behavior at age 5 predicted subsequent changes in children's picture book comprehension.

Regarding individual differences in the initial level of picture book comprehension at the age of 5, we hypothesized that each variable would be associated with picture book comprehension, but vocabulary would be its strongest concurrent predictor. This assumption is based on the prominent role of vocabulary in picture book comprehension (Lepola et al., 2012; Strasser & del Rio, 2013), listening comprehension (Silva & Cain, 2015) and other higher-level comprehension skills such as inference-making, theory of mind, and comprehension monitoring (Kim, 2016a). Further, we assumed that vocabulary, metacognitive knowledge and task orientation would be unique predictors of the growth of picture book comprehension (Annevirta et al. 2007; Lepola et al., 2016). Because of the exploratory nature of the study, we did not formulate hypotheses about whether achievement gaps would be increasing, decreasing or remaining stable across age (cf. Pfof et al., 2014).

Method

Participants

Ninety Finnish-speaking children (50 girls and 40 boys) participated from preschool to Grade 3. Their mean age was 62.5 months when the study started. The same children had participated in a previous study (Lepola et al., 2012) in which 135 Finnish children were followed from preschool to kindergarten. In Grade 3, contact could be established with 118 families, and written consent was granted by 90 (76%) of them for their child to participate in a further data collection. The attrition was, for the most part, due to families moving (for more detail, see Lepola et al., 2016). Initially, the participants were in 16 daycare centers located in socioeconomically varied districts in two towns with 176,000 and 14,500 inhabitants. In Grade 3, the 90 children were in 17 elementary schools (26 classrooms). Based on a questionnaire, 18% of the mothers had a master's degree, 53% had a BA or vocational college degree, 22% had vocational education or a high school diploma, and 7% had no vocational education. The average educational level of mothers was slightly above the mean of Finnish females between 25 and 49 years at the time the study started (Statistics Finland, 2007).

Materials and procedure

At Time 1 (age 5, preschool fall), Time 2 (age 6, kindergarten fall) and Time 3 (age 9, Grade 3 spring) picture book comprehension skills were evaluated individually in one session lasting 30 min. We also assessed metacognitive knowledge and vocabulary at Time 1 (from September to November). Children's verbal responses in all tasks were recorded by a MP3 player for later transcription and scoring. Task-oriented behavior was assessed by preschool teachers at Time 1.

Vocabulary

A word definition test was used to assess vocabulary knowledge at Time 1. The test was an adaptation of the vocabulary test of the Finnish Wechsler Intelligence Scale for Children (WISC—III; Wechsler, 1999). Cronbach's alpha in this sample was .82.

Wordless picture book comprehension

We used the tasks and procedure developed by Paris and Paris (2003). The *Robot-Bot-Bot* picture book by Krahn (1979) was used at the ages of 5 and 6 years. The book tells the story of a family (a child, parents) whose new robot "housecleaner" goes wild after the child plays with the wires. We used an adapted version of the book with 18 pages with one black line drawing on each double page. In Grade 3, we used the picture book *A Boy, a Dog and a Frog* by Mayer (1967). The procedure in Grade 3 was the same as that in preschool and kindergarten. The experimenter instructed the child at each time point by saying "I will give you a picture book that is about a robot/a boy, a dog and a frog. Look at what is happening in this book. Look carefully at all the pictures, and as you look at the pictures, you may tell me whatever there is going on. Now, you can start." In the present study, we used a retelling task, and 10 prompted questions to evaluate children's narrative comprehension (for details, see Paris & Paris, 2003).

Retell task After the child had viewed the picture book the experimenter took the book and the child was asked to retell as much as possible of the story. The transcribed retellings were scored according to the six narrative elements of story grammar (Mandler & Johnson, 1977). One point each was given for phrases referring to information from each story element: *characters, setting, initiating event, problem, solution and resolution*. The maximum score was six. Two raters independently scored the 5-, 6- and 9-year-olds' retellings. The percent match by each element was calculated. Interrater agreement was 89% for Time 1, 89% for Time 2 and 81% for Time 3 across the elements.

