How Temporal Contiguity between Oral Text and Pictures during Listening to a Digitalized

Storybook Influences Young Kindergartener's Vocabulary Growth

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August 2013

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Abstract

Storybook reading is a widespread activity in the kindergarten classrooms. Preschool teachers usually read the narration of each page from print storybooks and show the illustrations around afterwards. However, presenting the illustrations at the same time as the oral narration might be more effective for children's vocabulary development. The aim of the present study was to examine the effect of different timing between pictures and text during a story reading on young kindergartener's vocabulary acquisition. 22 children listened to digitalized storybooks presenting the visual and the verbal information either at the same time or successively. Children's book-based vocabulary growth was assessed. The findings showed that simultaneous storybooks were more beneficial than non-simultaneous ones on young kindergartner's vocabulary development. Students with larger initial vocabularies benefited more from the simultaneous storybooks than the non-simultaneous ones. However, the mode of presentation made no difference in learning gains for students with low initial vocabulary knowledge. Digitalized storybooks are suggested for preschool reading sessions.

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There is strong evidence of the relationship between children's vocabulary knowledge and later reading comprehension (de Jong & van der Leij, 2002). As reading comprehension is the superior skill that a reader should attain through schooling years, the relationship between early vocabulary knowledge and reading comprehension makes us realize the importance of vocabulary acquisition in students' educational progress. Thus, in the present study I aimed to investigate ways that could help young children (4- to 5-year-old) to improve their vocabulary knowledge before entering formal schooling.

Storybook reading with young children fosters their vocabulary knowledge and their emerging literacy skills, like letter knowledge and phonological awareness (Bus, van IJzendoorn, & Pellegrini, 1995). Notably higher gains on vocabulary is produced after repeated readings of a storybook as the child has more opportunities to encode the novel words and finally store them in memory (Senechal, 1997). Teachers and parents traditionally read print storybooks to their children. However, with the spread of technology, electronic storybooks are becoming more often present in a lot of families and schools, for example as apps on the iPad.

A wide range of electronic storybooks are available on the market with different multimedia and interactive features such as animations, zooming, background music and sound effects. In a previous study, digital storybook features such as video images, static illustrations, music and sounds were combined during a story reading, in order to examine which combination better supports word learning in children with severe language impairment (Smeets, van Dijken, & Bus, 2012). It was revealed that video images and static

illustrations were equally beneficial on word learning; however, the use of music and sounds deteriorated the learning. It is still unknown how the different timing between illustrations and oral text facilitates the vocabulary acquisition of normally developing children, hence it is important to investigate it to provide guidelines for developers and educators. In this study digitized storybooks with static pictures without extra sound or music effects was my focus, in order to assess solely the effect of the timing of illustrations.

Before designing a multimedia storybook, we should take into account how the human mind processes information and what are the procedures that occur during learning. Paivio's *dual coding theory* (1986) assumes that there are two cognitive subsystems, one processes the verbal information and another one processes the visual information. The human mind processes the information through distinct channels and creates two independent representations, a verbal and a pictorial one. The chances to retain and retrieve information from memory are higher when the information is stored in two different representations. Based on these theories, the two important sources of information for children during storybook reading are the narration and the congruent illustration. However, the most optimal way to present the verbal and the visual stimuli is still a question.

According to the *multimedia learning theory* of Mayer (2001) people learn more deeply if the words are accompanied by congruent images than without this visual help. All multimedia presentations, however, are not equally effective and that is because adding pictures to words in a random order cannot guarantee any learning improvement (Mayer, 2001). Thus, it is important to investigate the most optimal ways to combine pictures and words.

Furthermore, the *temporal contiguity principle* of Mayer (2005c) suggests that people tend to learn more deeply from a multimedia presentation when the words and their matched

pictures are displayed simultaneously rather than successively. To integrate the oral text and illustrations during storybook reading, children store the verbal information from the narration in working memory until the reception of the visual information. If the verbal and the visual representation are unsynchronized, there is more information that someone has to keep in memory resulting in working memory overload. Thus, in this study I expected that presenting the oral narration and the illustrations of story simultaneously would help a learner to keep more information in memory leading to higher vocabulary gains.

