Video storybooks as a bridge to literacy

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Video Storybook Reading as a Remedy for Vocabulary Deficits: Outcomes and Processes

Abstract

A substantial percentage of the kindergarten population in the Netherlands lags so far behind in L2 proficiency that they may hardly profit from picture storybook reading promoted as a remedy for vocabulary deficits. The first aim of this study was to test whether young children with limited proficiency in their second language benefit more from repeated readings of a digitized storybook that includes video instead of merely static illustrations. Subjects (N = 106) were randomly assigned to a control condition or one of four treatment conditions crossing two levels of repetition (one or four exposures) with two versions of the same story (merely static pictures or, instead of pictures, video representations). A second aim was to test the hypothesis that video storybooks promote the acquisition of new language because children are more inclined to sustain their efforts to extract meaning from the text when video is added. As indicator of the amount of mental effort, skin conductance was monitored in a sub-group that encountered the same story four times (N = 42). The results support the hypothesis that video storybooks offer a suitable framework for vocabulary acquisition in kindergarten children with low L2 proficiency. Furthermore, mental effort remains at a higher level when a video storybook is repeated and this stability is one of the generating mechanisms through which video storybooks are more effective than static storybooks at stimulating L2 vocabulary.

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Introduction

In the Netherlands about 18% of all primary school children lag behind in the language of teaching (CBS, 2008) and are therefore at great risk of reading failure (Juel, 2006). These children mainly come from low educated immigrant families (CBS, 2008). As a result, many early childhood educational programs focus on language and literacy, promoting storybook reading as an educational tool to enhance second language acquisition (Broekhof, 2006; Stolwijk & Peters, 2006). It is considered essential that children familiarize with the type of language used in books as this form of discourse is most common in academic texts (Anderson, Anderson, Lynch, & Shapiro, 2003; Delpit, 1995). In Dutch kindergartens children are read to on a daily basis or even several times a day (Blok, 1999). The favourable effect on language and in particular on vocabulary so often found in storybook reading research with L1 learners (Bus, 2001; Bus, van IJzendoorn, & Pellegrini, 1995; Frijters, Barron, & Brunello, 2000; Sénéchal, LeFevre, Thomas, & Daley, 1998) might be non existent or at least more modest in L2 learners. There is some evidence that the beneficial effect of storybook reading on first language vocabulary is the same in second language learners (Collins, 2005), however, Garcia and Godina (1994) found that young children learning English as their second language were not attentive at all when an English storybook was read to the whole group. They concluded that children were not fluent enough in English to understand the text and therefore gave up their efforts to comprehend the story.

Storybook reading is seen as an efficient way to enhance oral language; preliterate children thus encounter unfamiliar words in a meaningful story context (Weizman & Snow, 2001). Reading a storybook repeatedly is a common practice in many families (Sulzby, 1985) and found to benefit vocabulary growth in young children (Karweit & Wasik, 1996; Leung & Pikulski, 1990; Penno, Wilkinson, & Moore, 2002; Sénéchal, 1997). Repeated readings provide children with the opportunity to gradually understand more of the story plot and the story language. With each new reading story events become more predictable leaving more time to attend to details like specific words instead of just the overall meaning of the story (Robbins & Ehri, 1994, Snow, 1983). After a first encounter with a word in a meaningful context a child may at best derive its partial meaning (Clark, 1993); several exposures to a word are needed for the new word to become part of children's vocabulary (De Temple & Snow, 2003; Stahl, 1999). Despite repetition, L2 children may fail to accumulate information about words and phrases. Due

to too many gaps in understanding the story text they may fail to derive the meaning of unknown words from the context.

Nowadays many picture storybooks are available in a digitized format including all the relevant qualities of the print versions but at the same time offering new information. As accessibility of digitized storybooks is improving due to the growing number of personal computers at home and in classrooms and the better and faster internet connections, it is essential to study whether digitized storybooks assist or hinder learning. "Reading" digitized storybooks may not automatically be as beneficial as adult-child shared readings. In digitized storybooks information is presented in two ways, visual and oral, and children have to relate the spoken story text to the accompanying visual information to make sense of the story without the help of an adult.

Illustrations in books are found to facilitate word learning from storybook reading in L1 children (Ninio & Bruner, 1978; Snow & Goldfield, 1983; Weizman & Snow, 2001). However, providing pictures is not a guarantee that L2 children are able to extract the relevant information from the pictures or interpret the visual information in the picture correctly (Peeck, 1993). Previous experiments with digitized storybooks show that additional information like motion, images, sound and music hold great promise for young L2 children (de Jong & Bus, 2002, 2004; Neuman, 1997). A recent experiment (Verhallen, Bus, & De Jong, 2006) showed that L2 children benefit most from repeated encounters with the same story when the storybook includes additional information sources such as video. By contrast, none of the studies so far supported the expectation that, as a result of video, children ignore the text that is spoken out loud (e.g., de Jong & Bus, 2004).

However, when visual information is incongruent, either unrelated or even contradictory, with oral information, this may interfere with the processing of oral content (Anderson, Lorch, Smith, Bradford, & Levin, 1981; Hartman, 1961; Severin, 1967). High correspondence between visual and auditory information in video storybooks, on the other hand, may result in a more coherent mental model of the story (Cennamo, 1993; Dubois & Vial, 2000; Grimes, 1990; Salomon, 1983). Video additions may help children to select the important or central content connected to the story text, just as a spotlight on a stage tells the audience where to look, thus probably limiting the overload of information offered by illustrations with numerous irrelevant details, and help to integrate words, sounds and moving images (Calvert et al., 1982; Neuman, 1997). Consequently, differences in effectiveness of the two storybook formats may be based on differences in memory load (Paas, Tuovin, Tabbers, &Van Gerven, 2003).

Story repetition may only help second language acquisition when children remain willing to invest mental effort to process the story language. Mental effort or the cognitive capacity that is allocated to the task (Britton, Muth, & Glynn, 1986; Paas et al., 2003) presupposes non-automatic processing of a stimulus and is therefore assumed to be under the control of the individual (Salomon, 1983). The relationship between mental effort and learning may therefore depend on perception of the task (Cennamo, 1993). Research with Grade 3 to 10 children corroborates this idea: children reported that they had expended more mental effort processing print than television and the amount of effort influenced the amount of learning (Salomon, 1984 Salomon & Leigh, 1984). Video may be perceived as an easy medium as it bares much resemblance to watching television, the result being that they invest less effort in processing the content (Cennamo, 1993). In this line of argumentation we may expect that adding video to a digitized storybook may be detrimental to children's language acquisition.

It is also conceivable that mental effort decreases when the task is perceived as difficult (Field & Anderson, 1985, Salomon & Leigh, 1984). For instance, children in a study by Lorch and Castle (1997) were encouraged to watch a televised program, but still looked away from the screen one-third of the time when segments with incomprehensible language were shown which suggests that visual attention is especially motivated by children's current understanding of the program (Pecchinenda & Smith, 1996; Weiner, 1979). Reeves and Thorson (1986) found that overall complexity negatively affected mental effort, and frequent breakdowns in understanding resulted in less overall expenditure of effort and lower achievement. It fits in this line of argumentation that individuals work best at tasks of intermediate difficulty because those result in higher task persistence (Britton, Westbrook, & Holdredge, 1987; Reed, Burton, & Kelly, 1985; Thorson, Reeves, & Schleuder, 1985; Weiner, 1985).

