Exploring Usability of mHealth Apps Through Combined Expertise of Researchers and Practitioners

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ABSTRACT

Researchers focusing on mHealth apps work hard to engage the healthcare practitioners who will be end users or stakeholders. Acknowledging that these perspectives must be included throughout a design process, we commonly apply human-centered and participatory approaches to the design and evaluation of mHealth apps. Yet as we focus on innovative sociotechnical systems, these can sometimes be far removed from the real-world systems healthcare practitioners must commonly use in their work. Practitioners are enthusiastic partners in innovation with mHealth, but the reality of their day-to-day work is a significant number of constraints that dictate which systems they can implement. We present a collaborative workshop built on the paradigm of participatory action

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KEYWORDS
Autism Spectrum Disorder, special education, technology implementation, heuristic evaluation.

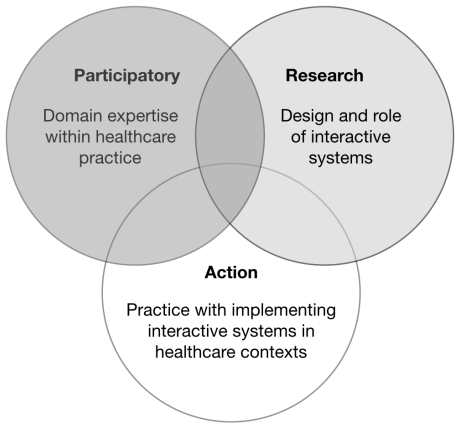

Figure 1: We present a workshop format that uses a Participatory Action Research approach to enable healthcare practitioners and HCI researchers to learn from one another.

research, which seeks to bridge the gap between research and practice. The HCI researchers learned more about how mHealth apps are integrated into practice, and the healthcare practitioners learned how to more efficiently evaluate a range of consumer apps.

BACKGROUND AND RELATED WORK

A range of frameworks have been developed to enable human-driven design of interactive systems through the participation of the people who will be impacted by them—these include human-centered design, participatory design, and value sensitive design [6]. To realize the potential of these approaches, Marc Steen [7] challenges us to be conscientious of our role and influence, by organizing activities with an open mindset and using reflexivity about our role in the process. Similarly, Gillian Hayes [3] brings the tradition of action research to human-computer interaction (HCI) research in order to democratize innovation with interactive systems, explaining:

> *"[The action research] view privileges local knowledge as being as important as scientific or scholarly knowledge, and thus all involved are co-investigators of, co-participants in, and co-subjects of both the change and evaluation activities of the project."*

As these approaches are increasingly used in HCI, there has been a parallel rise of participatory action research within the field of public health. In public health, participatory action research involves engaging individuals in reflecting and taking action to improve their own or others' health [2]. Baum, MacDougall & Smith [2] highlight two key aspects of this approach as: using the lived experience in its entirety rather than understanding it separate from its context within the world, and critical reflection on professional practice as a key component of taking action.

In this paper, we describe a workshop format that brings together HCI researchers and healthcare practitioners to share their knowledge and experiences. Instead of an explicit design goal, the aim of the workshop is to critique a range of relevant interactive systems, in order to investigate what functionality and aspects are key for adoption and integration into practice. By performing this critique together, researchers can learn from the lived experiences of practitioners, and practitioners can engage in critical reflection of how they go about their work. .

CHALLENGES OF INCORPORATING MHEALTH APPS FOR AUTISM

We developed a pilot workshop for practitioners who serve children with autism spectrum disorder (ASD)—including therapists, speech language pathologists, and special education teachers. A myriad of mHealth apps are marketed toward ASD, and practitioners rarely have enough time to triage them in order to find one that fits therapeutic goals, and is also intuitive enough to integrate into practice without significant effort.