Many times it has been pointed out that storybook reading boosts young children's vocabulary levels, although we do not know which aspects of word knowledge it supports. According to Nagy and Scott (2000) word learning is achieved in many steps arguing for an *incremental nature* of word acquisition. Also, they suggest that word learning is *multidimensional* because word knowledge has different qualitative levels. Based on the above theory, the present study considered vocabulary knowledge on two levels: receptive knowledge reflecting a child's understanding of a word's meaning and expressive knowledge reflecting the ability of a child not only to understand the meaning of a word but also to use the word in an oral context.

The central question of the present study is whether the illustrations of a storybook should be presented simultaneously with the narration or successively. So far, when a teacher reads storybooks to a whole preschool classroom, usually starts with the reading of the text and then shows around the illustrations. However, it is not yet clear whether this temporal contiguity of the verbal and visual information is more facilitative of word learning as compared to presenting the illustration at the same time.

In my first research question I aimed to test whether the simultaneous presentation of illustrations during narration results in higher gains in young kindergarteners' word learning -

on the expressive and receptive levels- as compared to the non-simultaneous presentation. I hypothesized that the gain in vocabulary knowledge would be different between these two conditions. Specifically, based on the *temporal contiguity principle* (Mayer, 2005c), I expected that a simultaneous presentation of a static picture during narration would lead to higher gains in young kindergarteners' word learning.

Additionally, differences were expected on the receptive and expressive vocabulary levels of children after both interventions. Verhallen and Bus (2010) showed that the understanding of words (receptive vocabulary) precedes the ability of using the word in context (expressive vocabulary). In other words, it has been revealed that the understanding of words (receptive vocabulary) precedes the ability of using the word in context (expressive vocabulary). It was assumed that the above results would be repeated in the present study. In a sample of mono- and bilingual speaking 4-year-old children, it was expected that children would learn more words receptively than expressively.

The second research question of the present study was based on the *Matthew effect theory* (Stanovich, 2000). According to this theory, the existence of individual differences in reading occurs because good readers enhance their reading skills faster than poorer readers do. Hence, strong readers become stronger after their exposure to reading, while weak readers improve less through years. Being able to read fluently good readers learn more from their exposure to new reading experiences, however weak students encounter difficulties that stops them from a similar progress.

Thus, in my second research question I aimed to examine whether bigger initial receptive vocabulary would be related to higher vocabulary gains from storybook reading. Based on the *Matthew effect theory*, I hypothesized that students with higher initial receptive vocabulary would benefit more from the interventions and that they would improve their

vocabulary skills more than the low initial vocabulary students. Moreover, I investigated whether vocabulary size had a different effect, in the simultaneous and non-simultaneous condition. Relying on the *temporal contiguity principle* (Mayer, 2005c), I hypothesized that both high and low initial vocabulary students will benefit more from the simultaneous presentation of the storybooks than the non-simultaneous one.

Method

Participants

Native English-speaking preschool-aged children were recruited in an international school in the Hague, during two consecutive school years: in the falls of 2011 and 2012. Second language speakers were not approached because the materials of the present study was in English and the second language English-speaking children were not yet fluent according to the teachers of the classes.

At the beginning, the total number of participants was 26 children (14 from the year 2011 and 12 from the year 2012). From the 26 children two refused to co-operate after the first two sessions, another child encountered health problems and was missing from school during the time of data collection and one child was excluded because he was an older sibling of one of the participants and already in first grade. The final intervention sample consisted of 22, 4-year-old children (10 boys and 12 girls) aged between 50 to 59 months ($M = 54.45$, $SD = 3.39$). All participants attended all sessions of the pre-test and the reading sessions.

The children were from international families living in the Netherlands. The parents were originally from 11 different countries (Australia, Croatia, England, Finland, France, Germany, Ireland, Norway, Portugal, Thailand and U.S.). Each child had at least one native English speaker parent. 13 children were monolingual English speakers and 9 children were

bilingual speakers (English with German, Dutch, Spanish, etc.). From the 22 children 16 returned an extensive questionnaire including questions regarding the socioeconomic status of the family. All of those families returning the questionnaire reported high socioeconomic status with a monthly net income of more than 3200 Euros. Furthermore, all the parents were highly educated reporting at least a Bachelor's degree except of one parent reporting high school degree as the highest educational level.

