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make a move

**a multi-sensory, movement coordinated furnishing
support system for children with ADHD**

a thesis submitted in partial fulfillment of the degree of
master of design

written and designed by
brigid burnham

Key Words

ADHD

ADHDer

Developed Disorders

Disabled Learners

Self Directed

Movement

Body-Brain Connection

Sensory Stimulation

Coordination

Product Interaction

Learning Experience

Classroom Furnishings



The contemporary school chair.

abstract //

We must allow the time to think more deeply and broadly about our [design] . . . Deep inquiry . . . is critical . . . Broader thinking also helps us break out of our current mindset. Looking [differently] can reveal new opportunities, and challenge more entrenched thinking.¹

The contemporary school chair is representative of the conflict between established traditional student behaviour in the conventional classroom and the ADHDer's desire and need for more movement and sensory stimulation.

Classroom furnishings, by their active potential, have the ability to change the dynamic embodied in existing classroom environments. New furnishings in the classroom may positively affect the traditional culture of conventionality (standardized classroom behaviours) in a positive way by directly involving students in the interplay between active

learning and sensory stimuli. Ultimately, my design approach is to provide a furnishing that responds to the ADHDer's learning experience in the classroom environment.

Using my individual experience of having ADHD as an investigative blueprint, my study took on a design process that overlapped four explorative modes: I examined the context of traditional classrooms (searched for understanding), developed contextualisation (searched for ideas), tested the concepts (searched for solutions), and logically reasoned (searched for meaning) an optimal design. These explorative modes were not done entirely sequentially. There was an ebb and flow throughout my whole design process. The interrelatedness between the explorative modes, and iterative process of learning and knowledge generally, helped generate a reactive design process which was ultimately represented by my design solution.

1. Laurel, Brenda. *Design Research, Methods and Perspectives*. MIT Press: Cambridge, Massachusetts; London, England, 2003, 148.

acknowledgements //

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friendship and patience in teaching me the ins and outs to Rhino. To my brother and roommate- Richard- thank you for putting up with me during the challenging parts of this study and keeping me motivated. My editor, best friend, and partner, Brad Marrett, thank you for encouraging me the whole way through and giving me the ongoing support I needed to maintain momentum during the ups and downs of this study.

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The conventionalist.

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purpose of this study // introduction

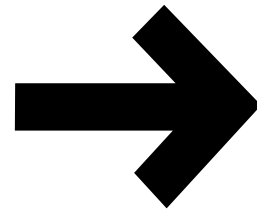
If a child wants to stand or rock while writing, or if a child wants to feel something to get tactile stimulation while reading, these behaviours might actually be facilitating their independent work even if they don't look 'right'.²

The researcher's interest in & perspective on this study.

It started with a pen and a teacher. I was ten years old and had an uncommon fascination with pens. I collected a variety of pens ranging in type, texture, colour, and ink bleed. I loved to feel and hear the different ways the pens clicked, listening to the spring move back and forth while I applied pressure with my thumb. I liked to take apart the many components and put them back together, creating a plethora of new pen designs; the range of pen combinations I would create kept me entertained for hours!

One day I was in class listening to my teacher give a lecture, when suddenly she snatched my pen from my hand and threw it in the trash can. I never forgot the day my collection became "minus one." I felt so guilty and embarrassed for the unconscious continual clicking noise that I had been making. If only I had been aware of the sound my movements were making, or the consequences that would ensue, I would not have done what I did . . . or would I have?

Through my research I have learned that ADHD students tend to be under-aroused, constantly seeking external stimuli to bring themselves to a higher level of arousal. ADHDers, like myself, require more noise (or other sensory stimuli) than others to reach an arousal level that allows for effective cognitive functioning. Such cognitive



². Harvard University. "ADHD: A Window into Disability as Variability." October 11, 2010: 21.

functioning can be characterized as mental processes, dealing with perception, thinking, and reasoning about ideas. These external stimuli are usually novel and salient to the ADHDer because “conventional” noises, feeling sensations, or movements in a learning environment do not give them (or me) a “normal” arousal level (normal meaning an arousal level that is consistent with the standardized design of the traditional classroom environment).

When a child is clicking their pen (like I was) or attending to some other external stimulus, they are attempting to self-regulate their individual arousal levels while also trying to find their unique homeostasis.³ While in the classroom environment, ADHDers often need sources of stimulus that are deemed unacceptable. Such stimuli, however, are commonly suppressed. Thus, the question may be asked, how are ADHDers ever going to be able to boost their arousal levels and focus with such uncon-

structive conditions in the traditional classroom atmosphere? There is a need to enable such students to engage those stimuli (even if it’s an action we would not personally do ourselves).

My motivation behind this investigation was the disparaging passivity that my teachers displayed toward my unbeknownst fidgeting: a passivity that I have discovered to be all too common within the learning community. As a designer and a student with ADHD, I have a deep understanding of how much the classroom environment can impact and shape one’s learning experience. My personal stance has developed through the interplay between my personal experiences and theoretical knowledge that I have gained through this research project.

As a student who struggles with ADHD, I felt as though I was well-equipped to bring about a meaningful change to

these individuals. I believe that through my investigation of personal principles and philosophies, as supported by scientific research conducted by other others in the field, my examination of various educational environments, and through understanding the solutions that currently exist, my development of this investigation could proceed with more formative assessment backing this thesis’s central claims.

