Interaction Technics and its Implementation into Designing Interactive fidget-friendly classroom furniture for ADHD

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Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is highly common in children all over the world and it started to increasingly be recognized in adults (Reda El-Sayed, 2018). According to the National institute of Mental Health, ADHD occurs in an estimated 3 to 5 percent of preschool and school-age children. Thus, it is possible to detect at least one child in a class of 25 to 30 children, conditioned with ADHD. As a result, 6.5% and 7.9% among the primary school children reported prevalence of ADHD (Reda El-Sayed, 2018). Boys 13.2% are more likely than girls 5.6% to be diagnosed with ADHD. Males with ADHD are reported to have more hyperactive/impulsive symptoms than females with ADHD. (Skogli, 2013)

As ADHD is also highly misunderstood. Most of the people visualize this disorder as something normal happens to their children but they don't understand the circumstances of this disorder and they act with the symptoms as if it is something normal happening to their children.

Therefore, the main question for this paper is "How to use interaction design technics to support the Physical treatment plan, help diagnosing children with ADHD in an early stage? Along with help relieve recurring symptoms of ADHD young schoolers enhancing their learning capabilities? The research relied on using various methodologies which are interviews along with gathered information from psychiatrists.

Suggesting a conceptual layout for the component that could be used designing an Interactive fidget-friendly classroom furniture for ADHD offering more opportunities for both monitor and regulate the physical activities and energy release at class room environment of ADHD children, updating the involved parties with the condition of the ADHD child, in order to prepare or refit the educational activities according to his needs and capabilities.

Key Words

ADHD, ADHD Children, Interaction Technics, fidget-friendly classroom furniture.

ملخص البحث

إن مرض فرط الحركة وقلة الانتباة (ADHD) من الأمراض الشائعة بين الأطفال حول العالم إلا أأن أثاره قد بدءت في الأونة الأخيرة في الظهور بين البالغين. ووفقا للمعهد الامريكي للصحة العقلية، فأن هذا المرض يصيب ما بين ٣ الي ٥% من الاطفال سواء في مرحلة ما قبل المدرسة أو المراحل المبكرة من التعليم الاساسي. إذ يمكن تشخيص حاله واحده مصابة من كل ٢٥ الي ٣٠ طفل. لتصبح النسبة الاجمالية ما بين ٦,٥ الي ٧,٩ % من الاطفال في مرحلة التعليم الاساسي من المصابين بفرط الحركة وقلة الانتباه. ويمثل الذكور النسبة الاكبر من هذه الاصابات، إذ أن نسبة الاصابة تصل الي ١٣,٢ % من الاطفال الذكور، بينما تصل الي ٥,٦% من الاطفال الإناث. كذلك فأن هؤلاء الذكور المصابين بمرض فرط الحركة قد سجلوا زيادة ملحوظة في الأعراض الظاهرة عليهم مقارنة بالأناث.

إلا أن المشكلة الحقيقة تكمن في سوء فهم وتقدير هذا المرض. إذ أن العديد من الناس يتعاملون مع هذا الخلل المرضي كشئ طبيعي يمر به أطفالهم في ضمن مراحل نموهم، دون إدراك لملاباسات هذا المرض وأعراضه المختلفة التي قد تؤثر وبشدة علي سلوك أطفالهم وقدراتهم ومهاراتهم الحياتية المختلفة.

لذا، فأن السؤال الرئيسي لهذه الورقة هو "كيف يمكن إستخدام التقنيات التفاعلية في عملية تشخيص المرض بصورة مبكرة، وكذلك الإستفادة منها ضمن برنامج العلاج البدني لهؤلاء الاطفال؟ تزامنا مع توفير قدرات وإمكانيات للتعامل مع الأعراض والسلوكيات المصاحبة للمرض بهدف تحسين المهارات والقدرات التعليمية لهم؟". وذلك إعتمادا علي مجموعة من الدراسات السابقة التي قام بها الباحث متضمنة منهجيات مختلفة منها المقابلات الشخصية، بالاضافة الي جمع المعلومات من المصادر المختلفة التي تضمنت المعالجين المتخصصين.

