

CHILD'S PLAY: TEACHING YOUNG CHILDREN HEBREW MORPHOLOGY USING E-LEARNING TECHNOLOGIES

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ABSTRACT

Hebrew words are known to be composed of roots, entities of three or four consonants that are combined in different patterns. Roots form an integral part of Hebrew morphology and the knowledge of extracting them is essential for high-school matriculation exams. Even though these skills are formally taught starting from second-grade, students still exhibit difficulties applying them. Hence, we created an innovative online root instruction program of five short video lessons that teaches 5- to 8-year old children to extract roots. Children significantly improved their root extraction skills after having completed our program. Furthermore, our program helped close the gap between the younger children and the older children who had already been introduced to the notion of the root in school. Using advanced technologies that allow the development of new teaching methods that are not traditionally used in schools, we managed to teach very young children a complex subject in morphology.

KEYWORDS

E-Learning, EduTech, Hebrew Morphology, Root Extraction

1. INTRODUCTION

As a Semitic language, Hebrew is known for its root-and-pattern morphology, which means that words are composed of three or four consonants, referred to as root, combined in a vocalic pattern, sometimes with additional affixes. The root carries the basic meaning of the word, while the pattern classifies the word into a specific category (Ravid and Schiff 2006). For example, the verb *bišel* 'cooked' is composed of the root *b-š-l* in the pattern CiC[C]eC (C stands for consonant), and the noun *nasix* 'prince' is composed of the root *n-s-x* in the pattern CaCiC.

Root extraction is formally taught in schools in Israel from second grade on, and is essential for high-school matriculation exams, where students are required to extract roots of different words (Avinun 1996, Bolozky 1999, 2003; Lipkin 1985, Ravid 1990, 1991, 2003; Ravid and Malenky 2001). However, students seem to demonstrate low achievements in this section. In light of that, we created an innovative online root instruction program that teaches young children to extract roots in only five short video lessons. Unlike school pedagogy which focuses on identifying roots in written words, the program does not require any literacy skills and is suited for young children starting from preschool.

In this paper we present the effects of our program, as demonstrated by the improvement in children's root extraction abilities. In five short online video lessons, the children learned to extract roots from verbs, nouns and even pseudowords of different patterns in Hebrew. The children's prior knowledge was assessed in a pre-test, and after having completed the program, we examined their root extraction abilities in a detailed post-test. The whole experiment was conducted online, using various E-Learning technologies, and has been accessed from computers, tablets and smartphones. This allowed us to reach a large audience, drawing many participants from varied backgrounds. The program was suited for the challenges posed by Covid-19 that necessitated specialized distance education, yet it can be easily implemented in frontal instruction as well.

2. METHODOLOGY

2.1 Technology and Method

We prepared the videos using recorded audio text and avatars from SitePal.com ©, a dedicated commercial website that enables integration of audio files and animated avatars. As shown in figure 2, we used two cartoon-like avatars, which we named Tutty and Fuzzy, to address the appropriate age range. The recorded videos were uploaded to Youtube.

Our new method develops the skill of actively identifying roots using oral instruction only. In the videos, the children are provided with a long series of structured examples of words and their roots. The avatar poses the question "what is the root of the word X?", then, after giving the children a few seconds to answer, the avatar provides the correct answer, adding a compliment after each set. The questions and answers are given in a rhythm that resembles recitation, and the cartoon avatars encourage active participation from the children, as the children decipher the roots alongside the avatars. This way, children learn to extract roots without any theoretical explanations nor literacy skills.

2.2 Participants

96 children took the pre-test and completed the first lesson, 84 completed the second, 73 completed the third, 69 completed the fourth and 68 completed the fifth. The final analysis was performed on 64 children (32 males and 32 females) who completed both the pre- and the post-test and participated in the entire program. The children were preschoolers ($n = 29$), first-graders ($n = 23$) and second-graders ($n = 12$), aged 5;3-8;9 ($M = 6;11$). All participants were native speakers of Hebrew: 55 monolinguals and 9 bilinguals with dominant Hebrew. Parents were requested to fill in a form of demographic and personal information, which indicated that participants were of different regions and varied backgrounds.

The study was approved by the Institutional Review Board (IRB).