Prompted comprehension questions After the retelling task, the experimenter and the child went through the story together and the experimenter asked 10 comprehension questions about it. The first five questions were explicit in nature demanding the identification of and reasoning about the main narrative elements: characters, setting, initiating event, and problem as well as outcome resolution. The answers to the remaining five questions were not directly illustrated in pictures but required the child to make inferences about characters' feelings, causal relations, dialogues, predictions and the theme of the story. Each question, apart from the characters, setting and theme, was followed by the question: "Why/how did that happen?" The follow-up discussion aimed to differentiate the answers referring to picture-level and narrative-level information.

Each question was scored on a scale of 0–2 according to the criteria by Paris and Paris (2003). More points were given for a child's answer when s/he integrated information across pages and made connections among the events (e.g., initiating event—problem, problem—solution, outcome—feelings). Thus, 0 points referred to no answer or a wrong or inappropriate answer; 1 point was given for an answer describing a single picture in isolation, or in implicit questions referring only to the previous page or event; and 2 points were awarded for an answer including information from other events/pictures to construct the meaning of the particular event in the story (i.e., to get 2 points in implicit question, a child had to refer at least to two pictures or tell a more global meaning of the picture; for details, see Lepola et al., 2016, Appendix A). For example, in the implicit question asking why the family got the robot, 2 points were given for answers such as “because they don't need to do all the work by themselves” and “because it can then wash and take garbage out.” One point was given for a response reflecting page-level information, such as “because no more clean up” or “because it can wash up,” and 0 points for no answer or an inappropriate answer, such as “the child wanted to”. Inter-rater reliability that is, the percentage agreement, was above 85% for every question with a mean of 91% for Time 1, 96% for Time 2, and 94% for Time 3 data. Composite scores were computed for all prompted questions. One experimenter showed a wrong page/picture to a subset of children while asking the initiating event question at Time 1. Therefore, we had to eliminate that question from the longitudinal data. Consequently, there were nine prompted comprehension questions. Cronbach's alphas for picture book comprehension, based on retell task, prompted explicit and prompted implicit questions, were .73 for Time 1, .75 for Time 2 and .70 for Time 3. The retelling and the prompted questions scores were summed to get picture book comprehension composites which were used in latent growth curve modeling.

Metacognitive knowledge

Children's knowledge of factors influencing memory, comprehension and learning were assessed by a pictorial metacognitive knowledge test including nine tasks (Annevirta & Vauras, 2001). In each task, the experimenter showed all three pictures to the child (line drawings) simultaneously describing verbally each picture in which a boy or a girl was asked to do something that is, to remember, to understand or to learn. First, the child was instructed to choose the best alternative that is, to point out the picture that depicted the best way or strategy to remember, learn or understand something. Second, after choosing the particular picture s/he was asked to verbally explain the reason for selecting this alternative (e.g., why in this picture did the girl/boy remember, understand or learn best?) (See Appendix for an example of memory task and scoring it).

The quality of explanation that is, the child's ability to verbally refer to memory, comprehension or learning involved in the selected picture, was used as a measure of metacognitive knowledge. The quality of explanation was scored on a five-point scale from 0 to 4. The child got 0 points if s/he did not point or verbally refer to any out of the three pictures. One point was given if the child selected one of the pictures, but her/his explanation for selecting the picture was unclear or naïve or child

said that s/he did not know. Picture selection, even when based on irrelevant or no reason, is seen as a reflection of young child's emerging metacognitive knowledge as opposed to no action at all (Salonen, Lepola, Vauras, Rauhanummi, Lehtinen, & Kinnunen, 1994). Two points were given for less explicit reference to the person's memory, understanding and learning, for instance by referring to the distinct feature in the selected picture. Three points meant fairly adequate description of memory, understanding and learning that is, the child referring to both the distinctive feature in picture and also to memory, understanding or learning. Four points were given to even more explicit accounts (for more details, see Annevirta and Vauras, 2001, Table 1). The agreement between two independent raters was computed for 20% of the data. The interrater agreement ranged between 88 and 93% with a mean of 89%.

Task orientation

Preschool teachers were asked to evaluate the behavior, attention, and emotional expressions of each participating child in their class. Teachers rated the children in the fall term of preschool (November). Each teacher was asked first to recall play-like and crafts situations and new task activities that the child was asked to perform by the teacher, and then rate the child's behavior using a 7-point Likert-type scale that ranged from "the behavior does not occur at all" to "the behavior occurs most of the time or always." The instructions underscored that the focus of assessment was not free-play or the child's cognitive-linguistic abilities but the way the child adapts to the task at hand given by an adult. In the present study, five items reflecting task orientation were used: (1) is able to concentrate on crafts and play-like tasks, (2) shows a desire to do more challenging things, and (3) wants to continue the tasks (asks if s/he can do more), (4) ponders alternatives and plans for what s/he does, (5) is able to continue his/her activity despite external disturbing factors. Cronbach's α was .81. This scale, apart from the last item, has been shown to measure children's task orientation from age 4 to age 9 (Lepola et al., 2016). The last item was included to obtain broader view of the child's task focusing and self-regulatory behavior.

