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Vocabulary development at home: a multimedia elaborated picture supporting parent–toddler interaction

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Abstract

Some children enter elementary school with large vocabulary delays, which negatively influence their later school performance. A rich home language environment can support vocabulary development through frequent high-quality parent–toddler interaction. Elaborated picture home activities can support this rich home language environment. This study compares the effects of a multimedia versus a paper elaborated picture on the parent–toddler interaction and toddlers' vocabulary development. In a within-subjects design, 20 toddlers (age 3–4) discussed a multimedia and a paper elaborated picture with a parent. Results showed that toddlers knew significantly more words (receptively and expressively) after both activities. Moreover, the improvement in receptive vocabulary knowledge was significantly larger with the multimedia elaborated picture compared with the paper-based picture. In addition, both parent and toddler engaged in a significant higher level of decontextualized language in response to multimedia. The present study shows that multimedia elaborated pictures can support parents at home to engage in a parent–toddler interaction that is richer and supports the development of receptive vocabulary more compared with traditional paper-based activities. In the future, multimedia-based home activities for toddlers' vocabulary development, supporting parent–child interaction, can be offered relatively cheap and easily via internet.

Keywords

multimedia learning, parent–toddler interaction, vocabulary development.

Each child needs to learn its native language fluently in the first years of life (Webb, 2005). Children learn new words by hearing them in their surroundings. The child's receptive vocabulary includes words that a child understands, whereas his/her expressive vocabulary contains words that the child can actively use as well. Learning new words is predominantly receptive. The majority of vocabulary is learned receptively, as words are used in sentences (Webb, 2005). When words are used over

different contexts, spelled and pronounced, they are learned expressively. Children's vocabulary entering first grade predicts both their word reading ability at the end of that year and their reading comprehension later in their school career (Mol, Bus, De Jong, & Smeets, 2008; Dickinson, De Temple, Hirschler, & Smith, 1992). Approximately 8% of the variance in later vocabulary can be explained by the variation in practicing and experience with words during the preschool years (Hammett, Van Kleeck, & Huberty, 2003).

In this period, parents are the toddler's first teachers, and they can support their child's word learning in the home environment (Britto, Brooks-Gunn, & Griffin, 2006; Mol & Neuman, 2014). Intensive help and interaction with parents is essential to acquire a large

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[Correction added on 14 July 2016, after first online publication: The third author, Miss Rosa Catharina Teepe, was previously omitted and has been added in the current version.]

vocabulary. Home activities, such as book reading, playing games or discussing elaborate pictures, are an ideal context for parents to interact with their toddlers supporting their toddlers' vocabulary development (Chow & McBride-Chang, 2003; Roser & Martinez, 1985; Vygotsky, 1978). Both the quantity and the quality of the parent-toddler interaction during home activities are important for its effectiveness (Mol & Neuman, 2014). Specific parents' behaviours and practices are needed to enhance toddler's language skills, such as describing and naming objects, asking questions and extending information beyond the given context (Chow & McBride-Chang, 2003). For example, when a parent gives his/her child the opportunity to be an active participant in a conversation, the child shows greater gains in vocabulary compared with activities in which the adult simply reads a story (Chow & McBride-Chang, 2003).

Parents can achieve high interaction quantity in home activities by naming different objects in the activity, describing the context and repeating story elements (contextualized language) (Van Kleeck, Gillam, Hamilton, & McGrath, 1997). Furthermore, high-quality parent-toddler interaction is promoted when the parent expands the dialogue beyond what is immediately perceptually present (contextualized language), by talking about what is beyond perception (decontextualized language), for example, making inferences to the child's own life (Van Kleeck et al., 1997). Specifically, this lexical richness has proven to be an important determinant of vocabulary learning (Mol & Neuman, 2014); when parents engage in richer, more decontextualized language, this supports the child's vocabulary development.

Nevertheless, there is much variation in the way parents interact with their child (Leseman & De Jong, 1998). Some of this variation is systematically related to background variables such as the culture, ethnicity or parents' educational level (Crain-Thoreson, Dahlin, & Powell, 2001). Leseman and De Jong (1998) propose that high-educated mothers focus more often on eliciting a conversation, whereas low-educated mothers tend to focus on directing their children's behaviours. This indicates that high-educated mothers generally use more decontextualised language and give their children a more active role as a conversation partner.