In the view of the *active theory* visual attention is mediated by children's current understanding of a story and children are more inclined to visually attend to the screen when information matches their level of understanding and they expect to benefit from their efforts (e.g., Anderson & Lorch, 1983; Bickham, Wright, & Huston, 2001; Crawley, Anderson, Wilder, Williams, & Santomero, 1999; Huston & Wright, 1983). As children are well accustomed to televised stories they will direct their attention to cues to fill up gaps in their story schema and, when all gaps are filled they stop paying attention (Anderson & Lorch, 1983; Huston & Wright, 1983). Results of research with 3- and 5 year old L1 children were consistent with the *active theory* (Crawley, Anderson, Wilder,

Williams, & Santomero, 1999). Visual attention of 5-year old boys declined somewhat after several repetitions, but initially they had paid more visual attention to the program than the girls.

When the story is hard to understand, for instance because language in television segments is rendered incomprehensible, children may compensate by investing more mental effort to the task (e.g., Meadowcroft & Reeves, 1989), however, within a finite cognitive capacity (Paas et al., 2003). When children, in spite of investing more mental effort, are unable to create a coherent mental model of the content (Salomon, 1983) they will selectively disengage (Lorch & Castle, 1997; Meadowcraft & Reeves, 1989; Pecchinenda & Smith, 1996). The *active theory* may thus explain our previous finding that L2 children indeed benefited more from repeated encounters with stories including video but not from repeated encounters with static picture storybooks (Verhallen et al., 2006). In sum, repeating a story may not be profitable unless children's appraisals of coping options remain high.

We designed the present study to test how kindergarten children with low L2 proficiency respond to repeated encounters with two versions of the same age-appropriate picture storybook. The events were represented by either static pictures or by video dramatizing the story events. The story text in both versions was identical. We circumvented another crucial difference in the sessions by presenting both versions on the computer so that only the iconic information differed. A main aim was to explore the theory that mental effort may explain variation in learning from repeated encounters with the story. Without additional video information children may lose interest in the story text after a few replays and hardly profit from repeated encounters with the same story. A decreasing amount of effort invested in understanding the story with every repetition of the story, may result in story understanding not further developing during new encounters with the same story, thus explaining why repetition of static stories is much less effective (e.g., Detenber, Simons, & Bennett, 1998). By applying mediation analysis (Baron & Kenny, 1986) we tested the hypothesis that a sustained level of mental effort explains the added value of video.

There are several ways in which mental effort may be assessed; for instance: self-reports, dual-task performance, or psycho-physiological measures (Cennamo, 1993). Self-reports are used with the assumption that the investment of mental effort is a voluntary process, under the control of the individual and as such available for introspection (Paas et al., 2003). Young children may be unable to report how much mental effort a task has

required (Geiger, 1993; Pingree, 1986). Moreover, post viewing measures are unsuitable to estimate the intensity of mental effort during exposure to a digitized storybook. Using a secondary task to measure mental effort (e.g., Lorch & Castle, 1997) is based on the assumption that when the first task requires more mental effort little is left for the performance on a secondary task. Although most secondary tasks are simple tasks, like detecting a visual signal, they may interfere considerably with the primary task, especially when the primary task is complex like story language comprehension (Meshkati & Loewenthal, 1988; Paas et al., 2003). Furthermore outcomes of a secondary task are not always congruent with self-report results (Beentjes & van de Voort, 1993). Comprehensibility of a television program has been found to influence visual attention (Anderson, Lorch, Field, & Sanders, 1981; Lorch, Anderson, & Levin, 1979) but, as indicator of mental effort it is less suitable. Even when a child is visually attentive it is unknown how much mental effort is devoted to processing of the story (Lorch & Castle, 1997).

Taking the above mentioned results into account we took skin conductance responses (SCRs) as an indicator of children's mental effort (Dawson, Schell & Filion, 1990; Pecchinenda & Smith, 1996), similar to other studies of learning (Carpenter and Haddan,1966; Clariana, 1989,1992; Clariana and Schultz, 1991). The main advantage of SCRs over other physiological measures like cardiac responses is that small changes in SCRs are easily discernible while changes in cardiac responses as a result of experimental manipulations are more difficult to discern from other causes of variance in heartbeats (Dawson, Schell, & Filion, 2000). Earlier research has shown that intraindividual variations in the frequency of SCRs are quite small (Fahrenberg & Foerster, 1982; Wahlschburger, 1976) even over longer periods (Clariana, 1992).

Unlike event-related skin conductance activity, spontaneous or non-specific SCRs are considered to be an indicator of the amount of attention and effort a person is devoting to a task and as such SCRs reflect an effortful allocation of resources to a task (Dawson, Schell, & Filion, 1990; Sundar & Kalyanaraman, 2004; Pecchinenda & Smith, 1996). Research by Pecchinenda and Smith (1996) also showed that mental effort was determined by appraisals of coping potential where the relation between mental effort and task broke down when the task became too difficult and the hope of successfully completing it was lost, resulting in disengagement from the task. In other words, non-specific SCRs indicate mental effort which in turn is influenced by appraisal of coping potential. Assessing

children's mental effort using skin conductance activity allowed us to examine the intensity of mental effort during repeated exposures to a digitized storybook, without the interference of a secondary task and without relying on self-reports.

To summarize we aimed to test the following three hypotheses:

1. When children experience gaps in story text understanding repetition of a story supports language acquisition on condition that video is added.
2. When children do not experience sufficient support in figuring out the meaning of the story text, they will cease to invest mental effort in processing the story content after a few sessions, as indicated by a decrease in number of skin conductance responses.
3. A sustained level of mental effort elicited by video storybooks may function as generative mechanism through which video is able to improve vocabulary acquisition.

Method

Design

Participants (*N*=106) were randomly assigned to one of five conditions. In addition to a control group, there were four treatment groups crossing two levels of story format (with or without video) with two levels of repetition (one or four exposures). In order to keep the number of sessions equal, all children participated in four sessions. Children in the 1x condition (one encounter with the focal story) played with a non-verbal computer game during the three sessions that preceded the session in which children heard the story. During the story encounters, we registered skin conductance activity during intervention sessions as an indicator of mental effort. To test whether mental effort continues over sessions and consistency of mental effort affects language acquisition, we focused on a sub-sample, namely the 4x video and 4x static groups ($N = 42$).

Participants

From 48 classrooms (13 schools) we selected 106 children with the highest at-risk status (0.9) that the Dutch school system acknowledges. The government distributes educational funding on the basis of a combination of educational level and ethnic origin of the parents. A student weighting of 0.9 refers to a child with parents with a low educational level from an ethnic minority group who learns Dutch, the language of

instruction, as a second language. The selected children are judged as most at-risk for reading problems (Bosker & Guldemond, 2004). All children were from the largest group of immigrant families in the Netherlands speaking Turkish, Moroccan-Arabic or Berber at home (van Praag, 2003). At the start of formal education at the age of four these children, like most immigrant children, have had little exposure to Dutch, the language of instruction in preschool and kindergarten classes (Verhoeven, 2000; 2007).

The selection of subjects was made in three steps:

(1) We contacted inner-city schools in The Hague with at least 80% immigrant children from low educated families according to the school administration.

(2) With the help of information provided by teachers and school administrations we made a first selection of pupils based on the following criteria: (a) 5 years old, (b) speaking Turkish or Moroccan-Arabic or Berber at home, (c) receiving instruction by means of a second language educational program in immersion classes since they started attending school (the day they became four years old), and (d) no special language impairments or special educational needs.

(3) Next, tests were applied individually to select children according to the following three criteria: (a) scoring at the level of the lowest 50% on a language test standardized for Dutch kindergarten children, as is true for about 90% of this population at-risk, (b) nonverbal intelligence in the normal range, and (c) not familiar with the focal story.

