

Kathryn Tietz, Abigail Troeder, Victoria Walter and Laura Wojdyla
Dominican College

AttendIt Design Brief

Background

Attention-deficit/hyperactivity disorder (ADHD) is a genetic brain disorder characterized by continuous patterns of inattention, hyperactivity, or impulsivity impacting everyday functioning or development. ADHD is more commonly diagnosed in males as early as age three, and can continue to late adulthood, impacting success and participation in academics during school-aged years (National Institute of Mental Health, 2016). Specifically, characteristics of ADHD, such as inattention, difficulties with working memory, and decreased planning and organization, have been found to be significant barriers to classroom participation (Daley & Birchwood, 2010). Although there is no cure for ADHD, many treatments are available to reduce these symptoms and improve everyday functioning and development. Treatment options include pharmacological interventions, psychotherapy, education and training, and occupational therapy (OT; Cordier, Vilaysack, Doma, Wilkes-Gillan, & Speyer, 2018). Low and high tech assistive technology (AT) have been commonly used to address functional impairments caused by ADHD and facilitate participation within the classroom setting (Anson, 2018). Self-monitoring and task modifications have been found to be the most successful interventions in improving classroom participation for this population, specifically through improving working memory skills, reasoning, and inattentive symptoms (Daley & Birchwood, 2010). Therefore, modifying classroom tasks with use of an AT device designed to promote self-monitoring can begin to bridge the gap between the expectations of the classroom and the child with ADHD's functional level.

Problem Statement/Research Question

Research question: Is the AttendIt a viable AT option for improving classroom participation in children with ADHD through promotion of self-monitoring skills?

Problem statement: According to the United States Department of Education (2010), every child in the United States is entitled to a free and appropriate public education. However, children with ADHD are prone to limited classroom participation due to common symptoms of inattention and hyperactivity, ultimately leading to decreased opportunity for academic success. Utilizing evidenced-based intervention techniques incorporating AT, a positive learning environment that promotes classroom participation can be created and children with ADHD can experience success in their student role as their peers.

Method

To address this need, the students created an assistive technology device, AttendIt, which is designed to promote sustained attention during lessons with three main components: an iPad, counter, and LED lights. Within a predetermined amount of time, the child must send notes to his teacher on his iPad in a chat application, Discord, relating to the topic currently being discussed in the classroom. Once the notes are received on the teacher's tablet, he or she will hit the switch, resetting the timer, allowing the LED lights to stay turned off. If the child does not send a note within the timeframe the switch will not be hit and the lights on the child's and teacher's desk will turn on. This is a subtle cue for the child to refocus his or her attention on the teacher or their work and send a new note. Once the new note is received and the teacher hits the switch, the lights will turn off, resetting the timer. If the child is unable to regain his or her focus with the light on his desk, the teacher will see the light on his or her desk and give the child a verbal cue or tap on the shoulder to regain their focus. The counter attached to the lights will keep track of how often the light turns on during a school day, thus, how many times the child needs a cue to return their attention to the class; there is also a button on the counter to reset the counter at the end of the school day. This will become a powerful tool for parent-teacher conferences and 504 planning. This device modifies teacher instruction and provides measurable monitoring of attention. With extended use, the timer should be able to be set with longer time increments, indicating that the child requires less consistent monitoring. The child's notes do not have to be monitored during the school day for ease of the teacher but will be documented for the child's chart along with a sign-off from the teacher saying that the notes generally relate to the topics discussed in class that day. This will monitor for notes containing unrelated words or sentences and look for improvements in the types of notes sent in each message.

Original Design Specifications

The first part of AttendIt is an iPad or tablet; the teacher will have one as well as the child. This iPad or tablet will use Discord, which runs off wifi and locks the child into the messaging app once logged in, preventing the child from using the tablet for other work or as a distraction. Google classroom is an additional option in districts that use it. The other piece of equipment is a connection between two small LED lights, a button, and a counter. The counter resets the timer and turns off the lights if they are on. On the teacher's desk sits one LED light and the switch, and on the child's, desk is the second LED light. The timer is set on the for a time that fits the child's attention level and ability and can be extended if improvements are seen over time. The counter tracks how many times the light turns on, displaying the number of times the child was not paying attention to the lecture. At the end of the day, the number on the counter may be reset at the end of the day.