As an industrial designer, I know product interaction can be vital to the experience and connection that one develops with a particular design. Can this interplay positively aid ADHD students’ connection to the learning experience through the use of a classroom furnishing developed solely for them?

Validation. In 2007, Alvin Toefler wrote: ‘I just feel it’s inevitable that there will have to be change. The only

question is whether we’re going to do it starting now, or whether we’re going to wait for catastrophe.’⁴ My intention is to break away from conventionality and, in a conscious way, enable learning to coexist with movement in the classroom environment. According to Sir Ken Robinson, there is an interrelatedness of movement and learning in the classroom environment; however, academics are often predisposed to ignore this relationship. As Sir Ken puts it, ‘Academic education is focused on developments from the neck upwards. One result is that people think of their bodies as a form of transport for their heads.’⁵ To involve both use of mind and body is vital to experience “learning.” American athlete, cardiologist, and author, Dr. George Sheehan would agree, “The mind’s first step to self-awareness must be through the body.”⁶

In a Los Angeles Times article written by Jeannine Stein, it was reported that the Paediatric Academic Societies found

3. Harvard, *op.cit.* 14, 15, & 21.

4. Le, Trung. “Redesigning Education: Designing Schools in a Spiky World.” *Fast Company’s Co.Design & Mansueto Ventures LLC*, July 2010. <http://www.fastcodesign.com/1661831/redesigning-education-designing-schools-in-a-spiky-world>.

5. Robinson, Sir Ken. *Out of our Minds: Learning to be Creative*. Capstone Publishing, June 15 2001. Kindle edition, 2061.

6. ThinkExist. “George Sheehan Quotes.” <http://thinkexist.com/search/search-quotations.asp?search=George+Sheehan+Quotes> (July 2011).

7. Stein, Jeannine. “Combining Exercise With School Lessons Could Boost Brain Power.” *The Los Angeles Times*, May 2, 2011. <http://articles.latimes.com/2011/may/02/news/la-heb-gym-academics-20110502>.

that combining exercise with school lessons can boost academic performance.⁷ It follows that those who facilitate education need to break away from seeing “the new” in terms of the past and like Arthur J. Cropley states, ‘facilitate a production of novelty.’⁸ There is a growing demand for formative experiences that cater to a child’s natural impulses. Although some may believe that making the learning environment more conducive to active learners is too costly and shouldn’t be considered, the fact that ‘[t]he social impact combined with the environmental impact may have a temporary greater monetary cost . . . should not outweigh the long term right thing.’⁹ Academic success should be reflective of and reactive to the demands of the students and readily permit personal learning and behaviour modification if necessary. What serves as a cost effective model in achieving academic success should be an increase in the attention to understanding and responding to what best serves the needs of young children;

to create wholesome and loving environments that enable children to fully actualize their human potential.¹⁰

Maybe there is resistance towards change because the education system we have is all we have ever known. The classroom environment is for learning. But is learning the ability to memorize facts and analyse a sequence of ideas by sitting in a stationary position, or is it instead the process of engaging with the surrounding environment and individually becoming aware of what is needed for one to independently flourish, comprehend, and learn in their own way by their own actions? Our minds are not vessels to be filled, but vital organs to be exercised.

Teaching and learning are often preoccupied almost exclusively with one another without consideration of the learning needs of students outside the teaching style of the instructor. Sir Ken Robinson uses the word

“[s]eptic focus” to describe the tendency to look at a problem in isolation from its context. In his book he stated that a holistic doctor would recognize a problem someone was having with a particular body part by looking at the overall health of the individual. If that doctor were to only look and fix one part in isolation, he might not know what side effects might occur to the other parts of the patient’s body.¹¹ Teaching cannot be done properly if its relationship with learning remains underdeveloped.

An ADHDer needs to be allowed to self-regulate. A teacher, who desires only students who sit, move, and behave the same, does not pay observance to the foundation of teaching as a holistic art. By solving one problem (classroom control via unified conduct) another set of other problems results (less mind stimulation, more boredom, less learning) – thus, in net, conformity is no solution at all. The recent progression of unnatural behavioural modalities in

the conventional classroom environment demonstrates the growing need for a synthesis of mind and body in the field of “learning” as being prerequisite to an environment where total learning can be harvested and utilized. Agreeing with Sir Ken Robinson, the education system will potentially stay dormant and over time, be less effective if things continue as is, and ultimately, intellectual capacity will radically decline.¹²

Learning drives human intelligence, and the way in which we learn varies amongst individuals; ADHD students are no exception. Alternative design solutions that bridge the gap between ADHDers’ learning experiences and the classroom environment are needed.

8. Cropley, Arthur J. *Creativity In Education & Learning*. London: Kogan Page Limited, 2001. 161.

9. Raffi Cavoukian in OWP/P Cannon Design Inc. VS Furniture & Bruce Mau Design. *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching & Learning*, 1st Ed. Abrams Publishing, March 1, 2010.

10. Cavoukian, Raffi & Sharna Olfman. *Child Honoring: How To Turn This World Around*. Praeger Publishing: Westport, Connecticut; London, England, 2006.

11. Robinson, Intro. & Cap. 2.

12. RSA Animate. *Changing Education Paradigms*, video recording, April 2011. <http://sirkenrobinson.com/skr/watch> (March 2011).