A rich home language environment can thus support vocabulary development through frequent and high-quality parent-toddler interaction. The use of decontextualized language by parent and child during home

activities is important for the toddlers' language development (Van Kleeck et al., 1997). However, many parents experience difficulties in engaging in high-quality dialogue with their child during home activities. Family literacy programs are implemented to support parents in the development of their child's language abilities and to prevent early school problems (Van Tuijl & Leseman, 2004; Reese, Sparks, & Leyva, 2010). In these programs, parents are provided with home-based activities that they can execute themselves at home during preschool years. Observational studies have shown that many parents do not spontaneously apply decontextualized language during home activities (Britto et al., 2006; Silvén, Ahtola, & Niemi, 2003). Thus, the effectiveness of these programs is largely determined by the extent to which parents are able to effectively use these activities. In order to help parents to use optimal interactive techniques, training programs are provided with diverse effectiveness (Mol et al., 2008).

An alternative approach is to select home-based activities that elicit decontextualized interaction. Parents mostly use contextualized language instead of decontextualized language during book reading. In contrast, Curenton and Kennedy (2013) found that parents' oral storytelling contains more decontextualized language compared with book reading. Elaborated pictures are often used as more open home activities to elicit interaction between parent and child (Smeets & Bus, 2012; Verhallen, Bus, & De Jong, 2004; Wood, Pressley, Turnure, & Walton, 1987). An elaborated picture is a page with a drawn picture, containing a day-to-day situation with a number of objects, such as a farm with different animals. The picture is used to trigger the child's memory and imagination and prompts the child to express himself. As such, these pictures provide ample opportunities for decontextualized language.

Next to the selection of particular home activities that elicit specific types of parent-child interaction, support for parents can be included in the activities. An effective way to support word learning can be through actively introducing a story to the toddler. A good story involves articulation of the main character's problem or conflict, a description of attempts to solve the problem and an analysis of the chain of events that lead to resolution. In addition, it contains an analysis of how the different characters react to the events in the story. Using a pattern to reconstruct a story is called story grammar (Dimino, Taylor, & Gersten, 1995; Lefebvre, Trudeau, & Sutton, 2011).

Dimino, Gersten, Carnine, and Blake (1990) indicate that students who use story grammar to learn words perform significantly better on vocabulary tests than students who use traditional learning methods. These findings are explained by magnitude of the interaction, the decontextualized elements of the dialogues and the need to pay attention to comprehend the story. The interactions between students and teachers and the clear structure of the story were crucial elements for its effectiveness. Although this study was conducted with 11th graders in a school context, the authors state that the effects could well be translated to younger children. These results correspond closely to the conclusions of Van Kleeck et al. (1977) with respect to toddlers' gains in language development. They also found that parents' use of decontextualized language beyond the picture triggers toddlers' word learning and thus is an essential aspect of effective parent-child interaction for vocabulary development.

However, introducing story grammar to parents with paper-based elaborate pictures demands for extensive training and practicing of parents. Therefore, the story grammar may be integrated in the elaborated pictures on tablet computers. Specifically, multimedia has the potential to queue appropriate techniques to parents while they perform the home-based activity with their child on a tablet computer. For example, by highlighting important elements to discuss or providing suggestions to the parent for questions or comments beyond the direct context of the story. Mayer (2004) found that learning can be supported through multimedia, as there is a stronger match between verbal and nonverbal information in multimedia activities. Also, results of previous studies suggest that multimedia can support vocabulary acquisition (Moody, Justice, & Cabell, 2010).

Verhallen et al. (2004) found that multimedia can be helpful to increase the word knowledge of the child. Moving images, compared with static pictures, enhance children's attention and can be used to develop a story about the situation. In a similar vein, important elements of the image can be enlarged and emphasized to guide the attention. In addition, a meta-analysis has recently been conducted concerning multimedia and interactive features in word learning, consisting of 43 studies and 2147 children (Takacs, Swart, & Bus, 2015). This review showed that meaningful nonverbal additions to stories, such as animated pictures, can boost story comprehension and word learning when it is congruent with the narrative. As such, we suggest that multimedia can be an

effective tool to introduce story grammar to enhance the parent-child interaction to support toddlers' language development.

Present study

Family literacy programs are often used to support toddlers' vocabulary development and to prevent early school problems (Van Tuijl & Leseman, 2004; Reese et al., 2010). Different home activities are provided to elicit parent-child interaction. However, parents mostly engage in contextualised talk during these activities. Elaborated pictures are potential tools to elicit decontextualized parent-toddler interaction that is more effective for vocabulary development. Parents can be further supported with multimedia, which allows for elaborated pictures enriched with story grammar instructions to help parents improving the parent-child interaction and consequently toddlers' word learning (Dimino et al., 1990; Takacs, Swart, & Bus, 2015; Verhallen et al., 2004).