للإنتهاء الي إقتراح تصور للمكونات الواجب توافرها في تصميم وحدة أثاث تفاعلية تستخدم داخل الفصل المدرسي، بهدف توفير الفرص لمراقبة وتشخيص حالات الاصابة بمرض فرط الحركة وقلة الإنتباه بشكل مبكر، وكذلك العمل علي توفير المجال لتفريغ الطاقة الحركية للاطفال المصابين بهذا المرض وتنظيم حركتهم داخل بيئة الفصل المدرسي. انتهاءا بإعطاء الفرصة للأطراف المختلفة ذات اصلة بالبقاء علي إطلاع ودراية بكل المستجدات المتعلقة بحالة الطفل المصاب، وبالتالي القدرة علي صياغة الانشطة التعليمية المختلفة بما يتوافق مع قدرات وإحتياجات الطفل.

الكلمات المفتاحية

فرط الحركة وقلة الانتباه، التقنيات التفاعلية، اثاث مدرسي تفاعلي

INTRODUCTION

ADHD stands for Attention Deficit Hyperactivity Disorder. It is a medical condition. A person with ADHD has differences in brain development and brain activity that affect attention, the ability to sit still, and self-control. ADHD is one of the most common neuro-developmental disorders that starts during child development. Signs usually appear before the age of 7, but frequently persists throughout adolescence and into adult years. It appears in between 3% to 9% of the general population of children, with an average onset of 3-6 years of age (American Psychiatric Association, 1994; Anastopoulos and Shaffer, 2001).

The name of the disorder got changed in 1994 in a way that was confusing for many people. Ever since, all types of attention deficit disorder are officially called "Attention-Deficit/ Hyperactivity Disorder," regardless of whether the person has any symptoms of hyperactivity or not. Despite that these are the official labels, ADD and ADHD are still the used terms by a lot of professionals (about ADHD - Symptoms, Causes and Treatment, 2019). People diagnosed with ADHD disorder immensely struggle with paying attention and/or controlling impulsive behaviors. On the other hand, they tend to be more active and restless. People with ADHD show an ongoing pattern of three different types of symptoms as following:

- The first type is the Inattentive type.
- The second type is Hyperactive/Impulsive type.
- And the third last type of ADHD is the one that combines both Hyperactivity/Impulsivity and Inattention (Combined).

ADHD is a misunderstood condition. Leading experts in the field hold widely differing opinions on the cause, the treatment, and even what ADHD is, how then are we average people diagnosed with ADHD, or parents with an ADHD child, expected to make decisions in this confusion?

The need to implement interaction technics is that it will not only help the children, but also their parents in treating their children in a safe way. As ADHD is highly misunderstood. Most of the people visualize this disorder as something normal happens to their children but they don't understand the circumstances of this disorder and they act with the symptoms as if it is something normal happening to their children.

ADHD SYMPTOMS

Attention Deficit Hyperactivity Disorder (ADHD) is highly common in children all over the world and it started to increasingly be recognized in adults. (Reda El-Sayed, 2018).

Children can be diagnosed at different ages according to level of how severe is the case. Where ADHD can be diagnosed according to the symptoms, and there is no exact cause for ADHD that was found till now.

Children with ADHD are different from other children, the differences lie in their hyperactivity and inattention levels, which are clearly greater than normal for their age and causing them distress while working at home, school or/and with others. ADHD includes three types of behavior Symptoms as mentioned before.

With the Inattention type, the child is easily distracted from study or play, often does not seem to listen, and has a hard time paying attention. Additionally, the child does not follow through on instructions or finish tasks, has problems organizing tasks and work.

Where with the hyperactive type the child displays behavior like frequently fidgeting and squirming while seated, getting up and moving around in situations when staying seated is expected, being unable to play or engage in hobbies quietly.

The last type which combine the previous two types, where the symptoms are impatience, the child frequently has trouble taking turns, acts and speaks without thinking, cannot wait for things, and interrupts others. Due to the fact that the ADHD symptoms are capable of changing by time, thus children may experience different symptoms as they get older. (About ADHD - Symptoms, Causes and Treatment, 2019).