RESEARCH QUESTIONS

The primary research question for this investigation was:

Is there a furnishing design that can respond to the learning needs of the ADHDer, while also interactively involving the ADHDer in the classroom experience?

- *Can a furnishing be developed with the right level of salient stimuli to create the optimal level of arousal without generating detractive levels of noise boosting the ADHDers arousal levels?*
- *Can a furnishing incorporate both sensory stimulation and movement variability?*

In seeking an answer to the above inquiry, my research also sought answers to the following sub-questions:

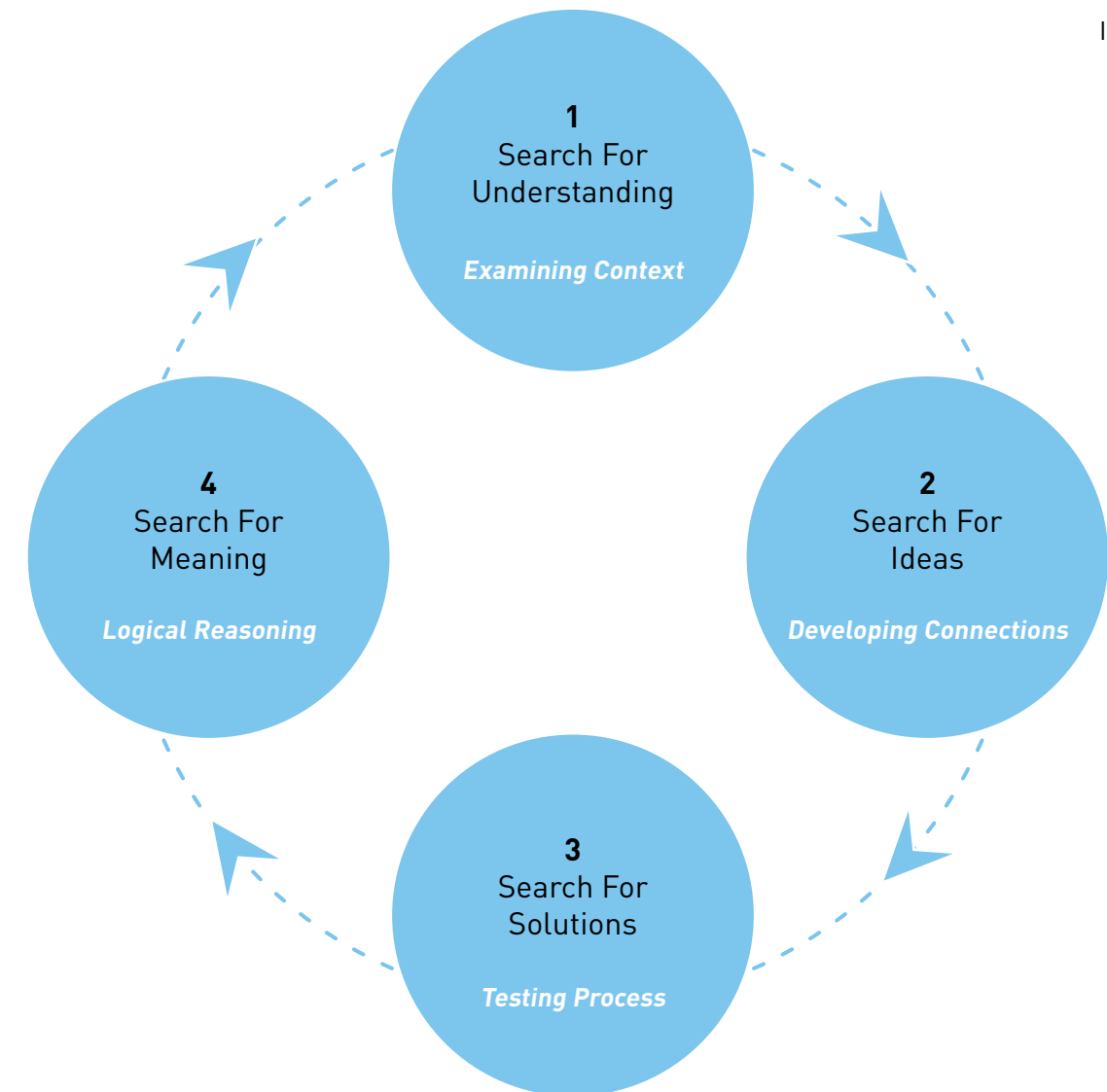
- *What role can furnishings play in the classroom?*
- *What user-focused pioneering educational studies and classroom learning theories already exist?*
- *Who are the supporters of a user-focused, multi-sensory, movement coordinated learning approach in the education environment?*
- *How can our perceptions of movement and fidgeting in the classroom environment change?*
- *How can we accommodate students with varying behaviour and learning needs?*

PROCEDURES

Throughout my entire investigation I have been constantly researching and using the knowledge gained to further inform my design process. For ease of interpretation and evaluation this paper has been divided into four main parts:

1. Search for Understanding (Examining Context)
2. Search for Ideas (Developing Connections)
3. Search for Solutions (Testing Process)
4. Search for Meaning (Logical Reasoning)

| Design Process |¹³



13. Modified Source: Press, Mike & Rachel Cooper. The Design Experience: *The Role of Design and Designers in the Twenty-First Century*. Gower Pub Co., June 2003.