2.3 Procedure

An invitation to participate in the experiment was posted on social media and sent to potential participants individually. Parents who were interested in signing up their children to the experiment had to consent to participate, then fill in a form of demographic and personal information. First, the children had a one-on-one Zoom meeting with an interviewer, where they watched a short introductory video in which they were invited to join 'The root detective club', and provided with a short training of three examples of root extraction. Then, the children were asked to extract the roots of 13 words of different patterns. The interviewers were instructed to always give positive feedback to the children, regardless of the answer they provided. After the pre-test, the children participated in five different lessons, in which they watched five root instruction videos on Youtube in their free time. The duration of each video was between 6 to 10 minutes, and the overall duration of all lessons was approximately 40 minutes. After each lesson, the parents filled in a feedback form in order to get the link for the following lesson. Later, having completed all five lessons, the children were invited to another one-on-one Zoom meeting, in which, after a short video, they took the post-test. In the post-test, the children were requested to extract the roots of 34 words. The post-test contained all pre-test items and 21 additional items. It is important to note that the experimental items did not appear in any of the lessons and the children were not exposed to them prior to the test.

2.4 Results

We first analyzed the percentage of all correct words in the pre- and post-tests. As shown in Figure 1, two-tailed paired t-tests revealed that the percentage of correct answers in the post-test was significantly higher than the pre-test (Pre-test: $M=0.1$, $SD=0.16$, Post-test: $M=0.73$, $SD=0.09$. Pre-Post: $M=0.62$, $SD=0.16$, $t(63)=30.95$, $p<0.01$). Moreover, the percentage of correct answers out of the identical thirteen items of the pre- and post-tests, was significantly higher in the post-test, compared to the pre-test (Pre-test: $M=0.1$, $SD=0.16$, Post-test: $M=0.72$, $SD=0.11$. Pre-Post: $M=0.62$, $SD=0.18$, $t(63)=26.99$, $p<0.01$).

The roots of the extra 21 items that appeared in the post-test, but not in the pre-test were also successfully extracted ($M=0.73$, $SD=0.12$). These results were significant with comparison to the pre-test (Pre-Extra: $M=0.63$, $SD=0.17$, $t(63)=29.65$, $p<0.01$).

As for demographics, two-tailed paired t-tests revealed no significant difference between boys and girls, bilinguals and monolinguals, and children of Jewish religious and secular education.

In a one-way ANOVA, a significant main effect for grade in the pre-test has been found ($F(2,61)=7.57$, $p<0.01$). As demonstrated in table 1, post hoc tests revealed that second-graders performed significantly better than preschoolers in the pre-test (preschoolers: $M=0.04$, $SD=0.08$, second-graders: $M=0.23$, $SD=0.24$, difference: $M=0.19$, $SD=0.05$, $p<0.01$). However, no such difference was found in the post-test (Preschoolers: $M=0.7$, $SD=0.09$, Second-graders: $M=0.77$, $SD=0.09$. Difference: $M=0.07$, $SD=0.03$, $p=0.08$).

2.5 Figures and Tables

Table 1. Mean normalized scores by grade and standard deviation

Grade	Test	Mean(SD)
Preschool	Pre	0.04(0.08)
	Post	0.7(0.09)
First-grade	Pre	0.12(0.14)
	Post	0.73(0.1)
Second-grade	Pre	0.23(0.24)
	Post	0.77(0.09)