Build on this rationale, in the present study, a multimedia application with story grammar instructions was used to support parents while discussing an elaborated picture with their child. Elements of the elaborated picture were enlarged to focus the attention on those components and parents' received queues on the screen to tell the story and asking questions. In this study, we compare a multimedia with a paper-based elaborate picture. Effects on toddlers' vocabulary development and parent-child interaction are studied using a within-subject design. The following two research questions were addressed:

1. What is the effect of a multimedia versus a paper-based elaborate picture on the toddlers' receptive and expressive vocabulary development?
2. What is the effect of a multimedia versus a paper-based elaborate picture on the level of decontextualized language use of the parent and toddler?

The first hypothesis was that the multimedia condition, in which parents were guided, supports larger gains in toddler's word knowledge (both receptively and expressively) compared with the paper-based activity without guidance. This was hypothesized as previous studies indicate that the parent's contextualized and decontextualized language with the child can enhance children's language learning (Chow & McBride-Chang, 2003; Van Kleeck et al., 1997). In the multimedia condition,

moving and enlarged pictures are used to focus a parent's and child's attention to specific parts of the story (Verhallen et al., 2004), and story grammar instruction can influence the quantity and quality of the parent-child interaction (Mol & Neuman, 2014). Mol and Neuman (2014) conclude that the lexical richness and the quality of the parent-child interaction influence the word development of the child.

In line with this rationale, the second hypothesis was that multimedia supports a higher level of decontextualized language of the parent and consequently of the child. Because of multimedia effects, parent and child follow a more coherent story in the multimedia condition, which is expected to help parents reaching a higher level of decontextualized language. The toddler typically responds by asking more elaborated and specific questions, enlarging his/her type of language as well (Van Kleeck et al., 1997).

Method

Participants

Participants in the present study were 20 children attending preschools ($Mage=40.85$ months, age range=33–49 months): 12 boys ($Mage=41.67$ months, age range=33–49 months) and 8 girls ($Mage=39.63$ months, age range=33–44 months). The parents were 19 mothers and 1 father. All parents were asked about their

educational level. This was measured with a 9-point answer scale, ranging from 0 till 9 [0=no education completed, 1=primary education, 2–5=secondary education (different levels), 6=practical vocational education, 7=intermediate vocational education, 8=higher vocational education, 9=university]. The mean educational level of the whole group was 7.00 ($SD=1.15$). The families had Dutch as their first ($N=17$) or second ($N=3$) language.

Materials

Intervention

Two elaborate pictures (refer to Figures 1 and 2) were selected from the family literacy program VVE Thuis from the Dutch Youth Institute. They formed the basis for the home activity. Parents took on average 15–20 min to discuss the picture with their child.

In the multimedia condition, parents discussed an elaborated picture about a supermarket. In advance, parents received a short introduction into story grammar, and the app guided the parent with hints in the interface (refer to Figure 3). The supermarket image was digitalized and shown with an application on a tablet computer. The story was about a father and daughter who go to the supermarket to buy several groceries. They encounter different kinds of food and select their groceries. Finally, they pay at the cashier. The application supported parents during the activity. Different parts of the elaborate



Figure 1 Elaborated Picture of the Theme 'Supermarket' (Taken from VVE Thuis)



Figure 2 Elaborated Picture of the Theme 'Birthday' (Taken from VVE Thuis)

picture were enlarged to focus parent's and child's attention to the elements they were talking about. Additionally, hints appeared which the parent could read to the child during the activity. The hints included a sentence or a question, refer to Figure 3.

In the paper condition, an image with the theme birthday was handed to the parents on a piece of paper, refer to Figure 2. Parents were asked to create a typical image sharing interaction using as many words on the provided list as possible.

Measures

Target vocabulary

The vocabulary knowledge was tested with specific vocabulary tests that were especially designed for this study. For each elaborated picture, 16 words (mostly unknown by the majority of the children) were selected as target vocabulary words. Each set of words consisted of eight nouns, four verbs and four adjectives/adverbs. An overview of the target words per condition is provided



Figure 3 Multimedia Condition. The following hint was shown: "You see different kinds of meat. How many slices of sausage do you see here?" (taken from VVE Thuis)

in Appendix A. The target words were tested receptively and expressively in a pre-test and post-test. In both conditions, the target words were initiated by the parent twice.