Design

A within-subjects design with three conditions: a control, a picture-oral text simultaneous and a text-first condition were used to examine how different timing between the oral text and the static pictures during listening to a digitalized book on a whiteboard influences young kindergarteners' vocabulary growth. Six digitalized storybooks were divided into three pairs of books so each pair had comparable length and difficulty of the oral texts. The pairs were assigned to the three conditions (control, simultaneous, non-simultaneous) in 6 possible ways following a Latin square design (Keppel, 1991). As shown in Table 1, 6 intervention groups were created and the participants were equally assigned to these: 4 children participated in Group 1, 3 in Group 2, 4 in Group 3, 4 in Group 4, 4 in Group 5 and 3 in Group 6.

Moreover, the order in which the books in the two intervention conditions were presented was counterbalanced so half of the reading groups started with a simultaneous and half with a non-simultaneous book. On the first session children listened to one book presented in the simultaneous condition and another in the non-simultaneous condition. On the second session children listened to another two books: one presented in simultaneous and another one in non-simultaneous matter. On this second session the order of the presentation

of the intervention conditions was changed. Children repeated the first two reading sessions on the next two sessions, so that the children to read each book twice.

Each child listened to four digitalized books during the intervention, two of them in the simultaneous condition and the other two in the non-simultaneous condition (see Table 1). Serving the purposes of the control condition, one pair of e-books was not presented to the participants. Eventually, the data collected in the control condition was not used in the present study. In the simultaneous condition the pages of the books were presented in a simultaneous matter, meaning that the pictures of the pages were presented at the same time as the oral narration of the pages. In contrast, the pages of the books in the non-simultaneous condition were presented in a consecutive manner: children first listened to the oral text of the page while a black screen was presented on the whiteboard and afterwards they saw the picture on the whiteboard for the same amount of time.

The amount of time the static illustrations and the oral text were presented was exactly the same in each condition, in order to eliminate the possibility that the differences on vocabulary knowledge were caused by any other differences between the two intervention conditions. Thus, the non-simultaneous presentation of a book lasted double time comparing with the simultaneous presentation. In that way the only difference between the intervention conditions was the timing the static picture was presented during the oral narration which is either simultaneously or consecutively.

Table 1

The intervention schedule of the reading groups.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Session 1	The great white man-eating shark (SIM)	Miss Nelson is back (NON-SIM)	Doctor De Soto (SIM)	Miss Nelson has a field day (NON-SIM)	Panama (SIM)	Officer Buckle and Gloria (NON-SIM)
	Doctor De Soto (NON-SIM)	Miss Nelson has a field day (SIM)	Panama (NON-SIM)	Officer Buckle and Gloria (SIM)	The great white man-eating shark (NON-SIM)	Miss Nelson is back (SIM)
Session 2	Officer Buckle and Gloria (NON-SIM)	The great white man-eating shark (SIM)	Miss Nelson is back (NON-SIM)	Doctor De Soto (SIM)	Miss Nelson has a field day (NON-SIM)	Panama (SIM)
	Miss Nelson has a field day (SIM)	Panama (NON-SIM)	Officer Buckle and Gloria (SIM)	The great white man-eating shark (NON-SIM)	Miss Nelson is back (SIM)	Doctor De Soto (NON-SIM)
Session 3	The great white man-eating shark (SIM)	Miss Nelson is back (NON-SIM)	Doctor De Soto (SIM)	Miss Nelson has a field day (NON-SIM)	Panama (SIM)	Officer Buckle and Gloria (NON-SIM)
	Doctor De Soto (NON-SIM)	Miss Nelson has a field day (SIM)	Panama (NON-SIM)	Officer Buckle and Gloria (SIM)	The great white man-eating shark (NON-SIM)	Miss Nelson is back (SIM)
Session 4	Officer Buckle and Gloria (NON-SIM)	The great white man-eating shark (SIM)	Miss Nelson is back (NON-SIM)	Doctor De Soto (SIM)	Miss Nelson has a field day (NON-SIM)	Panama (SIM)
	Miss Nelson has a field day (SIM)	Panama (NON-SIM)	Officer Buckle and Gloria (SIM)	The great white man-eating shark (NON-SIM)	Miss Nelson is back (SIM)	Doctor De Soto (NON-SIM)

