An App Recommendation System for Children with Autism Spectrum Disorder

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Abstract
Technology can help children with Autism Spectrum Disorder (ASD) gain functional and academic skills when the tools match their specific needs. This paper proposes the development of an app recommendation system for young learners with ASD based on their general attributes and instructional goals. Through a qualitative experiment, we gathered characteristics of children with ASD; this information will be used in the recommendation system proposed.

Keywords: Technology; Apps; Autism Spectrum Disorders; Software Selection

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1 Introduction

Tablets and Computer-Assisted Instruction can be used to promote student learning, present information in multiple ways, promote practice and interaction, support review, and deliver instruction (Kagohara, 2011; Bugaj, Hartman, & Nichols, 2014). Though there are many apps for tablet computers, to our knowledge, there are few app recommendation systems designed to help educators and caregivers select appropriate apps for children with Autism Spectrum Disorder (ASD). An effective match between App technology and the characteristics of children with ASD could aid instructional delivery, increase the potential for student learning, and provide better support. This paper proposes an app recommendation system built on an understanding of the needs of children with ASD.

2 Related Literature

Numerous studies have been conducted to understand the impact of technology on children with ASD (Oakley, Howitt, Garwood & Durack, 2013; Oberleitner, R., Ball, J., Gillette, D., Naseef, R., & Stamm, B., 2006). However, only a few tools provide information on app selection for children with ASD. Autism Apps (http://www.autismspeaks.org/autism-apps) from Autism Speaks is one system that lists names of apps, their category, platform, age group, and supportive research. It also allows users to search the list based on purpose, device, age group, and keyword(s). The results provide a short description of the retrieved app, its cost, and a link to users’ comments, if any are listed (Autism Apps, 2014). Upon further examination, it became clear that Autism Apps is a repository based on the number of times an app is downloaded. No literature was found on how the website was created and used. Its search and interaction function is very limited.

A recommendation system like the one implemented by Amazon.com is considered a better resource for teachers and caregivers of children with ASD than an app repository. Recommendation systems have been built applying different approaches to identify the items: Content-based filtering (CB) provides recommendations based on the user’s past preferences, Collaborative filtering (CF) provides recommendations based on the past preferences of other users, and hybrid approaches combine CB and CF methods (Adomavicius & Tuzhilin, 2005). Park, Kim, Choi, & Kim (2012) reviewed 210 articles on recommendation systems published in MIS Journals between the years 2001 and 2010, and none of the articles addressed app recommendation systems for children with ASD.

3 Systems Design

Our proposal includes the following steps for developing an effective and user-friendly app recommendation system.
(1) Understanding Children with ASD. A user-oriented systems design approach (Kramer, Noronha & Verga, 2000) will be applied. Therefore, understanding the characteristics of children diagnosed with ASD is the first step. We conducted a qualitative inquiry for that purpose, and its findings are in Section 4.

(2) Designing System Functions and a Recommendation Approach. A hybrid approach that integrates children’s qualities, user expectations, product functions, and selected user experiences will be designed after a careful examination of the literature related to recommendation systems. The proposed system will contain user profiles, preferences, and comments in addition to appropriate information about the apps. Initially, it will store around 1,000 apps after system designers survey the Internet and other sources.

(3) Implementation. We will adopt one of the Web Content Management Systems such as Drupal to implement the system.

(4) User Evaluation. The system will be tested by its users; various testing groups will include teachers, parents, and researchers interested in ASD. User experience methodologies will be applied to make the system easy to use. Through this iterative design, we will collect both formative and summative evaluation information that will inform each step and make existing versions more useful.

This work is in progress. We are currently working on both the first and second steps; we are reporting the results from the first step.

4 Understanding Children with ASD – Findings from a Qualitative Inquiry

We observed children with ASD and collected information from their parents for the purpose of designing the recommendation system. This section describes the procedures and preliminary results of our observations.

4.1 The participants

A purposive sample of 9 children was recruited, and their challenges were gathered from our direct observations and interviews. See Table 1 for a description. While our study was limited to only 9 participants, we intend to thoroughly examine the literature available to create a profile of the average young learner with ASD and his or her challenges. Our system will store that comprehensive profile and allow a user to extract features from that profile and use the extraction to recommend app titles stored in the system.

4.2 The Sessions and the Observations

Participant observation was used to explore the phenomena of learner characteristics of children with ASD. Data was collected through semi-structured interviews with each child during his or her visit to a special university-based technology laboratory. University procedures were followed to obtain IRB approval, informed consent, and child assent. During the course of a 15-week semester, each child visited the lab a minimum of two times and a maximum of 9 times. Each visit was between 1.5 to 2 hours in length one day each week; during each visit, the child engaged in four activities - three of which were software reviews of instructional games or complementary learning tasks. During each child’s software review, data was collected on his or her responses to questions about the software, whether or not he or she enjoyed the package, and his or her behavior while working in the program. Open-ended questions based on literature were asked, and the children’s responses were recorded. The children explored each piece of software at least two times; titles that were not appealing were removed from the review list.

The children’s answers were reviewed at their next lab visit, and this served as a member check. The reviewed comments were transcribed and read multiple times by two coders – these contained comments on both preferred and non-preferred software titles. The children's comments were brief, but informative. No disagreements were noted between the coders. Through content analysis, coders examined students’ responses and placed text into categories (Strauss & Corbin, 2008). The major category was interaction, and the minor categories were action, memorization, social content, and curiosity. By analyzing the themes that emerged, researchers were able to gain insight into the unique perspectives of participants.
4.3 Observations and results

Software and tools that were not appealing to the children were noted and examined by researchers. Titles that were preferred by children were also examined by the researchers. They found that the preferred software included short games, visual and auditory feedback for correct responses, video presentations, a gradual increase in difficulty, familiar activities, animation controlled by the child, choice, full-screen presentations, realistic content, and the ability to explore different paths.

Participants used iPad apps, Computer-Assisted Instruction, e-books, and other tools. Some students became upset using software when it responded in unpredictable ways, there were timed exercises requiring motor planning and coordination skills the student lacked, slow system responses were experienced, or success was not evident. Many participants hated to miss problems, and several lost interest in programs that did not read aloud.

4.4 Discussion

There are many challenges for individuals who are selecting Apps for children with ASD. Among them: variability, a need for individualization, and limited resources. There are considerable levels of variability in the level of communication, behavior, and social skills of children with ASD. Since ASD is a spectrum of disorders, it is very difficult to create one tool and apply it universally. Individualized approaches for learning are needed. In addition, software selection is challenging because it is usually a trial-and-error process which is not financially feasible or time efficient. Hence, it is necessary to create a recommendation system to better utilize the resources of families, teachers, and other individuals who are working with learners diagnosed with ASD.

5 Conclusion

This paper proposes the development of an app recommendation system for children with ASD. Through a qualitative experiment, we gained knowledge of the traits of children with ASD and their behaviors using selected technology tools. The next steps will be to create the user profile and design the system applying promising recommendation approaches.

6 References


7 Table of Tables

<table>
<thead>
<tr>
<th>Gender</th>
<th>Diagnosis</th>
<th>Challenges of Children with ASD</th>
<th>Technology Use- Home</th>
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Table 1. Challenges of Children diagnosed with ASD (as observed in a special technology laboratory).