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Virtual Inclusion via Telepresence Robots in the Classroom

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Abstract

The recent development of telepresence robots provides the opportunity for virtual inclusion to students who are not able to attend school due to medical conditions. Every year, large numbers of K-12 students are not able to attend class due to illness. Extended absence from the classroom has negative and overlapping educational, social, and medical consequences as students may fall behind in instruction, feel isolated from their peers, and experience difficulties in their recovery due to loneliness and depression. The recent development of telepresence robots provides a possible means for addressing this situation. Preliminary results from a local case study on the use of these robots in a public school system indicate that virtual inclusion may provide significant improvements in the educational, social, and healthcare experiences of this vulnerable population.

Author Keywords

Virtual Inclusion; Robots; Education; Interaction Technologies; Health Care

ACM Classification Keywords

H.5.m Miscellaneous

Problem Statement

Advancements in the medical field are improving the prognosis for many childhood illnesses and cutting edge technological advancements in pediatric medicine have allowed for reclassification of diseases once considered fatal or terminal to be categorized as chronic illnesses (Sexson & Madan-Swain, 1993). This trend has led to a growing population of children who are not able to attend school due to medical conditions and/or treatments who need academic services at home. These children may experience physical challenges that do not allow them to attend school. However, most of these children do not have an increase in cognitive challenges that may prevent them from participating in social and academic activities. Thies (1999) captures the essence of this phenomenon with respect to one of the most feared illnesses, "Cancer has joined the ranks of chronic illness" (Thies, 1999). Five-year survival estimates for childhood cancer survivors have increased from 59% in 1975 to 80% in 2002 (National Cancer Institute, 2009). With these advancements in medicine, comes great responsibility to ensure quality of life for children living with chronic illness. Educators are among the group of professionals accountable for ensuring quality of life experiences for students living with chronic conditions. Unfortunately, traditional educational systems and policies are not designed to lend support to students battling chronic illness. With limited resources to draw from, well-intended teachers and administrators respond to children with chronic medical conditions by attempting to provide comparable academic experiences through tutoring and at-home services. These services provide students with some academic benefits but do not provide an avenue for these children to gain critical social development experiences with their peers and school culture. Recently, virtual inclusion via telepresence robots has started to take place in a several schools across the United States to provide academic services for children who cannot attend school due to illness. Virtual inclusion provides the opportunity for a child with a chronic condition to participate in classroom and school activities via real-time virtual communication through the use of a robot in the classroom and school that is controlled by the child from home.

Motivation for Research

As an educator with a background in public health and access to healthcare issues, I gained experience in working with telemedicine technology to address primary care issues in rural areas. The more I learned about promising practices in telemedicine, the more I saw the potential for this same technology to also be applied in an educational setting. Instead of a doctor interacting with patients and providing services via telemedicine technologies, I felt there could be an application for pediatric patients to use robots to interact with classmates and teachers and receive educational services. Some students with chronic conditions experience a drastic transition from spending seven to eight hours a day in their schools to having zero contact with classmates and teachers. They are isolated from their classrooms and school cultures and most receive homebound services from a tutor or teacher with whom they are not familiar. There was a time when there was no other option for these children but that is no longer the case. The technology exists and is being utilized by medical professionals, business executives and other members of society with the financial means to utilize this technology. If virtual inclusion via telepresence robots provides social and academic benefits for students with medical conditions, this technology could change the standard of care for all children with medical conditions in our educational and healthcare systems.



Research Approach

The recent development of telepresence robots provides a possible means for providing virtual inclusion to students who are not able to attend school due to medical conditions. This project aims to investigate the academic and social benefits of virtual inclusion. One

low-cost telepresence robot originally developed for telemedicine, called VGo, is now being used by a few dozen homebound children in the United States (US). This robot allows for live, two-way, secure audio-visual communication between the classroom and the homebound child, and can be operated from home by the child for movement around the class or school. Use of the robot, in theory, allows a child to participate in educational and social activities throughout the day.

A descriptive study was designed which would observe, evaluate, and record the experiences of homebound children using a telepresence robot for virtual inclusion along with input from their parents/guardians, teachers, classmates, and school administrators. There are two main parts to the study:

- A local case study that took place in November, 2013

The local case study took place over five consecutive days. Classrooms and homes were visited and homebound children, parents/guardians, teachers, and administrators were interviewed. Detailed field notes were recorded and observations and informal focus groups were conducted to gain insight from classmates.

- A national survey which is currently underway

Survey will capture the experiences of the estimated 50-60 current and past users of robots. The national survey consists of three groups for this population:

(1) parents/guardians, (2) classroom teachers, (3) administrators/technology support personnel

Survey questions will address how the robot is used, advantages and disadvantages of robot use, and perceived impact of its use.

A third component, a local case study in Orange County, California is currently being discussed and may be implemented in the near future.