Receptive target vocabulary test. To assess children's receptive knowledge of the target words, they were asked to select the target word out of four pictures by clicking on the right word. The correct image was presented on a tablet among three distracters (refer to Figure 4). The test consisted of 32 items ($\alpha=0.84$).

Expressive target vocabulary test. To assess children's expressive knowledge of the target words, a task was designed in which children were asked to complete sentences with the target word. The researcher read the stimulus sentence, while a picture of the target word was shown on the screen. For example, "On the birthday cake are...(candles)." This test consisted of 24 items ($\alpha=0.90$). The eight adjectives/adverbs were not suitable for this test.

Observation parent-child interaction

During the intervention, the quality of interaction between parent and child was analyzed observing contextualized and decontextualized language use. Language use of both parent and child was scored using the observation

scheme of Van Kleeck et al. (1997) and the four levels of abstraction coding scheme, developed by Blank, Rose, and Berlin (1978a, 1978b). Following van Kleeck et al. (1997), we distinguished utterances that were related to the story and content of the game (story-related utterances), those that served tablet and game use (procedural-related utterances) and utterances that guided the interaction (interaction-related utterances). Interaction-related utterances involved utterances that parents and children used to support each other, give feedback or engage to complete the task (refer to Table 1 for examples). Procedural-related utterances included utterances on functional aspects of the game and tablet. Story-related utterances were comments and questions about the story told within the game. The story-related utterances were the focus of the observation scheme and were coded on four levels of abstraction. These levels describe to which extent an utterance refers to contextualized information that is perceptually present or to decontextualized information that is beyond perception. The first two abstraction levels included concrete contextualized utterances, whereas the third and fourth level contained abstract decontextualized utterances.

First level utterances (matching perception) were about perceptually present objects and characters in the



Figure 4 Receptive Vocabulary Test

Table 1. Coding Scheme for Observing Contextualized and Decontextualized Parent–Child Interaction Based on Van Kleeck et al. (1997)

Main category	Definition	Examples
Interaction-related	Utterances to support each other, give feedback or engage to complete the task.	Very well done, you already know a lot! Now we are playing this game, later you can play.
Procedural-related	Utterances about functional aspects of the game and tablet.	Look, this is how you pick up Jeffy. Don't click on that button.
Story-related	Utterances about the story told within the game.	
Level 1	Utterances about perceptually present entities, focused on labelling, locating and noticing entities.	Where do you see the polar bear?What do you see here?
Level 2	Utterances about perceptually present entities, focused on entities' characteristics and actions, recalling information and completing sentences.	The polar bear wears red shoes.The bird takes the suitcase.
Level 3	Utterances beyond perceptual presence, focused on summarizing story content, defining words, providing a point of view of a character, comparing similarities and differences, providing judgements about story content and associating different images.	Why would the lion be angry?That is an ugly sweater.
Level 4	Utterances beyond perceptual presence, focused on making predictions about story content, describing and solving a problem and explaining concepts.	Jeffy is happy again, because he found back his clothes.Where do you think the bird is flying to?
Non-codable	Unintelligible utterances, filler words when they were the only word of a sentence	Hmmm, uhuh
Non-response	Denials and refusals to participate	I don't know No

game. This included labelling, locating and noticing entities. Level 2 (selective analyses/integration of perception) also included utterances about perceptually present entities, but these utterances were slightly more abstract. Utterances focusing on entities' characteristics and actions, recalling information and completing sentences were included in this level. At level 3 (reorder/infer about perception), utterances were more abstract because they were beyond what was perceptually present. These utterances focused on summarizing story content, defining words, providing a point of view of a character, comparing similarities and differences, providing judgements about the story content and associating different images. Utterances at level 4 were of the highest level of abstraction with abstract and decontextualized utterances. This level contained utterances focused on making predictions about the story content, describing and solving a problem and explaining concepts. During the parent–child interaction, the level of decontextualized utterances was counted. This count was translated into a score between 1 (not present) and 5 (regularly present).

Procedure

Parents were approached by letters in kindergartens, orally outside of the kindergarten, via letters at home and via associates. The participating children were visited at home three times. In the first session, the expressive and the receptive target vocabulary tests were administered (pre-test). The two elaborated pictures were discussed during the second session. The parent and child started with the multimedia condition after which they continued with the paper-based elaborated picture. The third session took place between 5 and 7 days after the second, and in this meeting, the expressive and receptive target vocabulary tests were administered again (post-test).