Social impact of ADHD

Children with ADHD specifically those who are diagnosed with attention deficit or hyperactivity disorder face a lot of problems especially while socially interacting with peers which results in facing social isolation and peer rejection. (J.M. Prins & Gerly M.de Boo, 2007) Further, a lot of these children may face mild delays that are not part of ADHD for instance delay in their social development, motor skills or even their language. What causes dispute regularly at the school and/or in the workplace.(Parris M. Kidd, 2000) For example, the studies highlighted that there is a connection and a link between the lack of social skills and self esteem, and the future development of emotional, behavioral, academic, or/and interpersonal difficulties.

What means on the social level that there will be many interaction problems among the child, the surrounding environment and tasks at different levels of functions (that is, neurological, psychological and behavioral) by synthesizing different research evidence (as reviewed by Chu, 2003b). Consequently, the existence of the coexisting conditions may result in more difficulty and complexity in educational and behavioral problems, and emotional issues.

What creates a need for assessment tools to evaluate the primary behavioral features pertaining to ADHD, tools to identify the psychological correlates for the presenting behavioral patterns. In terms of management, the child with ADHD needs psychological and behavioral intervention strategies to support performance and promote participation in different occupations.

Regarding the contexts in which children engage in different tasks or occupations, and include the physical and social settings (Case-Smith, 2001). Different environments have inherent features that can enable or disable a child's performance. Children with ADHD typically have different symptoms at different times and in different situations.

School Environment & Physical Activities

It is important to consider the different environmental factors that may affect the different behavioral patterns in children with ADHD. In order to provide the basis for effective intervention. Regarding that some of ADHD treatment programs consists of 4 stages, including ADHD behavior program using three main approaches which is (Parenting, School and Coaching) (Fig.1).

Fig.1 - the 4 stages ADHD treatment program
(https://adhdclinic.com.au/adhd-treatment/)

Therefore schools as one of the main environments for children needs to offer relatively effective settings for children with ADHD, which include positive attitudes towards and understanding of ADHD, support at authority level, and provision of coordinated intervention through teams of professional workers (Burcham et al., 1993). On the other hand, each child with ADHD has a unique constellation of problems and multiple domains of functioning may be affected (Whalen & Henker, 1996). Therefore, it is important to adopt a multidimensional evaluation approach (Chu, 2003c) in order to determine whether or not ADHD is present and how it affects the child's development and performance in different areas of occupation.

The teacher has another important means of assessment and support, which is classroom observation. The therapist can observe the child across a variety of settings (for example, classroom, playground…etc.) and in interaction with different individuals. In many cases, direct observations will provide the most fruitful data when conducted during independent seatwork situations and transitions between lessons (Dowdy et al 1998).

Also, the adaptation of the sensory and physical environments is considered to be an important area of intervention in pediatric occupational therapy practice (McEwen, 1990). Regarding the school environment, the therapist needs to help teacher to appreciate the extent to which

naturally occurring activities and interactions within the environment provide the sensory input required to regulate, or disrupt regulation of, arousal level, attention control and activity level (Williamson and Anzalone 2001).

Fidget-friendly classroom furniture for ADHD

Hyperactive behavior isn't a choice, but an expression of a brain-based biological disorder. Hyperactive students also have problems with impulse control — among other things, they can't resist the impulse to move. Therefore, there are in continuous motion. It is difficult for them to sit or stand still for long periods of time so they may turn in their seats, kick their desk legs, or stand up or pace while working. Often, they talk excessively or make noises while trying to sit still. Therefore, the best way to help hyperactive children is to offer them till the moment, which is a channel for excess energy into constructive activities, or provide sufficient opportunities for kids to burn it off, without distracting the rest of the students in the same time.

However, most of the available treatment outcome studies have not been conducted in general education classroom settings (Du Paul GJ, Eckert TL,1998) and have focused on reducing problematic behavior rather than on improving scholastic status (Hoffman JB, Du Paul GJ, 2000). Even current rates of utilization are difficult to determine because ADHD itself is not an eligibility criterion for special education (Forness SR, Kavale KA, et al., 2002) in quite a big number of countries around the globe.

