Abstract — Confusion, frustration and anxiety are caused by the ineffective communication in healthcare system. Patients and family members usually have a hard time to acquire necessary information in hospitals. The healthcare literacy, a wide range of patient-age population, and the text-only teaching sheets are important factors to block the communication. Therefore, the proposed work presents an innovative information board that is designed specifically for current pediatric healthcare environment to deliver messages more effectively through a fun and interactive approach. The I See! System carries four goals: Inform, Set expectation, Educate and Ease Anxiety (I.S.E.E). The innovative I See! System achieves these goals through categories, such as introduction video clip, interactive games, key words section and parents’ place. Using different sections in the module, patients and families can engage more effectively in medical procedures. The distinguishing features in I See! module are Age-Adaptable, Audio-Visual, Multi-Lingual, Multi-Sensory, Interactive and Procedural. In addition, this module is a mobile, touch-screen and web-based appliance to prepare patients and families well to take the examinations in hospitals. Lastly, this work also discusses how the information in healthcare system could be delivered to patients and families more efficiently.

Keywords: information board; children healthcare system; pediatric hospital

I. INTRODUCTION

Confusion, frustration and anxiety are caused by the existing barriers in healthcare system that block the effective communications of patients and families. Healthcare literacy is a major challenge when creating informational tools [1]. Literacy and stress affect people’s ability to read, understand and act on health related information. Table 1 shows the statistics indicating how a teaching sheet primarily in text could be ineffective [2]. Research shows that people who cannot read are more likely to make mistake when taking medicines, as they are less likely to follow a recommended treatment plan at the cost of higher risk for hospitalization and readmission [3].

The age of patients is also a critical issue to communicate in the healthcare system. Educating and informing patients and families in an effective way create a patient-centered environment to reduce stress, anxiety and frustration. The best way to prepare a toddler or under-school-age children medical examination is on the same day, while a school-age child can be prepared up to one or two days in advance [4]. Since the information board provides necessary information to all patients and families, this tool accommodates the needs for all diversity. The difference in preparation time indicates that there should be a mobile tool and wireless internet accessible to allow the material to be reviewed before the exam in hospital or from patients’ home. On the other hand, patients, who are going to receive the same-day preparation, can also acquire information from the same tool.

Pediatric hospitals have to communicate with a very diverse patient and family population due to the wide range of ages. The age range can be from a 1-day-old infant to an 18-year-old adolescent. Besides the ages of patients, translation of medical information also needs to fit into the education levels of patients and families. This means that one information tool is not sufficient to serve the entire population, but rather multiple tools are required for each group. A computed tomography (CT) scan, for instance, will be explained very differently to a 6-year-old verse a 15-year-old based on different background knowledge that each children possesses. There is also the added communication complexity to family members as children always mimic and rely on the adults around. That is, in pediatric hospitals, the understanding and anxiety of all involved members can influence the experience of children patients. Therefore, it is as important that both the children and parents understand what is going to happen in the exam.

The education tools are necessary in pediatric hospitals to deliver information to children patients and families. The most common resources are teaching sheets, which are
primarily text-based. These materials do not meet the criteria for pediatric preparation, but they are not fun and interactive. Small children are not able to read and understand the teaching sheets in text only. Therefore, younger patients may not be engaged in the information based on teaching sheets. Videos can solve literacy issues, but they are not age-adaptable or interactive (refer to Fig. 1). The book “Child Life in Hospitals–Theory and Practice” by R. Thompson and G. Stanford [5] outlines some case studies that have indicated the preparation in pediatrics is a proven technique that significantly reduces stress and anxiety for the child. In the book, it also shows that pediatric preparation techniques are most effective as they are interactive, procedural, and multi-sensory. Thus, all the evidences suggest that pediatric hospitals need a more interesting information board to draw children’s attention at education information.