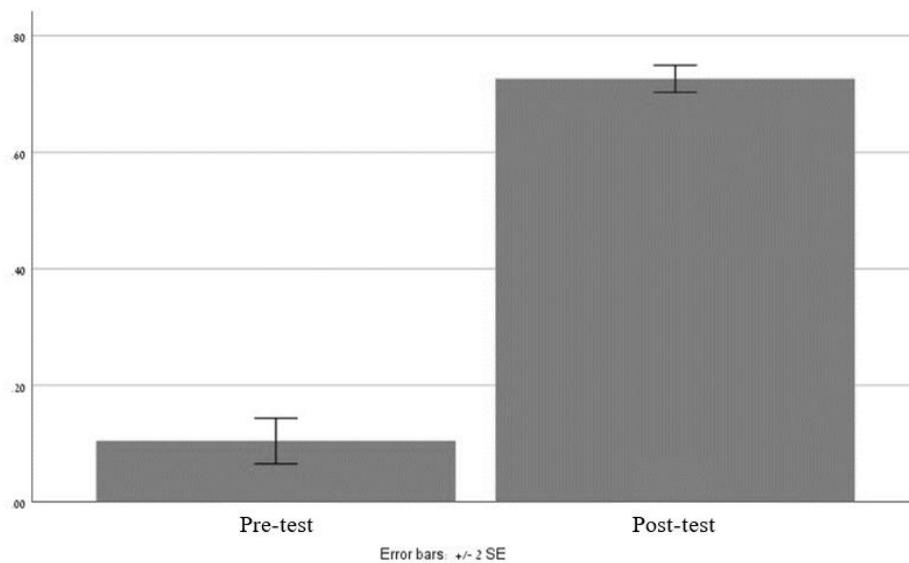


Figure 1. Mean normalized scores

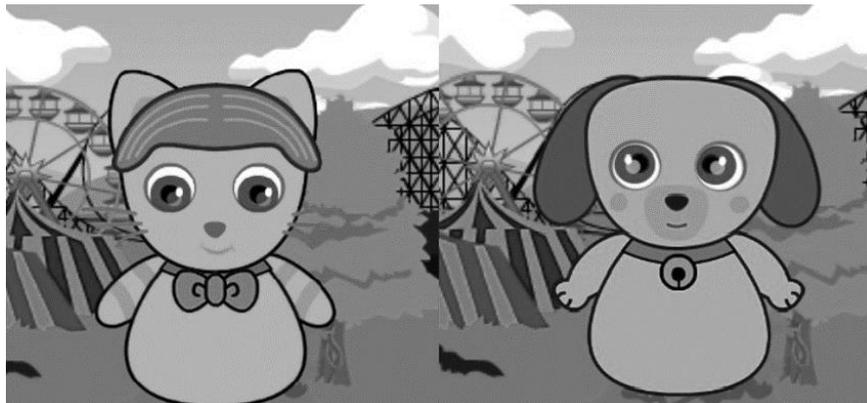


Figure 2. An image of the cartoon-like avatars, Tutty (left) and Fuzzy (right)

3. CONCLUSION

The results of the experiment show that children significantly improved their ability to extract roots of Hebrew words after having completed our program. As the results show, the average score increased drastically between the pre-test and the post-test from 0.1 to 0.73 (out of 1). The same items that appeared in the pre-test got a significantly higher rate of correct answers in the post-test. The extra items that appeared only in the post-test were also successfully extracted. Furthermore, the overall number of correct answers in the post-test was significantly higher than that of the pre-test. It is worth pointing out that not only did children succeed in extracting roots of common verbs, but they also successfully dealt with complex verbal forms, as well as nouns and pseudowords.

Our program helped preschoolers reach the same level as the second-graders in their root extraction skills. The experiment was conducted in June, which is when the school year in Israel is almost over. By this time, second-graders had already been formally introduced to the notion of the root in school, while younger children were not at all familiar with it. Therefore, the second-graders' pre-test served as an ad-hoc control group in the experiment. After participating in our program, the significant difference that was found between preschoolers and second-graders in the pre-test was no longer present.

Although our program is extracurricular, it can be easily implemented in schools in Israel, and with some modifications, also abroad, serving for instruction of Hebrew as a foreign language. As roots are typical of Semitic languages, we are currently working on a parallel research, examining our method on native Arabic speakers as well. The program provides younger children with a deeper understanding of Hebrew morphology. It may also facilitate the process of the acquisition of the lexicon, as children rely on the consonantal skeleton while identifying relationships between lexical entries and interpreting novel words (Bat-El 2017; Berman 1985, 2003; Clark and Berman 1984; Levy 1988; Nespors et al. 2003). This is of high relevance for the education system, as the program improves students' linguistic competence, and teaches skills that are necessary for high-school matriculation exams. Our program is highly accessible to children all over the country, even in times of a global pandemic, and is compatible both for self- and group-learning, inside a classroom and out (see Levinson et al, 2020).

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