

Sensory Morning e-games

Christopher Wong
UMBC, Human Centered
Computing
909 Walker Avenue

Catonsville, MD 21228
917-239-1374
cwong7@umbc.edu

ABSTRACT

Sensory Morning is a program designed to make the Walters Art Museum more accessible to children with Sensory Processing Disorders and Autism Spectrum Disorders. During the two-hour event, the museum provide a number of resources to the participants including hands-on activity stations, educational lessons, and physical 'fun packs'. While both children and families tend to be satisfied by the event, there are a number of issues that currently exist with these in-person events. This study will address these problems, and then will create a mobile application that is similar to the 'fun packs' in order to help solve some of these problems.

Categories and Subject Descriptors

I.2.2 [Assistive Technology] - *Autism Spectrum Disorder, Sensory processing disorder, Mini-games, Mental Health.*

General Terms

[Human Factors, Design]

Keywords

Mini-games, ASD, SPD, Mental Health, Sensory Morning, Autism, Sensory Processing Disorder.

1. INTRODUCTION

Sensory morning is a program designed to make the Walters Art Museum more accessible to children with Sensory Processing Disorders. The museum welcomes participants to explore the museum an hour before it opens to the public. During the event, the children are not only encouraged to explore exhibits through activity stations, but are also given places where they can calm themselves.

While both children and families have given positive feedback about the event, there are a number of problems that may be preventing these audiences from interacting further with the museum.

The primary problem is low retention rates due to limited resources. In the most recent Sensory Morning on October 26th, more than 120 participants

were registered. However, less than 60 people actually attended. While retention rates of this target audience have not been fully studied, the majority of families interviewed said that they tend not to visit outside of this event. One of the reasons why is due to the resources that are only deployed during Sensory Morning. As mentioned before, participants are given 'fun packs' during this event. This pack contains games and activities, but also 'fidgets' which the child can use to calm down. These fun packs are not available to children during normal museum hours due to a limit on physical resources.

In addition, there are some concerns regarding how educational the content presented may be. Although both the fun packs and activity stations try to teach an educational lesson, the activities available are often not structured in a manner that is conducive to learning.

The other problem I will address is how to utilize the exhibits more effectively. Although these activity stations are often right next to paintings and sculptures, the children most often interact with paper and laminated plastic images of the exhibit instead.

My research goal is to create a mobile app version of the 'fun pack' which teaches an overall educational theme through mini-games. This 'fun pack' will be available even outside of the Sensory Morning events, and will be structured in a manner which teaches children through repetition. Lastly, the app will allow the child to haptically interact with the exhibits without resulting in physical damage.

2. Related Works

In order to design a mini-game for Sensory Morning, it is first important to understand why mini-games should be used. According to Prensky [12], mini-games are often cheaper, simpler, and require less time to create compared to complex games. In addition, mini-games can be more easily developed in conjunction with the target audience. Mini-games are usually limited in their scope, usually only able to

teaching a single concept, but this is not a disadvantage with this audience.

In addition, a study done by the behavioral sciences institute of learning shows that utilizing serious games may help improve retention rates of learning significantly.[15] This may be due to the simulation of real life situations as well as the act of learning by doing.

2.1 Sensory Processing Disorders

After this it is important to understand who the target audience is. According to the Sensory Processing Disorder Foundation,

“Sensory Processing Disorder, formerly known as sensory integration dysfunction”, is a condition that exists when sensory signals don't get organized into appropriate responses...A person with SPD finds it difficult to process and act upon information received through the senses, which creates challenges in performing countless everyday tasks. Motor clumsiness, behavioral problems, anxiety, depression, school failure, and other impacts may result if the disorder is not treated effectively.” [1]

There are three different categories of SPD: Sensory Modulation Disorder, Sensory Discrimination Disorder, and Sensory-based Motor Disorder. [2] Each of these disorders has a much different set of requirements.

Children with Sensory Modulation Disorders can be classified into three categories: Sensory over-responsivity, sensory under-responsivity, and sensory seeking. Sensory over-responsive children usually avoid particular senses and can be upset by certain types of stimuli. Sensory under-responsive children are unable to understand sensory inputs. This may result things such as clumsiness. Sensory seeking children tend to seek particular stimuli, interested in odd material or being messy. [3]

Sensory Discrimination is a characteristic humans use to distinguish between sensory inputs, similarities with different senses, and the quantity and quality of said sense. Children that are have Sensory Discrimination Disorder may not be able to understand how hard they are pulling something, or may not even understand that something hurts.

Lastly, Sensory Motor Disorder comes in two forms: Dyspraxia and Postural Disorder. Postural Disorder prevents children from maintaining stable positions, often leading to them appearing clumsy. Children with dyspraxia cannot organize several steps in advance.