Note. SIM = Simultaneous condition, NON-SIM = Non-simultaneous condition

Materials

Six English language storybooks were digitized: *The Great White Man-Eating Shark* (Mahy, 1995)*, Doctor De Soto* (Steig, 1982)*, Officer Buckle and Gloria* (Rathmann, 1995)*, Miss Nelson Has a Field Day* (Rathmann, 1995)*, Miss Nelson is Back* (Allard, & Marshall, 1982) and *The trip to Panama* (Janosch, 2005)*.* The texts of these commercially available books were recorded by a native speaker. The pictures of the books were scanned so they can be presented on a whiteboard. In order to asses children's word learning from the book, 9 quite difficult target words were chosen from each book resulting in 54 testing words in total.

For each book two versions of digitalized stories were created: a simultaneous and a non-simultaneous one. As mentioned above the only difference between the two versions was the timing the static picture was presented next to the oral narration. The oral text and the pictures were exactly the same in both versions of the stories. The amount of time the pictures were displayed was also the same resulting in double time duration of the non-simultaneous presentations compared to the simultaneous ones.

Procedure

A consent form was sent to the parents of native English speaking children in the three kindergarten classrooms to inform them about the study and asking permission for their children to participate in the experiment and be videotaped during the sessions. Parents of two children agreed to participate but refused for their children to be videotaped. For those children, a researcher took extensive notes of the sessions for recording purposes. The sessions were conducted in a separate room in the school during school hours.

The experiment first time took place in the fall of 2011 and it was repeated following the same procedure again in the fall of 2012. Each year Bachelor's and Master's students conducted 9 sessions of experiment which were spread over 7 weeks in 2011 and 6 in 2012.

The first two sessions included tests of general vocabulary, executive functions and pre-testing of storybooks' target words. Afterwards followed four reading sessions where children listened to the stories in pairs in front of a whiteboard. On the final 3 post-test sessions children's knowledge of the target words of the books was assessed. The order of the tests was the same for all children, starting with tests measuring expressive knowledge and finishing with receptive tests of the target words in order to avoid a testing effect.

During the testing sessions, the researchers administered the tests to children on the screen of a laptop. Additionally to videotaping the sessions, the researchers kept written records of the children's answers. The test items were recorded by a native speaker so the main responsibilities of the researchers were to play the items and to encourage and motivate the children during the testing, without giving them feedback about the suitability of their answers. Children could earn a sticker as a prize after completing each test.

The tests were administered to each child individually whereas the children listened to the stories of the intervention program in couples. The children only had one session per day in order to avoid exhausting them.

Measures

General Receptive Vocabulary Knowledge. Children's initial receptive English vocabulary was measured by using the *Peabody Picture Vocabulary Test, Third Edition Form B* (PPVT-IIIB; Dunn, & Dunn, 1997). This test was administered to each child individually with the aid of a laptop. At this test the participant first listens to one stimulus word and afterwards selects from among four pictures which one depicts the word best. This test has excellent reliability; the alpha reliability coefficient for the age group of 4-6 years old has been found .95 and the test-retest reliability .91 (Dunn, & Dunn, 1997).

Specific Vocabulary knowledge. Four types of tests were developed for the 54 target words to examine word learning from the books on both expressive and receptive levels. In order to assure students' apprehension of tasks before start testing, two trial items were added at the beginning of every test. The final answers were scored by two raters and any disagreements were discussed until they came to an agreement. Percentage scores were calculated separately for the three conditions for every child.

Expressive vocabulary test. To assess children's expressive knowledge of the target words, a picture depicting the target word was selected from the storybooks. Participants were asked to answer a question about the picture which provoked the use of the target word (e.g., "How is called the boss of the teachers?"). Only a reply of the target word (e.g., *principal*) was considered as correct answer and was awarded with 1 point. Synonyms and other answers were grated as incorrect and they were given 0 points. The inter-rater reliability for this test was high (Kappa = .72, $p < .001$).

Context integration test. In the Context Integration Test children were asked questions containing the target words which required the child to provide an explanation of the target word in the context (e.g., "How a crate can help you?"). This task examines the ability to expressively reflect on the meaning of the word in a context, thus it was considered as a measure of expressive knowledge. Answers that reflected on the meaning of the target word were grated with 1 point. 0 points were given to every incorrect or irrelevant answer. The inter-rater reliability for this test was high (Kappa = .92, $p < .001$).