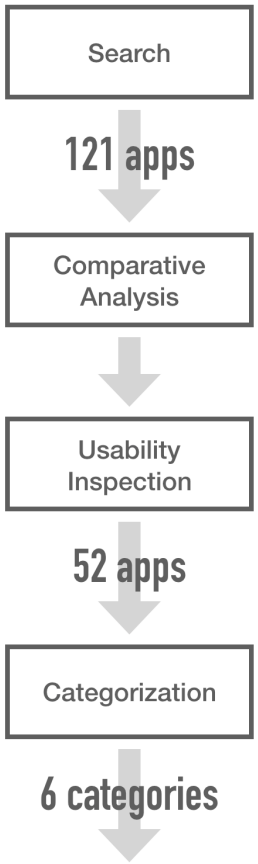

Figure 2: Workshop preparation consisted of searching for consumer apps for ASD, then performing comparative analysis, usability inspection, and categorization.

Our approach built on related work [1] showing that reviewing mHealth apps and performing an expert-based usability evaluation can help us understand what is currently available for consumers (in their case, for diabetes), and why *"patients and physicians alike should be involved in the app development process to a greater extent"*. In our workshop, we therefore involved practitioners in performing usability inspections. An "expert" evaluation typically refers to knowledge about usability, but for mHealth, the practitioner experts provide another critical perspective for determining whether an app would be usable for its intended purpose.

METHODS

Over a period of three months, we prepared for the workshop by reviewing and categorizing mHealth apps that would be relevant to the practitioners. The workshop was advertised to local practitioners by a nonprofit organization hosting it as part of a workshop series. Three researchers from our team facilitated the workshop over three hours on a Saturday.

Preparing for the Workshop

In preparation for the workshop, we categorized consumer mHealth apps related to ASD. As illustrated in Figure 2, we reviewed 121 apps using comparative analysis of their features and functionality, and usability inspection. The top 52 apps were then grouped into 6 categories.

Search. Using the keywords 'Autism', 'Autism Spectrum Disorder' and 'ASD', we searched for apps on the Apple App Store, Google Play Store, and resources provided on the ASD-oriented websites Appyautism, Autism Speaks, and Autism Plugged In. Product descriptions from the developers and consumer reviews were used to verify relevance to ASD, resulting in 121 apps.

Comparative Analysis. We attempted to download each of the 121 apps on the appropriate platform. We eliminated any apps that we could not successfully download and interact with—e.g., they were no longer being maintained, required in-app purchases for basic use, or did not have a demo or free trial available. In addition, all of the following criteria were required for functionality: applicable to children with ASD, relevant for use in the school setting rather than only for parents, appeared to address the need intended, and provided skill development or structure rather than purely entertainment.

Usability Inspection. We also conducted a usability inspection [4], eliminating apps with enough problems related to Nielsen's usability heuristics [5] that we judged them to be infeasible for practitioners.

Categorization. A remaining 52 apps were then categorized based on how they could be used. First, we divided the apps based on their primary intended user—e.g., a game that helps a child develop a skill, or a tool that helps a practitioner or parent monitor that skill development. Then, our research team discussed what need(s) each app would be able to support. As shown in Table 1, 44 apps designed for

Table 1: Categorization of 52 apps for ASD, based on primary intended user and need addressed.

Use by Students/Children	44
Communication & Language	
- Language acquisition / Vocabulary	12
- Augmentative & Alternative Comm	7
- Independence / Visual schedules	6
- Language / ABA / Therapy	4
- Emotional expression / Recognition	3
- Reading	2
Motor & Sensory Skills	
- Eye-hand coordination	4
- Gross-motor skills	2
- Sensory skills	2
Recreation	2
Use by Practitioners/Parents	8
Data Collection / Monitoring	5
Information / Resources	2
Classroom Management	1

use by students/children were categorized across three main areas: communication and language; motor and sensory skills; and recreation. 11 apps designed for use by practitioners or parents were categorized across three main areas: data collection and monitoring; information and resources; and classroom management.

Facilitating the Workshop

Over 40 practitioners participated in the three hour workshop—including special education teachers, paraprofessionals, social workers, occupational therapists and physical therapists.