RESEARCH OBJECTIVES

The focus of this research was to develop a new type of furnishing for use by ADHD students, which allows for diverse forms of movement, interaction, and sensory stimulation.

I began by assuming as true the ideology that learning is a process (not an event) in order to foster creativity and innovation through my design process. Taking a less uniform approach and developing an integrated design methodology through research, interaction, and experience, the goal of my thesis was to enhance the ADHDer's ability to focus by modifying their distinctive classroom behaviours in an indirect way.

My aim was to understand the context of the classroom environment through the eyes of the ADHDer, using my own

experience and classroom exploration as precedential criterion. The information gathered during design research activities aided in the cultivation of this creative process, it balanced aesthetic content with regard to use and helped shift my thesis toward self-discovery while simultaneously probing exploration.

ASSUMPTIONS & LIMITATIONS

The information gathered from this research explores the ineffectiveness of standard classroom furnishings through a participatory design process. This process is centred on developing a learning experience through the development of a new furnishing that engages those with ADHD. By conducting a multi-modal methodological approach and using both deductive and inductive reasoning qualitative and

quantitative data was collected. The use of this data was interpreted on an individual basis with the influences of other expert designers and educators. This information contributed to the development of the final design solution.

In hindsight, this research holds true for each individual – but the exact design proposed may be prepared and interpreted in a completely different manner depending on the researcher's own interpretation, instruments used, and theoretical foundation.

SUMMARY

This study explored an area that often goes unnoticed. The investigation of the learning experiences and behaviours of ADHD students in classroom environments provided

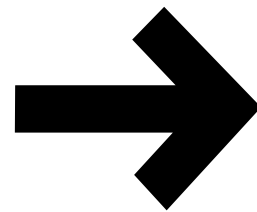
an answer to the following question: *What school furniture design can respond to ADHDers learning experiences in the classroom environment?*

DEFINITIONS

ADHDeR- those who struggle with the various forms of Attention Deficit Hyperactivity Disorder: defined as inattentiveness, over-activity, impulsivity, or a combination thereof.¹⁴

14. American Psychiatric Association. *The Diagnostic & Statistical Manual of Mental Disorders*, 4th rev. ed. Washington, DC: American Psychiatric Press, 2000.

search for understanding // examining the context



ADHD-WHAT IS IT?

Just because I have ADHD doesn't mean I know all there is to know about it. Thus, my design process began with a simple idea: would a deeper understanding of ADHD lead to designing a furniture solution that is more conducive to ADHDers in the classroom environment? I needed to know more. This initial investigation enhanced and supplemented my existing ADHD knowledge. For the sake of ADHDers like myself, I inquiringly studied the causes of ADHD, the various treatments readily available, the scope of our learning difficulties, and the varying behaviours that accompany ADHD, in order to strengthen the foundation of my thesis.

Attention deficit hyperactivity disorder (ADHD) is a developmental disorder previously known as "ADD" (attention defi-

15. Spencer, Thomas J., Joseph Biederman, Timothy E. Wilens, Stephen V. Faraone, "Overview And Neurobiology Of Attention-Deficit/Hyperactivity Disorder," *Journal of Clinical Psychiatry* vol. 63, no.12(2002): 3-9.

cit disorder)¹⁵ ADHD is the distinct disorder that can manifest itself in three conventional types of ADHDers (dependent upon the strength of the various symptoms):

- Inattention (ADHD, Predominantly Inattentive Type)
- Hyperactivity/impulsivity
(ADHD Predominantly Hyperactive-Impulsive Type)
- Combined Type (ADHD Combined type)

ADHD initially manifests in childhood and affects three to seven percent of school age children (at least one student in a class of twenty five).¹⁶ The American Academy of Paediatrics estimates that as many as 3.8 million school children (mostly boys) are currently diagnosed with attention deficit hyperactivity disorder.¹⁷ Over seventy percent of children

16. *Attention Deficit Hyperactivity Disorder*. National Institute of Mental Health Booklet, 2008. <http://www.nimh.nih.gov/health/publications/attention-deficit-hyperactivity-disorder/complete-index.shtml>.

17. Magno Zito, Julie, Daniel J. Safer, Susan DosReis, James F. Gardner, Myde Boles, & Frances Lynch. "Trends in the Prescribing of Psychotropic Medications to Preschoolers." *Journal of the American Medical Association*, 2000.

diagnosed will continue to manifest the full clinical syndrome in adolescence, and the majority will continue to have ADHD in adulthood.¹⁸

Causes. Confusion and controversy over ADHD's diagnosis started with the preliminary assumption that all persons diagnosed with ADHD had some form of a brain defect. However, over time, we have learned of many possibilities as to why ADHD exists, which in turn has resulted in more accurate and numerous diagnoses. Diagnostics criterion has also broadened, so meeting the criteria for having the disorder has become more generalised. There are many theories that have shown that genetics, environmental factors, and developmental issues could all play a role in ADHD. ADHD may also be instigated from birth defects, genes, brain injury, toxic chemicals, diet, allergies, and/or one's pure intelligence.¹⁹

Scientific studies have shown that ADHD is very likely to be caused by biological factors that influence neurotransmitter activity in certain parts of the brain, thus proving a strong genetic basis exists for the disorder. In one study using positron emission tomography (PET) Scans, an ADHDer's brain (in areas inhibiting impulse and attention control) and its levels of glucose were measured. The study found a direct link between a person's ability to pay continued attention and the level of activity in the brain. Those with ADHD used less glucose, indicating that they were less active in some parts of the brain.²⁰