Results

Descriptive statistics for the measures at Time 1, Time 2, and Time 3 are shown in Table 1. The distributions of the scores for summed measures were analyzed by the Kolmogorov–Smirnov test. The test showed that the data for vocabulary ($p=.09$) and task orientation variables ($p=.07$) at Time 1 were normally distributed. Normality assumption was not met for metacognitive knowledge at Time 1 and picture book comprehension scores at Time 1 and Time 3 ($p<.01$). Picture book comprehension scores at Time 2 were normally distributed. As Table 1 indicates, 10% of children scored 0 in retelling at Time 1 and 2, and 63% of children scored 6 in retelling at Time 3.

To analyze developmental changes and gender differences in the means, we conducted a 3×2 (Time \times Gender) ANOVA with repeated measures on picture book comprehension. An ANOVA with linear contrasts revealed a significant linear effect

Table 1 Descriptive Statistics for Vocabulary, Metacognitive Knowledge, Task Orientation and Picture Book Comprehension Variables (N=90)

Variables	<i>M</i>	<i>SD</i>	Range	Skewness	% scoring at floor	% scoring at ceiling
Age (months)	62.5	3.52	11			
Vocabulary knowledge, T1 (64 ¹)	10.74	4.86	22	-.18	3	0
Metacognitive knowledge, T1 (36)	11.57	2.48	14	.81	0	0
Task orientation, T1 (7)	4.44	1.21	4.80	-.27	0	0
Picture book comprehension, T1 (24)	12.66	4.37	21	-.59	1	0
Retelling (6)	2.93	1.80	6	.09	10	11
Prompted questions (18)	9.72	3.23	16	-.75	1	0
Picture book comprehension, T2 (24)	14.54	4.54	22	-.52	0	0
Retelling (6)	3.09	1.94	6	.004	10	14
Prompted questions (18)	11.46	3.26	16	-.80	2	0
Picture book comprehension, T3 (24)	19.20	3.64	21	-2.12	0	1
Retelling (6)	5.20	1.31	6	-1.97	1	63
Prompted questions (18)	14.0	2.76	16	-1.70	1	3

T1 preschool, at age 5; *T2* kindergarten, at age 6; *T3* Grade 3, at age 9–10

¹Maximum value in test

of time in picture book comprehension, ($F[1, 86] = 163.89, p < .001$, partial $\eta^2 = .34$). No significant gender differences were found across time.

Before reporting results of the latent growth curve modeling, we describe concurrent and longitudinal correlations of the variables across the three time points. Table 2 shows that vocabulary and metacognitive knowledge were significantly related to concurrent picture book comprehension. Interestingly, task orientation at age 5 was more strongly related to picture book comprehension at Time 3 ($r = .43$) as compared to the concurrent association between them ($r = .23$). The autocorrelation of the picture book comprehension variables was strong from Time 1 to Time

Table 2 Correlations among Vocabulary, Metacognitive Knowledge, Task Orientation and Narrative Picture Book Comprehension Variables from Preschool to Grade 3

	1	2	3	4	5	6
1. Age						
2. Vocabulary knowledge (T1)	.28**					
3. Metacognitive knowledge (T1)	.15	.35**				
4. Task orientation (T1)	.26**	.25*	.37***			
5. NPB comprehension (T1)	.24*	.48***	.45***	.23		
6. NPB comprehension (T2)	.31**	.43***	.50***	.34**	.69***	
7. NPB comprehension (T3)	.05	.35**	.42***	.43***	.34**	.48***

NPB narrative picture book. *T1* preschool, at age 5, *T2* kindergarten at age 6, *T3* grade 3, at age 9

* $p < .05$, ** $p < .01$, *** $p < .001$

2 (.69) and moderately strong from Time 2 to Time 3 (.48). Age was significantly related to vocabulary ($r=.28$), task orientation ($r=.26$) and picture book comprehension at Time 1 ($r=.24$) and Time 2 ($r=.31$).

