

LDT 505 Museum Case Study

Mobile Technology in the Museum to Support ADHD Students

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## Introduction

The following case study is an examination of the environment of the Places of Innovation exhibition utilized as a location for an elementary school class field trip. The study will propose technological applications to enhance the student's experience within the museum as well as environmental measures that can assist in creating a calm environment for the student who has been diagnosed with ADHD or an emotional/behavioral disorder.

While this study takes into account the special needs for the ADHD student, I believe that the measures and applications described will benefit all students. The environmental changes suggested by this study to mitigate noise levels can also provide a less over-stimulating environment for adults who are affected by ADHD.

### Attention Deficit Hyper Activity Disorder

Attention-deficit Hyperactivity Disorder (ADHD) affects 9% of school-aged children. (CDC, 2014) ADHD is the most common behavioral disorder that affects children today. Children diagnosed with ADHD often exhibit strong symptoms of inattention, hyperactivity, and impulsivity. (Modesto-Lowe et al., 2008) There are three defined sub-types of ADHD (Aziz et al., 2012), (Saad and Lindsay, 2011).

- Inattentive Type (ADHD/IT): Students have great difficulties focusing on a task or an activity. This type affects primarily girls. The students are likely to exhibit the following symptoms: under activity, lethargic, daydream, sluggishness, lack of interest, and lack of communication skills, forgetful.
- Hyperactive-Impulsive (ADHD/HT): The student is extremely active but does not display gross levels of inattention. Attention may be lost due to the child's highly active and impulsive behavior. This type affects primarily boys. The students are likely to exhibit the following symptoms: impulsive, moody, aggressive, hyperactive, lack of social or communication skills.
- Combined type (ADHD/CT): The student exhibits symptoms of both the ADHD/IT and ADHD/HT types.

Because of the number of visual and auditory exposures that kids have today (television, video games, the Internet), children are more likely to have a lower ability to concentrate and focus their attention on learning. The ability to maintain focus on learning is directly related to a student's learning success (Dewi et al., 2014) The ability to focus for an ADHD student is at a higher risk due to the disorder. When planning a program for a museum to incorporate that is inclusive of ADHD students we must attempt to limit unnecessary sensory exposure.

### Setting

This case study is centered on the Places of Innovation (PoI) exhibition in the Lemelson Center for the Study of Invention at the National Museum of American History in Washington, D.C. The PoI exhibition has 7 main display areas, each focused on a particular place in a particular time where invention and innovation blossomed. The different Places of Innovation that are presented do not just focus on different time or physical location, but also differ in subject matter presented. For example, the Bronx, NY in the 1970s was a major innovative hub for the pioneers

of hip-hop while in the 1930s, Hollywood, CA is where inventions were developed that were focused on color technologies. Other subject areas represented include manufacturing, medical, technology, and clean energy. Centrally located in the exhibit is the Hands on Lab which will house hands on activities as well as provide a place that the museum attendee can borrow mobile devices for use throughout the exhibit.

### **Audience**

The learners for this study consist of an elementary school class (K-6) with one or more students who have been diagnosed with ADHD or a mood disorder resulting in behavioral and emotional challenges. The ADHD learner has not yet mastered the skills required to self-regulate and experiences disruptive episodic events. The audience will be the elementary school class accompanied by their teacher and chaperones.

### **Museum Learning Environment**

In order to create a safe and effective learning environment for the ADHD student on a field trip, it is essential that we address many of the needs of the ADHD student. Students with ADHD are found to be highly responsive to educational strategies that include animation, multimedia and interactivity. (Aziz et al., 2012) The presentation of static material has shown to be ineffective for students with ADHD. (Aziz et al., 2012) The following applications and environmental accommodations will create a space that not only helps to address the needs of the ADHD student, but I believe can also create an effective learning environment for non-ADHD students. Both of the applications incorporate either augmented reality or virtual reality. Virtual and augmented reality applications are used in education for story telling and information delivery incorporating images and sounds. (Carrozzino & Bergamasco, 2009) These applications focusing on simplification and focused sensory feedback can be easily understood by most users, and by extension elementary school children. (Carrozzino & Bergamasco, 2009)

### **Museum Tour**

A member of the museum staff or the class teacher typically conducts museum tours. The museum staff, teacher, or chaperone will supervise the tour, but the information will be disseminated through a virtual tour guide through an iPod application. Prior to beginning the tour, the class will check in at the desk in the Hands on Lab. Each student, teacher, and chaperone will be provided an iPod and a set of headphones. On each iPod will be the museum tour app that will guide the student through the museum and prompt learning. The teacher's app will have the ability to control the application on all of the student's iPods as well as allow the students to move throughout the museum exhibition at their own pace. Interconnectivity of all of the iPods throughout the class will allow for questions and communication to be shared by all participants.

