

TOY DESIGN: IMPROVING LEARNING EFFECTIVENESS FOR ADHD STUDENTS

Mei Yee LUI, Lok Yiu WONG, Ho Yin MAK and Yi-Teng SHIH
School of Design, The Hong Kong Polytechnic University

ABSTRACT

With the rapid development of medical knowledge, more young generations are confirmed to suffer from attention deficit hyperactivity disorder, abbreviated as ADHD. Inattentive, hyperactive and impulsivity symptoms are three categories that are signs of ADHD. Fidgeting, interrupting, losing homework, daydreaming are all common signs of ADHD. It affects student learning performance and classroom order. The most effective ADHD treatment is a combination of medication and behavioural therapy. However, there are many side effects of ADHD medication use. Thus, fidget toys, therapeutic devices, and other solutions that make use unconscious repetitive actions to increase their concentration. In this solution, feedback is considered as a helpful tool to let ADHD students concentrate on class and improve their learning effectiveness. Nevertheless, in some cases, other students are attracted to the attention by fidget toys and lose focus on class. Therefore, students are forbidden to bring fidget toys back to school. How to take a good balance between regulations of school and student needs was the problem that we were concerned about. This study aims to help ADHD students to reduce their concentration disorders and anxiety problems and use them with school at the same time. Finally, there was testing to let ADHD patients try the model in reality to evaluate the performance. The experimental results show the effectiveness of our proposed method.

Keywords: ADHD, attention deficit hyperactivity disorder, learning effectiveness, fidget toy

1 INTRODUCTION

Students with attention deficit hyperactivity disorder (ADHD) face greater challenges than the ordinary student on their way to success. Inability to pay attention, trouble sitting still, and difficulty managing impulses are all signs of ADHD, and they can make it difficult for children with this diagnosis to achieve well in school [4]. Therefore, therapies, school support and fidget toys are able to help the ADHD students improve their learning experience. Concerning treatment, combination of medication and behavioural therapy is the most effective ADHD treatment. However, there are many side effects of long-term ADHD medication use such as stunting or slow growth. Besides, many people do not like the idea of taking medicine for ADHD if not a serious case. [1] [7]. Concerning school support, Individualized education plans (IEP) and section 504 plans are two possible school services for students with special education needs. For example, provide technology-assisted tasks and changes to the classroom to limit distraction. Nevertheless, some cases are hard to control like talking out of turn or moving around the room to draw attention. Their behaviours take time away from instruction and disrupt the whole class.[15][5]. Concerning fidget toys, it can help ADHD students to reduce their concentration disorders or anxiety problems, so that they can concentrate and settle. Minor repetitive movements can improve the nerve function of the brain and improve concentration when children have to perform long and tedious tasks such as listening to a teacher or reading, playing fidget toys may improve performance [11]. Unfortunately, some schools banned fidget toys both in class and at recess. Feedback is considered distracting other students in some classes [6]. Thus, the aim of this study is to find an effective and safe method to reduce ADHD students' concentration disorders and anxiety problems in classes. How to take a good balance between regulations of school and student needs was the problem that was concerned.

2 ADHD X STATIONERY FOR ADHD

Providing tools to help children develop the sensory processing skills, emotional regulation skills, and social skills needed. Fidget toys are an example of a “self-regulation toolbox” and come to use them

without others' help. Thus, as time goes on, they could improve self-regulation skills [14]. For children with ADHD, the toys can offer a movement outlet that allows the child to focus and concentrate better. Some people with anxiety also benefit from using fidget tools [13]. By keeping their hands engaged in basic, repetitive motor actions that help people concentrate and pay attention by allowing the brain to filter out extraneous sensory information. It allows them to self-soothe in peaceful, predictable, and repetitive motor patterns [14]. Holding, pulling, pushing and sliding are common hand actions used in the fidget toys for children with ADHD [12]. Based on the children's stance, there is no doubt that toys are attractive things in their daily life. Compared with those treatments, education plans and school support, using fidget tools is better. Fidget toys are not only tools for self-regulation that let ADHD students reduce their disorders and anxiety problems but also could effectively decrease the times of disrupting classes and others.

Increased focus and concentration, create movement for stimulating the brain stem, provide fun mental occupation and reduce stress and anxiety are the main benefits that are found in fidget toys [8]. Some studies proved that fidget toys improved scholastic achievement, especially students with ADHD [8][11]. However, some educators do not agree. They say the toys have become a major distraction to teachers and students. In some cases, fidget toys, especially fidget spinners, are forbidden to bring back to school. Some school administrators find that the toys distract students, or worse [17]. Putty, stress balls, and other therapeutic fidget products can be used for the same purpose as fidget spinners, but more classroom-friendly and less distracting. Visual attention is the main concern [9]. Referring to the current fidget tools market, all products look like toys and easily attract other students' attention. In order to help ADHD students, relieve some of the fidgeting symptoms in class and use the product with school permits. The design should not only be functional but also need to reduce the attention of others. Therefore, stationery is a good choice to combine with the fidget tools since all students need to bring stationery to school.

