Comparing L2 Word Learning through a Tablet or Real Objects: What Benefits Learning Most?

Rianne Vlaar *
Utrecht University, Netherlands

Josje Verhagen
Utrecht University, Netherlands

Ora Oudgenoeg-Paz
Utrecht University, Netherlands

Paul Leseman
Utrecht University, Netherlands

ABSTRACT

In child-robot interactions focused on language learning, tablets are often used to structure the interaction between the robot and the child. However, it is not clear how tablets affect children's learning gains. Real-life objects are thought to benefit children's word learning, but it is not clear whether virtual objects provide the same learning experiences. The present study aims to find out whether there is a difference in L2 vocabulary learning gains between children who manipulate physical objects and children who manipulate 3D models of the same objects on a tablet screen during a word-learning task. Data indicate no clear benefit of real-life objects over virtual objects.

Keywords

L2 word learning; Child-robot interaction; Embodiment; Tablets; Real-life objects

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1. INTRODUCTION

In recent years, robots have been employed more and more for language tutoring purposes. In many of these child-robot interactions, a tablet is used to establish common ground and to ensure a successful interaction between the robot and the child [4,6]. However, it is not clear how the use of tablets in these interactions affects learning gains.

* Corresponding author: m.a.j.vlaar@uu.nl

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The embodied-cognition approach, which states that language is grounded in real-life sensorimotor interactions [3], predicts that children's interactions with real-life objects benefit vocabulary learning [2,5]. From this approach, one would expect children to learn new words better if they manipulate physical objects rather than virtual objects on a tablet, as the former allow children to experience sensorimotor interactions with the objects. It is not yet clear, however, whether this actually is the case. Here, we report data from an experiment comparing the effect of real objects versus virtual objects on a tablet screen on L2 word learning. The main research question is whether there is a difference in L2 vocabulary learning gains between children who manipulate physical objects and children who manipulate 3D models of the same objects on a tablet screen. This question is not only relevant for language-learning theories, but to the field of robotics as well, for its implications on the design of robot-assisted language learning tasks.

2. PRESENT EXPERIMENT

Participants: Forty-six Dutch kindergartners (M = 60.6 months, age range = 50-73 months, SD = 6.77; 26 girls) with no knowledge of English participated in the experiment. Most children had experience working with touch screens, and all practiced with the tablet prior to the training.

Procedure: A pre-test was used to make sure the children did not know the target words. The training immediately followed the pre-test, using a between-subjects design such that children were randomly assigned to either the tablet or objects condition (n = 25 in the tablet condition; n = 21 in the object condition). Various tests were administered to measure the children's knowledge of the target words. One week later, the same tests were re-administered to measure children's retention of the target words.

Materials: In the training, children were presented with a story in Dutch containing six L2 (English) target words (i.e., 'heavy', 'light', 'full', 'empty', 'in front of,' and 'behind'). These targets were chosen as children should benefit from sensorimotor interactions with objects in learning them. For example, learning the word "heavy" could be easier when actually holding a heavy object than seeing a 3D model of this object on a tablet screen. The target words were each presented ten times. During the training, children were asked to repeat each target word once, translate the Dutch word to its English equivalent, and perform simple actions in relation to these words on either the tablet or with the real objects (e.g., put a “heavy” elephant in its cage).

The immediate and delayed post-tests included several tasks to assess children’s learning of the L2 words. Two translation tasks (English to Dutch and Dutch to English; maximum score six) were used to measure productive vocabulary. To measure receptive vocabulary, a comprehension task in which children were asked to select the picture (out of four options) which best matched the target words (maximum score twenty-four), and a sorting task was used in which children had to sort pictures in trays according to their meaning, per word pair of antonyms (i.e., all the “heavy” pictures in one tray; all the “light” pictures in the other tray; maximum score thirty). Last, a story comprehension task was used to measure the child’s recall of the narrative (maximum score six).

3. RESULTS

Independent-samples *t*-tests revealed no significant differences between using a tablet or physical objects on any of the tasks, as indicated by children’s mean accuracy scores on the direct and delayed post-tests (see Figure 1 and 2; all $ps > .243$). In the receptive tests (the comprehension task and sorting task), children scored significantly above chance level (indicated by the black line), irrespective of condition (all $ps < .001$). In the production test (the translation tasks), children accurately produced one or two translations. Children also showed proper recall of the narrative, as indicated by the data of the story task in both conditions. Interestingly, in both conditions, the mean scores on the Dutch-to-English translation task were higher for the delayed post-test than for the immediate post-test (both $ps <.001$), possibly indicating some sort of sleep effect (see [1] for an overview).

4. DISCUSSION

The data show that children’s manipulations of physical objects or virtual objects on a tablet screen do not affect L2 vocabulary learning gains differently. These results may be due to the fact that we studied L2 word learning as opposed to L1 learning. In L1 word learning, one has to learn both the word form and the concept, while in L2 learning, one can often make use of the L1 knowledge and connect it to the L2 word form. It is possible sensorimotor interactions with objects do not affect learning gains as much when one has already acquired a concept in

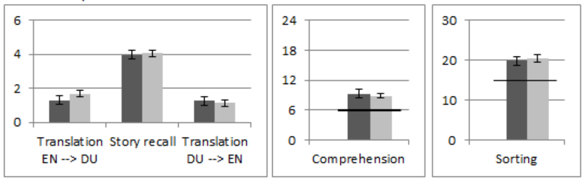

Figure 1. Mean accuracy scores on the direct post-test (dark grey = object condition; light grey = tablet condition)

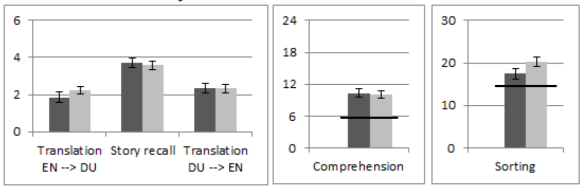

Figure 2. Mean accuracy scores on the delayed post-test (dark grey = object condition; light grey = tablet condition)

their L1, and can subsequently use this knowledge in learning the L2 word.

Future research should therefore look into L1 word learning with objects or tablets, or L2 words of which the concepts do not match the L1 concept the child has acquired. However, present data indicate virtual objects on a tablet screen can be incorporated in child-robot interaction studies on L2 vocabulary learning.

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