We continued the recruitment process until a sufficient number of eligible subjects was found. Subjects were recruited from 48 kindergarten classrooms in 13 different inner city schools in The Hague.

Table 1 shows the characteristics of the five groups involved in the experiment. The groups (one baseline group and 4 treatment groups) were similar in ethnic background, educational level of the parents, age (F (4, 101) = .11, *n.s.),* scores on the *Cito Language Test* (F (4, 101) = .51, *n.s.)*, and scores on the *Raven's Colored Progressive Matrices* (F (4, 101) = 1.49, *n.s.*).

Procedure

Each child worked at the computer in a room other than the classroom during four separate sessions spread over approximately nine days. The other persons present in this room were the experimenters, one of whom instructed the child, while the other was

Table 1

Characteristics of Subjects per condition

		n	Ethnicity (Turkish/ Moroccan)	Gender (M/F)	From families with a low educational level	Schools/ classes[1]	Age in months Mean scores (*SD*)	*RPM*[1] Mean standardized scores (*SD*)	*Cito Language Test* Mean standardized scores (*SD*)
Static	1x	23	11/12	11/12	23	9/21	67.43(3.67)	4.63(1.45)	57.26(5.45)
	4x	20	10/10	10/10	20	9/19	67.35 (3.42)	4.06(1.49)	57.40 (5.72)
Video	1x	21	11/10	10/11	21	10/16	67.81 (2.68)	4.88(1.94)	58.10 (5.27)
	4x	22	11/11	11/11	22	10/18	67.23 (2.98)	4.46(1.48)	56.45 (6.60)
Baseline		20	10/10	10/10	20	5/11	67.30 (2.75)	5.25(1.84)	55.75 (5.72)
Total		106	53/53	52/54	106	13/48	67.42 (3.08)	4.65(1.66)	57.00 (5.72)

Note[1] Number of different schools/classes from which children were recruited.

Note[2] *Raven's Progressive Matrices.*

responsible for registering skin conductance. At the start of the sessions the experimenter placed electrodes on the child's hand to register skin conductance activity. The first time the experimenter explained at length what she was doing and first applied the electrodes to her own hand to show that the electrodes would not hurt. None of the participants gave the impression that they experienced the device as aggravating or frightening.

Intervention programs

The Dutch CD-ROM *Heksenspul*, a translation of an English CD-ROM (Winnie the Witch by Thomas & Gorky, 1996) includes a version with merely static illustrations and a version that includes video representations. The static version consists of 22 screens with static illustrations. The text is read aloud after a click at the start of the text. In the video version, the static illustrations representing the story events are dramatized congruent with the story text. Motion and camera work (cuts, pans, and zooms) guide children in selecting the important or central elements of pictures that relate to the story text. The text, exactly the same for both versions, is read by the same voice. We chose a story with all the characteristics of a classical story scheme: A problem (everything in the house is black, including the cat causing the witch to stumble over her cat time after time) generates a series of solutions (first transforming the cat into a green cat and later into a cat in all the colors of the rainbow) that in turn create new problems and new solutions to these problems until the most obvious solution is found (transforming the house into a house with colors and the cat into a black cat).

Selection tests

Children's Dutch language proficiency was assessed with the *CITO* standardized *Language Test for Senior Kindergarten Children* (CITO [Dutch Organization for Test Development], 1996). Children with scores belonging to the lowest 50% of the Dutch norm group were included in the study.

The Dutch version of Raven's Colored Progressive Matrices (Van Bon, 1986) was used to assess nonverbal intelligence. Children scoring within the normal range were selected.

To assess familiarity with the focal book children were presented with 12 pictures on a computer screen; six of the pictures came from well known children's picture storybooks including the stimulus book. When children knew the title of the stimulus book

(*Heksenspul*), were able to name the main character (Winnie the Witch) or could tell the story they were excluded from participation.

Tests to asses effects of the intervention

To assess growth in story language, the first part of the test tested expressive knowledge of 42 content words from the *Winnie the Witch* story and the second part expressive knowledge of sentences by asking children to repeat a selection of sentences from the story text. In the first part children filled in the last word of a stimulus sentence that the experimenter orally presented while the children saw a matching picture on the computer screen. For instance, "the cat lies on the….. (carpet)" with a picture of a cat lying on the carpet. These words, selected from the story text, have a low frequency and are therefore assumed to be unknown by most participants (Schrooten & Vermeer, 1994). This set included nouns (*heks – witch*; *rozenstruik – rosebush; gras – grass; tapijt - carpet*), adjectives (*snorrend – purring; woedend – furious*), and verbs (*struikelen – stumble*). Two words (*witch* and *grass*) were known by the majority of children (80% or more) at pre-test and therefore excluded. One test item familiarized children with the test. The second part was made up of 24 sentences with an average length of 8 to 9 words per sentence (*SD* = 2.57). Elicited sentence imitation is seen as a reliable indicator of second-language competence (Ellis, 2001) as it is influenced by long term knowledge of language (Speciale, Ellis, & Bywater, 2004). We scored the number of correctly repeated sentences. One sentence was correctly repeated by the majority of children (80% or more) at pretest and therefore excluded. To familiarize children with the test they practiced with a simple sentence until the child could correctly repeat the test sentence without assistance.

As the correlation between the word knowledge test and sentence repetition was substantial (> .60) we calculated one score for story language. We computed an average *z*-score.

Internal consistency of the tests was fair: alpha reliabilities for the pre- and post-test were .78 and .85, respectively. The inter-rater reliability for vocabulary was .99 and for repeating sentences .94.

Skin conductance

We used an ambulatory monitoring device to register skin conductance activity during the story reading. The skin conductance was registered every 500 msec by applying a constant voltage (0.5V) to Ag/AgCl electrodes placed on the palmar surfaces of the

medial phalanges of the second and third finger of the non-dominant hand. The electrodes were secured by soft tape. As conductive medium between the electrodes and skin we applied an electrolyte paste consisting of physiological saline (9% NaCl) in a Unibase.

A computer program was applied to assess the number of spontaneous SCRs with amplitudes higher than .02 micro Siemens (Kroonenberg, 2004). Fluctuations in skin conductance of .02 micro Siemens were considered as "spontaneous" or "non-specific" SCRs (Boucsein, 1992). Non specific SCRs are commonly expressed as a rate per minute (Dawson, Schell, & Filion, 1992; Pecchinenda & Smith, 1996; Ravaja, 2004). In the first session we started out with hand electrodes, attached to the thenar and hypothenar eminences of the palms. Displacement of the hand electrodes due to movement spoiled measurements in the first session so we switched to finger electrodes in the second session. Because there is a linear relationship between the size of an electrode and the number of non specific SCRs (Mahon & Iacono, 1987) the results found in the first session were incomparable with results of subsequent sessions; therefore the first session was ignored. Three children were excluded from the analyses, as the registration in one or more sessions was invalid as a result of technical problems.

Results

Effects of video additions

To test whether repetition of a story only supports language acquisition when video is added we performed ANOVAs with treatment as the independent variable and understanding story language as dependent variable. Assumptions of normality of sampling distribution and homogeneity of variance were tested and approved. See Table 2 for means and standard deviations. As there was no statistically significant effect of treatment on the pretest score, we had a strong assurance that experimental conditions did not differ in a measure that could have interfered in subsequent analyses. An ANOVA with treatment as independent variable and posttest as the dependent measure revealed a statistically significant main effect for treatment, $F\ (4, 101) = 4.59$, $p < .002$, $\eta_p^2 = .16$ (see Figure 1).