Analyses

In order to answer the first research question investigating the effect of different elaborate picture conditions on word development, a within-subjects, two-way repeated measures analysis of variance was conducted.

This examined whether there was an effect over time (pre-test and post-test) and if there were differential effects between the conditions (multimedia and paper). The second research question examining the effect of the elaborate paper conditions on the parent–child interaction was also answered by means of a repeated measure analysis. Specifically, the effects of the two conditions on the parent’s and toddler’s decontextualized language used were examined.

Results

Descriptive statistics

The descriptive statistics are presented in Table 2, showing means, standard deviations and ranges of the pre-test and post-test (receptive and expressive) word knowledge and parent’s and child’s abstraction level. The descriptive statistics indicated that the data were relatively well distributed with only a noteworthy difference between pre-test scores of the conditions.

Effects of the conditions on toddler’s word knowledge

Receptive word knowledge

The analysis yielded significant main effects for time, $F(1,19)=104.60, p < 0.001$. This indicated that in both the elaborated and paper condition, children’s receptive word knowledge was improved between the pre-test [$M=10.50$ (paper) and $M=7.75$ (multimedia)] and post-test [$M=12.80$ (paper) and $M=11.85$ (multimedia)]. There also was a significant main effect for condition, $F(1,19)=18.43, p < 0.001$, with higher scores in the paper condition ($M=10.50$ in the pre-test and $M=12.80$

in the post-test) compared with the multimedia condition ($M=7.75$ in the pre-test and $M=11.85$ in the post-test). This indicates that both on the pre-test and the post-test children obtained higher scores in the paper condition compared with the multimedia condition. Finally, there was a significant interaction effect between time and condition, $F(1,19)=7.54, p=0.013$. This indicates that the improvement in word knowledge over time was significantly larger in the multimedia condition than in the paper condition. Figure 5 shows the development of receptive word knowledge during the pre-test and post-test for both conditions.

Expressive word knowledge

The analysis indicated a significant main effect of time, $F(1,19)=132.13, p < 0.001$. There was a clear improvement in expressive word knowledge between the pre-test [$M=6.05$ (paper) and $M=3.25$ (multimedia)] and the post-test [$M=8.45$ (paper) and $M=6.35$ (multimedia)] for both conditions. There was also a significant main effect of condition, $F(1,19)=61.73, p < 0.001$, with significantly higher scores in the paper condition ($M=6.05$ in the pre-test and $M=8.45$ in the post-test) compared with the multimedia condition ($M=3.25$ in the pre-test and $M=6.35$ in the post-test). This indicates that again, as with receptive word knowledge, both on the pre-test and the post-test, children obtained higher scores in the paper condition compared with the multimedia condition

Table 2. Descriptive Statistics of Pre-Test Scores, Post-Test Scores, Child Abstraction Level and Parent Abstraction Level in the Multimedia and Paper Condition

Condition	Paper		Multimedia	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pre-test receptive	10.50	2.42	7.75	2.45
Post-test receptive	12.80	2.14	11.85	2.80
Pre-test expressive	6.05	2.74	3.25	1.89
Post-test expressive	8.45	2.20	6.35	2.08
Child abstraction level	3.30	1.13	3.60	1.20
Parent abstraction level	3.85	1.09	4.30	0.87

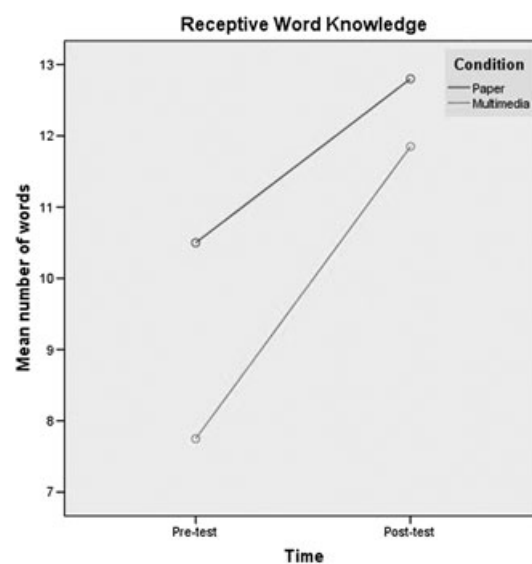


Figure 5 Receptive Word Knowledge

on expressive word knowledge. There was no significant interaction between time and condition, $F(1,19)=1.753$, $p=0.201$, indicating that the improvement over time in expressive word knowledge was comparable in both conditions (refer to Figure 6).