Therefore, number of the solutions has been designed as a try to solve such inequality problem to be more as fidget-friendly classroom furniture (Fig.2) focused on helping ADHD students to make some simple moves such as rocking, squirm and fidgeting alternatives, to help them release energy and keep moving without disturbing others, that let them regularly release pent-up energy and improve focus, all in the name of better learning.

Fig. 2 - Examples for fidget-friendly classroom furniture for ADHD

The implementation of interaction Design technics

Returning to Whalen and Henker statement that each child with ADHD has a unique constellation of problems and multiple domains of functioning may be affected, using interaction technics will be a very supportive improving the personalization requirements. In order to, create better chances for continuous monitoring for the state of the child, diagnosing if he has ADHD or not. And in the same time, working on providing appropriate educational experience, through the following capabilities that will be helpful to be used within the new design:

- **Recognize**

Identify the different symptoms for each child use the furniture, and relate these symptoms to him. Letting the chance to diagnose if the child has ADHD or not, because as mentioned before that quite big number of children with ADHD remain undiagnosed for many reasons.

Therefore, camera with face recognition and expression detector software (Fig.3). This technology has the potential to transform how instructor screen and monitor children's development, capturing the state of the child continuously allowing him/her to be aware about his students, and able to deal with them properly.

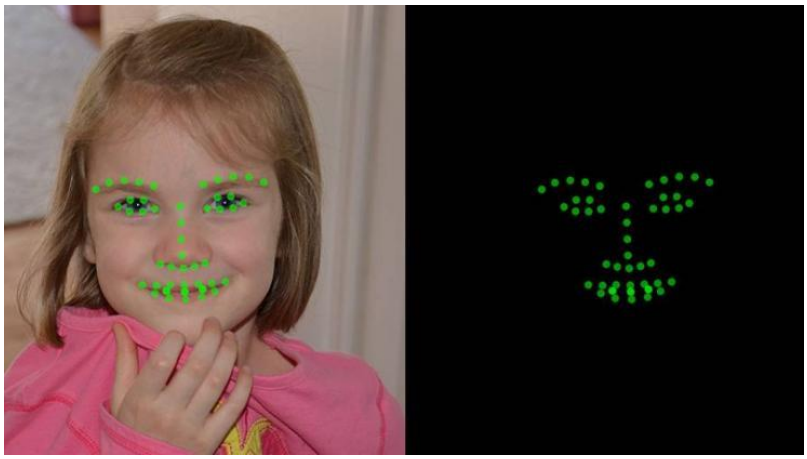

Fig.3 – Example for an app that helps screen young children for signs of attention creates landmarks on the child's face for software analysis of her facial expressions. (https://pratt.duke.edu/).

Also, using motion detector device, will complete the capability of monitoring the physical activity of the child.

- **Remember**

Knowing each child`s history, means not just knowing what they do, but also find out why they made those actions or behavior (defining the actuators or the triggers), through using the suitable technics that enable holistic computer vision (recording every estimated variable that is known as actuator).

The application of IOT in this approach is exciting due to its different scope of use in various directions (Fig.4). Where in helps in:

- Tracking children, and inventory
- Enhancing drug management (if needed)
- Updating the involved parties according to the need (instructor, medical assistant and parents)
- Ensuring availability of critical hardware

IoT is also applicable through several wearables & devices which have made lives of patients more comfortable. And make it easier for the designer to develop his concept according to the envisioned usage scenario.

Fig.4 – application of IOT in healthcare (https://www.peerbits.com/)

- **Relevance**

Delivering personalization within the context of the digital educational experience, regarding his medical history (if any), recent activities, problems and /or behaviors. In order to measure how is his momentum state.

- **Recommend**

Reach him with the right educational content, activity, or even with the medical assistance (if needed) based on his actions, preferences, and interests.

All of these capabilities are easy to be achieved using different interaction techniques, increasing the computer visioning abilities, offering the chance for the involved parties to be up

to date, regarding each case individually, ensuring the privacy and secrecy, and in the same time help planning the most appropriate treatment program for each case.
In the following table (Table.1) some examples of the interaction techniques and devices that could be used in designing the new interactive fidget-friendly classroom furniture for ADHD.