Analyzing which treatments caused the overall treatment effect, we tested eight contrasts: the four treatments versus the control group, the video versus static group after 1 and 4 sessions, and effects after 1 session with effects after 4 sessions for the video and static group separately. Type I error rate was controlled by subjecting comparisons to family-wise error correction applying the Šidák-Bonferroni procedure (Keppel & Wickens,

2004). With eight comparisons at α = .05 level, the individual tests were evaluated at the 0.639% level. Contrasts between the treatment groups and the control group were statistically significant after 4x video, F (1, 101) = 14.19, $p < .000$, $\eta_p^2 = .13$, but not after 1x video, 1x static or after 4x static. No other contrasts reached significance. The contrast between 4x static and 4x video was marginally significant, F (1, 101) = 3.68, $p < .058$, $\eta_p^2 = .04$.

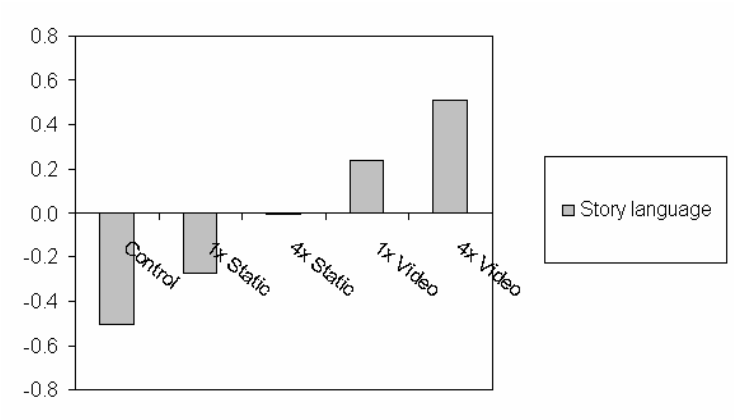

Figure 1 Mean *z*-scores for post-test.

Rate of SCRs

Next we tested whether SCR rate remained at the same level or changed with repetition of the story. We assumed that children would only invest mental effort in processing the story content after a few sessions when they experienced sufficient support in figuring out the meaning of the story. We performed an ANOVA with repeated measures for the second, third and fourth session and as factors format (video versus static) and sample. For reasons explained above the first session was ignored. In three cases there were mechanical problems, resulting in 22 subjects in the video condition and 17 in the static condition. Results of the evaluation of assumptions relating to normality of sampling distribution and of homogeneity of variance were satisfactory. Table 3 shows the average rate of SCRs as a function of format and session number.

Format or session number did not cause main effects. However, the linear trend for session number varied significantly with format as appeared from the statistically

Table 2

Mean scores and standard deviations on tests to measure knowledge of story language in percentages

		Words		Sentences		Combined *z*-scores	
	n	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
1x static	23	11.41(5.21)[1]	17.39(7.21)	10.02(9.22)	11.15(8.58)	-.03(.76)	-.27(.66)
4x static	20	11.38(6.10)	20.75(11.24)	8.91(12.34)	13.48(12.77)	-.08(.87)	-.01(.92)
1x video	21	13.93(7.36)	21.79(8.70)	13.25(12.41)	18.43(17.00)	.32(1.03)	.24(1.00)
4x video	22	12.95(6.06)	26.76(8.80)	9.88(11.56)	18.77(14.10)	.09(.85)	.51(.87)
Control	20	8.38 (4.54)	13.00 (7.50)	9.13(9.96)	11.09(9.62)	-.32(.76)	-.50(.68)
Total	106	11.65(6.10)	20.02(9.76)	10.25(11.03)	14.60(12.97)	0.00(.87)	0.00(.90)

Note[1] standard deviations in parentheses

Table 3

Mean Rate of Skin Conductance Responses (SCRs) in the Second, Third and Fourth Session (N = 39)

Session number	SCR rate	
	Static	Video
Winnie the Witch 2	7.13 (5.26)[1]	6.21 (3.48)
Winnie the Witch 3	5.56 (3.13)	6.35 (3.82)
Winnie the Witch 4	4.40 (3.06)	7.09 (4.17)
Winnie the Witch total	5.69(3.22)	6.55(2.93)

Note[1] standard deviations in parentheses

interaction (linear) between session number and story format, F (1, 35) = 5.31, $p < .03$, η_p^2 =.13. This interaction was due to a slight linear increase in the video condition, E = 5.2 + 0.4R, where E is the rate of skin conductance responses (SCRs) per minute and R repetition. By contrast there was a significant linear decrease in rate of SCRs for the static condition, E = 9.6 - 1.4R (see Figure 2). Repetition thus resulted in a stable number of spontaneous SCRs in the video condition, while the rate of spontaneous SCRs significantly declined in the static condition, t (df = 16) = 2.54, $p < .02$. Three post hoc comparisons testing the difference between the video and static format for each session separately revealed a statistically significant difference for session 4 (t (df = 37) = 2.23, $p < .03$, two-tailed), not for sessions 2 or 3. Therefore, this result is in agreement with the prediction that with video additions children retain a quite high level of mental effort when they encounter the same story time and again. A score of 6-7 SCRs per minute is quite high compared to a typical rate of 1-3 SCRs per minute for subjects at rest (Dawson et al., 2000). By contrast, with only static pictures children seem to lose interest after a few repetitions as is indicated by a decrease in SCR rate from 7 in the second session to 4 in the fourth session.

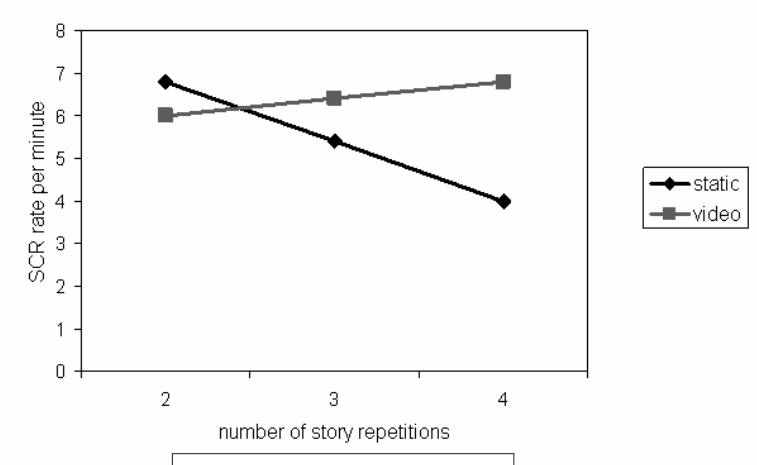

Figure 2. Linear Increase in the Video Condition and Decrease in the Static Condition, where E is the SCR rate per minute and R the order of Repetition.

Skin conductance responsivity as mediator

In order to test whether a sustained level of mental effort elicited by video storybooks functions as generative mechanism through which video is able to improve vocabulary acquisition we applied the logic of a mediational analysis. We tested whether SCR was a possible mediator between video additions and language acquisition (Baron & Kenny, 1986). The correlations in Table 4 indicate possible mediation between video and story language, with the stability of skin conductance responsivity serving as a mediator between these variables, as illustrated in Figure 1. To control for differences between Moroccan and Turkish children (due to differential exposure to the Dutch language Moroccan children scored on average higher on the story language post-test (r = .42, p < .004, one-sided, Table 4) we included ethnicity as covariate in all regression analyses. Assumptions of normality of sampling distributions, linearity, homoscedasticity, and independence of residuals were tested and approved. We used one-sided directional tests because the predicted pattern includes specific directionality (Levin & Neumann, 1999).

