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The Effect of Playing with Tablet Games Compared with Real Objects on Word Learning by Toddlers

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Abstract

The purpose of this study was to determine the effect of a vocabulary intervention with tablet games or with real objects on word learning by normally developing toddlers. The vocabulary intervention aimed at stimulating word learning by providing the children multiple exposures to target words during playful interaction with a speech language therapy student.
A randomized-controlled crossover trial using a pre-test, intervention, post-test design was used. The number of words learned during an intervention delivered through playing a tablet game was compared with an intervention using real objects as play material. Both interventions were delivered in a 12-minute interactive play session. Participants were 22 children with a typical development, aged 3 years. The children were randomly assigned to the tablet game-first group (n=9) and the real objects-first group (n=13). All children played with both materials and acted as their own controls. In each condition the objective for children was to learn five target words. The selected words were expected to be unknown to children this age, while being relevant to the theme. Receptive word knowledge of the ten target words was measured with a picture pointing task before, immediately after the intervention, and in a delayed post-test, one week later.
Results show that children had learned new words in both conditions in the delayed post-test, but not immediately after the intervention. On average the children learned one new word in both conditions. There was no significant difference in word learning between the two conditions.
Vocabulary intervention for toddlers using a tablet game as material is as effective as an intervention using real objects.

Introduction

With the introduction of the iPad, parents and educators found that it´s an attractive toy for young children. With it's easy to use interface, toddlers gained access to digital content that was previously unavailable to them [1]. Since then many claims have been made on supposed benefits and harms of tablet game playing by young children. On the one hand, gaming is thought to increase engagement and attention and to have a positive effect on toddler's capacity to learn [2]. On the other hand, time spent on a tablet cannot be spent on social interaction, which could hamper language development [3]. Empirical evidence suggests that a more balanced view is justified: beneficial effects of screen media use depend on the degree of resemblance between the content and real-life experiences (e.g. story listening, handling objects, performing routines). Repeated exposure to language during screen use facilitates language development, as does the presence of a competent co-viewer [4].
Efficacy studies on vocabulary interventions for children using ICT indicate that games can be used to teach children new words. Heitink (2012) conducted a quasi-experimental classroom intervention study with typically developing Dutch children (n=206, 9-12 years old), using an online game for vocabulary lessons in a period of four weeks. Three groups were formed: online game + teacher instruction, online game only, and paper game + teacher instruction. Passive word knowledge was tested before, immediately after and four weeks after the intervention with a picture pointing task. All children had learned new words independent of the instruction method, but retention was best when games and teacher instruction were combined [5]. In another quasi-experimental study, Dutch children with normal language development (n=412, 3-7 years old) were taught vocabulary by playing PC-games, or by listening to a storybook in addition to regular instruction. Both groups learned new words, but children playing PC-games learned more words than the storybook group [6]. In this study it remains unclear whether the same results would be obtained when the game or the storybook would have provided the only form of instruction.
To date there are no studies indicating that toddlers can learn new words through tablet use. Children are thought to develop language during social interaction with linguistically knowledgeable others [7]. Processing linguistic input during play helps children to form a distinction between the outside world and the internal world of thoughts and ideas. This is essential for acquiring new concepts [8]. ´Fast mapping´ helps the child to form interpretations of word meanings through repeated, meaningful

exposure [9]. This theoretical understanding of language learning and empirical findings suggests both tablet games (TGs) and real objects (ROs) can be used for word learning. Children might prefer tablet games however. The purpose of this study was to determine if toddlers can learn new words in vocabulary training with tablet games.

Method

Design

A randomized-controlled crossover trial using a pre-test, intervention, post-test design was used. Subjects were randomly assigned to the group that started with TGs or the group that started with ROs, by splitting a randomly ordered list in two. Due to practical considerations, eventually nine children participated in the TG-first group and thirteen in the RO-first group. Four students in their third year of the bachelor program speech and language therapy (SLT), performed the intervention. They also measured children's spoken word comprehension before, immediately after and a week after the intervention.

Participants and setting

Parents of 60 typically developing Dutch children attending a day-care centre were asked for their child's participation in this study. Of 22 children informed consent was attained. Children were aged 3;1-3;11 years (mean 3;6). Eight boys and fourteen girls participated.

Materials

- *Intervention.* The intervention consisted of two 12-minute joint play sessions. In the TG-first group children started with playing the TG 'Dr. Panda's Airport', while the SLT students repeatedly used the target words 'luggage', 'traveller', 'passport', 'checking' and 'carrying' in natural conversation during play. One week later, these children played with real objects found in a supermarket for 12 minutes. During this play session the students used the target words 'filling', 'client', 'scanning', 'all kinds of' and 'price'. In the RO-first group, children started playing with real objects around the theme 'Airport', and played the TG 'Dr. Panda's Supermarket' one week later.
- *Themes and words.* The Dr. Panda games were chosen since these games received positive reviews [10], were suitable for 3-year olds, and contained situations that could be played out with ROs. The selected target words were expected to be difficult enough for the children to allow for word learning.
- *Pre- and post-tests*. As measures for word comprehension two picture-pointing tasks were developed. One task was developed for each set of target words. Each task consisted of five four-choice items. The SLT student stated each target word, the child pointed to one of the four pictures that matches the word best.

Procedure

The intervention sessions took place in a quiet room in the day-care centre. A preschool teacher who knew the child was present. The first session started with a picture pointing task (pre-test T0). Next the student read a short story, to introduce the subject. Then, the child and SLT student played together for 12 minutes with either TGs or ROs, while the student used each of the five target words at least seven times during interaction. Immediately after playing, the picture pointing task was repeated (post-test T1). One week later the procedure was repeated. Now the child played with the other material, and the students offered five new words. After this session the child was asked to indicate which material he or she liked best, by pointing at a picture of the material. The children repeated the picture pointing tasks one week after each intervention (post-test T2).