3 METHODOLOGIES

Throughout the project, we interviewed three people through the introduction of teachers and friends. During the interview, we learned about the daily life of ADHD adults and young people, their needs and requirements for fidget toys, also how parents face the impact of ADHD on their children and how they treat fidget toys. The first interviewee is a 35-year-old male instructor in the design department. He was diagnosed with ADHD when he was 12 years old. The following are the key points learned in the entire interview. When he was a child, he lived in Brazil and under the Western education system in primary school, there was not much pressure caused by homework and tests, life was very pleasant and cheerful. Moreover, Western children are more talkative and actively participating. As an ADHD, he is no different from other children. Until high school, with more and more homework and exams, he found that his ability to concentrate was very poor, and he couldn't patiently listen to the teacher in class. With the increase in pressure, he began to feel low self-esteem during his middle school life. After knowing that he had ADHD, he became less self-confident, afraid that he was different from others. The symptoms of ADHD have even accompanied him until now. He pointed out that sometimes he cannot be fully engaged and focused on work. The problem of concentration gives rise to the problem of poor memory. Due to insufficient concentration and uncaredful listening, it is easy for him to forget things in class and work. In his childhood, there was no fidget toy, but there was Lego. He liked Lego's creativity, size and touch feel, which could stimulate his concentration. After touching Lego with his fingers, the bumpy design can make him feel familiar and comfortable and can quickly merge and build.

The second respondent is a 15-year-old male secondary school student who was diagnosed with ADHD when he was in primary school. The following are the key points obtained in the interview. When he was in primary school, he was often scolded by the teacher because he was very active and talked a lot during class. In addition to the behavioural problems in the school, the teachers and social workers also found that he also had difficulties in making friends with his peers, such as often interrupting and not talking. Also, he didn't know how to cooperate with others, it was obvious that he could not adapt to the school environment, so he was designated by the school to do the test of ADHD, so that the school's educational psychologist could make further evaluation. In the end, he was confirmed to suffer from distracted attention and excessive activity. In school, he knew he liked to talk and interrupted. He liked to sing and climb. He often walked out of position during class. Not only was he unable to concentrate on class, but he also affected other people in class. Teachers often stopped the class progress because of

him. This led to his poor interpersonal relationship in primary school, and not many classmates were willing to play with him.

Until secondary school, he began to receive different support channels, such as medication, to improve behaviour problems through the room, so that he could concentrate more easily and reduce their activity. In addition, there are behaviour therapies, which use reward programmes and social skills training to improve his behaviour and relationships with other people. Without taking medicine, it is difficult for him to listen to the teacher intently. It is difficult to maintain concentration when doing homework, and it is easy to be distracted by external interference, so his grades can only be maintained at the middle level.

The third respondent is a 42-year-old mother, and the mother of the second respondent. The following are the highlights of the entire interview, summarizing the choices and feelings of parents facing their children's ADHD. Her child was confirmed to have ADHD in primary school. But at that time, she just thought that the child was too active and was too young to concentrate, so she was unwilling to give the child medication and did not take any behavioural treatment. It was only when she was about to take the secondary school examination that she realized that the situation was more serious than she imagined, and the child could not concentrate on studying. She began to accept the doctor's advice to give the child medication. After taking it for a period of time, she found that the child's appetite was poor. For a child of developmental age, he was weaker and shorter than the child of the same year.

Therefore, she started to choose to take medicine only during the exam phase, hoping that it would not affect his physical development. She also tried to buy some fidget toys for her child to play with. They did make him suddenly quiet when he was active. It didn't matter if he was playing with fidget toys while watching TV or reading a book. On the contrary, his body could be distracted by a fidget toy. A big problem is that these fidget toys can't be taken to school. If fidget toys can be taken, they can improve his concentration in class.

4 DESIGN OVERVIEW

4.1 Concept

In the stance of ADHD students, fidget tools are a good helper to reduce their concentration disorders and anxiety problems in classes. Therefore, the product should be accompanied with their school life. The outer case of the pen is decided to develop because it could be long lasting use. Besides, this design encourages students to replace the new ink cartridge with no ink rather than buy a new pen. It could be more environmentally friendly. The pen is designed not only for writing, but also as a fidget tool of ADHD. Referring to the movements on the fidget toys, extended design is used in the structure of the pen. In order to write smoothly, the extended part would design on the upper part of the shell. After extending the pen, the user needs to rotate the upper cover to lock the structure.

When the user unlocks and push it back, it could save space in your pencil case. Pull and push with simple movements that are able to let ADHD students unconsciously repeat the actions during class. To improve their concentration in class and have a better learning performance at school. Concerning material, Polylactic acid (PLA) is the material that is considered to be used. Since it is a biodegradable thermoplastic polymer obtained from resources like corn starch, or sugarcane which is made from renewable raw materials. Compared with fossil-based plastics, PLA has a reduced carbon footprint [3]. Besides, it is classroom and children friendly because PLA is a nontoxic corn-based, biodegradable material and is considered safe to use in classrooms. Moreover, it is a good part of stiffness, since PLA will maintain its form up until its breaking point which is important in applications [10]. The pen would keep a tough structure and be supposed to long lasting use.