In the first regression in Table 5 with the mediator (SCR) as criterion (path a) video additions accounted for 13% (p < .05) of the SCR rate. When testing path b - the relationship between the mediator (SCR) and language acquisition (dependent variable) -, we controlled for the effect of video as both stability of SCR rate and the post-test may be caused by video additions. This relationship is shown by the second regression in Table 5, where stability of skin conductance responsivity accounted for an additional 6% (p < .05) of the unique variance in language acquisition. Because paths *a* and *b* both were statistically significant, mediation was indicated. Third, the independent variable (video) must be related to the dependent variable (language). This relationship is shown in Table 5 where video additions accounted for an additional 8% (p < .05) of the unique variance in language. The fourth regression of Table 5 shows that the significance of video additions as a predictor of vocabulary changed from significant to non-significant when the mediator was controlled, indicating a complete mediation of stability of skin conductance responsivity (Kenny, 2005). Figure 3 summarizes these results.

Due to the correlational nature of some data it is conceivable that arousal remained at a higher level because the increasing understanding of the story language made the story more enjoyable. Put differently, the relation between video additions and stability of skin

Table 4 *Zero-Order Correlations Among Measures*

	Gender	Age	Raven	Ethnicity	Video	Mean Skin Conductance Response Rate	Increase in Skin Conductance Response Rate	Story Language Post-test
Gender	---							
Age	.19	---						
Raven (standardized)	-.24	.03	---					
Ethnicity	-.03	-.35*	-.17	---				
Video	-.03	-.05	.17	-.03	---			
Mean Skin Conductance Response Rate	.22	-.06	.15	-.16	.14	---		
Increase in Skin Conductance Response Rate	-.20	.09	.12	-.02	.37**	-.08	---	
Story Language (post-test)	-.12	-.03	.11	.42**	.27*	-.31*	.32*	---

Note: N = 39

* $p < .05$ ** $p < .01$ (1-tailed).

Table 5

Four Hierarchical Regressions to Test the Mediation Function of Increase in Skin conductance response rate

Step		*R*	R^2 change	*F* change[1]	Final β[2]
Regression 1: Effects of video additions on increase of SCRs controlling for ethnicity					
1	Ethnicity	.02	.00	.02	-.01
2	Video	.37	.13	5.53	.37*
Regression 2: Effects of Skin conductance response rate on text comprehension controlling for ethnicity					
1	Ethnicity	.42	.18	8.00	.43**
2	Video	.51	.08	3.74	.18
3	Increase in Skin conductance response Rate	.56	.06	2.93	.26*
Regression 3: Effects of multimedia additions on text comprehension controlling for ethnicity					
1	Ethnicity	.42	.18	8.00	.43**
2	Video	.51	.08	3.74	.28*
Regression 4: Effects of multimedia on text comprehension controlling for ethnicity					
1	Ethnicity	.42	.18	8.00	.43**
2	Increase in Skin Conductance Response Rate	.53	.11	5.29	.26*
3	Video	.56	.03	1.50	.18

Note: $N = 39$

[1] using directional tests the critical value of F equals 2.85

[2] * $p < .05$ ** $p < .01$ (1-tailed)

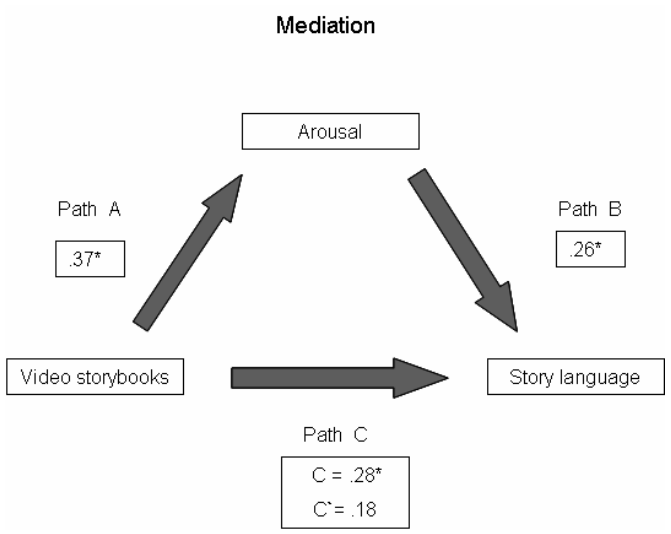

Figure 3.

Mediational Model indicating that Increase in SCR Rate Mediates the Relation between Video additions and Vocabulary. The Numbers on the Arrows are Standardized Regression Coefficients. * $p < .05$.

conductance responsivity may be mediated by story language. Applying the logic of mediational analysis to story language as a possible mediator of the relationship between video and stability of skin conductance responsivity we did not find statistical support for this model. Inspecting the separate paths, mediation was indeed indicated but the significance of video additions as predictor of stability of skin conductance responsivity did not change from significant to non-significant when story language was controlled, indicating that the relationship between stability of skin conductance responsivity and video was not mediated by familiarity with the story language.

Discussion

This study makes plausible that second language learners lose interest after a few replays of the same story as is often suggested in the book reading literature (e.g., Leung & Pikulsky, 1990). In line with this hypothesis, mental effort decreased with every replay of

Heksenspul [Winnie the Witch] when children were exposed to the digitized book version with static illustrations. This may explain why these children's language did not benefit from repeated encounters. However, repetition does not by definition result in a gradual decrease of mental effort. A unique result of the present study is that children's level of mental effort remains at a high level when the story includes additional information sources like video. This finding indicates that for L2 learners video instead of static pictures is essential (Lang, 2006). It seems a plausible assumption that the children in the video condition may have retained a higher level of mental effort because they experienced the video version as more supportive of their text comprehension than children exposed to a book with static illustrations.

This assumption was corroborated by the outcomes of the language tests used in this experiment; children who had heard the story 4 times with video additions learned substantially more story language than children who had heard the story with static pictures. When they experience the available information sources as more helpful, young children who have low L2 proficiency are more inclined to continue their efforts to figure out the meaning of text in every replay of the story, thereby improving their understanding of words and phrases. When, however, nonverbal information supporting understanding of story events is less helpful and children are more dependent on the (oral) text to understand the story events, children may cease to invest mental effort. In a similar vein, research into effects of language comprehensibility on visual attention in young children showed that televised stories, edited so that language was incomprehensible, elicited visual attention initially, but when comprehension was found to be unattainable, showed a subsequent decrease in children's visual attention (Anderson & Lorch, 1983; Anderson, Lorch, Field, & Sanders, 1981; Pingree, 1986).

We did not find support for the hypothesis that mental effort is just a side effect of improving story understanding. In that case the relationship between video and mental effort would have been mediated by language growth. But this assumption did not hold true. On the contrary, we found evidence for the theory that sustained mental effort resulting from a better story understanding plays an essential role in the causal chain of learning from repeated encounters with stories. Sustained mental effort mediates between video additions and linguistic understanding. Our findings match best with the so-called *active theory* that was developed to explain learning from television viewing (Anderson & Lorch, 1983; Bickham et al., 2001; Huston & Wright, 1983). In line with this theory, children continue to invest more mental effort in utilizing or processing what they see and

hear when they perceive the story as more comprehensible (Crawley et al., 1999), thereby promoting memorization of so far unknown language. However, when the story becomes too familiar children will cease to stay actively engaged (Rice, Huston & Wright, 1982). In accordance with this theory it thus seems not very plausible that children who comprehend the story quite well after one or two encounters continue to invest mental effort after repeated encounters. We expect that then mental effort may drop after a few repetitions. This influence of perception of comprehensibility of a story on mental effort expenditure is in line with research on the relation between appraisals of problem-focused coping potential and mental effort (Pecchinenda & Smith, 1996). In this research, the rate of SCRs, significantly correlated to task performance, was maintained during trials with tasks of moderate difficulty that were perceived to be attainable but declined during tasks that were perceived as too demanding (Pecchinenda & Smith, 1996).