Meaning recognition test. Both a true and a false statement were phrased for each target word and presented to the children in a semi-random order without items for the same target words following each other (e.g., "Does run-down mean that something was destroyed by some people?"). Children were asked to decide if the statements are true or false. This test

designed to measure children's receptive understanding of the target words. One point was

given to correct answers and 0 points for the incorrect ones. The inter-rater reliability for this

test was high (Kappa = .94, p < .001).

Receptive Vocabulary Test. In the Receptive Vocabulary test children were asked to

point to the picture that best depicts the target word among 4 pictures from the same book

(e.g., "Where can you see 'horsing around'?"). Incorrect answers were given zero points

whereas every correct answer was awarded with one point. The inter-rater reliability for this

test was high (Kappa = .96, p < .001).

Results

Inspecting the data, the normality of the variables was assured and the alpha value was

set at .10 as the size of the sample was small. An overview of the mean scores of each

condition on every vocabulary test is provided in Table 2.

Table 2

Means (*M*) and standard deviations (*SD*) of vocabulary tests' scores in every condition

	Simultaneous Condition		Non-simultaneous condition	
	M	*SD*	*M*	*SD*
Expressive Vocabulary Test	0.15	0.12	0.11	0.12
Context Integration Test	0.23	0.17	0.20	0.14
Receptive Vocabulary Test	0.54	0.13	0.52	0.15
Meaning Recognition Test	0.60	0.16	0.56	0.14

In order to examine the first research question about which condition leads to higher

gains in word learning on the expressive and receptive levels, I performed a 2x4 repeated

measures ANOVA with two within-subject factors. One factor was the condition with two

levels (simultaneous and non-simultaneous) and the other factor was the vocabulary tests

with four levels (Expressive Vocabulary Test, Context Integration Test, Meaning Recognition

Test and Receptive Vocabulary Test). There was no significant interaction effect between

conditions and tests (F (3, 19) = .042, p = .99). There was a marginally significant main

effect of condition (F (1, 21) = 2.29, p = .145) with generally higher scores in the

simultaneous condition than in the non-simultaneous condition meaning that performance

was higher over the four vocabulary tests for the simultaneous books as compared to the non-

simultaneous ones. The main effect comparing the four types of tests was significant (F (3,

19) = 193.79, p < .001) suggesting a significant effect of the test on the vocabulary scores

(Figure 1). The performance was notably higher at the receptive vocabulary tests than the
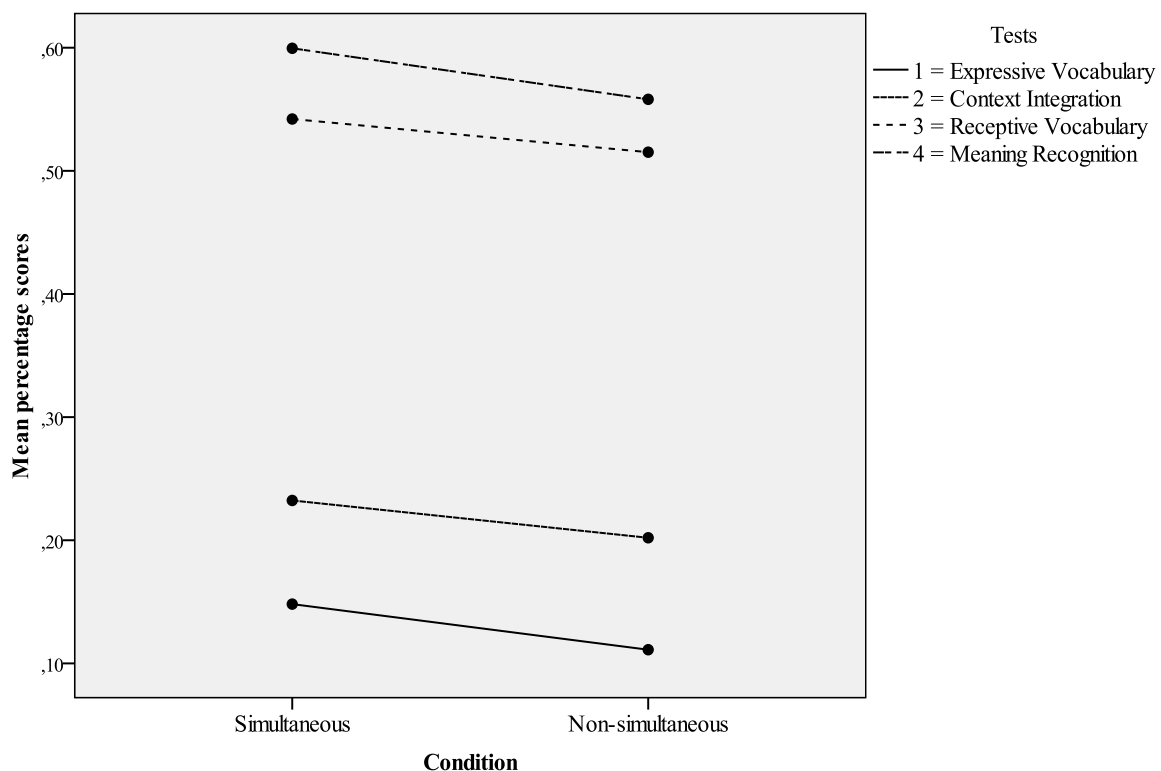
expressive ones.