(Table.1) Examples of useful interaction techniques and devices

Capability	Techniques/Device
Recognize	Proximity reader or NFC (Personalization) Face Recognition Camera (Personalization & Monitoring) Motion Detector (Monitoring Physical Activity) Microphone (Monitoring Sounds)
Remember	GPU AI – Deep Learning System based on (Unsupervised Learning – Recurrent Neural Network - RNN)
Relevance	In order to monitor, measure, evaluate and make decision (Reporting & Acting)
Recommend	Motion regulator (as Physical Treatment) Interactive Screen (Customizing Visual Activities) Sound zone System (Isolation & Customizing the surrounding personal space)

Discussion

Education is an essential right for all the children, either way they have any medical condition or not. Keeping in mind the different qualities that must be ensured within this process, in equity and equality. Avoiding any chance of creating negative psychological and sociological effects, could be caused due to ignoring the individual differences among the children according to their capabilities and needs. As for example, services include accommodations and related services in the general education setting, such as preferential seating, modified instructions, reduced classroom and homework assignments, and increased time or environmental modification for test taking.
For ADHD, it`s a more complicated case, as being mentioned before, ADHD is not an eligible criterion for special education. In the same time, quite a huge number of children with ADHD has not been diagnosed totally or properly. Increasing the gape among those with ADHD and the rest of the children, causing a variety of problems that may be vital for the child to develop his skills and continue his life as it should be.
The children most likely to obtain services are those with the most severe functional limitations. Therefore, it would be difficult to interpret associations among use of services and outcomes. There are no data regarding effectiveness of many commonly recommended accommodations, such as preferential seating, on outcomes. (Susan Baglieri, Janice H. Knopf, 2004)
In this manner, using fidget-friendly classroom furniture isn’t a special accommodation for kids with ADHD. It’s being used by the whole class eliminating the individual differences, normalizing difference in inclusive teaching, and decreasing problems like bulling among the classmates.

Furthermore, using interaction technics developing interactive fidget-friendly classroom furniture, could be more helpful to provide the child with ADHD, to be diagnosed in an early stage, letting the chance for both parents, school instructor to be aware of child condition, in order to prepare the suitable treatment program, and being up to date with any development in his case. In addition to the ability to work on refitting the surrounding class room context in general, or the personal zone, to be a part of the treatment process.

In other words, achieving the recommendation of Susan Baglieri, Janice H. Knopf, by creating more chances for inclusion practices and special education that can be transformed by using a disability studies perspective, which constructs differences as being natural, acceptable, and ordinary. Although inclusion is a moral imperative in promoting social justice, and the school culture reflects an ethic of caring and community.

Results

Using interaction techniques developing interactive fidget-friendly classroom furniture, is a promising approach to normalize the school context promoting social justice. Through normalizing child's behavioral differences to be recognizable only for the involved parties, in order to prepare the suitable treatment program according to requirements for each case.

Both AI (Artificial Intelligence) and IOT (Internet of Things) will be supportive technologies to be used for increasing the capability of the interactive fidget-friendly classroom furniture taking urgent and vast actions according to the child`s needs and state. In a pleasurable experiment ensuring a smooth and sufficient educational process, that attract child`s attention and encourage him to participate in class room activities.

Number of conceptual designs has been developed by the researcher in cooperation with number of undergraduate students, which hypothetically will not only develop the class room context in order to provide better normalized educational experience, but also considered as an effective tool with the treatment process (Behaviorally & physically). In depth studies and experiments is in progress to validate the concepts.

Recommendations

Implementing interaction technics into any specific design approach such as disabilities (ADHD, Autism, Epilepsy …Etc.), woman empowerment, even in public services needs more studies to open the horizon towards more benefits out of these implementations.

It`s enabling not only developing user experience toward the product or the services, but also it helps developing the psychological and social impact on both personal and community levels. Through participating effectively in fixing or fulfilling the different user`s requirements (behaviorally or medically), what needs cross-disciplinary researches in different fields related to the various implementations of interaction design.

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