Walkthrough of Categorization. The workshop started with our team walking the practitioners through the process our research team used to search and categorize the 52 mHealth apps. We described examples of a few apps to illustrate each category, showing videos from developers when available. The practitioners found our categorization to be understandable.

Heuristic Evaluation. Next, we introduced the heuristic evaluation method to the practitioners. We explained Nielsen's 10 usability heuristics, illustrating them with some examples from our list of 52 mHealth apps for ASD. The practitioners then conducted their own heuristic evaluation in groups of 4-5. Groups were assigned 3-4 of the apps, and provided with the platforms required (e.g., iPad, Android tablet, laptop).

Interprofessional Collaboration. We randomly assigned practitioners into groups, to facilitate interprofessional collaboration as they evaluated each app's usability and discussed its potential uses in their practice. Each group was provided with poster paper and markers to summarize their findings. When evaluations were complete, practitioners had the opportunity to visit all of the other groups and interact with the rest of the 52 apps. Finally, each group presented their app evaluations to the entire workshop, resulting in questions, comments, and a broader discussion of the usability and perceived usefulness of all 52 mHealth apps.

Workshop Evaluation. At the end of the workshop, practitioners filled out an evaluation survey consisting of seven 5-point Likert questions and two open-ended questions.

FINDINGS

We found that the design of the workshop resulted in learning outcomes for both practitioners and researchers. Our observations of this efficacy matched feedback we received from practitioners through the evaluation survey and word of mouth.

Nielsen's 10 Usability Heuristics for User Interface Design [5]

(1) Visibility of System Status
(2) Match Between System and the Real World
(3) User Control and Freedom
(4) Consistency and Standards
(5) Error Prevention
(6) Recognition rather than Recall
(7) Flexibility and Efficiency of Use
(8) Aesthetic and Minimalist Design
(9) Help Users Recognize, Diagnose, Recover from Errors
(10) Help and Documentation

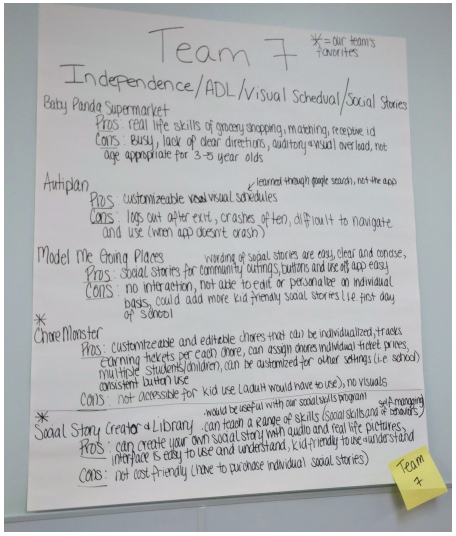

Figure 3: Example of the discussion summary of Team 7's heuristic evaluations

Learning Outcomes for Practitioners and Researchers

The practitioners were very engaged with the heuristic evaluation activity, with each member of a team interacting with the apps. We, as the researchers, had the opportunity to observe every group's conversations in which practitioners: applied the heuristics, explained whether they thought the apps could be incorporated into their practices with students, and discussed potential uses of the apps. The group presentations were also informative for everyone in the room, as practitioners effectively summarized their experiences interacting with the apps, and comparing their usability based on the heuristics. In their posters, they were able to showcase their favorite apps and explain group findings about the usability and practicality of potentially using them in their practice (Figure 3). Unexpectedly, although evidence-based practice is central to the practitioners' work, an app with available scientific evidence for its efficacy was not evaluated highly if it was not also intuitive and easy to use.

Through their randomized interprofessional groups, practitioners were also able to remain open-minded and reflective about potential uses for different apps. If one practitioner explained why they did not think they would be able to use the app, they could hear from others who had a different opinion, and gain another perspective on implementing mHealth apps for ASD. For example, a special education teacher would find an app for monitoring behaviors not useful for tracking the behavior of all students in the classroom, but he would comment that the app could be helpful for a psychologist when she works with students one-on-one. Practitioners often have to collaborate with others outside of their own profession, so gaining an appreciation for how others creatively solve problems in their work with children with ASD can be valuable in their practice.