4.2 Style

Because of the fidget toys with nice appearance, some students are attracted to the attention by the toys and lose focus on class. Therefore, a simple look is the style that is considered. In the design concept, making good use of pattern, repetition and variation could make an interesting design for many different effects. Unified composition and stability are shown by pattern and repetition. For example, when repeating the shapes, the intervals between each repetition might give people a sensation of rhythm and movement. It is the five types of visual rhythm. Also, variation of the pattern adds interest to the design [16][2]. Rhombus pattern is used on the appearance of structure. Since it is a simple and suitable shape

in a seamless pattern that combines to form a whole in order to enhance the aesthetic appeal [16]. In order to look simple and clean, only one colour would be used in each pen (Please refer to Figure 1~4).



Figure 1. Section view with pen structure

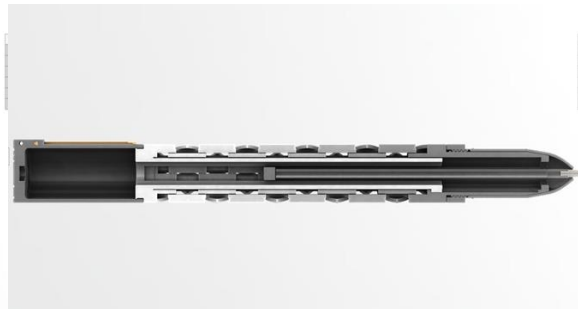


Figure 2. Section view with extended pen structure



Figure 3. Functional test - Length record
(Before extending)

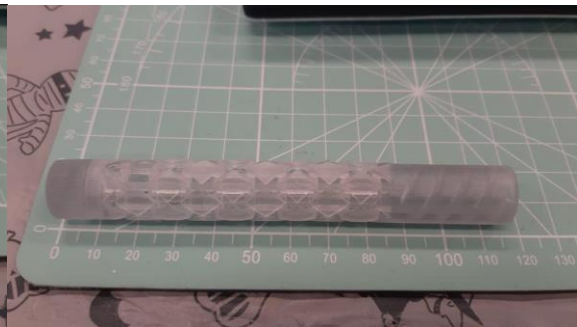


Figure 4. Functional test - Length record
(Extended)

4.3 User test

After the structure with the rhombus pattern extended successfully, users tests would be prepared. 6 students were invited that included 1 ADHD student and 5 other students that aged 11 to 17. This user test aimed to prove the design is effective or not and observe the behaviour of the user and other students. Each of them started to finish their homework. The test lasted an hour. Without informing other students, our team offered the mock up to the ADHD student. During the testing process, other students were still able to concentrate on their work, and the user kept pulling and pushing the pen shell when he was stuck in his work. Thus, he did not show signs of anxiety in the test. By touching the raised patterns, the repeated rubbing between the fingertips and the pen can make ADHD students settle down, reduce anxiety, and achieve a little soothing effect. Coupled with the stretching and twisting, ADHD students kept doing the slight but repetitive hand movements by twisting the pen. It can improve concentration without being taken away by the pen, helping the user to focus on the appropriate place more easily, and reduce excessive movement due to insufficient concentration. The pen effectively reduces the negative effects of ADHD and helps study and work (Please refer to Figure 5 & 6) .

Through user feedback, we hope to have more different pattern designs and have provided more choices of stationery. This was testing to let ADHD patients try the model in reality to evaluate the performance. The experimental results show the effectiveness of our proposed method.



Figure 5. Mock-up (1)



Figure 6. Mock-up (2)

5 CONCLUSIONS

The purpose of this study is to find a suitable plan for young people with ADHD to relieve some of their fidgeting symptoms during class to improve their learning performance. At the same time, it can be used without affecting the classroom and other students, which can effectively maintain the order of the class and make the teacher's teaching process smoother. Therefore, the design should be not only functional but also concealed to reduce the attention of others. Through the analysis of the research, it can be inferred that fidget toys can be "invisible" in the classroom. For example, a simple appearance and playing method can reduce the vision attraction problem.

In order to improve practicality and concealment, a combination design of fidget toys and stationery is an option since students need to bring their stationery to school. The product should be accompanied with their school life. The outer case of the pen was decided to develop because it could be long lasting use. To let ADHD students unconsciously repeat the actions during class, pull and push with simple movements are applied in the design. The testing to let ADHD patients try the model in reality to evaluate the performance. The experimental results show the effectiveness of our proposed method. It is believed that this design can improve the class performance of ADHD students and relieve the inattention. At the same time, the entire classroom process will not be interrupted, and the learning performance can also be improved.

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