
TangiPlan: Assistive Technology to Enhance Executive Functioning Among Children with ADHD

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Abstract

Children with Attention Deficit and Hyperactivity Disorder (ADHD) experience a deficit in cognitive processes responsible for purposeful goal-directed behaviors, known as executive functioning. In an effort to assist them, we developed TangiPlan – a tangible prototype that assists with planning, organization and time-management during morning routines.

Author Keywords

TUI; ADHD; Executive Functioning; Time Management.

ACM Classification Keywords

K.4.2. **[Computers and Society]:** Social Issues - Assistive technologies for persons with disabilities.

Introduction

Attention Deficit and Hyperactivity Disorder (ADHD), estimated at 3%-7% in school-age children, is reflected in a persistent pattern of inattention and/or hyperactivity-impulsivity [1]. Central to the meaning of ADHD is a deficit in cognitive processes responsible for ongoing, purposeful, goal-directed behaviors, known as Executive Functioning (EF) [3]. Behavioral manifestations of poor EF are organization, time management, and planning difficulties, which adversely



Figure 1. The TangiPlan prototype consists of a set of objects that represent routine morning tasks. The objects are placed around the house in locations relevant to a target task. Each object communicates with a central server and offers a visual representation of the time allocated to the corresponding task. Each object also gives real-time feedback of the gradual count-down of time left to complete the task.

affect children's functioning and persist through adulthood [2]. We developed an assistive technology, aimed to help middle school children with ADHD improve EF, especially during morning routines.

The TangiPlan System

TangiPlan [4] is a prototype comprised of tangible objects, and a dedicated application for Android tablets. Each object represents a task that needs to be performed by the child during the morning routine. Using TangiPlan consists of two main stages: planning and execution.

Planning: during this stage, which occurs at the previous evening, the child uses a tablet application to divide the morning routine into small tasks, and allocate time for completing each one. The child pairs each task with a tangible object, and then places each object at the location where the task is supposed to be performed. For example, an object representing the "brushing teeth" task is placed near the bathroom sink.

Execution: during this stage, which occurs the next morning, the objects serve as physical reminders for performing their corresponding tasks. The child activates each object at the beginning of the task, and deactivates it when the task is complete. While active, the object indicates elapsing time.

The tablet application enables real-time monitoring of task-completion. In this manner, the child can be reminded to complete overlooked tasks. Moreover, the application provides performance-based feedback, guiding the child to allocate more or less time to a certain task according to past performance.

The Tangible Objects

TangiPlan objects are 3D-printed truncated square pyramid. A nano-Arduino board, a WiFi board, a LED matrix, and a battery are embedded inside the object. The entire front panel is transparent to allow LED lights to be easily observed from several angles (see Figure 1). As time elapses, green light flows across the front panel from top to bottom, resembling a "digital hourglass". When the allocated time for a task is up, red light begins to flow in the opposite direction.

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