



# Autism and tablet computers in Turkey: Teaching picture sequencing skills via a web-based iPad application



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## ABSTRACT

We conducted the first study on Turkish children with autism and tablet computers, with a web-based iPad application designed especially for them. We performed a pilot study on three Turkish boys of different ages with autism to observe their reactions to the tablet application and its effectiveness in teaching the sequencing skill, which is part of their educational curriculum. Our application had a testing session with no prompts or rewards and a teaching session with prompts, rewards, and demonstration of correct responses. First, our participants played the testing session to determine their baseline sequencing abilities. Next, they played the teaching session. Finally, they played the testing session again to see if they were now able to sequence the cards on their own. Through this application, the 11-year-old boy's sequencing skills improved without external help, via only the prompts and reinforcements of the iPad application. The application was not enough to teach sequencing to the 4-year-old, who required external help, and it was too simple for the 15-year-old, who did not use any prompts and quickly became bored. Based on our findings, we discuss how to improve similar sequencing applications and offer suggestions for designing iPad applications for individuals with autism.

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## 1. Introduction

Individuals with autism are impaired in social interaction and communication, and have repetitive, restricted, and stereotyped behavior patterns and interests [1]. Early diagnosis and effective interventions through structured programs and educational methods result in significant progress in autism [2]. Autism is universal. Individuals with autism show similar behavioral impairments and share similar learning characteristics all around the world. Information about new methods in the education of individuals with autism from one country can help those in another and is invaluable for international generalization of new technologies that are available in today's world.

The Turkish government organized a project named Fatih Projesi to deliver tablet computers to public schools and purchased the

tablets in November of 2013 (relevant press release can be found in <http://fatihprojesi.meb.gov.tr/tr/haberincele.php?id=108>). For students with autism who attend public schools to benefit from this project as well, there should be Turkish tablet applications designed specially for the needs of these individuals. Moreover, the United States Embassy in Ankara is conducting a project to develop a Turkish iPad application to be used as a voice output communication aid, i.e. voice what the children with autism who have problems with speaking wish to say. Yet, there is no information currently available in Turkey on how Turkish children with autism will interact with tablet applications designed for them. So, we have performed a pilot study to code and test a tablet application in Turkish for a skill that is in the educational curriculum of children with autism. The purpose of this study was to observe the reaction and interest of Turkish children with autism to educational iPad applications and see whether they will be able to learn from such an application.

This is the first study that has designed a Turkish application for children with autism and has tested it on Turkish children with

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autism. We carried out this pilot, data-based study since in Turkey, we currently do not have available educators for a period of time that is required for a single-subject experimental design and the time constraints on the curriculum of the participating children with autism do not allow for such an extensive design. Our purpose was to open the way for the coding of such applications in Turkey and provide information to help design controlled experimental studies in the future when the resources will be available.

This study is important in two ways: 1. to provide useful information about how Turkish children with autism react to the tablet application, if they are able to learn from it, and how the future applications should be developed, and 2. to lead the way for future studies that will allow cross-cultural comparison of the interaction of individuals with autism and tablet computers in Turkey and other countries.

*Why iPads?* There are several iPad applications that can be used by both individuals with and without autism, some flashcards and images that could be used within Applied Behavioral Analysis (ABA) therapy (<http://www.autismspeaks.org/autism-apps>), and several iPad applications that are intended for individuals with autism. Because the use of mobile technology by individuals with autism is still quite new, experts call for more in depth research in this field (Yee 2012) and the purpose of this paper is to show how Turkish children with autism interact with tablet computers and whether they are able to learn from a tablet application. We selected a skill that our participants needed to learn and aimed to teach it through the tablet computer technology. We have conducted our tests in Tohum School for Autism in Istanbul, the only school for individuals with autism in Turkey that applies ABA principles.

Previous experiments show that teaching concepts to children with autism through technological devices has many advantages over the traditional methods. Children with autism were more attentive, more motivated, and learned more vocabulary with educational software programs of a computer than with the behavioral program [3]. Adding computerized games to the regular language therapy sessions produced the following results: children were more attentive, had more communicative initiatives and more eye contact, were more interactive, used more verbalizations, and made more action requests [4]. Given these advantages of technology, the portable and engaging nature of iPads and their easy-to-use touchscreens that provide instant gratification for children [5], we used iPads as our teaching medium.