More recently, with the use of single photon emission computerized tomography (SPECT) scans it has been found that ADHDers also have reduced blood circulation, indicating an association between the disorder and low neural activity. ADHD children have a delay in the development of the frontal

cortex and temporal lobe, which are both areas responsible for focus and thinking control. Their genes have been found to affect dopamine transporters resulting in decreased functionality of dopamine in the brain.²¹ Even though there are genes linked to ADHD, no single gene has been shown to be the cipher unlocking the root cause of ADHD.²²

Although an ADHDer has lower glucose levels, decreased dopamine function, and reduced blood circulation, the ADHDer's motor cortex (the area responsible for planning, control, and execution of voluntary movements) has been observed to mature faster than in average, non-ADHD children.²³ Could the combination of an ADHDer's faster developing motor skills be the result of their "inattention" and/or other ADHD symptoms? What the preceding findings have identified and suggested is that the issues regarding behavioural control mechanisms and the motor development of ADHDers, signals the

need for designing non-medicinal behavioural remedies.

Longitudinal studies have failed to show that Ritalin or other psycho stimulants have consistent long-term behavioural effects. (Even if they did, another question would arise: Would you want to be dependent on a stimulant for the rest of your life?²⁴

Treatments. According to the New England Medical Journal, clear-cut clinical diagnostic criteria and ADHD testing, developments, and research, have required several decades to achieve the current level of refinement.²⁵ Today, ADHD is diagnosed through psychiatric assessment. In North America, the Diagnostic Statistical Manual of Mental Disorders (DSM) published by the American Psychiatric Association is often the basis for a diagnosis, while European countries usually use the World Health Organization's International Classification of Diseases (ICD). If the DSM

18. WebMD Medical Reference. "Attention Deficit Hyperactivity Disorder: ADHD in Adults." <http://www.webmd.com/add-adhd/guide/adhd-adults?page=3>.

19. Nigg, Joel T. *What Causes ADHD?* The Guilford Press. New York, New York, 2006.

20. Zametkin, AJ, LL Liebenauer, & GA Fitzgerald. "Brain Metabolism In Teenagers With Attention-Deficit Hyperactivity Disorder." *Arch. Gen. Psychiatry*, vol. 50, no. 5(1993): 333-340.

21. Lou, HC, J Andresen, B Steinberg, T McLaughlin, and L Friberg. "The Striatum In A Putative Cerebral Network Activated By Verbal Awareness In Normals And In ADHD Children." 5, no. 1 (1998): 67-74. <http://www.ncbi.nlm.nih.gov/pubmed/10210814>

22. Sadock, Benjamin J., Harold I. Kaplan, and Virginia A. *Sadock. Kaplan & Sadock's synopsis of psychiatry: Behavioral Sciences/Clinical Psychiatry*. N.p.: Lippincott Williams & Wilkins, 2007. Cap. 43: 1206; Attention Deficit Disorders.

23. National Institute of Health. "Attention Deficit Hyperactivity Disorder (ADHD) Fact sheet."

24. Mark Rapport in "Better Learning Through Fidgeting. Kids With ADHD May Seem Distracted, But All That Wiggling Can Help Them Focus." John Cloud, *Time Magazine*, March 25, 2009. <http://www.time.com/time/health/article/0,8599,1887486,00.html> (July 2011).

25. American Psychiatric Association. *The Diagnostic & Statistical Manual*.

26. Singh, Ilina. "Beyond polemics: science and ethics of ADHD." *Nature Reviews: Neurosciences* 9, no. 12 (2008): 957-964.

criteria are used, a diagnosis of ADHD is 3–4 times more likely.²⁶ Are we either over- or under-diagnosing ADHD? This is a highly controversial issue amongst those who are educated in the ADHD subject.

A strong correlation also exists between the rise in standardized testing and the rise in ADHD diagnoses. According to the American Psychiatric Association, the percentage of ADHD child diagnosis has increased by 22% between 2003 and 2007.²⁷ During that same period, the amount of money spent on standardized testing rose from \$423 million to almost \$1.1 billion in 2008 (a 160% increase compared to a 19.22% increase in inflation over the same period), according to the Pew Center on the States.²⁸ Have we started to classify unconventional, different behaviors as new pathologies? Or could standardized testing be to blame for ADHD? These questions serve to express potential valid subjective opinion, which cannot be verified or denied. What serves

as truth however, is that ADHD is recognized as a disability and if appropriate and reasonable accommodations are made at school for ADHDers, they have proven to work more efficiently and productively.²⁹ Behavioural interventions have also proven to contribute substantially to the success of ADHDers.³⁰ Some of the types of treatments that an ADHDer uses in order to learn coping skills and adaptive behaviours are:

- Stimulant pharmacological medication
- Behavioural therapy management
- Individual/family counselling
- Exercise and dietary guidelines

The number of children taking psychiatric stimulants today has risen over forty-fold; current estimates are between six and seven million children are taking them.³¹ However, if appropriate classroom accommodations are made for the ADHDer, their individual learning styles and strengths are practiced, and their learning experience is heightened.³²