II. BACKGROUND

Incorporating preparation techniques are fun and interactive, while demonstrating procedural and sensory elements of an examination or procedure will help empower children to understand the following steps well. Proper preparation eliminates the discrepancy between children’s imagination and real situation. Using information boards, more children are expected to understand next steps better, as they reduce fears and anxiety. Pediatric preparation for Diagnostic Imaging has also shown improved results. The Lucile Packard Children’s Hospital Radiology Department reported a 20% decrease in sedation for CT scan once the personnel started preparing children before the exam [6]. Child life specialist uses a wooden, 3-D model of a CT scanner, to teach children about the exam and allows them to perform their own exam. This preparation helps replace the anxiety with the comfort, and therefore the increased understanding and the decreased fear reduce the need for sedation. This results in a safer, faster and less costly exam for the children.

Center for Healthcare Strategies (CHCS) also emphasizes the impact that access to information can have on a family’s hospital experience and outcomes [7]. The CHCS has shown that the metrics being informed have a high correlation with their overall satisfaction. Being informed is a critical element to create a patient- and family-centered experience in taking the exams. Thompson and Stanford [5] also stressed the importance of educating parents and keeping them involved in the preparation process. When parents are informed and at ease, they could translate to the children and help ease the fears.

Child life specialists are employed in hospitals to explain children what is going to happen during the exams. These specialists break down complicated medical procedures into a language that children can understand. They are able to calm children's fears and empower their understanding in sequential steps. These specialists are great resources to prepare children for the exams. However, they are not always available due to the small number employed in the hospital and their working hours. Even when they are available, they only have limited teaching resources, such as paper pamphlets or books. It is difficult to make these tools fun, engaging, and interactive. In addition, many times, they are not available for multiple educational levels or languages. Hospital interpreters are critical for communicating with foreign-speaking patients and families, but they are not always available for patients who need them. Therefore, the I See! System is demanding in the market to deliver information correctly and efficiently.

III. THE INNOVATIVE INFORMATION BOARD

The main idea of I See! System was proposed to have a tool explaining procedures in Radiology Department. As the problems were identified earlier, the range of children’s ages affected the design role of information board in two aspects: how the information board is presented and what message is being delivered to the patients. At many pediatric hospitals, CT scan is a high priority exam. Many children from three to six years old coming for a CT scan are scared and anxious about it. Thus, preparation by a child life specialist is a necessary mission. This demand determines the development of the I See! module for CT scan with a focus on children ages from three to six. Also, a high portion of the population is Spanish speaking in the United States [8]. The Radiology Department had a difficult time explaining the procedures and communicating to foreign speaking patients and families. The prototype features videos, interactive games, a keywords section, and a parents’ place section and all tools are available in both English and Spanish.

This proposed work conducted research on the latest pediatric preparation techniques and reviewed the existing Children’s Healthcare of Atlanta (CHOA) materials to develop the content of the I See! System [9]. This system is a mobile, touch-screen computer with web-based appliance. The goal of the I See! System is to: Inform, Set expectations, Educate and Ease anxiety (I.S.E.E). This system was created in collaboration with child life specialist to overcome communication barriers and incorporate the best techniques in pediatric preparation. Moreover, the I See! System provides information in a fun and effective way that all people can understand through user-friendly interfaces. Anyone from a Spanish-speaking 5 year-old to an English-speaking parent will be able to use this module.

Figure 1. The child life specialist at the introduction video.
They could use this system to answer their questions, calm their nerves, and improve their understanding.

The I See! System, however, was not developed to replace the child life specialist. It is designed to aid the specialists when teaching children procedures. Once if the child life specialists are not available, it can be used by children and parents themselves about their doubts. This system has several tools that explain complicated medical procedures in a way that the children patients can understand. Introduction videos explain procedures in kid-friendly language that helps them experience the exam more familiar. Interactive games put the children in control and expose them to both the procedural and sensory aspects of the process. In the end, the goal of the system is to empower the patients and their families and to create a patient-centered environment.