Judging by the wide variation in abilities, it is important to clearly define what the scope of this project is. To do this, we must understand what is currently being done at the event.

One of the treatment options for SPDs is a room called a Sensory Room. [4] This is a place where children with specific needs can both relax and self-regulate. However, sensory rooms must be catered to the individual's specific needs, which is something that is done well by Sensory Morning.

At the event, there were a number of different stations set up in various environments. Some, such as the events on the second and third floor, were set up in bright open areas which allowed the child to gain stimulation through multiple senses. Others were set up in a darkened auditorium, which allowed both parents and children to recover from sensory overload.

2.2 Requirements for Game-based Learning

After examining the user needs of the target audience, the next thing to address is the wide range of requirements for game-based learning. In order to incorporate mini-games into this event, an extensive list of requirements was examined.

One of the first requirements, as addressed by Laurillard[5], is that any theoretical or conceptual model must be able to be illustrated in a practical environment. He also stresses the idea that the specific lesson should not only be able to be applied in a practical setting, but that the specific lesson be able to fit in a larger generalized body of knowledge. [6]

Koper and Olivier introduced the idea that mini-games should be “learner-centred, non-linear and self-directed.” Some of the requirements that they stressed include being compatible with different standards and being customizable to different user's needs. [7]

Other authors include Merrill [8], with the “first principles of instruction”, which talks on how

new knowledge is used and applied to existing foundations, and Paras and Bizzochi [9], who examined other criteria such as Norman's "seven basic requirements of a learning environment."

Greitzer[10] put forth the idea of cognitive principles that guide the creation of learning-based instruction. These principles are:

- Stimulate semantic knowledge.
- Manage the learner’s cognitive load.
- Immerse the learner in problem-centered activities.
- Emphasize interactive experiences.
- Engage the learner.

While this is a somewhat lengthy list of possible requirements for game-based instruction, none of these lists have specifically been targeted towards the target audience. Therefore, one last set of requirements must be examined: those used to teach children who have these disabilities.

Kwon [11] offers a number of useful tips on how to approach designing games for children with special needs. One thing she addresses is to create a concept paper, which explains the essential idea of the game. There are several things to be included in this paper, including instructional objective, game genre, and mini-games. She also addresses special strategies to utilize when dealing with this audience. These strategies include:

- Repetitive practice
- Immediate feedback
- Visual cues
- Task analysis
- Experience of success
- Individualized play

In addition, she also mentions how designers must pay special attention to graphics, as they may distract the user from the gameplay. She specifically mentions that the Background, Cut Scenes, Characters, Objects, Items and GUIs should be taken into special consideration.

Attending Sensory Morning also allowed me to gain additional insight from Kennedy Krieger High School (KKHS) therapists. They offered a number of

guidelines used by those who teach children with sensory processing disorders. These include things such as providing sensory breaks for movement, having a clear visual schedule, allowing for tactile fidgets such as pens, and allowing the child to skip things that may overload the senses.

After reviewing the literature, I have come up with my own list of requirements that will be incorporated into the mini-game. They are:

1. The mini-game should utilize repetition of the educational theme, but through multiple methods.
2. The mini-game should seek to create specific examples and then incorporate them into more generalized knowledge.
3. Sensory stimuli should be able to toggled on/off based on the user's desires.
4. The mini-game should provide tactile feedback based on user input.
5. The mini-game should seek to individualize the user's play experience.

After establishing this set of requirements, I used a pre-existing theme from the fun pack, Faces and Emotions, and incorporated that into a mini-game.

3. Methods

Concept	How it is addressed in mini-game
Target Audience	Children with SPD/ASD who either attend or wish to attend Sensory Morning
Game Genre	Puzzle
Target Platform	Mobile (Android)
Instructional Objective	1. Present educational lesson in text 2. Test user's knowledge 3. Personalize the concept, then test the concept again.
Storyline	A bad child has gone around and erased all of the faces on the paintings. The user must help re-create the emotions of the painting.
Mini-games	Drawing mini-game Matching emotions to faces mini-game

Table 1: Kwon's Concept Paper for the mini-game

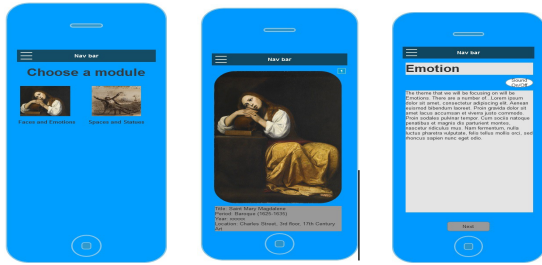


Figure 1. Phase 1 of the mobile app

The mobile application is divided up into three phases. The first phase is primarily dedicated to a traditional educational lesson.