Latent growth curve analyses

First, to analyze the growth in picture book comprehension across three time points and to understand the role of inter-individual differences in the initial level (i.e., intercept), a latent growth curve model was estimated in Mplus 7.11 (Muthén & Muthén, 1998–2012). For the intercept factor, factor loadings of the observed variables were fixed to 1 for each measurement point. Prior to fitting the growth model, we visualized individual trajectories for all children (Fig. 1). The plots of individual trajectories in picture book comprehension suggested linear growth, and therefore the factor loadings were fixed to 0, 1 and 4. These loadings correspond to a linear time scale of the assessments (i.e., preschool, kindergarten and Grade 3). Because of the residual variance in picture book comprehension in time 3 (Grade 3) was negative, this parameter was fixed to 0.

The results of LGC model 1 showed that the level and the linear growth components were stochastic. This means that the variances of level (16.130) and linear

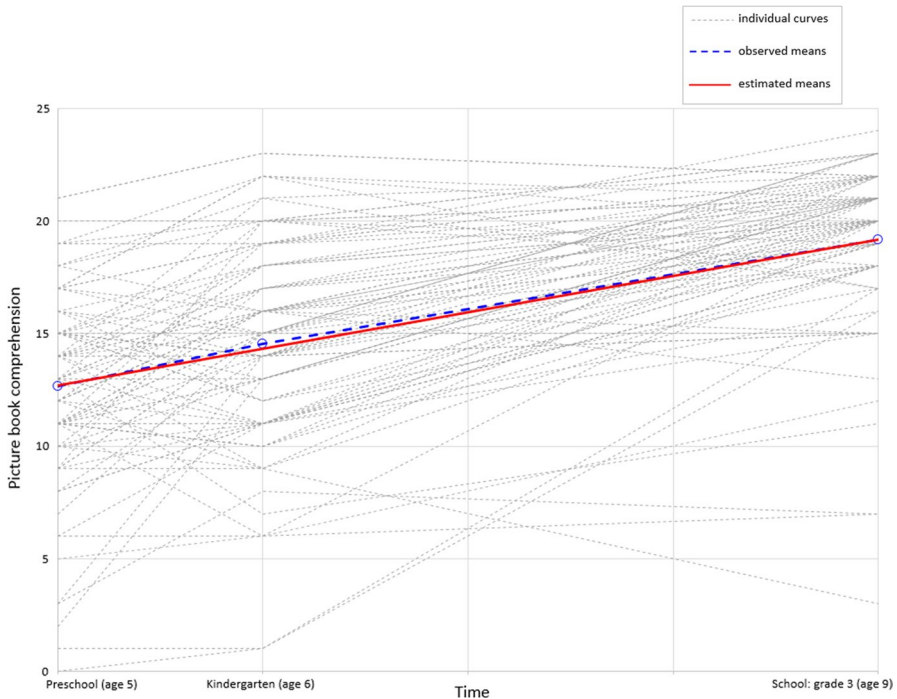


Fig. 1 Individual observed curves, observed means and estimated means based on the latent growth curve model

Table 3 Latent growth models for narrative comprehension from preschool through Kindergarten to Grade 3 (Unstandardized Coefficients Reported; Standard Errors in Parenthesis)

	Model 1 (linear)	Model 2 (linear model including predictors of the level and the trend components)
<i>Means</i>		
Level (intercept)	12.689 (.453)***	12.696 (.457)***
Metacognitive knowledge ¹		.687 (.171)***
Vocabulary ¹		.300 (.089)***
Task orientation ¹		.053 (.325)
Growth rate (linear growth)	1.601 (.121)***	2.126 (.687)**
Level (intercept) ²		-.233 (.027)***
Metacognitive knowledge ²		.092 (.040)*
Vocabulary ²		.029 (.016)
Task orientation ²		.211 (.080)**
<i>Variance components</i>		
Variation in intercept	16.130 (3.712)***	8.728 ³ (2.947)***
Variation in linear trend	1.153 (.263)***	.551 ³ (.140)***
Residual variance for NC-t1	2.824 (2.071)	3.513 (1.981)
Residual variance for NC-t2	8.083 (1.388)***	7.685 (1.245)***
Residual variance for NC-t3	.000	.000
Model fit	$\chi^2(2) = 1.172, p = .556$; RMSEA = .00; CFI = 1.00; TLI = 1.017; SRMR = .013	$\chi^2(5) = 3.333, p = .648$; RMSEA = .00; CFI = 1.00; TLI = 1.030; SRMR = .021