Once the students and teacher have acquired their iPods and headphones from the Hands on Lab, they can proceed to start the Touring app. The teacher can then start the app from her iPod, which will, in turn, start the Touring app on all of the students' iPods. All of the users will be greeted with the instructions to now put on their headphones and click and OK button indicating that they are ready. Headphones will be incorporated for all students to limit the exposure to unnecessary distractions. By limiting the auditory exposure to just that which comes through the headphones, children may not be distracted due to external conversations and sounds and

therefore may have a higher level of focus on the activities related to exploring and learning about the places of innovation. (Dewi et al., 2014) A video will begin to play introducing the PoI exhibit and the exhibit's mascot, Rascal the Red Panda. Rascal is an animated mascot that will instruct the students of the components of the app and guide them through each exhibit. By incorporating animation into the application, there is an increased likelihood that the ADHD student will become more engaged and will increase participation. (Aziz, et al., 2012) Animation use in applications serves to attract the learner's attention, clarify concepts in a visual way, increase understanding, motivate the student, and captivate their attention. (Yusof et al., 2010)

The Touring app is location aware to the specific exhibit area that the student is currently in. When the student enters a Place of Innovation, Rascal will appear on the screen to introduce the location, time period, and brief history for the place of innovation being displayed. When each room is entered, Rascal will direct a specific order of events to establish structure:

- The student will be introduced to the room
- The place and time period will be presented
- The student will hear the high level introduction to the innovations
- The student will be reminded of the photo and help functionality of the app
- The student can explore the room

By providing a higher structured environment, ADHD students are shown to be able to improve their level of attention and ability to stay on-task. (Imeraj, 2013) The application will continually repeat the directions and remind the student of the tasks at hand as well as the ability to ask for help or to switch environments. Repetition is important in helping a student with ADHD to stay on task and focused on the learning objectives. (Harrison, 2013)

The student can then look for Rascal's picture next to any of the parts of the exhibit and scan the QR code. If the QR code is scanned next to an implement or physical item, the student can aim their iPod at the item and enter a world of augmented reality where the item will come to life displaying how it was used and audio will describe what is going on. Augmented reality supports the real world by merging virtual objects with the real ones to create a new reality. (Aziz, et al., 2012) The student can interact with the virtual item to examine it more closely. If the QR code is scanned next to a photo, article or other static information, Rascal will highlight parts of the photo that are interesting and tell the story about it in an entertaining way, often utilizing other animated characters to present the information in a fun way that is entertaining and educational for the student. If the photo is of one person who is significant for that place of innovation, this person will be introduced by Rascal and will tell their own story.

The touring app will also contain features that allow the students to ask questions and take photos. The students may take photos during the animations or virtual reality displays as well as taking photos around the exhibits. The photos will be uploaded to a class website which can then be downloaded upon return to the classroom. The photos will also be geo-tagged for the room that the student was in when they took the photos. The museum class website will allow the students to interact with a map of the United States where they can select to zoom in on the location and see the photos that the students took. This can lead to a class discussion about what the children thought was important in the exhibit. The students will also be able to further their learning experience by analyzing information that they have acquired through the use of the

iPods within the museum. (Lee, et al., 2015) Examples of activities they can perform with the data are geographically mapping out the locations of innovation, performing analysis on the number of artifacts or photos taken from each place of innovation, explore the differences between augmented and virtual reality. By monitoring what the students are taking photos of, the exhibition designers can learn what types of things are drawing the students attention as well and use this information for future exhibit design.

The questions feature will allow the students to signal that they have a question and then speak into the microphone. The students who are also in the room as well as the teacher and museum guide will also be able to hear the questions and help to answer them by either approaching and talking with the student or by utilizing the answer feature within the app so that all of the students in the room can hear the answer.

Once the tour has started, the teacher has the option to allow the students to utilize the app asynchronously so that students can move between places of innovation exhibits asynchronously. Self directed activities have been shown to increase the likelihood of the student being both on-task and out-of-seat. (Imeraj, 2013) These two behaviors, while in a classroom may not be an ideal combination, it allows the student to both stay on-task as well as experience movement while they are performing the structured and self-directed tour. The teacher will always have the option to, through the app, message or speak to all students or to a selected student. The ability to speak to a specific student allows the teacher to deliver words of encouragement, warning, help, or reminders of self-regulation techniques to not just the ADHD student, but also any student in the class in a discreet manor.

