Evidence-Based Digital Interventions for Adolescents with ADHD: Stakeholder-Generated Solutions to Optimize Engagement and Implementation in School Settings

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Abstract

Despite evidence demonstrating the effectiveness of behavioral/organizational skills interventions for adolescents with ADHD, relative to younger children, adolescents with ADHD demonstrate notoriously poor treatment utilization, express limited motivation for treatment, and struggle to engage in behavioral skills interventions. There is a critical need for identifying strategies to improve quality of care and reduce treatment disparities in adolescents, thereby decreasing negative long-term patient outcomes associated with ADHD. The proposed study used a stakeholder-centered, theory-driven, empirical approach for optimizing treatment for ADHD by engaging key adolescent, parent, and school/community stakeholders in the iterative, co-development of a technology-enhanced intervention that target skills acquisition/utilization. ATOM (Advanced Tools for Organization Management) was developed facilitating a user-centered design with iterative stakeholder input collected via focus groups/interviews, and formative usage evaluation with adolescents, parents, teachers, and providers. Key themes identified from focus group and qualitative interviews emphasized adolescent, family, and provider preferences for features and design of ATOM, including immediate points, in-vivo prompts for skills, and interactive rewards. Iterative development addressed stakeholders' feedback via enhanced features. ATOM was continuously revised until it met key stakeholders' needs, and ratings suggest high usability (System Usability Scale scores > 80). Results highlight the importance of stakeholders input in intervention refinement in order to understand the lived experiences and adequately reduce barriers and promote treatment engagement.

Background

•Current evidence-based psychosocial treatments (EBTs) for adolescents with ADHD focus on promoting compensatory skills in order to address executive functioning deficits and use rewards and adult reinforcement to motivate skills use (Bikic et al., 2017; Evans et al., 2018; Sibley et al., 2014)

• Due to the significant barriers to receiving, engaging, and adhering to EBTs for adolescents with ADHD, including interfering symptoms (e.g., forgetting, disorganized), limited family involvement, and motivational factors, 41-60% of adolescents have difficulty fully participating in treatment (Langberg et al., 2016).

• Existing EBT practices fail to address the underlying issues of low motivation, poor reward saliency, and inconsistent adult reinforcement, resulting in poor generalization and maintenance of skills.

•ATOM is a digital solution co-developed with adolescents, parents, and school stakeholders to target these barriers to existing EBT for ADHD. ATOM is designed to promote skill use, enhance intervention response, and support sustained improvement for adolescents with ADHD.

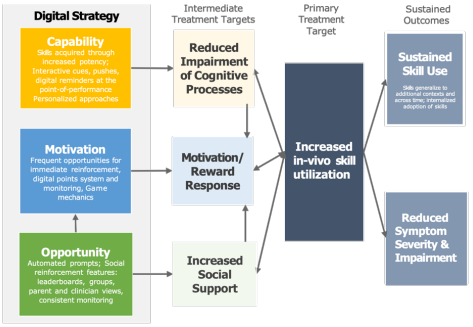
Method

•ATOM was developed and designed with iterative stakeholder input collected via focus groups/qualitative interviews across three phases with adolescents (n=26; Mage=12.4 years; 50% female; 63% Black, 18.5% White, 18.5% other; 7.4% Hispanic/Latinx), parents (n=16), and teachers and school providers (n=16).

•Qualitative analysis results during the discovery and iterative development phases are summarized in the stakeholder focus group themes tables

• Descriptive findings on the usability/functionality from the extended usability testing and feasibility open trial investigation of ATOM are also described.

Figure 1. Conceptual Model for Improving Treatment Outcomes in Adolescents with ADHD based on the COM-B Framework for Behavior Change (Michie et al., 2011).



ATOM Features

Stakeholder Focus Group Themes

Adolescents

Themes	Exemplars
Tools to engage	*"Could create levels that you move up as you gradually earn points and rewards, which brings in new themes"* *"To be able to upload a picture of the reward you're working toward"* *"Needs to grab your attention...like with short videos, variety of colors, GIFs...and not a lot of words"* *"Make it like a game so people want to use it"*
Personalization	*"Choose different themes...put a profile photo up"* *"Pop-up messages that congratulate you when you've leveled-up!"* *"Set my own goals with my [school provider] or parent and then any of us can view anytime"* *"I want to pick my own theme and color settings"*
Reminders/ Prompts	*"Tell me if I'm close to an assignment's due date!"* *"I want to be able to choose how often I get reminders ...'often' 'sometimes' 'daily' or 'several times a day"* *"If something was missing, I would love it if it had a star next to it."* *"Banner notification...whenever I get points"*

Caregivers

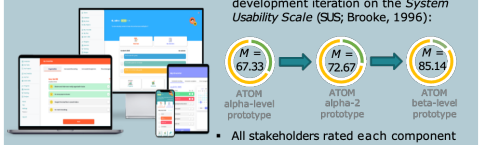
Themes	Exemplars
Tools to Engage	*"There should be a student view and a parent view- something that's different so students can know what their progress is as well as how their parents are rating their progress"* *"I think in any circumstance, you should always reward or incentivize the behavior."*
Personalization	*"Progress graphs should plot how you're doing with organization, getting homework done, time management...so you can see where you need to improve"* *"You can adjust your notification settings. Do you want every week? It may be grades that you might want once a week."*
Reminders/ Prompts	*"Make the notification like an ad, where you have to wait a certain amount of time before you can click off of it"* *"If you are going to have an option for parents to add stuff to the calendar, it needs to give [students] a notification"*

Interventionists & Educators

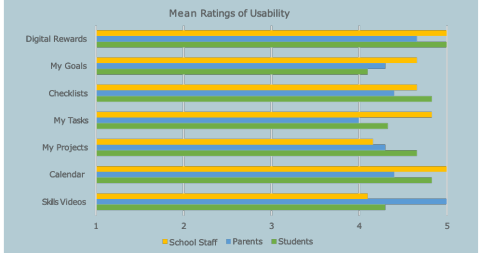
Themes	Exemplars
Tools to Engage	*"Want a streamlined view...to be able to see multiple students' that I am working with"* *"If you get five days in a row [of completing all assignments], the case manager can decide the length of time..."*
Personalization	*"I'd like the ability to hide and show certain aspects of the graph...to have the ability to highlight what's going well"* *"I should be able to turn on/off certain modules as students move through the program at different paces"*
Reminders/ Prompts	*"It would be cool when you get a notification if it says, 'Two o'clock, it's time to start your work for five minutes', and you can swipe it open"* *"May be better if you can customize it [notifications] yourself and have automated responses for comments like 'Oh good job.'"*

Usability and Functionality Assessments

- Students, parents, and school staff rated the ATOM prototype as having increasing levels of usability with each development iteration on the *System Usability Scale* (SUS; Brooke, 1996):



- All stakeholders rated each component of the ATOM platform as at least "moderately useful" and at least "moderately easy" to use.



Conclusions and Recommendations

Conclusions: Key focus group themes highlighted preferences for features in ATOM such as immediate points, in-vivo prompts for skills, and interactive rewards. Continuous revisions of ATOM and following assessments indicated high usability across participants (SUS beta-level prototype = 85.14 out of 100), and stable improvements in usability following iterative software development, demonstrating the significant value of stakeholder input.

Recommendations and future steps include preparing extra time/back-up plans with the web developers during development, prioritizing direct communication between team members regarding all aspects of ATOM, finalizing the ATOM website platform, and continuing to conduct both open and RCT trials to compare levels of efficacy.

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Learn more about ATOM at:
https://theatomprogram.com