Effects of multimedia condition on decontextualized language use

The effects of the multimedia condition on the parent's and child's level decontextualized language use were examined. The results indicated a significant main effect of condition, $F(1,19)=18.19$, $p<0.001$. Both the parent's and child's decontextualized language use were significantly higher in the multimedia condition compared with the paper condition (child: $M=3.60$ vs $M=3.30$ and parent: $M=4.30$ vs $M=3.85$). There was also a main effect for the actor, $F(1,19)=12.44$, $p=0.002$, with a higher abstraction level for parents ($M=4.08$) than for children ($M=3.45$). Figure 7 shows the effects of condition on the language use.

Illustrative case description

To illustrate parents' and toddlers' decontextualized language use in the multimedia condition, we selected an exemplary case. We transcribed the video, selected a

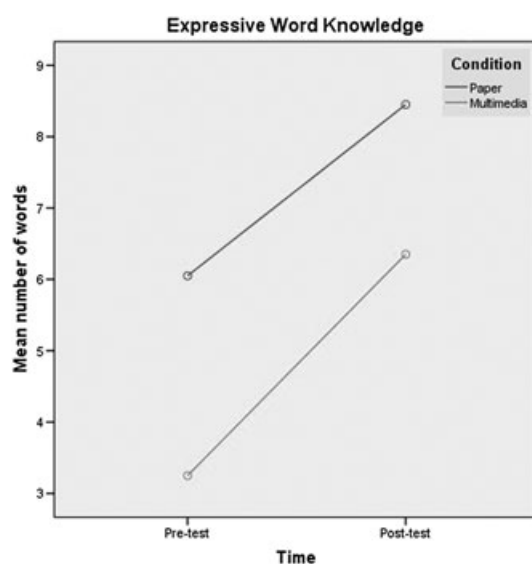


Figure 6 Expressive Word Knowledge

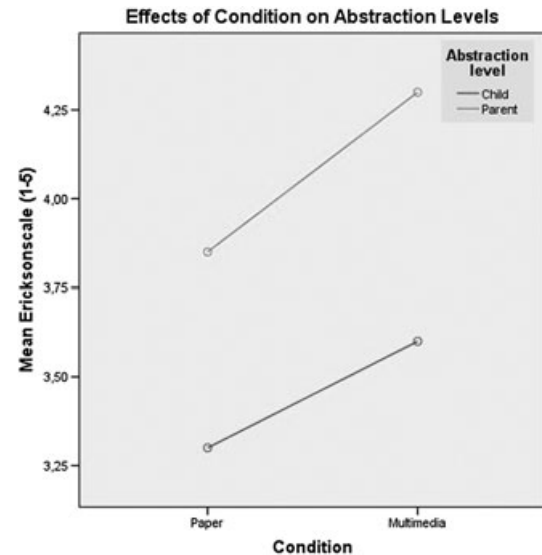


Figure 7 Effects of Multimedia Condition on Decontextualized Language Use of Parent and Child.

small abstract of the conversation and translated it to English (refer to Table 3).

The mother describes the situation in the elaborate picture ("Daddy is in the supermarket, because he has to do his groceries"), and the child adds that he is with his child ("With his child."). Mother confirms and asks the child to point out the groceries and name them ("Indeed. Where do you see the groceries? What is it?"). The child points to the groceries and confirms that there are different types of food ["There" (*while pointing*). "All kinds of foods"]. The mother further specifies that dad is looking for bread ("Daddy needs bread. Where do you see the bread?"). Again, the child pointed to the right objects, and the mother confirmed the answer ("Yes, there is the bread"). The mother states that the father had difficulties taking the bread ("Daddy has to completely raise his arm, because the bread is almost at top"), and the child reacted enthusiastically by saying that she also "ate a slice of bread." The mother confirms that the child ate a slice of bread and added that it was in the morning ("Indeed, this morning you were also eating a slice of bread"). After that, she continued the story by introducing another object that is at top of the cabinet and asks the child whether she sees that too ("At top of the cabinet, there is also something else. That is a biscuit rusk. Do you see that?"). The child replied 'yes', and the mother asked where she was seeing it ("Where do you see it?"). The child pointed to the right object, and the mother praised the child ("Well done").