27. RSA Animate. *Changing Education Paradigms*.

28. Vu, Pauline. "Do State Tests Make the Grade?." January 17, 2008. <http://www.stateline.org/live/details/story?contentId=272382>

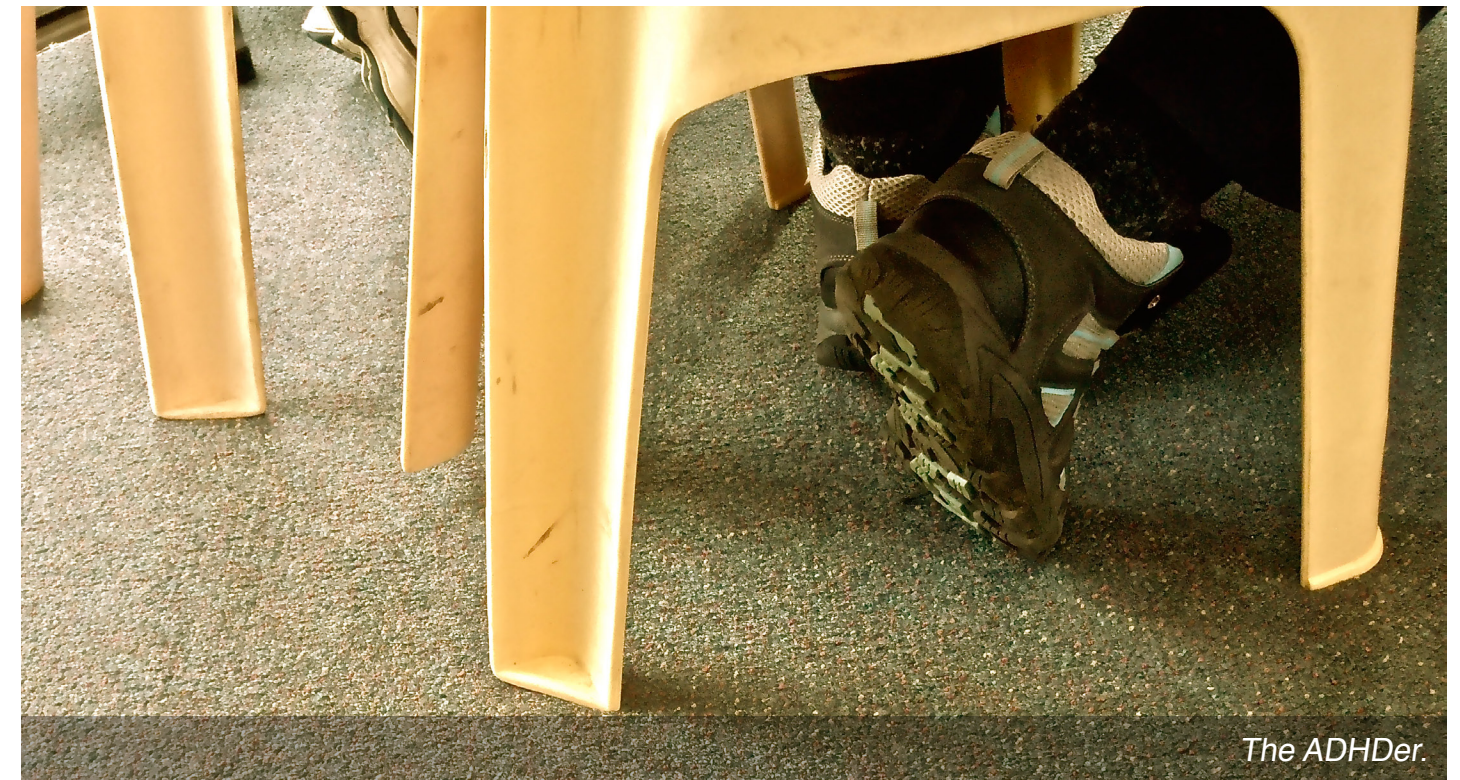
29. Learning Disabilities of Canada [LDAC]. "Fact Sheet #1: An Overview Of ADHD." March 2005. <http://www.ldaa.net/ld.php>.

30. Barnhill, Frank. "Treatment Options For the ADHDer." April 2009.

<http://adhdbehavior.com/index/modules/smartsection/item.php?itemid=32>.