### **Touring Pod and Virtual Tour**

The touring pod is a small room that resembles a little playhouse in the corner of the Hands on Lab. The pod will be dimly lit and contain beanbag chairs for the students to sit on. If a student becomes over stimulated and stressed during the tour through the exhibits, the student can exchange their iPod for an iPad at the desk in the Hands on Lab and experience the PoI exhibition through a virtual tour app.

Similar to the Touring app, the Pod Tour app, hosted by Rascal, allows the student to virtually walk through the exhibition, similar to a video game. They can select the different objects in the place of innovation and experience the same videos and virtual reality experiences that were present in the Touring App. This will allow the student to be in a safe environment and still gain the experiences that the other students are experiencing, but in a way that is less distracting and stimulating to them. The teacher will also be able to communicate with the student in the pod through the Touring app. By allowing the student to determine their own anxiety level and switch to a less stimulating environment, the student can self-regulate their reactions to multiple stimuli and react accordingly. (Cassuto, et al., 2013)

To signal that they need to transfer to the pod, the ADHD student can select a button on the iPod app that will discreetly inform the teacher of the need to change settings. The museum staff member or teacher can then escort the child to the Hands on Lab to exchange devices and enter the pod. By providing a way for the student to choose to change environments, the student can continue to strengthen the skills that they have been learning for self-monitoring and self-

regulation between both formal and informal learning environments. (Looi et al., 2010) Self-regulation is

### **Environment**

To minimize the noise transfer from room to room, and keep the noise levels as low as possible I recommend installing acoustical ceiling tiles and wall panels. The addition of classical music or white noise in the background will also help to control noise transfer between rooms as well as create an environment conducive to strengthened concentration and attention for the ADHD student. By playing classical music or white noise in the background, a calming environment can be created (Rana, et al., 2014) and the levels of attention increased (Dewi, et al., 2015) in students with ADHD. Music intervention has been shown to increase non-ADHD student's learning attention by 11.7%. (Dewi, et al., 2015) For students with cognitive and behavioral problems (like ADHD), music has been shown to strengthen cognitive abilities, deficits, and inattention disorganization while improving the concentration ability of students. (Rana, et al., 2014) By utilizing music throughout the museum and in the rooms, or included in the app through the presentations or as background music between instruction, learning potential can be increased in both ADHD and non-ADHD students.

### **Conclusion**

The environment and applications described above provide the class and ADHD students with an engaging application that will both provide structure and autonomy in their learning experience. In addition, by allowing the student to explore each room and record their parts that they connected with the most, the experience is transferred back to the classroom with additional possibilities for instruction. The touring pod also creates a safe place for ADHD students who may be overwhelmed by the large amounts of stimulation that is provided by an out of class experience. The pod allows the student to perform all of the activities both in the museum and afterwards in the classroom by providing a virtual tour. By designing an environment that allows the ADHD student to experience the museum in a way that suits them, we can provide an environment that inclusive to both non-ADHD and ADHD students.

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## Appendix A

## Mobile App Design Sketch

An example of the features of the mobile touring application for both the teacher and student for the iPod is below.



### Student Touring App

The bottom half of the screen stays consistent throughout the tour, except when a student is using virtual reality, augmented reality, video, or camera features of the application. The student's touring app has Rascal the Red Panda in the bottom left corner to help guide the student through the exhibit. The brown box next to Rascal's head will display helpful text from Rascal. The 4 buttons in the lower left corner represent the following functionality:

- QR code starts the QR code scanner for the student to scan a code next to an item in the exhibit in order to learn about the item scanned.
- The camera allows the student to take pictures for upload to the class repository.
- The hut alerts the teacher that the student wishes to continue the tour from the pod.
- The question mark allows the student to ask a question to the teacher or class.

### Teacher Touring App

The teacher's touring app has 6 buttons.

- The students button will bring up a list of the students so that the teacher can contact a student individually, if needed.
- The location button displays a map of the exhibition and the location of each student within the area.
- The Rascal button displays the student's touring app so that the teacher can participate with the students.
- The Play button plays helpful tips for the teacher to promote learning with the students.

- The microphone button allows the teacher to make announcements or answer questions posed by a student.
- The phone button allows the teacher to contact the museum staff.