Figure 1. Mean percentage scores of four different tests (Expressive Vocabulary, Context Integration, Receptive Vocabulary and Meaning Recognition) after the two intervention conditions (simultaneous and non-simultaneous).

In order to answer the second research question about whether bigger initial receptive vocabulary results in higher vocabulary gains after storybook reading, children were divided into low ($N = 11$) and high PPVT ($N = 11$) groups based on the median of the PPVT standard scores (108). Similar to the first analysis, I performed a 2x4 repeated measures ANOVA with two within-subject factors which were the condition with two levels (simultaneous and non-simultaneous) and the vocabulary tests with four levels (Expressive Vocabulary Test, Context Integration Test, Meaning Recognition Test and Receptive Vocabulary Test), but including a between-subject factor with the low and high PPVT groups. As shown previously, there was a marginally significant effect of condition (F $(1, 20) = 2.42$, $p = .14$) on the vocabulary scores. There was a marginally significant interaction effect between condition and PPVT scores ($F (1, 20) = 2.25$, $p = .15$) suggesting differences on the final vocabulary scores for each PPVT group after each intervention condition. Finally, there was also a marginally significant effect of PPVT groups (F $(1, 20) = 2.42$, $p = .14$) meaning that regardless of the condition or the test there was a difference on vocabulary learning between the high and low PPVT group. The high PPVT group had higher gains on vocabulary knowledge than the low PPVT group regardless of type of test or condition (Figure 2).