The app begins first by asking which educational module will be run. In this case, the Faces and Emotions is selected. The game will begin by loading up up a work of art available in the Walters Art Museum. These works of art will be long-term pieces that will not change on a rapid basis. Included with the picture will be identifying text, such as the Title, the Period that the piece is from, and the location in the museum.

After the child looks at the picture, they can touch the painting to get an overview of the educational theme that they will cover. In this explanation the basics of what they will learn will be discussed. In this particular example, different emotions (such as happy, sad, etc.) will be explained. There will be a toggle for sound if the user would prefer the text to be spoken, but it will not be implemented in the scope of this paper.

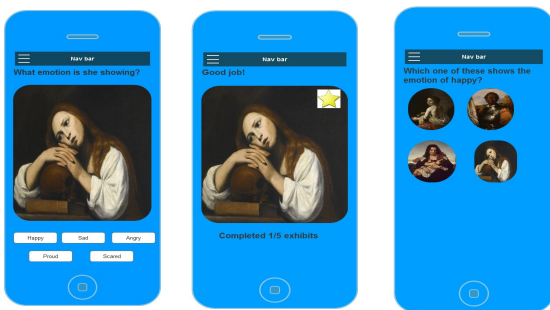


Figure 2. Phase 2 of the app

Once the user feels like they have understood the concepts, the user can move on to the second phase, where they can test their knowledge. In this example, the user should be able to identify that the woman in the painting is expressing the emotion of sadness. After that, another mini-game is introduced where the user is asked to identify a particular emotion among a set of paintings. During this time, the user's progress

can be tracked, and a reward may be given out if the user is able to complete this game for all 5 exhibits.

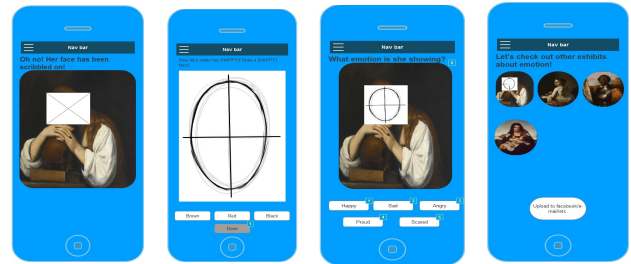


Figure 3. Phase 3 of the mobile app

Once the user has completed this, then the user can move on to phase 3, where the user can personalize the mini-game. In the story, the user is introduced to the 'bad guy' within the mini-game. This bad guy scribbles on to the face of the painting, damaging it.

In order to repair the damaged painting, the user is instructed to create a new face for the painting. In the example below, the user is asked to create a sad face for the painting below.

After the child completes the painting, they can go to the next screen and then seen their creation brought to life. The face of the painting, which they were looking at, will instead become the face that they just drew.

Lastly, the app will quiz the users on different types of emotions, but this time with the faces that the user drew. By doing this, the user can better understand what emotions are using their own examples. After this, the app will again offer other paintings for the user to check out in order to complete the theme. The last page will also act as a reward: the user's past work, including the painting with the modified faces, will also be displayed. When the user is ready to leave, the progress can be uploaded to an external site and they can have a copy of what they accomplished on that day.

4. Work accomplished

While not all milestones have been met, there is still time to adjust the project moving forward. The way that the phases are set up are structured so that only completing 2 out of the 3 phases within the allotted timeline will nevertheless allow the app to function as a mobile fun pack.

After visiting and volunteering for Sensory Morning on October 26th, I have been able to

understand the needs of the population that I am working with. One of the challenges that I have run into is the implementation of the last phase of the mobile program.

While I have programmed in related programming languages such as Java and XML, implementation of super-imposing a face on to an existing painting is not an easy task.

My plan moving forward is to concentrate my efforts specifically on polishing phase 1 and 2 to the point where if I am unable to complete phase 3, I will still have a solid program to present next Sensory Morning on December 14th. I will also develop a general framework so that implementing additional themes will be easier.

Below are my current milestones to aim for.

4.1 Future Milestones

Week 6 (11/3-11/10):

- Finish debugging the rest of the application
- Re-examine if details of application fit into proposed requirements
- Finish creation of mid-term paper/poster

Week 7 (11/11-11/18):

- Basic user testing of the application
- Re-examine emotional recognition/recall capabilities of target audience
- Re-examination of possible user needs/concerns based on user testing

Week 8 (11/19 – 11/26)

- Start on iterative design process for second version of application
- Examine possible conclusions/results based on framework, future research

Weeks 9-12 (11/27-12/15)

- Final poster session (12/11), Final paper (12/15)
- Second Sensory Morning 12/14, prepare app for this

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