* $p < .05$, ** $p < .01$, *** $p < .001$

¹Predictors of level component (unstandardized estimates with standard errors in parenthesis)

²Predictors of growth rate component (unstandardized estimates with standard errors in parenthesis)

³Residual variance in level/growth rate factor

growth (1.153) components were statistically significant (Table 3). As model 1 shows, picture book comprehension was found to increase by 1.60 points in every consecutive time point. The results also showed that the path from the level to the linear growth of picture book comprehension was negative and statistically significant ($-.623$). This indicates, as also displayed in Fig. 1, that the lower the initial picture book comprehension was at age 5, the more improvement was observed from age 5 to age 9. Thus, children with initial low picture book comprehension caught up with the children with initial high picture book comprehension.

Our second and third aims were to study the extent to which vocabulary, metacognitive knowledge and task orientation assessed at Time 1 (age 5), would each contribute to the initial level of picture book comprehension as well as predict the growth in picture book comprehension. To address this, a second latent growth curve model with initial level (i.e., intercept), linear growth component (i.e., trend) and the four predictors were constructed. It is important to note that we also controlled

for the initial level. Thus, we examined whether the rate of change in picture book comprehension is a function of initial level and the predictors (see, e.g., Viljaranta et al., 2015; Wang & Wang, 2012, p. 153). This was done because model 1 showed that initial level is a strong determinant of the subsequent growth of picture book comprehension. Age was not included in model 2 because it did not contribute significantly either to the initial level or to the growth of picture book comprehension in model 1.

As Table 3 shows, the fit of model 2 to the data was good. The results of model 2 show that metacognitive knowledge and vocabulary significantly contributed to the initial level of picture book comprehension at age 5. As can be further seen from Table 3 and Fig. 2, the pattern of predictors changed somewhat for the growth rate component. When the initial level of picture book comprehension was controlled for, task orientation and metacognitive knowledge turned out to be statistically significant predictors of the growth of picture book comprehension. Thus, vocabulary was not a significant predictor of the growth of narrative comprehension in the presence of metacognitive knowledge and task orientation. Model 2 ($\chi^2(5)=3.333$, $p=.648$; RMSEA=.00; CFI=1.00, TLI=1.030; SRMR=.021) with statistically significant associations between the predictor variables, level and growth rate component is displayed in Fig. 2. Model 2 suggests that metacognitive knowledge and

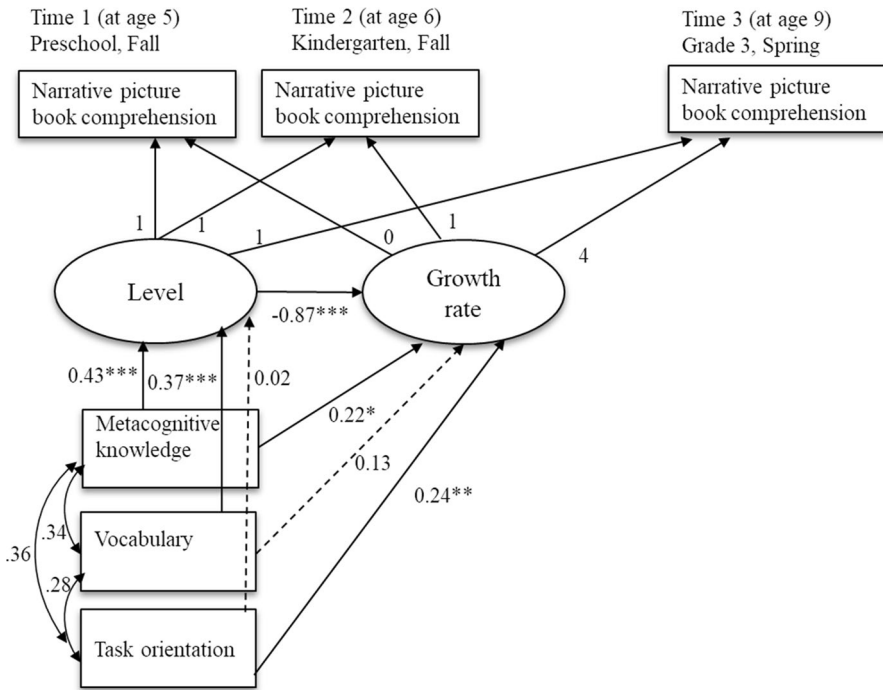


Fig. 2 The latent growth curve Model 2 for narrative picture book comprehension and the predictors (standardized estimates). All paths displayed as solid lines are significant at $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

task orientation are uniquely contributing to the growth of picture book comprehension from preschool to Grade 3.

