# Computer vocabulary training in kindergarten children with special needs

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**The aim of the present study was to determine whether vocabulary training on a computer can enhance vocabulary learning of young children with special needs and whether the task-on-behaviour of these children differed when story reading was carried out by the teacher or by the computer. An experimental group ($n=9$) listened to a story read to them by the computer and played additional computer vocabulary games during three 20-min sessions. The control group ($n=9$) had the same story read to them by a teacher and then followed the normal school curriculum. The results showed that children with special needs were equally able to keep their attention on the story when it was read to them by the computer as when it was read to them by the teacher. For vocabulary growth, the intervention showed positive effects. The children from the experimental group learned more experimental words between the pre-test and retention test than the children in the control group. The study shows that a group of kindergarten children with special needs can enhance their vocabulary by working with a computer program without human intervention.** ***International Journal of Rehabilitation Research*** **29:343–345 © 2006 Lippincott Williams & Wilkins.**

**International Journal of Rehabilitation Research** 2006, **29**:343–345

**Keywords: computer training, kindergarten, special needs, task awareness, vocabulary**

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**Received** 10 March 2006 **Accepted** 9 May 2006

## Introduction

Storybook reading in kindergarten is important for children's vocabulary development (Bus *et al.*, 1995). The computer can be used to supplement reading to children, but a more intensive training seems necessary to further enhance vocabulary learning by computer (Segers and Verhoeven, 2002, 2003).

The present study focuses on a special group of children – kindergarten children with special needs as a result of physical disabilities. They are at high risk of a delay in the development of vocabulary (Horn *et al.*, 1985; Seidman *et al.*, 1986). To date no studies have been conducted on enhancing their vocabulary with the computer.

The present study aimed to determine whether vocabulary training on a computer could enhance their vocabulary learning and to find out whether their task-on-behaviour differed when story reading was carried out by the teacher or by the computer.

## Method

### Subjects

The subjects were 18 children (average age 5 years 11 months; range 4 years 8 months to 7 years 4 months) with special needs (Table 1), selected out of 41 children, belonging to a special school for physical and multiple disabled children. The selection criteria were linguistic age level between 4 years 0 months and 6 years 0 months, and non-verbal intelligence quotient (IQ) and computer mouse ability not below 2 standard deviations (SDs) of the mean of the group of 41 children.

The average language age was 4 years 10 months (SD = 0 years 8 months, range 4 years 0 months to 6 years 0 months). The average non-verbal IQ standard score was 80 (SD = 13.2, range 67–114). The average score on a mouse ability task (De Moor *et al.*, 1999) was 609 s (SD = 202.5, range 439–909).

Children were randomly assigned to the experimental or the control group via a matching procedure based on scores on coloured progressive matrices (CPM) and on a curriculum-dependent vocabulary test.

### Instruments

The curriculum-dependent vocabulary test consists of 57 nouns (34 experimental words and 23 control words). The experimenter presented a photograph and the child was then asked to name what he or she saw.

The curriculum-independent vocabulary test was The Active Vocabulary Task from the Dutch Language Test for All Children (Verhoeven and Vermeer, 2001). The experimenter presented a drawing and the child was then asked to name what they saw. The test consisted of 60 words of increasing difficulty. The average score at the test was 19.5 (SD = 8.3, range = 6–35).

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**Table 1 Characteristics of the participants**

| Child | Age (years; months) | Diagnosis | E/C | CPM | LD | CIVT | Mouse ability (s) |
|---|---|---|---|---|---|---|---|
| 1 | 6;0 | cerebral palsy, right hemiplegia | E | 72 | 4;0 | 29 | 577 |
| 2 | 6;4 | cerebral palsy, right hemiplegia (mild) | E | 114 | 6;0 | 23 | 484 |
| 3 | 5;0 | spina bifida with hydrocephalus and epilepsy | E | 87 | 5;0 | 20 | 636 |
| 4 | 5;0 | motor delay | E | 79 | 4;2 | 24 | 758 |
| 5 | 5;0 | spina bifida with hydrocephalus | E | 91 | 5;0 | 16 | 909 |
| 6 | 4;8 | cerebral palsy, quadriplegia (mild) sequel to encephalitis | E | 70 | 4;2 | 6 | 879 |
| 7 | 5;8 | caudal regression syndrome | E | 72 | 5;5 | 21 | 595 |
| 8 | 7;4 | developmental delay | E | 67 | 5;0 | 19 | 619 |
| 9 | 6;7 | kabuki syndrome | E | 72 | 5;0 | 10 | 585 |
| 10 | 5;1 | spinal cord injury sequel to vascular disorder | C | 96 | 5;1 | 35 | 528 |
| 11 | 6;2 | cerebral palsy, right hemiplegia | C | 81 | 5;8 | 17 | 439 |
| 12 | 4;11 | myopathy (mitochondrial) | C | 92 | 4;7 | 14 | 877 |
| 13 | 5;6 | cerebral palsy, left hemiplegia, visual disorders and autistic behaviour | C | 67 | 5;0 | 13 | 541 |
| 14 | 5;6 | cerebral palsy, quadriplegia and visual disorders | C | 88 | 5;0 | 11 | – |
| 15 | 7;3 | developmental delay | C | 60 | 4;0 | 33 | 561 |
| 16 | 6;4 | myopathy (central core disease) | C | 89 | 6;0 | 31 | 618 |
| 17 | 6;5 | cerebral palsy, quadriplegia and mental; retardation | C | 69 | 4;5 | 17 | 806 |
| 18 | 7;1 | cerebral palsy, right hemiplegia, epilepsy, speech and language disorders, visual disorders | C | 67 | 4;0 | 13 | 746 |

E/C, experimental or control group; CPM, standard score at coloured progressive matrices (Raven, 1961), except for child 15 (measured with Revisie Amsterdamse Intelligentie Test; Bleichrodt *et al.*, 1987); LD, language development (years; months); CIVT, score on curriculum-independent vocabulary test.