Table 3. Illustrative Case in Multimedia Condition

Person	Utterance	Code	Multimedia
Mother	"Daddy is in the supermarket, because he has to do his groceries."	Story-related utterance; level 3	Prompt in screen
Child	"With his child."	Story-related utterance; level 2	
Mother	"Indeed. Where do you see the groceries? What is it?"	Story-related utterance; level 2	Prompt in screen
Child	"There" (<i>while pointing</i>). "All kinds of foods"	Story-related utterance; level 1	
Mother	"Daddy needs bread. Where do you see the bread?"	Story-related utterance; level 1	Prompt in screen
Child	"There" (<i>while pointing</i>).	Story-related utterance; level 1	
Mother	"Yes, there is the bread."	Interaction utterance	Bread is enlarged (zoomed in)
Mother	"Daddy wants to take the bread. Look, it is almost at top of the cabinet!"	Story-related utterance; level 2	Cabinet is enlarged
Child	"He doesn't wear a coat."	Story-related utterance; level 2	
Mother	"No, I think the weather is good outside."	Story-related utterance; level 3	
Mother	"Daddy has to completely raise his arm, because the bread is almost at top."	Story-related utterance; level 2	Cabinet is still enlarged
Child	"Yes...I also ate a slice of bread!"	Story-related utterance; level 3	
Mother	"Indeed, this morning you were also eating a slice of bread."	Story-related utterance; level 3	
Mother	"At top of the cabinet, there is also something else. That is a biscuit rusk. Do you see that?"	Story-related utterance; level 2	Prompt in screen
Child	"Yes."	Interaction utterance	
Mother	"Where do you see it?"	Story-related utterance; level 2	
Child	"There" (<i>while pointing</i>).	Story-related utterance; level 1	
Mother	"Well done."	Interaction utterance	Biscuit risk is enlarged

This case description illustrates how story grammar supported by multimedia can facilitate a conversation between parent and child that includes both utterances that are related to the picture itself and also beyond the direct visible context of the picture, for example, when the child related the bread to her own breakfast. When posing specific questions, the child and the mother were talking about the same part of the image, and when the child responded well to an answer, the parent confirmed her answers and started a new part of the story. Also, the child reacted more extensively because of the clearness of the story.

Additionally, based on observations during the conversations between parent and child, differences between the conditions were found. Parents described the situation more elaborately in the multimedia condition and made more use of decontextualized language. The storyline was more coherent, and they asked more and more detailed questions. Moreover, in the multimedia condition, there was a great amount of talk in the same time. Because of hints in the multimedia condition, parents did not have to make up the story themselves, which led to more fluent conversations. Also, the enlarging pictures made it more convenient for parents to focus the

child's attention to the specific parts of the elaborated picture that the parent was talking about at that moment.

Discussion

The aim of the present study was to compare the effects of a traditional paper-based with a multimedia-based elaborate picture on toddlers' vocabulary development and the parent-child interaction. Using a within-subjects design, parents and toddlers discussed two elaborated pictures: one on paper (paper condition) and one on a tablet (multimedia condition).

The first hypothesis that in the multimedia condition, in which parents were guided, toddler's word knowledge would be enhanced more compared with paper condition was confirmed for children's receptive knowledge. In the multimedia condition, children learned significantly more words receptively than in the paper condition. Nevertheless, there was no effect found for children's expressive word knowledge. This can be explained by previous findings of Webb (2005) that children easier learn words receptively than expressively. The positive effects on children's receptive word knowledge can be explained by the fact that in the multimedia condition, words are

both used in sentences and triggered by the parent with questions as well as the emphasis on these words by meaningful multimedia additions congruent with the story narrative.

The second hypothesis was a check on the proposed mechanism that the multimedia elaborate picture enhanced the level of decontextualized talk more than the paper condition, and thereby positively influencing the child's use of decontextualized language. Results indicated that indeed in the multimedia condition, the parent's and child's decontextualized language use was higher compared with the paper condition. Providing instructions for parents by using story grammar and enlarging pictures through multimedia thus positively influenced both parents' and children's levels of abstraction.