Discussion

In the present study, we examined the development of narrative picture book comprehension among Finnish-speaking children from preschool (age 5) to Grade 3 (age 9). We used wordless picture books and investigated individual differences both in the initial level and the growth of comprehension. We also analyzed the unique contributions of vocabulary, metacognitive knowledge and task orientation to the initial level as well as to the development of narrative picture book comprehension.

Several important findings emerged. First, latent growth curve modeling showed significant variability in the growth of picture book comprehension. In addition, the robust negative association between the initial level and the growth rate of picture book comprehension suggests a pattern of decreasing achievement gaps. The lower the level of picture book comprehension at age 5, the steeper the improvement of it from age 5 to age 9. This developmental pattern is a novel finding. It adds to previous longitudinal studies (Florit, Roch, & Levorato, 2014; Kendeou et al., 2009; Lepola et al., 2016; Paris & Paris, 2003), which have not considered individual growth rates in narrative picture book comprehension.

Second, in line with our hypothesis and previous studies (Annevirta et al., 2007; Paris & Paris, 2003; Silva & Cain, 2015; Strasser & del Rio, 2013), both vocabulary and metacognitive knowledge uniquely contributed to the concurrent level of picture book comprehension. The results further showed, partly in contrast to our hypothesis, that metacognitive knowledge was as strongly related to picture book comprehension as vocabulary. Thus, the more the preschoolers could verbally refer to factors influencing memory, understanding and learning, the better they comprehended the narrative conveyed exclusively in pictures.

Third, metacognitive knowledge and task orientation were positive and statistically significant predictors of the growth of picture book comprehension over and above its initial level. Vocabulary at the age of 5 was not related to this development. However, this is not to say that it does not play a role. Rather, the positive correlations in Table 2 for vocabulary suggest that the associations are just not strong enough to yield predictive significance in addition to that of metacognitive knowledge and task orientation.

Contribution to research on narrative comprehension

Previous studies have shown that metacognitive knowledge is associated with listening and reading comprehension during the early school years (Annevirta et al., 2007; van Kraayenoord & Schneider, 1999). The present study expands these findings to wordless picture book comprehension among preschoolers and importantly, shows a positive association with the subsequent growth of comprehension. This suggests that children's metacognitive knowledge is associated with the development of their

ability to construct a coherent mental representation (a situation model) of a pictorial narrative. What is more, metacognitive knowledge as measured here bears a resemblance to theory of mind (i.e., ability to consider one's own and others' mental states such as thoughts and feelings). Indeed, both skills can be viewed as developmentally linked representational abilities (Lockl & Schneider, 2007; for a review, see Schneider, 2008). This way our findings corroborate studies which have suggested a unique role of kindergartners' and first graders' theory of mind in listening comprehension (for a review, see Cartwright & Guajardo, 2015; Kim, 2016a; Kim & Phillips, 2016).

The unique contribution of task orientation to the growth of children's narrative picture book comprehension is consistent with previous findings showing a positive correlation between teacher-rated off-line attention and children's listening comprehension (Kim, 2016a), as well as experimenter-rated on-line attention and picture book comprehension (Strasser & del Rio 2013). Thus, preschoolers' task orientation that is, their ability to concentrate on the task given by the teacher, independent mastery and positive attitude to challenges, seem to be particularly important in building a situation model of a pictorial narrative. Our finding is also compatible with the study by Lehtinen et al. (1995) among grade 5 students. Namely, Lehtinen and colleagues showed that task-oriented students displayed better discourse comprehension strategies, such as activating their previous knowledge and linking teacher's instruction to phenomena outside school, as compared to students with extrinsic motivational patterns.