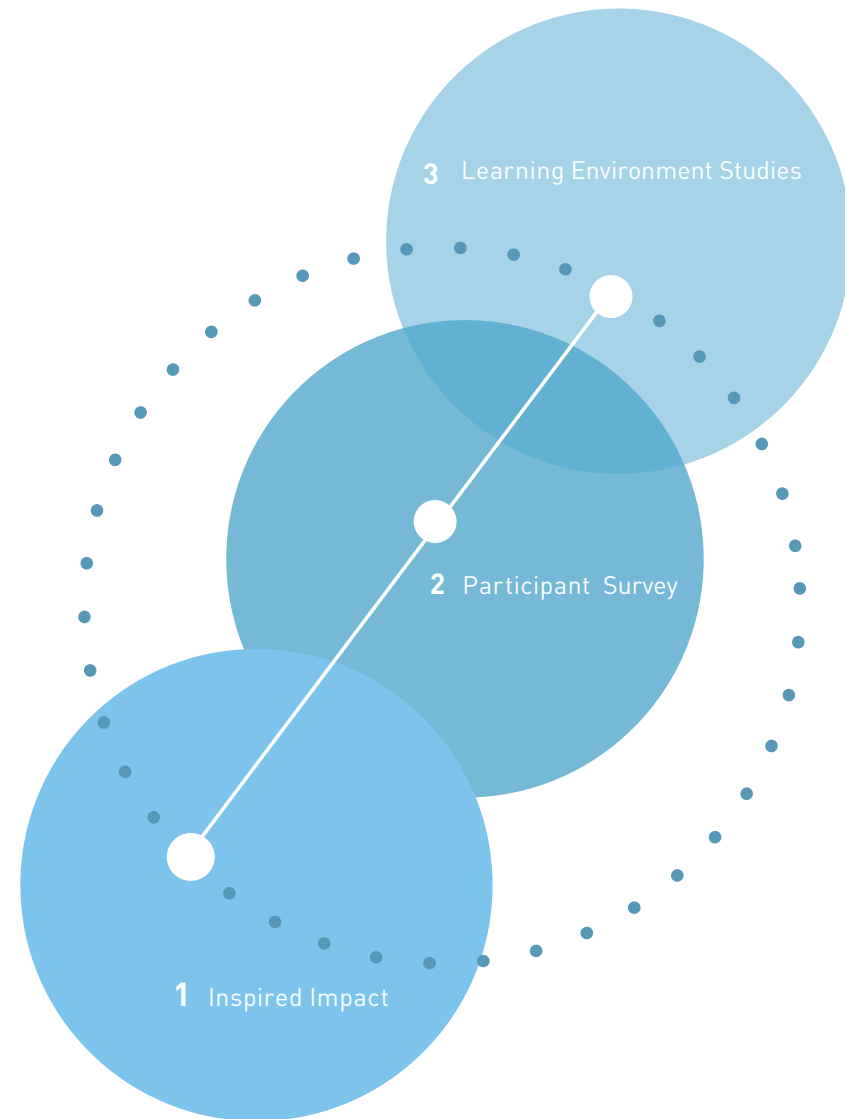
31. Citizens Commission on Human Rights. "The Hoax of Learning and Behaviour Disorders." Pamphlet, 2001.

32. U.S. Department of Education: Office of Special Education Programs. "Teaching Children with ADHD: Instructional Strategies and Practices" in *ADHD booklet*, 2004.



| **Structured Methods** |**Key Principles**

Creative thinker³³
 Driver of change
 Production of novelty
 Contemporary individualism
 Kinaesthetic learner
 Spontaneous response
 Response mechanism
 Aesthetics of interaction³⁴
 Stimulus



33. Creative Thinkers are strategists that act as a key resource of vision and support for a particular creative cause or movement. Their expertise and knowledge in an area or field is the key value to creative projects.

34. Aesthetics of interaction is the nature and understanding of the interaction with an object from an aesthetical standpoint in order to reconcile experiences with rational and feelings with thoughts.

structured methodologies //

These methods can be used as a valuable source for design criteria. Adapting and modifying traditional research methods to meet my own design research needs provided key information that helped direct my design process. My structured methodologies employed three research approaches, they were: Inspired Impact, Participant Survey, and Learning Environment Studies. Using these approaches allowed me to clearly understand the design decisions I was making and enhanced the documented support for each decision. Through self-documentation, these methods provided a starting point for a continuous design research process spurring further investigation and improvement.

RESEARCH QUESTIONS

- What behaviors and interactions do students have with present classroom furniture?
- What role can furnishings play in the classroom?
- What ergonomic, aesthetic, and functional aspects need to be included in “this type” of furnishing?
- How can we accommodate students with varying behavior and learning needs?
- Can a furnishing incorporate both sensory stimulation and movement variability?



Sir Ken Robinson.

INSPIRIED IMPACT

Drivers Of Change & Contemporary Individualism.

I was fortunate enough to attend an educational conference where Sir Ken Robinson was the honorary guest lecturer. He is known to be one of world's foremost creative thinkers. His words resonated with me and were greatly supportive to my design research, in one particularly salient remark he said, "We are living in times of revolution, but of a different quality; [we are] living in times that are unprecedented . . . [k]ids nowadays are running an empire, multitasking is getting even faster . . . [l]ife is not lineal it is organic . . . [w]e need to stand outside of our current situation and cultivate the possibilities . . . to act differently and create new solutions . . . [t]he gift of human imagination, if we invest properly, is we will see a harvest of human innovation unable to see it's future."³⁵

Modern behaviour experts have observed a surge in research related to learning behaviours and the classroom

environment. Researchers and practitioners have created new approaches and developed theories regarding behaviour management and behavioural influences. Some of these experts are not educators themselves, but have taken an interest in the learning environment. Drawing upon my notes taken during Sir Ken's lecture, I connected his ideologies with other revolutionary thinkers driving towards change. These "drivers of change" in one way, shape, or form support that there needs to be a change within the classroom-learning environment. Their research and findings together create a plethora of information and ideas supporting the movement towards what I have termed "contemporary individualism."