Via video observation, the percentage time-on-task was scored by means of partial interval recording (Didden *et al.*, 2003). Since a child may still be paying attention while not looking at the computer or at the teacher, a yes/no story vocabulary test served as a control measure for this observation. The experimenter presented words to the children and they had to respond with yes/no on whether this word was in the story just read to them or not. The correlation between the yes/no story vocabulary test and the time-on-task observation was high ($r = 0.66$, $P < 0.01$).

The Dutch kindergarten computer program 'Treasure Chest with the Mouse' (Zwijsen, 1999) was used for the intervention. The software consists of a story read to the child, with several vocabulary games, using story pictures (see Segers and Verhoeven, 2002).

### Procedure

Pre-tests were administered individually. After the pre-tests, the story was read to the children individually, either by the computer (experimental group) or by the teacher (control group). Directly after the story was read, the yes/no vocabulary test was administered.

Next, the experimental group worked with the vocabulary games on the computer, three times, in 20-min sessions across a period of 2 weeks. The curriculum-dependent vocabulary test was administered again directly after the third session; the control group was tested in the same week. The test was administered again 1 month later.

## Results

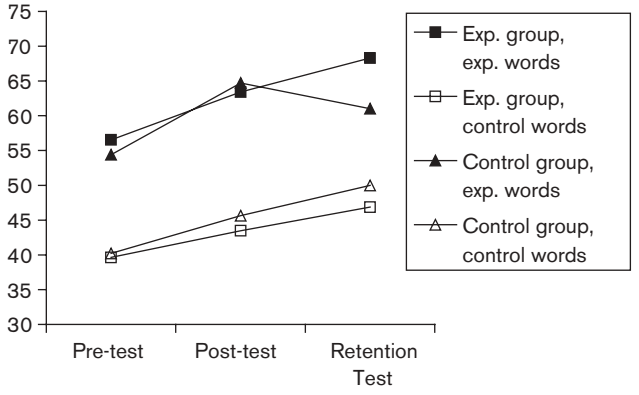
The experimental group demonstrated task-on-behaviour during listening to a story in 86% of all time intervals (SD = 8.0%) and the control group in 87% (SD = 7.9%). There was no difference in task-on-behaviour during listening to a story told by the computer as compared to a story told by the teacher ($t[16] = 0.17$, $P = 0.86$).

Children who scored more than 2 SDs below the mean(s) of the group on time-on-task or below the total score of 13 (binomial test, test proportion 0.50) on the yes/no vocabulary test were excluded from further analysis. This was the case in child 6 on the observation and again in child 6 as well as child 10 and 18 on the yes/no vocabulary test. The experimental and control group were still comparable after exclusion of these children.

Multivariate analyses of variance with repeated measures were performed on the percentage progress of correctly identified words in the curriculum-dependent test. Time (gain from pre-test to post-test, gain from post-test to retention test) and word type (experimental word, control word) were the within-subjects factors; the between-subjects factor was group (experimental group, control group). Child 14 was excluded from the analysis due to long-term illness.

The analysis showed a trend in the main effect of time ($F[1,15] = 4.07$, $P = 0.06$), an interaction between time and word type ($F[1,15] = 5.05$, $P = 0.04$), and a trend in the interaction between time, word type and group ($F[1,15] = 3.19$, $P < 0.10$). This last trend was further explored. The experimental group showed higher learning gains on the experimental words from post-test to retention test ($t[15] = 2.68$, $P = 0.02$). The experimental group also had higher learning gains than the control group on the experimental words ($t[15] = 2.07$, $P = 0.06$) but not on the control words ($t[15] = 0.61$, $P = 0.55$, see Fig. 1) from pre-test to retention test.

**Fig. 1**




Percentages correct on experimental (exp.) and control words during the pre-test, post-test and retention test of the experimental group ($n=9$) and control group ($n=8$).

## Discussion and conclusion

Children with special needs were equally able to maintain their attention on the story when it was read to them by the computer as when it was read to them by the teacher. There were no differences in learning gain between the experimental and control group between pre-test and post-test, probably because both groups had the story read to them and could thus learn new words. The experimental group had an additional intervention in the form of computer vocabulary games, which may have compensated for possible higher learning gains from listening to the teacher.

These additional vocabulary games may also explain the difference in learning gain between post-test and retention. The experimental words were seen more often in different contexts by the children in the experimental group and therefore had more chance to become part of their active vocabulary (Robbins and Ehri, 1994). Even though there was no intervention during that time period, children from the experimental group may have gained a deeper understanding of the words, making it easier to maintain in meaning.

The study shows that a group of kindergarten children with special needs can enhance their vocabulary by working with a computer program without human intervention. Because of the small size of the subject group, one should be cautious in generalizing the results to the population at large. There is a need for follow-up studies with larger groups of participants, focusing on the effects of software especially designed for this population.

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