Summarizing, the results indicated that there was a significant effect of the multimedia condition on the receptive word learning of children. The quality of the discussion was higher in the multimedia condition compared with the paper condition because of the structured story and questions. Subsequently, it positively influenced the word learning of the child, which is consistent with findings of previous studies (Chow & McBride-Chang, 2003; Van Kleeck et al., 1997; Mol et al., 2008). Story grammar instruction and multimedia enhanced the children's receptive word development and did also influence the decontextualized language use of parent and child. The hints that were offered with multimedia in the multimedia condition led to higher levels of decontextualized language. These higher levels positively influenced children's decontextualized language use and word development. The executed, relatively short, intervention provides a first step in showing positive effects of a multimedia-based home activity on toddlers' word learning and the parent-child interaction.

Of course, some limitations apply to the present study. First, in the present study, the word knowledge of very young children was measured. There were large differences in attention spans during each day within a child, so it might be possible to get different results when replicating the study with the same children. In many cases, according to both the parent and the researcher, the child may sometimes know more than he/she actually showed during the session. However, this is a problem that applies to all studies in which toddlers are being tested and provide active input.

Another limitation of the present study is that two themes were used and that each theme was assigned to

one condition. Before the intervention, almost all children knew more target words of the theme birthday (paper condition) than of the theme supermarket (multimedia condition). So, there were different levels of word knowledge in the pre-test and post-test between conditions. Therefore, it can be debated whether the difference in gain in word knowledge is only because of the condition. It can also be partly because of a ceiling effect in the paper condition, with less space for improvement in this condition compared with the multimedia condition. Although it might sometimes be better to have both themes in both conditions, this was the most optimal design with the current sample size, and there was a significant gain in toddler's receptive word knowledge within conditions as well.

In addition to the previous limitation, all parents performed the activity with multimedia first followed by the paper version. It may be possible that parents learned in the multimedia condition how to discuss an elaborated picture and therefore performed better afterwards while discussing the paper version than would be the case with a reversed sequence. However, we were mainly interested in the effects of the multimedia condition and all parents started with this condition because of the sample size. Reversing the conditions is likely to further increase the positive effects of the multimedia condition as parents would not have first performed an activity with hints in the interface.

A final limitation is that parents' educational level in the present study was on average quite high. Perhaps, those parents did already manage to have good parent-child interaction during a conversation by themselves, whereas low-educated parents would have experienced more difficulties in performing such a task on their own (paper condition), resulting in more differences in the interaction between conditions (Leseman & De Jong, 1998). Replication of this study with low-educated parents can add valuable information to the current knowledge.

Future research may focus on low-educated parents, to examine whether multimedia elaborated pictures with story grammar instructions are also applicable for this group.

Practical implications

The findings of this study indicated that multimedia elaborate pictures support a parent-child interaction and enhanced the receptive word knowledge of the participating

toddlers. By discussing the elaborated pictures, the children learned new words. It was also shown that the story grammar instruction and other tools had a positive effect on the decontextualized language use of parent and child.

The results have some practical implications. It leads to a renewed understanding on the supporting role of ICT (Information and Communications Technologies; here: multimedia) in the execution of parent–child activities, the role of story grammar and the parent–child interaction (decontextualized language use). This knowledge about effective methods to improve (receptive) word knowledge can be valuable for both program developers, parents and trainers who transmit the program to the parents. In addition, policy makers can make more informed decisions about investing in parental involvement with these results. The results of the present study provide more insights in effective support of parental engagement, and this knowledge can lead to adjusted activities in playrooms and at home. Parents are often willing to invest time and efforts in helping their child, but some of them simply do not know and/or are not capable of helping their children on their own. The multimedia condition did increase the parent's level of abstraction in the conversation, and these kinds of activities can train the parent in executing relevant vocabulary activities at home in the right way. Because of the ICT component, it can become easily accessible via internet. So in the future, it is able to reach both high-educated and low-educated parents and can be offered as a relatively cheap and effective program.

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Appendix A

Overview of the target words per conversation

Multimedia condition (supermarket): verkoopster (seller), geld (money), slager (butcher), vlees (meat), fruit (fruit), groenten (vegetables), kar (shopping cart), boodschappen (groceries), betalen (to pay), proeven (to taste), wegen (to weigh), pakken (to grab), tussen (between), haar (her), naast (near), bovenin (at top).

Paper condition (birthday): feestmuts (party hat), slingers (party garland), driehoek (triangle), ketting (chain), kaarsjes (candles), rietje (straw), strik (bow), pootjes (paws), trakteren (to treat), juichen (to cheer), uitblazen (to blow out), uitpakken (to unpack), enige (only), met z'n allen (all together), evenveel (as much), op (on).