By analyzing individual differences in the growth rate of picture book comprehension, our findings also expand the study by Lepola et al. (2016) within the same age range. Our latent growth curve modeling showed that task orientation (measured at age 5) fell short of significance as a concurrent predictor of picture book comprehension although it gained predictive strength in the later comprehension development. A possible explanation is that an average comprehension level of five-year-olds could be achieved by shallow processing, for example, straightforward recall of story details and what was presented in the picture. However, the higher scores typically achieved by older children demanded deep processing which presupposes effort and sustained attention when working out the storyline and integrating information across individual pictures. Interpreted this way, our findings about task orientation are compatible with the studies of the predictive role of executive functions such as planning and ability to focus on task-relevant goals in oral comprehension tasks (Fuhs, Nesbitt, Farran, & Dong, 2014) and beginning reading comprehension (for a meta-analysis, see Follmer, 2018).

A novel albeit counterintuitive finding was that while vocabulary at the age of five was moderately correlated with picture book comprehension at every time point (see also Silva & Cain, 2015; Strasser & del Rio, 2013), it failed to predict the growth rate of comprehension. Sufficient vocabulary is necessary for naming pictures and their elements. However, acquiring a better narrative comprehension is based on more than mere naming and telling. In other words, building a situational model as well as reasoning about it presuppose the active use of world knowledge and prior experiences. It is plausible that such processes are guided by, for example, metacognitive knowledge rather than knowledge of words. This is in line with the

recent finding by Edossa, Neuenhaus, Artelt, Lingel and Schneider (2019) showing that metacognitive knowledge at grade 5 contributed to positive gains in reading comprehension from Grade 5 to Grade 8 even after controlling of students' verbal ability.

Implications for research and pedagogical practice

Picture books in which the child must interpret pictures and make connections among the story events, provide a potential tool to study the development of inter-individual differences in narrative comprehension in the absence of constraints induced by listening or reading. Reading comprehension difficulties tend to remain unobserved during the first school years for the simple reason that they are overshadowed by problems of decoding accuracy and fluency particularly in opaque orthographies such as English. On the other hand, comprehension difficulties may even occur in the presence of reasonably good word reading skills. The latter situation is aptly depicted by terms such as specific reading comprehension difficulties (e.g., Cain & Oakhill, 2006; Nation, Cocksey, Taylor, & Bishop, 2010) and late-emerging poor reading (e.g., Catts et al., 2012).

The present findings contribute to research on late-emerging poor readers (Catts et al., 2012) because by using retelling task, explicit questions as well as implicit ones from preschool to Grade 3 we were able to delineate early individual differences in narrative picture book comprehension and its changes. Such a developmental approach is in several ways useful when identifying poor comprehenders. Previous research suggests that listening comprehension tasks differentiate among four-year-olds whereas picture book comprehension tasks start showing predictive validity one year later (Lepola, 2015). Comprehending wordless picture book does not require active listening, in which domain poor comprehenders often have weaknesses (Catts et al., 2012, Fig. 1), and therefore the growth in comprehension is less confounded by verbal memory. Also, while avoiding possible problems with word reading, the process of picture book comprehension otherwise resembles reading comprehension that is, the child can stop and study the picture in view and also turn back to previous pictures/events. In this way, picture book comprehension provides a less confounded access to processes underlying reading comprehension, thereby giving space to predictors known to be associated with later reading comprehension problems (Guthrie, McRae, & Klauda, 2007; Vauras, Rauhanummi, Kinnunen, & Lepola, 1999). In this vein, our modeling showed that task orientation and metacognitive knowledge, previously examined in relation to reading comprehension, are important in narrative picture book comprehension already in preschool. It is plausible that these factors play a role in children's responsiveness to early story comprehension interventions such as those carried out with preschoolers (Bianco et al., 2010) or first graders (Paris & Paris, 2007).

A promising finding was that the initial inter-individual gap in picture book comprehension showed a significant tendency to decrease over the years and that this positive development was positively associated with the level of task orientation and metacognitive knowledge at the age of five. In other words, the latter two factors

appear to be resources that facilitate the growth of comprehension. If the present finding about decreasing performance gap is replicable, it suggests that pictorial narratives have a potential detect comprehension skills otherwise not accessible and they could be utilized to fight Matthew effects in reading comprehension. However, a caveat has to be noted. As Fig. 1 suggests, there were students who did not show this pattern. It remains an open question whether this was caused by their low level of task orientation and metacognition or by factors not included in the present study.