Workshop Feedback

The practitioners scored all survey items above a 4 out of 5, indicating positive perceptions of the usefulness of the heuristics, the potential for using the apps in their practice, and the design of the workshop overall (Figure 4). We interpreted these scores together with answers to open-ended questions about the best and worst parts of the workshop, and feedback we received through word of mouth. Group work with random assignment was one of the highest rated aspects of the workshop, with practitioners stating they believed the design of the workshop facilitated the interpersonal collaboration and sharing of varying perspectives regarding the implementation and practical use of the apps presented.

Other aspects of the workshop rated highly were that it was interactive and provided hands on experience. Practitioners said they gained an understanding of what consumer mHealth apps are available to them, as well as how they can evaluate their usability and usefulness. They reported that the mHealth apps have the potential to help their students learn better and help them convey information in a more understandable way to their students.

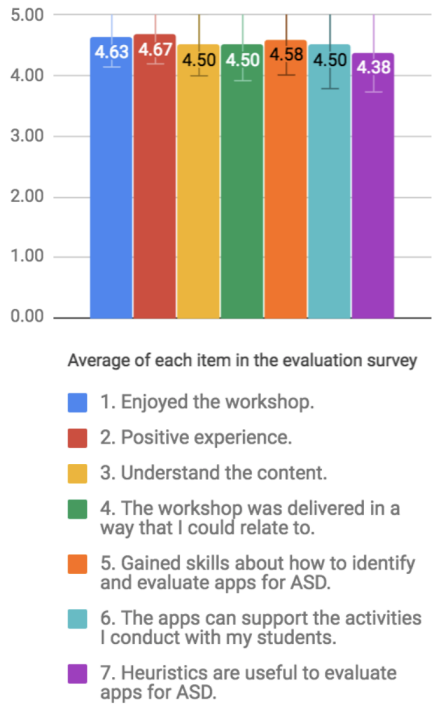

Figure 4: Scores from the workshop evaluation survey

CONCLUSION

Our pilot workshop for practitioners who serve children with ASD followed a participatory action research approach, and shows how researchers and practitioners can work together in evaluating mHealth apps for usability, usefulness, and feasibility of use. From the researchers' perspective, this approach helped us to understand how practitioners struggle to triage the myriad consumer apps designed to support them, as well as the process by which they select and incorporate mHealth apps in their work. Practitioners found value in applying Nielsen's usability heuristics and working in collaboration with others from across diverse professional backgrounds to discuss the merits of various mHealth apps.

REFERENCES

[1] M. Arnhold, M. Quade, and W. Kirch. Mobile applications for diabetics: a systematic review and expert-based usability evaluation considering the special requirements of diabetes patients age 50 years or older. *Journal of medical Internet research*, 16(4), 2014.

[2] F. Baum, C. MacDougall, and D. Smith. Participatory action research. *Journal of Epidemiology & Community Health*, 60(10):854–857, 2006.

[3] G. R. Hayes. The relationship of action research to human-computer interaction. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 18(3):15, 2011.

[4] T. Hollingsed and D. G. Novick. Usability inspection methods after 15 years of research and practice. In *Proceedings of the 25th annual ACM international conference on Design of communication*, pages 249–255. ACM, 2007.

[5] J. Nielsen. 10 usability heuristics for user interface design. *Nielsen Norman Group*, 1(1), 1995.

[6] M. Niemelä, V. Ikonen, J. Leikas, K. Kantola, M. Kulju, A. Tammela, and M. Ylikauppila. Human-driven design: a human-driven approach to the design of technology. In *IFIP International Conference on Human Choice and Computers*, pages 78–91. Springer, 2014.

[7] M. Steen. Human-centered design as a fragile encounter. *Design Issues*, 28(1):72–80, 2012.