Additionally, in order to investigate the interaction effect between condition and PPVT scores I repeated the first analysis (2x4 repeated measures ANOVA) for the two PPVT groups separately. As shown in Figure 2, there was no significant main effect of condition in the low PPVT group ($F (1, 10) = .002$, $p = .96$), but there was a significant main effect of condition in the high PPVT group ($F (1, 10) = 3.84$, $p = .08$). The high PPVT group and only this group had significantly higher vocabulary gains in the simultaneous condition than in the non-simultaneous one.
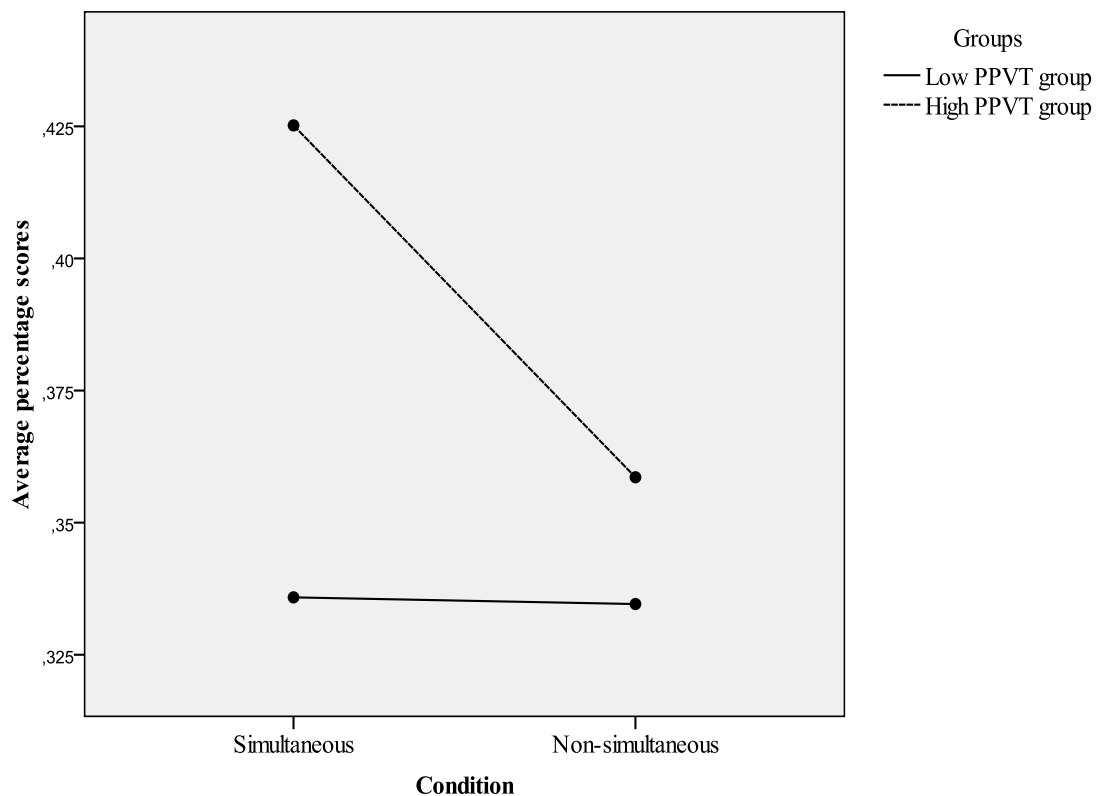
Figure 2. Average percentage scores over the 4 vocabulary tests for high and low PPVT group after the simultaneous and the non-simultaneous intervention condition.

Discussion

In the present study, simultaneously presented storybooks (illustration and oral text at the same time) were compared with non-simultaneous ones (illustration and oral text successively) to examine their effects on preschoolers' word learning. It was revealed that simultaneous storybooks resulted in higher vocabulary gains than non-simultaneous. Thus, it can be concluded that a digitalized storybook is more beneficial for a young reader when the pictures are presented at the same time with the relevant text in contrast to encountering the visual aids after the oral narration of the pages.

The above finding confirms my hypothesis of the superiority of simultaneous books and is in line with Mayer's *temporal contiguity principle* (2005c). Based on Mayer's theory,

it is possible that at the simultaneous presentation of the storybooks the cognitive load on children's working memory was smaller resulting in larger vocabulary learning. According to the theory, this happens because the relevant visual and verbal stimuli are presented at the same time so they are processed and stored simultaneously, a procedure less demanding for working memory. In contrast, when the two stimuli are presented successively a child has to make more effort to integrate the relevant but time distant information in order to achieve a successful storage of them in memory.

Since there was an effect of condition over the four vocabulary tests, children seemed to learn words from the books both on the receptive and the expressive levels. However, children seemed to perform better on the receptive tests than on the expressive ones. This finding is comparable with the results of Verhallen and Bus (2010), who showed that the receptive knowledge of words in storybooks of 5-year-old second language Dutch learner children formed earlier than their expressive knowledge of those words.

In total these findings suggest that the understanding of words establishes in an earlier stage than the ability of using the words in an oral context, a view that consorts with the theory of the *incremental nature* of word learning (Nagy & Scott, 2000). The findings also assert the effectiveness of static storybook for promoting vocabulary knowledge, firstly by forming the receptive levels of word acquisition. However, the possibility of guessing should be kept in mind regarding the difference between the receptive and expressive vocabulary tests, as the receptive vocabulary tests offered multiple-choice items while the expressive items were open-ended.