Research Background:

Related Theory: Inclusive education is understood as a philosophy that supports and celebrates diversity through the active participation of all students in the school culture (Kugelmass, 2004). Meaningful and active participation in familiar and recurring classroom routines is not only possible for young children but an essential component of belonging to a group (Erwin & Guintini, 2000). Currently, some school districts provide individual tutors who can make occasional home visits for children who cannot attend school due to medical conditions but such tutoring cannot substitute for regular participation in the classroom environment. Virtual inclusion allows for this participation and is already happening in several schools across the US, but studies have not been performed to evaluate the effects of this form of inclusion.

Children with chronic medical conditions may experience prolonged disruptions to academic attendance due to symptoms of illness, health risk associated with the illness, and/or effects of treatment for the medical condition. Inability to attend school may lead to feelings of loneliness, decreased self-esteem and a loss in sense of belonging. For childhood cancer alone, national reports on childhood cancer survivors indicate that this population is at increased risk for long-term social outcomes which include reduced educational attainment, fewer friendships, lower employment, and low income levels (Gurney, Krull, Kadan-Lottick, Nicholson, Nathan, & Zebrack, 2009).

Purpose of the Research:

This study will investigate the overall effects of telepresence robots for virtual inclusion in the classroom. Though the use of telepresence robots appears promising, no study has yet been conducted of their use for educational purposes. This study will investigate the following questions:

- 1) How is the robot used in classrooms by homebound students, their teachers, and classmates?
- 2) What appear to be the effects of robot use on the homebound students, classmates, teachers, and families?
- 3) Is classroom inclusion via telepresence robots financially and functionally feasible?



Novelty of Research

Until recently, the standard of educational services for children with chronic medical conditions who experience a prolonged disruption to academic attendance due to illness or medical treatments consisted of homebound services which may have included some or all of the following: at home instruction, at home tutoring, and make up work.

Innovative approaches to this problem have been limited by availability of alternative methods for including these children. Until recently, the technology for alternative methods of dealing with prolonged disruption to academic attendance was not readily available. Virtual inclusion via telepresence robot provides an opportunity for students to maintain social connections and relationships with peers, teachers, and administrators through real-time virtual communication. The robots allow the students to not only participate verbally in the

class but also to experience dynamic interactions with classmates and teachers. The student using the robot has increased autonomy in the school experience since s/he is able to control the movement of the robot, what the robot views, and to have a voice in any aspect of the classroom environment as if s/he were a physically-present traditional student. This opportunity to remain connected to the school culture may have a positive impact on the subjective well-being as well as academic achievement of the child.

Results

The local case study was conducted in November of 2013 and data was collected through direct observation and interactions with participants that consisted of:

Interviews:

- Five homebound children
- Five parents
- Eleven teachers
- Six school and district officials

Observations and classmate focus groups:

- Two classrooms

Over nine hours of interviews, three hours of observations, several pages of detailed field notes, and two hours of classmate focus groups were recorded and analyzed to explore concepts and emerging themes. When the national survey is complete, survey results, interview transcripts, observation data, focus group transcripts, and field notes will be reviewed, coded, and analyzed.

Preliminary results from the case study data indicate an acceptance of the robots by classmates along with some challenges for robot use in traditional school settings.

Three primary themes have emerged from the local case study data:

1) Overcoming isolation

- Child who spends most of the day alone, robot is only means of human interaction during the school day
- Child whose family thought his behavior was due to heart condition but after acquiring a robot, realized it was depression
- Child able to audition for and join the school choir via the robot
- Children who use a mobile “hotspot” so they can be in school during long drives to the hospital, waiting room time, and during lengthy medical visits

2) Anthropomorphization of the robot

- Classmates do not differentiate between the student and robot. Said things like:
 - “We don’t like it when he turns off”
 - “We wish he had arms”
 - “He’s raising his hand” (lights were blinking)
- Robots are bullied
 - A bully smeared ketchup on robot’s screen and taunted him
 - A boy called a female robot user a “vacuum cleaner”
- Children identify with robot
 - When homebound child complains of falling face down (the robot falling face down), classmates commiserate and recount their experiences with falling face down
- Robot is viewed as the student, not an extension of the student

- Classmates did not want the homebound child and the robot in the same picture

3) Robot as a bridge to the future

- Frequent references made by parents, teachers, classmates, and administrators to “when s/he comes back to school”
- Overwhelming interest and questions from a classroom of 2nd graders on how robots are designed, constructed, and operated

Some of the challenges identified were:

- Internet connection not adequate throughout the school to allow complete school access for the student
- Wheel size/grips not adequate for some of the indoor ramps
- Short battery life on robot

Contributions to the Field of HCI

Contributions from this research to the field of HCI will have great impact on how humans interact with robotic technologies on a daily basis and at early ages. This research may find additional applications for and consequences of using emerging robotic technologies in education and healthcare. Future studies may lead to changes in how robotic technologies, digital inclusion practices, and inclusion interfaces are designed and utilized. Also, this research and future studies may change the standard of care provided to socially isolated students with medical conditions in our educational and healthcare systems.

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