Description of Final Approach and Design

The current design of the AttendIt utilizes Arduino chips wired in neatly packed boxes to allow for the child's light and the teacher accessories to be separate and not connected by wires. The counter, button switch to reset the timer, and one LED light are all housed in one box. This

can be plugged into a small external battery to be easily portable. The child's box only houses the other LED light, and this can be plugged into an external battery or the laptop/tablet being used by the child to send notes. Each box contains a series of wires and an arduino chip that is coded in a way to function with the other box. Within the code there is a place that reads how many milliseconds the timer is set for. Thus when adjusting the timer, the code should be accessed and altered to read the new number of milliseconds the child requires it to be set for.

Outcomes

The final design of AttendIt has not yet been tried in a classroom setting with children with ADHD. Classroom trials of AttendIt with school-aged ADHD children is pending permission from the Special Education Committee in the Wappinger Central School District in New York; therefore, outcomes, results, and user feedback is pending.

Cost (Cost to produce and expected pricing)

While making the first wireless prototype, parts were ordered from two different websites and the device was built using minimal equipment and basic design. The total parts for the main device came to \$89.99 including tax and shipping. The engineer who manufactured the first prototype received \$200. A computer or tablet can be accessed through the student's 504 plan and thus be accessed with no cost. Also, Apple can provide grants to schools to obtain iPads for educational purposes (Maich & Hall, 2016). The final part would be an external battery for the teacher's box, making it easily movable around the room. External batteries range in price from \$20 to over \$100 depending on the brand and reliability. A final choice on external batteries would be made based on necessity of the device power after research begins.

Pricing of the device would need to cover the cost of the parts and labor of engineers, in addition to paying the creators 20% of the cost to make it in order to keep the product on the market (Ciotti, 2015). If device research were to show an evident increase in attention and reception of information for students, the price could increase based on its success and demand. If the cost were to stay consistent at \$89.99 (excluding the external battery), the price would be \$107.98 not including labor. Labor would be based on how many products are being made and by who. An external battery can be sold in conjunction with the device, raising the device's price based on the battery used. Funding of the AttendIt could come from the school district under the student's 504 or IEP if it proves successful in assisting students as a non-pharmacological assistance.

Significance

AttendIt addresses common functional impairments resulting from ADHD by keeping children with ADHD actively engaged in classroom lectures through interactive note-taking. Consistently utilizing this device will enable children to form positive skills to foster academic success. Such skills include effective note-taking, active listening, and decreased maladaptive behaviors (hyperactivity, fidgeting, distraction, etc.). The combination of effective academic

strategies and positive behaviors warrants classroom participation and thus, increased opportunity for academic success?

AttendIt empowers each child to learn self-awareness and self-monitoring skills. As the child uses the device throughout his/her academic career they will learn what subjects within their day pose strengths and weaknesses as monitored by the length of attention and level of participation they demonstrate. Consistent use will allow a child to acknowledge times of distraction when the light turns on, subconsciously tracking this overtime before being redirected to the task at hand. As a child advances out of a school setting and into a workplace setting, these skills may be carried over due to the individual recognizing when they are distracted due to the habit formation AttendIt provided for many years.

The device also modifies teacher instruction for an individual child and provides a measurable approach to monitoring attention through tracking the amount of cuing the child needs to sustain attention during classroom lectures. Thus, the counter component is a powerful tool for monitoring the child's progress, which inform parent-teacher conferences, goal writing between different disciplines (e.g., occupational therapy, special education) and 504 planning.

Additionally, the use of an iPad as a main component of AttendIt is not stigmatizing as it has become a common, everyday technology for many people. In fact, many classrooms, both inclusionary and special education, already utilize iPads within lessons, making them familiar and common within the classroom setting for all children (Mango, 2015).

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