*Why sequencing?* The reason we chose to design an application for the skill of sequencing is because sequencing events in a story is an important expressive language skill that is frequently absent in children with autism. It is one of the basic skills underlying communication, reading, and speaking, but there is no available evidence showing how the development of sequencing skills in children with autism can be assisted by an iPad application.

A lack of sequencing story events skills limits the use of language that promotes interactions, which results in a further decrease in opportunities to engage in a meaningful communication experience. For example, when an adult initiates a conversation with a child (e.g., tell me what you did today), the child may not respond if he/she does not know how to sequence in his mind and explain the events he/she was engaged in during the day in the order they happened.

Studies focusing on teaching sequencing story events skills to children with autism have reported favorable language development gains. Increase in sequencing story events skills has resulted in increases in social interactions, positive affect, and spontaneous speech [6], as well as improvements in expressive language and social-communicative behaviors [7]. Since children with autism are already at a communication disadvantage, these findings have led to the belief that sequencing story events should be a core

component of any intervention program for young children with autism [8].

Learning how to sequence story events helps children form connections between different stages of an event. For individuals with autism, it is hard to assemble the pieces from each stage and see the event as a whole. Sequencing game cards are used in the education of individuals with autism since they help children analyze pictures, put the events in the correct order, and predict the consequences of actions. If the individual does not understand the sequence of events, then he/she cannot narrate the event.

Sequencing activities also help children with autism acquire the prerequisite skills for reading and writing. In order to sort the images, children should be able to think of a story in pieces and distinguish the differences between its stages. The ability to notice the differences and understand what the images represent is one of the prerequisite skills for reading. In order to read, children should be able to differentiate the letters, i.e. realize that a is different from b. The skill of telling apart different photographs depicting distinct stages of an event prepares the student to differentiate letters and words later on, which are more abstract than pictures. Thus, the skills of reading and distinguishing different words that are written or spoken build on the skill of assigning meaning and distinguishing different stages of an event, which is acquired by sequencing story event photographs [8].

*Applied behavioral analysis (ABA).* Applied Behavioral Analysis (ABA) is a scientific method that investigates environmental variables influencing socially important behaviors and uses those findings to implement interventions that will improve such behaviors [9]. ABA principles posit that immediate consequences have the largest effects, and that reinforcement is key in behavioral change programs [9]. These ideas are employed in ABA-based behavioral modification programs for individuals with autism.

The first phase of ABA starts with evaluating the individual's behaviors and skills. In this stage, target behaviors need to be analyzed in detail. Skills are broken down into simple steps and every session consists of discrete trials that aim to teach the individual that specific skill. In the teaching session, first an instruction is presented to the individual in a clear and consistent tone. After waiting for a response for a while, if the correct response is not given, the individual is directed to the desired response by providing prompts. ABA, being a faultless teaching approach, aims to prevent individuals from giving erroneous answers, so prompting the individual to perform the desired behavior is an important part of this method. These prompts can be provided as visual cues, such as pointing out the correct answer or fading out the wrong options. Prompts need to be repeated until the desired behavior is performed and reinforcement should immediately follow the correct response to make the child understand the connection between the correct answer and the reward. These steps are repeated by fading the prompts and the reinforcers gradually as the child begins to perform better [10]. In our application, we have used the prompt and prompt-fading procedures of ABA and we have designed the testing and teaching versions of the application according to the ABA steps described above.

*Relevant iPad applications.* Below is a list and short description of the existing iPad applications that are in some way related to the sequencing game we set out to design for Turkish children with autism. After analyzing what is missing in those applications with regard to the ABA principles, we designed our application specifically for the education of children with autism.

- “Speech with Milo - Sequencing” intends to build sequencing and narrative skills for individuals who need special education. In the application, the player gets three different sequencing cards and needs to put them in the correct places. The application has a rich settings page that allows users to toggle on and off the success and unsuccessful sounds, background

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