

SUPPLEMENTARY FILE

Supplementary Material 1

Impute ADT-1 mobile medical application

ADT-1 (Autism Therapy App, Developed by IMPUTE Inc., Japan) is a digital application, intended to be a non-drug prescription treatment for autism spectrum disorder (ASD).

The application is based on the science of Applied Behavior Analysis (ABA) and incorporates evidence-based procedures and tactics, such as positive reinforcement, a token economy, prompts, and modeling. The focus is on four main skill-domains: social, behavioral, verbal, and academic. There are several difficulty levels within each skill domain. Each user will be asked questions, beginning with the preliminary level of each skill domain. Based on the data analysis of the user's answers to the assessment questions, the application will decide the level from where the user begins.

The application maintains precise records of the child's responses throughout the assessment and learning module. A data analytic algorithm is used to assess the user's progress to maximize learning. To do this, the user receives a quiz between learning buckets to ensure that they have met the requirements to proceed to the next bucket.

The app not only aims to teach children to acquire novel skills but also to use these skills in a natural environment. As the user progresses through the application, they are presented with questions to determine whether they have mastered and maintained the skills that they had acquired.

App Workflow

Step 1

The app begins with parent feedback. After a thorough assessment of the child, which is carried out on the app, the app provides a comprehensive, personalized therapy program that matches the child's needs. The child is then guided through their sessions by an animated avatar.

The feedback is filled out by the parents. It informs the ADT-1 app about the child. This creates a personalized assessment test for the child. Questions are based on different skill

domains in increasing order of effort and skill required by the child to fulfill the requirement of the question. Questions related to what food/toys they like are either reinforcing or aversive to the child, or are related to any sensitivity to sensory stimulation that they might have, and personal information.

Step 2: Assessment

The assessment is conducted based on ABA principles and covers skill domains such as conditional reinforcement for stimuli/matching, listener responding, echoic, MAND, VPMTS, intraverbal, motor imitation, LRFFC, reading, writing, independent play, math and tact. Every child starts with preliminary questions in each skill domain. Based on the number of correct responses, the app decides the bucket from which the child begins the learning module. The order of questions is fixed and is in increasing order of difficulty across all skill domains.

Step 3: Learning

A personalized learning-module design based on the number of correct responses provided by the child in each skill domain in the assessment. Everyday therapy-sessions cover social, verbal, behavioral activities, academic domain, and short quizzes after every learning bucket. There is an avatar for the child that guides them throughout the app and also tracks the child's behavior and progress.

Evaluation: Personalized Report

The app uses multiple data points, such as a learning score and responsiveness, to provide a system-generated personalized report. The report is comprised of learning progress and a quiz score in each skill domain, along with the time taken to complete it. This report is accessible anytime during subsequent sessions.

A "Mand" represents a type of verbal behavior influenced by factors such as deprivation, satiation, or motivating operations (MO), along with a controlling history. Positive reinforcement based on responses through the MAND screen, which has fun games and videos and social attention, praise, edibles, and tokens.