Numerous studies have suggested that repeated encounters with the same story are effective but how repetition affects language acquisition has so far hardly been explored (e.g., Bus et al., 1995; Frijters et al., 2000; Sénéchal,1993, 1998). This study confirms that repeated encounters with the same picture storybook are a necessary but not a sufficient prerequisite for the development of language. Repetition is stimulating on condition that the book features match children's needs by sustaining their mental efforts. When motion and camera work guide children through the images simultaneously, rather than successively, with the corresponding narration, then learners can engage in integrating text with sounds and moving images. This result suggests that sometimes learning might be enhanced more through media that are "easy," and less by media that are more "tough" like traditional picture storybooks (Neuman, in press). In the very same way repeated parent-child book sharing may be effective because an adult sensitive to children's needs keeps them interested and attentive by pointing at the picture or adding other clarifications thereby promoting learning. Note that book reading at home and in school may not always fulfill these requirements as a result of which children may lose interest similar to our subjects in the static book condition. Video in digitized storybooks may solve such problems. Note also that the present findings hold true for children with numerous gaps in their text understanding, taking into account that the participants in this study were unfamiliar with about 10% of all words in the story text - a very substantial part of the story vocabulary. We can imagine that children become less dependent on external support when gaps in their text understanding are fewer.

In sum, the assumption that story repetition is an effective strategy (e.g., Biemiller & Boote, 2006) is supported but also nuanced by the present pattern of results. It is a remarkable finding that just repeating a story is not sufficient to advance vocabulary in this group with low L2 proficiency. Repeated encounters with the same story only affect language acquisition when children continue to invest mental efforts in understanding the story text. Therefore, stories must have an appeal to children that motivates them again and again with every replay. Or put differently, the nonverbal presentation of the story must be of such high-quality that children perceive the story to be comprehensible even when they experience many gaps in the story text. Therefore the surplus value of video storybooks is not that they add new media, but rather the deciding factor here is the helpfulness of these additional information sources. For this reason the quality of video stories has to comply with the strictest requirements. Making designs for video storybooks, the story content and not the entertainment value should be the main source of inspiration. According to the present results it should be a priority to add visual information congruent with the story text and use cinematic techniques like zoom to guide children's attention to important visual information making the story more understandable and not add features that may distract children's attention, like incongruent animations (Labbo & Kuhn, 2000). Understanding more of the story is essential for language to expand as it provides a helpful context to derive the meanings of unfamiliar words.

Limitations and future directions

Remember that the present results apply to kindergarten children who, in comparison to their peers, lag behind in understanding the language of teaching hence being at great risk of developing a reading problem at school. Even though we did not compare groups of children differing in risk status, it seems a plausible assumption that especially children with relatively low L2 proficiency need the extra sources of information in the form of video to sustain engagement, but so far this assumption has not been tested by contrasting children at-risk with children not at-risk for reading failure. We may expect less pronounced results in average groups due to the fact that those children are less dependent on scaffolding for understanding the story text. For now it is important to conclude that the additional information available in video stories seems to stimulate a group at-risk to sustain a high level of mental effort thus enabling these children to profit from repeated encounters with age-appropriate stories. It should be emphasized that these

findings concern a substantial part (about 18%) of the primary school population in the Netherlands.

Note also that several pieces of the puzzle are still missing. We assume that temporal contiguity may enable children to build referential connections between the verbal and nonverbal representations, thus stimulating learning from repeated encounters with the story but a direct test of this presumption is still missing. If this assumption is correct we may, for instance, expect that overall eye fixations are more to the point with video stories than with static stories.

Summarizing and practical implications

This study adds new evidence to the theory that, by letting kindergarten children interact repeatedly with video storybooks, teachers have a powerful tool at their disposal to stimulate young children's academic language, a precursor to their becoming proficient readers. A most important finding in the present study is that in particular video storybooks – a way to present stories in this computer era that is growing in importance – are supportive of repeated encounters with stories because video storybooks seem to preserve mental effort more than static stories. Reduction in mental effort as the story is repeated, a plausible side effect of repeating the same static story time after time, poses less of a threat to video storybooks probably because children's appraisals of coping potential remain at a higher level. Video storybooks are sufficiently engaging for young L2 children at-risk to keep them attentive even when they fail to understand (parts of) the text in age-appropriate stories, a result supporting the use of computer technology in pre- and early school education. Of course, book sharing with an adult may produce similar or even better results (Bus, 2001) but high-quality support is often not available in school or at home (e.g., Bus, Leseman, & Keultjes, 2000). As yet the position of computer technology in classrooms is of minor importance and video storybooks are seldom part of the curriculum, even though computers are winning ground in preschool and kindergarten. The present finding that kindergarten children at-risk show more spontaneous investment in understanding video stories argues for a cultural shift. These media may be assets, rather than being considered as negative, giving new possibilities to kindergarten children who, in comparison to their L1 peers, lag behind in language proficiency and are at great risk of developing a reading problem at school (Tyner, 1998).

References

Anderson, D. R., & Lorch, E. P. (1983). Looking at television: Action or reaction? In J. Bryant & D. R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension* (pp 1-33). New York: Academic Press.

Anderson, J., Anderson, A., Lynch, J., & Shapiro, J. (2003). Storybook reading in a multicultural society: Critical Perspectives. In A. van Kleeck, S. A. Stahl, & E. B. Bauer (Eds.), *On reading books to children*: *Parents and teachers* (pp. 203-230). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Anderson, D. R., Lorch, E. P., Field, D. E., & Sanders, J. (1981). The effects of TV program comprehensibility on preschool children's visual attention. *Child Development, 52*, 151-157.

Anderson, D. R., Lorch, E. P., Smith, R., Bradford, R., & Levin, S. R. (1981). The effects of peer presence on preschool children's television viewing behavior. *Developmental Psychology, 17*, 446-453.

Baron, R. M., & Kenny, D. A. (1986). The moderator mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.

Beentjes, J. W. J., & Van de Voort, T. H. A. (1993). Television viewing versus reading: Mental effort, retention, and inferential learning. *Communication Education, 42*, 191-205.

Bickham, D. S., Wright, J. C., & Huston, A. C. (2001). Attention, comprehension, and the educational influences of television. In D. G. Singer & J. L. Singer (Eds.), *Handbook of children and the media* (pp 101-120). Thousand Oaks, CA: Sage.

Biemiller, A., & Boote, C. (2006). An effective way for building meaning vocabulary in primary grades. *Journal of Educational Psychology, 98*, 44-62.

Blok, H. (1999). Reading to young children in educational settings: A meta-analysis of recent research. *Language Learning, 49*, 343-371.

Bosker, R. J., & Guldemond, H. (2004). *Een herijking van de gewichtenregeling*. Groningen: GION Instituut voor Onderzoek van Onderwijs, Opvoeding en Ontwikkeling RU Groningen.

Boucsein, W. (1992). *Electrodermal activity*. New York, Plenum Press.

Britton, B. K., Muth, K. D., & Glynn, S. M. (1986). Effects of text organization on memory: Test of a cognitive effort hypothesis with limited exposure time. *Discourse Processes, 9*, 475-487.