As already stated, the precise roles of metacognition and task orientation in picture book comprehension cannot be fully outlined on the basis of the current data. However, it is reasonable to argue that at least facilitation of some type occurs. If this holds true, then the question arises as to how to bring about such a facilitation even earlier, for example, as a collaboration involving parents and early educators working in tandem (e.g., Zevenbergen & Whitehurst, 2003). Both early educators and parents can enhance children's narrative comprehension skills early on, for instance, by modeling retelling, giving opportunities to respond questions, and teaching children to ask what, why, and how questions. Such activities foster the children's metacognition and inference-making. It is also important that parents and early educators support the children's participation, agency and task-oriented behaviors during shared book reading. This can be achieved by showing responsiveness and giving supportive feedback to children's initiatives and contributions before, during and after story reading (Kajamies, Lepola, & Mattinen, 2019). Interestingly, wordless picture books have been found to facilitate pre-readers' verbal participation and responsive interaction more than the use of storybooks with text (Chaparro-Moreno et al., 2017).

Limitations

The present study has some important limitations. Firstly, there were only three time points (preschool, kindergarten, Grade 3) to examine individual differences in the growth of picture book comprehension. Thus, we could not evaluate the acceleration or deceleration of picture-book comprehension during the first two school years, a time that is critical for children's responsiveness to reading instruction and to the development of comprehension skills (LARRC, 2017; LARRC & Yeomans-Maldonado, 2017; Massonnié, Bianco, Laurent & Bressoux, 2018). Secondly, although only one child scored at maximum in Grade 3 picture book comprehension, this variable was skewed to the left. This means that room for the growth of narrative comprehension was restricted in Grade 3. Thus, caution should be exercised when generalizing the present finding of decreasing achievement gaps in picture book comprehension. Thirdly, we relied on off-line tasks in the assessment of comprehension skills. On-line measures focusing on a child's narrative thinking skills (Tompkins et al., 2013), comprehension monitoring (Kinnunen et al., 1998; Strasser & del Rio, 2013) and strategic behavior while viewing a picture book may better delineate the growth of narrative comprehension. Finally, we used teacher ratings for children's domain general task-oriented behavior, rather than direct observations.

Conclusion

The findings of this four-year-long study suggest that picture book comprehension showed a good diagnostic potential for preschoolers' narrative comprehension in terms of strengths and weaknesses as well as growth. Of note is that using wordless picture books as medium, problems of poor decoding while reading and memory overload while listening can be avoided in diagnostic work. Consequently, the early assessment of children's narrative picture book comprehension gives a fair chance to higher-order comprehension skills such as inference-making which is important in the construction of a coherent mental representation of a narrative. The absence of these cognitive and reading-related stumbling blocks also gives space to facilitative factors not directly related to literacy. In the present study the latter were represented by metacognitive knowledge and task orientation. The present results also lend support to the notion that in such a setting, it becomes possible to detect progress in children's comprehension skills which otherwise might remain in hiding.

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Appendix

An example of the memory task in metacognitive knowledge test: the number of items in remembering objects

There are 3 boys here, and everyone has been given the task. The task of this boy is to remember 18 objects, (experimenter points picture 1), the task of this boy is to remember 3 objects (experimenter points picture 2), and the task of this boy is to remember 9 objects (experimenter points picture 3). Which one of the boys had the most difficult task?



After picture selection, the child was asked why was it the most difficult for x (this boy) to remember all the objects? Explanations were scored on a five-point scale from 0 to 4.

The child got 0 points if s/he did not point or verbally refer to any out of three pictures. One point was given if the child selected one of the pictures, but her/his explanation for selecting the picture was unclear, naïve or child expressed that s/he don't know: "I don't know" (picture 1); "well, because it cannot remember anymore those tasks (picture 2)"; "that is because because" (picture 1). Two points for less explicit, slight reference to the person's mental processing, for instance by referring to the distinct feature in the selected picture: "because those are so much" (picture 3); "it has more" (picture 1); "that's because it has most" (picture 1). Three points for referring both the distinctive feature in picture and also cognitive processing (memory): "because it has the most of the objects to remember" (picture 1); "because it nearly does not remember all these" (picture 1). Four points for more explicit explanations referring to relevant mental processes (memory): "because so much, and you can't remember so much" (picture 1).

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