The initial phase combined the game and information and arranged them properly inside the module. The module was designed to use text information for parents and created some games to familiarize children with CT scan before the exam. The welcome window of the I See! module is a user-friendly interface for users to acquire the detail just by touching the name of examinations. The features of the innovative information board are dissected down into the follow subsections.

A. Videos

Upon entering the CT module, a video of a child life specialist explaining the procedure of taking CT scan was presented, as shown in Fig. 1. The specialist uses a kid-friendly language and shows pictures of an actual CT scan. The user can then choose to play games, learn keywords, or read about the basics of a CT scan from parents’ place.

B. Interactive Games

The games section includes three different games, as shown in Fig. 2. The first game is “Who’s Who?” Children can touch the person on the screen to listen to who they are and why they are in the Radiology Department. Table 2 lists the different characters and their mission in the hospital. The Fig. 3 drew the game “What is a CT machine?” which allows children to point out different parts of a CT scanner. It relates these different parts of the scanner to everyday objects that children are familiar with, such as lights, seat belts, donuts, and tables. The last game, “Let’s Perform a CT exam!” is pictured in Fig. 4. It allows children to perform their own CT scan. Children can move the table, hear the noise the CT scanner makes, see the light the CT scanner makes, and take their own CT scan.

C. Key Words

Another section of the module is the keywords section, where the user can learn some of the keywords that they might hear while having a CT scan. Fig. 5 presents four keywords definition: intravenous injection, contrast material, sedation and immobilization. This section incorporates pictures and texts to explain each term. All
written material is at or below an eighth grade reading level, as pointed out in Table 1 that the healthcare literacy is below eighth grade reading level for all class level.

D. Parents’ Place

The last section of the module is the parents’ section. This section includes explanations of the six questions: who, what, when, where, why, and how (refer to Fig. 6). All the answers not only correspond to the quires from parents and caregivers but also are written below an eighth grade reading level for easy understanding. This allows older school-age children or adolescents to learn as well without any trouble.

IV. DISCUSSION, CONCLUSION AND FUTURE WORK

The I See! System is a healthcare communication tool, created in collaboration with the supervisors from real pediatric hospitals. This system provides information that patients and families need in a fun and effective approach. It is a mobile and touch-screen computer module to overcome communication barriers because of the following features: Age-Adaptable, Audio-Visual, Multi-Lingual, Multi-Sensory, Interactive and Procedural. The proper pediatric preparations can significantly reduce stress and anxiety for the children, as well as increase the incidence of post-hospital benefits [4]. This system consists of introduction videos by child life specialists, interactive games, key words, and the notes for parents, caregivers and adolescent patients to deliver information through interactive ways. Also, the multi-sensory and audio-visual techniques allow the system to be fun for the children while triggering them to learn and understand the process.

This module should, however, be tested with children to see its real effect. In addition, the I See! System is also expected to be used in multiple applications, such as CT and Magnetic Resonance Imaging (MRI) scanners, in hospitals to teach the patients about the follow-up steps in the exams. Furthermore, it can have modules for many different departments in a pediatric hospital, such as Emergency Department, Surgery, Inpatient areas, Sickle Cell and Asthma Clinics.

In the future, the I See! System is expected to become a mobile device similar to a handheld game system, such as Gameboy. This would be familiar to children because they are used to play these types of games. A mobile system would allow it to be used anywhere in the hospital. Children and their families will be able to access the system at home via the internet as well, which allows preparation for the procedure before arriving at the hospital. This in return saves time at the hospital and let children and their families become more comfortable with the exams that they are going to take.

ACKNOWLEDGMENT

The authors would like to thank the Professors of Course COA8843 at Georgia Tech, Perkins+Will, Julia Jones (the Vice President of the Operations for Hughes Spalding [HS] CHOA, Georgia, USA), Starla Jones (the Radiology Department supervisor at HS), Angela Smith (the Emergency Department supervisor at HS), Melia Stephens (the Inpatient Areas supervisor at HS), Katie Bubser (a child life specialist at Egleston, CHOA) , and Alicia Sanchez (Spanish translator) for their support in this work.

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