Britton, B. K., Westbrook, R. D., & Holdredge, T. S. (1978). Reading and cognitive capacity usage: Effects of text difficulty. *Journal of Experimental Psychology, 4*, 582-591.

Broekhof, K. (2006). Een boekintroductie zonder boek: bibliothecarissen aan de slag met de Taallijn. *Leeskraam, 3*, 6-7.

Bus, A. G. (2001). Early book reading in the family: A route to literacy. In: S. Neuman & D. Dickinson (Eds.), *Handbook on research in early literacy* (pp.179-191). New York: Guilford Publications.

Bus, A. G., Leseman, P. P. M. & Keultjes, P. (2000). Joint book reading across cultures: A comparison of Surinamese-Dutch, Turkish-Dutch, and Dutch parent–child dyads. *Journal of Literacy Research, 32*, 53–76.

Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Storybook reading makes for success in learning to read. A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research, 65*, 1-21.

Calvert, S. L., Huston, A. C., Watkins, B. A., & Wright, J. C. (1982). The relation between selective attention to television forms and children's comprehension of content. *Child Development, 53,* 601-610.

Carpenter, F., & Haddan, E. E. (1966). *Effects of liked and disliked teachers on student behavior*. Ann Arbor, MI: University of Michigan. (ERIC Document Reproduction Service No. ED 010 375.

Cennamo, K. S. (1993). Learning from video: Factors influencing learners' preconceptions and invested mental effort. *Educational Technology Research and Development, 41*, 33-45.

Central Bureau of Statistics (CBS). (2008, July). *Kerncijfers*. Retrieved July 3, 2008, from http://www.cbs.nl/nl-NL/menu/cijfers/kerncijfers/default.htm.

CITO (Dutch Organization for Test Development). (1996). *Taal voor kleuters OK* [CITO Language Test for Kindergarten Children]. Arnhem: Author.

Clariana, R. B. (1989). Galvanic skin response biosensor. *Journal of Computers in Mathematics and Science Teaching, 8*, 43-45.

Clariana , R. B. (1992, February). *Media research with a galvanic skin response biosensor*. Paper presented at the Annual Convention of the Association for Educational Communications and Technology (AECT), Washington, DC.

Clariana, R. B., & Schultz, C. W. (1991, February). *Rate of lesson completion in*

computer-based instruction: The effects of progress reports on students different ability. Paper presented at the Annual Meeting of the Association for Educational Communications and Technology (AECT), Orlando, FL.

Clark, E. V. (1993). *The lexicon in acquisition*. New York: Cambridge University Press.

Collins, M. (2005). IRA outstanding dissertation award for 2005: ESL preschoolers' English vocabulary acquisition from storybook reading. *Reading Research Quarterly, 40*, 406-408.

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program *Blue's Clues* on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology*, 91, 630-637.

Dawson, M. D., Schell, A. M., & Filion, D. L. (1990). In J. T. Cacioppo & L. G. Tassinary (Eds), *Principles of psychophysiology: Physical, social and inferential elements* (pp. 295-324). New York: Cambridge University Press.

Dawson, M. D., Schell, A. M., & Filion, D. L. (2000). The electrodermal system. In J.T. Cacioppo, L. G. Tassinary, & G. G. Berntson, *Handbook of psychophysiology* (pp. 200-223). Cambridge: Cambridge University Press.

De Jong, M. T., & Bus, A. G. (2002). Quality of book-reading matters for emergent readers: An experiment with the same book in a regular or electronic format. *Journal of Educational Psychology, 94*, 145-155.

De Jong, M. T., & Bus, A. G. (2004). The efficacy of electronic books in fostering kindergarten children's emergent story understanding. *Reading Research Quarterly, 39*, 378-393.

De Temple, J., & Snow, C. E. (2003). Learning words from books. In A. van Kleeck, S. A. Stahl, & E. B. Bauer (Eds.), *On reading books to children: Parents and teachers* (pp. 16-36). Mahwah, NJ: Lawrence Erlbaum Associates.

Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York: New Press.

Detenber, B. H., Simons, R. F., & Bennett, G. G. (1998). Roll 'em!: The effects of picture motion on emotional responses. *Journal of Broadcasting and Electronic Media*, *21*, 112-126.

Dubois, M., & Vial, I. (2000). Multimedia design: The effects of relating multimodal information. *Journal of Computer Assisted Learning, 16*, 157-165.

Ellis, R. (2001). Memory for language. In P. Robinson (Ed.), *Cognition and second*

language instruction (pp. 33-68). Cambridge: Cambridge University Press.

Fahrenberg, J., & Foerster, F. (1982). Covariation and consistency of activation parameters. *Biological Psychology, 15*, 151-169.

Field, D. E., & Anderson, D. R. (1985). Instruction and modality effects on children's television attention and comprehension. *Journal of Educational Psychology, 77*, 91-100.

Frijters, J. C., Barron, R. W., & Brunello, M. (2000). Direct or mediated influences of home literacy and literacy interest on prereaders' oral vocabulary and early written language skill. *Journal of Educational Psychology*, *92*, 466-477.

Garcia, G. E., & Godina, H. (1994, December). Bilingual children's participation in classroom literacy activities: "Once upon a time" and its alternatives. Paper presented at the annual meeting of the National Reading Conference, San Diego, CA.

Geiger, S. (1993). Revealing the black box: Information processing and media effects. *Journal of Communication, 43,* 42-50.

Grimes, T. (1990). Audio-video correspondence and its role in attention and memory. *Educational Technology Research and Development, 38*, 15-25.

Hartman, F. R. (1961). Single and multi-channel communication: A review of research and a proposed model. *AV Communication Review, 9*, 235-262.

Huston, A., & Wright, J. (1983). Children's processing of television: The informative functions of formal features. In J. Bryant & D. R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension* (pp. 35-68). New York: Academic Press.

Juel, C. (2006). The impact of early school experiences on initial reading. In: D.K. Dickinson & S.B. Neuman (Eds.), *Handbook of early literacy research*, (Vol. 2, pp. 410-426). New York: The Guilford Press.

Karweit, N., & Wasik, B. A. (1996). The effects of story reading programs on literacy and language development of disadvantaged preschoolers. *Journal of Education for Students Placed At Risk, 1*, 319-348. ;

Kenny, D. A. (2005). Mediation. In: B. S. Everitt & D. C. Howell, *Encyclopedia of statistics in behavioral science* (Vol. 3, pp. 1194-1198). New York: Wiley.

Keppel, G., & Wickens, T. D. (2004). *Design and Analysis. A researcher's handbook* (4the ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Kroonenberg, P. M. (2004). *PeakDetect*. Leiden: Leiden University.

Labbo, L. D., & Kuhn, M. R. (2000). Weaving chains of affect and cognition: A young child's understanding of CD-ROM talking books. *Journal of Literacy Research*, *32*, 187-210.

Lang, A. (2006). Using the limited capacity model of motivated mediated message processing (LC4MP) to design effective cancer communication messages. *Journal of Communication*, *56*, 57-80.

Leung, C. B., & Pikulski, J. J. (1990). Incidental learning of word meanings by kindergarten and first-grade children through repeated read aloud events. *National Reading Conference Yearbook*, *39*, 231-239.

Levin, J. R., & Neumann, E. (1999). Testing for predicted patterns: When interest in the whole is greater than in some of its parts. *Psychological Methods*, *4*, 44-57.

Lorch, E. P., Anderson, D. R., & Levin, S. R. (1979). The relationship between visual attention and children's comprehension of television. *Child Development, 50*, 722-727.