Statistical analysis

One-way repeated measures ANOVA's were performed to assess word learning at three test intervals (T0, T1 and T2) in the TG- and RO-conditions. Pairwise post-hoc comparisons were made using the Bonferroni procedure. A two-way repeated measures ANOVA was conducted to determine whether children learned more words while playing with TGs or ROs. A two-sided t-test ($p = .05$) was used to calculate power. The relationship of mean frequency of words and chance of a correct response were viewed using a scatterplot. Finally, to judge the children's preference for therapy material, percentages of preference for both conditions and their 95% confidence interval were calculated.

Results

Table 1 shows that children learned words in both the tablet game and the real object condition. On average 1 new word was learned in both conditions.

Table 1: Mean correct responses in passive word knowledge measured in a picture pointing task on T0, T1 and T2 of Tablet Game and Real Objects conditions.

Material used and test interval	Mean and (standard deviation)
Tablet game T0	1,59 (0,959)
Tablet game T1	2,05 (1,558)
Tablet game T2	2,41 (1,368)
Real objects T0	1,68 (0,995)
Real objects T1	2,09 (9,921)
Real objects T2	2,68 (1,086)

There was a statistically significant increase in spoken word comprehension through time in both conditions, $F(2,42)=4,861$, $p=0,013$ (TG) and $F(2,42)=9,387$, $p<.0005$ (RO). Post hoc analysis revealed there was statistically significant word learning from T0 to T2 in the TG-condition: 0,82 ± 0,61 words, $p=0,006$ and in the RO-condition: 1,00 ± 0,64 words, $p= 0,002$. The differences in correct responses between T0 to T1 and T1 to T2 were not statistically significant in both conditions.
No statistically significant interaction between treatment and time for word learning was found, $F(2,42)=0,213$, $p=0,809$. The children learned the same amount of words while playing with TG or ROs.
A scatterplot (figure 1) was constructed to determine the relationship between frequency of word use by the speech and language therapy student and the chance of a correct response by the child. Figure 1 shows that the range of word repetition by the students was 10 to 20 times and that there is no linear relationship between the variables. This means that more frequently used words did not provoke more correct responses in children than less frequently used words.

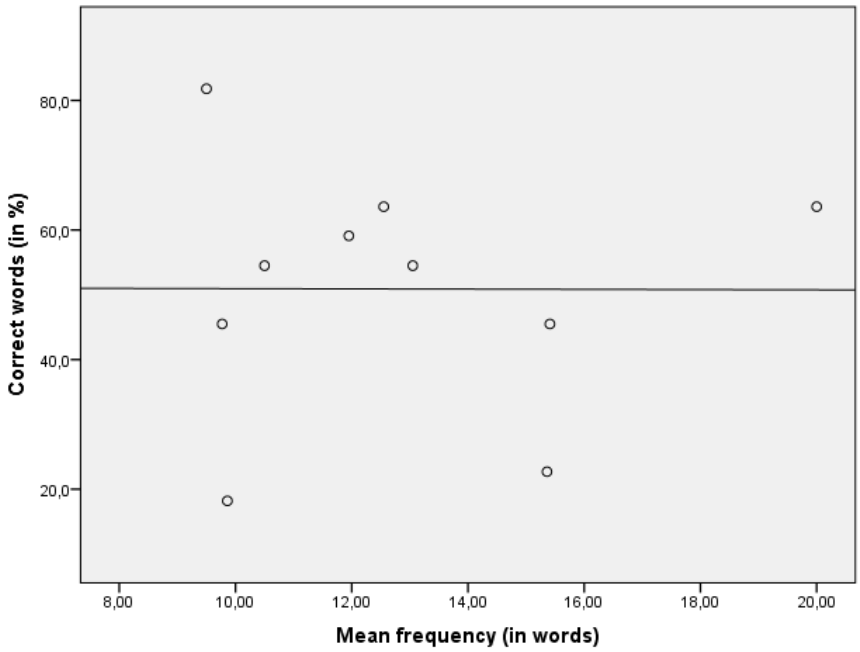

Figure 1: Frequency of word exposure in relation to percentage of correct words on T2.
The preference of 63,6% (CI = 43,5%-83,7%) of the children was to play with TGs while 36,4% preferred ROs. Since 50% is within the confidence interval, we cannot assume this difference in preference to be statistically significant.

Discussion

The results suggest toddlers learn as many new words during an intervention with tablet games (TGs) as they do during an intervention using real objects (ROs). This study can be expected to detect a

mean difference of one word learned between the RO and TG condition. Considering the number of included children the power to do so was strong (82%).
Although children learned words, significance was only reached after one week, and not directly after the intervention. This suggests that it takes some time for new words to be integrated into the vocabulary. Toddlers might need a week of pondering over new words before word knowledge is deep enough to correctly identify word in a picture pointing task [11]. No control words were used in this study, therefore it might be that the difference between T0 and T2 is a result of natural growth. This limitation in study design should be addressed in future studies by using control words.
The results hint at a preference in children for TGs, but this difference is not statistically significant.
Our results are in agreement with previous studies on the efficacy of games on vocabulary development of older children, even though our number of sessions was very limited. In one 12-minute individual intervention children learned about half of the number of words they learned in the group intervention in Schuur [6]. This intervention lasted 6 weeks for 20 minutes per week. In conclusion, this study suggest tablet games are a valuable alterative material to be used during interactive play aimed at vocabulary growth in educational settings for toddlers.

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