In regards to children with larger and smaller initial vocabularies and the effects of storybook reading, it was shown that high vocabulary knowledge children learned more words than low vocabulary knowledge children regardless of how the books were presented. The *Matthew effect* in word learning (Stanovich, 2000) was also evident in this study as after

the intervention the strong students became stronger and the weak students remain weak. As it seems, the fluent and unimpeded understanding of the text facilitates stronger students to interact with the story in a better way and results in an excellent reading experience for them. On the other hand, a story that is easy for stronger students can be very complicated to weaker students causing troubles to their understanding. When the vocabulary of the weak students is small, listening to a story can be difficult with many gaps in understanding. It is their limited understanding of the text that moderates the effects of storybook reading on their vocabulary.

Additionally, it was revealed that the high vocabulary knowledge children and only this group learned significantly more words from the simultaneously presented books as compared to the non-simultaneous books. For the low vocabulary knowledge group the mode of presentation of storybooks did not make any difference in their vocabulary gain. It is plausible that the stronger students took advantage of their large vocabulary size and learned significantly more words when the text and the picture were presented simultaneously during the narration. However, the fact that the low vocabulary group benefited to a comparable degree from each mode of presentation makes me suspect that the limited vocabulary gain was not caused by the ineffectiveness of the two interventions but because of the incompatibility of the texts for the students vocabulary levels. The sophisticated vocabulary that was included in the stories maybe impeded low vocabulary children to follow the line of the story. Thus, the inappropriate vocabulary level of the stories deprived these children from the opportunity to learn many new words. I assume that the pattern of results of the high vocabulary group would be repeated for the low vocabulary group if the stories were presented to them would be more appropriate for their delayed vocabulary level.

An important asset of this study was the use of powerful statistical tests (repeated measures ANOVA) that reduces the estimated errors. The use of such statistical tests makes

the results of this study reliable as they compare children's performance in one condition to their own performance in another (Leary, 2012). The vocabulary tests were also highly reliability as shown by the interrater reliability estimates. Additionally, one can argue that the data indeed reflected children's different vocabulary level ability since a different pattern of results was shown for the expressive and the receptive vocabulary tests.

Additionally, another strong point of this study is the thorough design of the materials of the conditions. The objective of this experiment was to check how the different timing between text and picture during storybook reading influences children's vocabulary growth. Hence, the conditions were carefully designed so that the only true difference between them to be the timing that text and picture are presented. Thus, one may infer that the variety in outcomes was caused only by the difference between the conditions which is the timing of text and picture. Last but not least, the within-subject design allowed for controlling for individual differences between the children. This design specified the way the students were assigned among the conditions so that all of them participated in every condition also counterbalanced the order of presentation of the conditions.

This study is not without limitations, one of which regards the size of our sample. With only 22 children participating at this study, it is difficult to proceed to generalizations of the findings. Thus, in future it is suggested to repeat the experiment with a bigger sample (e.g. separately with monolingual and bilingual children) and to examine if the findings could be applied to older or younger children. Another limitation of the study is the use of storybooks that were probably not at the appropriate vocabulary level of all the participants. The findings showed that, regardless of the presentation mode of the books, the gain in vocabulary knowledge was very small for the low vocabulary group. However, the above finding should not be generalized as the storybooks proved to be too difficult for students with smaller vocabularies. It would be much more useful if the experiment was repeated although this time

specifically addressing low vocabulary students' with easier and simpler stories that are more appropriate to their small vocabulary size.

Practical Implications

Group storybook reading is a traditional activity in which kindergartners get involved in school. Teachers read stories to the students, firstly by reading the text aloud and afterwards by showing the picture to the audience. This fashion of storybook reading resembles the non-simultaneous condition of storybook reading in the present study where text and picture are presented successively. However, this study showed that it is more beneficial for student's vocabulary growth when text and picture are presented at the same. In practice, this finding could be applied with the use of digitalized storybooks. Teachers are suggested to scan the illustrations of the storybooks and to present them on a whiteboard during group story reading so that children have access to the visual aid and text simultaneously. In that way children will have better comprehension of the story and will learn new words.

The publishers and the designers of e-books should also take into account the above results and while designing a storybook they should combine relevant text and picture together on the same page. Furthermore, teachers are suggested to preferably use easier and simpler stories for children who seem to be behind with their language development or at risk for delaying language development in order these children to also benefit from the storybook reading. In general, as this study revealed, two reading sessions of each book were sufficient to stimulate young kindergarteners' vocabulary, making the digitalized storybook reading a potentially promising activity for teachers.

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