Lorch, E. P., & Castle, V. J. (1997). Preschool children's attention to television: Visual attention and probe response time. *Journal of Experimental Child Psychology, 66*, 111-127.

Mahon, M. L., & Iacono, W. G. (1987). Another look at the relationship of electrodermal activity to electrode contact area. *Psychophysiology, 24*, 216-222.

Meadowcraft, J. M., & Reeves, B. (1989). Influence of story schema development on children's attention to television. *Communication Research, 16*, 352-374.

Meshkati, N., & Loewenthal, A. (1988). An eclectic and critical review of four primary mental workload assessment methods: A quick guide for developing a comprehensive model. In P. A. Hancock and N. Meshkati (Eds.), *Human mental workload* (pp. 251–267). Amsterdam, North-Holland.

Neuman, S. B. (1997). Television as a learning environment: A theory of synergy. In J. Flood, S. Brice Heath & D. Lapp (Eds.), *Handbook of research on teaching literacy through the communicative and visual arts* (pp.15-30). New York: Simon & Schuster.

Neuman, S. B. (2009). The case for multimedia presentations in learning: A theory of synergy. In A. G. Bus & S. B. Neuman (Eds.*). Multimedia and Literacy Development: Improving achievement for young learners.* New York: Taylor & Francis.

Ninio, A., & Bruner, J.(1978). The achievement and antecedents of labeling. *Journal of*

Child Language, 5, 1-15.

Paas, F., Tuovin, J. E., Tabbers, H., &Van Gerven, P. W. M. (2003). Cognitive load Measurement as a means to advance cognitive load theory. *Educational Psychology, 38*(1), 63-71.

Pecchinenda, A., & Smith, C. A. (1996). The affective significance of skin conductance activity during a difficult problem-solving task. *Cognition and Emotion*, *10*, 481-503.

Peeck, J. (1993). Increasing picture effects in learning from illustrated text. *Learning and Instruction, 3*, 227-238.

Penno, J. F.,Wilkinson, A. G., & Moore, D. W. (2002). Vocabulary acquisition from teacher explanation and repeated listening to stories: Do they overcome the Matthew effect? *Journal of Educational Psychology, 94*, 23-33.

Pingree, S. (1986). Children's activity and television comprehensibility. *Communication Research, 13*, 239-256.

Ravaja, N. (2004). Contributions of psychophysiology to media research: Review and recommendations. *Media Psychology*, *6*, 193-235.

Reed, W. M., Burton, J. K., & Kelly, P. P. (1985). The effects of writing ability and mode of discourse on cognitive capacity engagement. *Research in the Teaching of English, 19*, 283-297.

Reeves, B., & Thorson, E. (1986). Watching television: Experiments on the viewing process. *Communication Research, 13*, 343-361.

Rice, M. L., Huston, A. C., & Wright, J. C. (1982). The forms and codes of television: Effects of children's attention, comprehension, and social behavior. In D. Pearl, L. Bouthilet, & J. Lazar (Eds.), *Television and behavior: Ten years of scientific progress and implications for the eighties* (pp. 24–38). Washington, DC: U.S. Government Printing Office.

Robbins, C., & Ehri, L. C. (1994). Reading storybooks to kindergartners helps them learn new vocabulary words. *Journal of Educational Psychology, 86*, 54-64.

Salomon, G. (1983). The differential investment of mental effort in learning from different sources. *Educational Psychologist, 18*, 42-50.

Salomon, G. (1984). Television is "easy" and print is "tough": The differential investment of mental effort in learning as a function of perceptions and attributions. *Journal of Educational Psychology, 76*, 647-658.

Salomon, G., & Leigh, T. (1984). Predispositions about learning from print and

television. *Journal of Communication, 34*, 119-135.

Schrooten, W. K., & Vermeer, A. (1994). *Woorden in het Basisonderwijs*. [Words in the group of 4-12-yr-olds] Tilburg, The Netherlands: Tilburg University Press.

Sénéchal, M. (1993, March). *Preschoolers'production and comprehension vocabulary acquisition. Poster presented at the biennial meeting of the Society for Research in Child Development, New Orleans*: LA.

Sénéchal, M. (1997). The differential effect of storybook reading on preschoolers' acquisition of expressive and receptive vocabulary. *Journal of Child Language, 24*, 123-138.

Sénéchal, M., LeFevre, J. A., Thomas, E. M., & Daley, K. E. (1998). Knowledge of storybooks as a predictor of young children's vocabulary. *Journal of Educational Psychology*, *88*, 520-536.

Severin, W. J. (1967). Another look at cue summation. *AV Communication Review, 15*(4), 233-245.

Snow, C. E. (1983). Literacy and language: Relationships during the preschool years. *Harvard Educational Review, 53*, 165-189.

Snow, C. E., & Goldfield, B. (1983). Turn the page please: Situation-specific language acquisition. *Journal of Child Language; 10*, 551-569.

Speciale, G., Ellis, N., & Bywater, T. (2004). Phonological sequence learning and short-term capacity determine second language vocabulary acquisition. *Applied Psycholinguistics, 25*, 293-321.

Stahl, S.A. (1999). *Vocabulary development*. Newton Upper Falls, MA: Brookline Books.

Stolwijk, D., & Peters, S. (2006). Taallijn VVE. Investeren in woordenschat. *De Wereld van het Jonge Kind, 34*, 51-53.

Sulzby, E. (1985). Children's emergent reading of favorite storybooks: A developmental study. *Reading Research Quarterly*, *20*, 458-481.

Sundar, S. S., & Kalyanaraman, S. (2004). Arousal, memory, and impression-formation effects of animation speed in Web advertising. *Journal of Advertising*, *33* (1), 7-17.

Thomas, V., & Gorky, P. (1996). *Heksenspul met Hennie de Heks en de Kat Helmer* [Winnie Witch] [CD-ROM]. Nieuwegein: Bombilla.

Thorson, E., Reeves, B., & Schleuder, J. (1985). Message complexity and attention to television.*Communication Research. 12*, 427-454

Tyner, K. (1998). *Literacy in a digital world: Teaching and learning in the age of information*. Mahwah, NJ: Lawrence Erlbaum Associates.

Van Bon, W. H. J. (1986). *Raven's Coloured Progressive Matrices*: *Nederlandse Normen en Enige Andere Uitkomsten van Onderzoek (CPM)* [Dutch norms and further results from research (CPM)]. Lisse: Zwets & Zeitlinger.

Van Praag, C. (2003). *Rapportage Minderheden 2003*: *Demografie* [Minorities report 2003: Demography]. The Hague: SCP-publication.

Verhallen, M. J. A. J., Bus, A. G., & De Jong, M. T. (2006). The promise of multimedia stories for kindergarten children at risk. *Journal of Educational Psychology, 98*, 410-419.

Verhoeven, L. (2000). Components in early second language reading and spelling. *Scientific Studies of Reading, 4*, 313–330.

Verhoeven, L. (2007). Early bilingualisme, language transfer, and phonological awareness. *Applied Psycholinguistics, 28*, 425-439.

Wahlschburger, P. (1976). *Zur beschreibung von Aktivierungsprozessen*. Unpublished doctoral dissertation, Freiburg of University.

Weiner, B. (1979). A theory of motivation for some classroom experiences. *Journal of Educational Psychology, 71,* 3-25.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92,* 548-573.

Weizman, Z. O., & Snow, C. E.(2001). Lexical input as related to children's vocabulary acquisition: Effects of sophisticated exposure and support for meaning. *Developmental Psychology, 37*(2), 265–279.