Sir Ken Robinson discussed the need to shift from the "traditional" to "new habitats that create new habits." It has been proven that humans move to develop and maintain neural networks and/or memories.³⁶ Children raised in active, stimulating environments produce more and denser

35. Appendix A. Sir Ken Robinson, lecture for "Inspired Impact," Massey University, Palmerston North, January 2011.

36. Van Praag, H. "Neurogenesis and Exercise: Past and Future Directions." *Neuromolecular Med.*, February 20, 2008.

neural connections. Neural networks that are used are reinforced and strengthened.³⁷ The problem today, however, is that most schools neglect self-directed and independent learning. This weakness in the education system limits the abilities, values, attitudes, and self-image of learners resulting in unfavourable consequences that are particularly problematic for the production of novelty.³⁸

Development of the mind via motion is a part of being human, and choosing to ignore it or support it is a matter of choice. Personality and environment have a huge impact. A child's social and school environment as well as academic pressures at school are likely to be of influence.³⁹ Sir Ken said, "For the most part, we override and ignore the diversity in our education system; obsessed with particular academic ability." The modern school classroom environment forces children into labels that assume their nature is a fault. Usual, unexpected behaviours are mostly discour-

37. Bruer, J.T. "The Brain And Child Development: Time For Some Critical Thinking," *Public Health Reports*, 1991, 113(5): 388-397; Nash, M.J. "Fertile minds." *Time*, 1997, 149(5): 48-56. 38. Cropley, *Creativity In Education & Learning*, 160. 39. Murphy, Suzanne. "The State of the Science on Dietary Sweeteners Containing Fructose: Summary and Issues to Be Resolved." *The Journal Of Nutrition Paediatrics*, June 2009.

aged as classrooms have their "norms" through which socially accepted behaviours and ideas have been formulated. Such "norms" diminish creative and intellectual abilities.⁴⁰

Cutting-edge educational research is proving that movement and other brain-compatible techniques support the development of thinking skills in students.⁴¹ Like Sir Ken described in his lecture, our power of imagination separates us from all other species on earth, but this power gets lost in times of conflict and shuts down. There is a high level of silent conformity regarding movement in the classroom. Such conformity leads a child to react counter-intuitively to classroom conventions, at least with respect to the child's unique learning style needs and behaviour. Because of classroom conventions, the act of learning and its facilitation becomes predictable and standardization in classroom furnishing remains unchallenged.⁴²

40. Clancy, Mary Ellen. *Active Bodies, Active Brains: Building Thinking Skills Through Physical Activity*. Bonnie Pettifor and Bethany J. Bently: Versa Prints, 2006. Xi. 41. *Ibid.* 42. *Ibid.*

"You can't fix the symptom without looking at the cause" said Sir Ken. "When rote learning occurs, non-collaboration and non-creativity develops." He continued, "Promoting creativity and innovation is key to our success, but we 'can't' do it because 'we don't have time.' The key to transformation is changing our education system, which is modelled after the nineteenth century-reflecting industrialization, regularity, and standardized age group. It may have worked then, but not now and not in the future. We have to reshape it into a different metaphor with creativity at the heart of it."

Some of the most notable commentators in the field support the necessity to include movement during classroom learning activities. Helen Hirsh Spence once said, "Most of today's classrooms are designed with teacher at the centre. If the classroom focused on the learner instead, the learning becomes paramount."⁴³ Changing locations of regular

43. OWP/P Cannon Design Inc, *The Third Teacher*.

activities allow children to explore new surroundings with their bodies and minds.⁴⁴ Dr. Dieter Breithecker states that "we train kids to learn a behaviour that is far from natural . . . stimulating the balance system activates special hormones, such as neurotrophin that has a tremendous effect on brain activity. My fidgeting stimulates my brain to resist body and mind fatigue."⁴⁵ Howard Gardner also reiterated the need for education to "embrace multiple intelligences and appeal to diverse learning styles and intellects of children." Children are guided by "stop rules" to which they choose the socially approved actions. Children do not react how they normally would in particular situations unless their reaction is deemed as the socially acceptable "correct one."⁴⁶

"People with feelings and values make up human organizations," said Sir Ken. "They have to live in synergy with their environment, successful organisms adapt and enrich

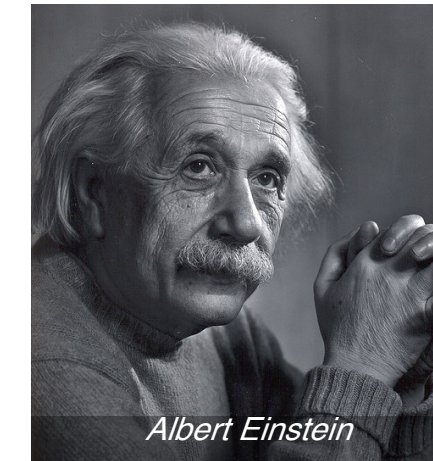
44. *Ibid.* 45. Breithecker, Dieter. *Workplace School. Demands on Ergonomic School Furniture for Today's Classroom*. Federal Working Group for Entertainment & Exercise: Wiesbaden, Germany, 2007 Revision. http://www.lsfurnishings.com/pdfs/VS/%2BBAG7_Educational_Workplace_long_US.pdf 46. Cropley, *Creativity In Education & Learning*, 65.

their environment . . . We need to cherish diversity, not constant linear movement.” Stepping towards contemporary individualism stems away from behavioural inhibition and recognises the paradigm of classroom nonconformity. Education can facilitate contemporary individualism by enhancing the privatization and execution of a child’s four executive mental functions (working memory, private speech, emotional control, & creativity).⁴⁷

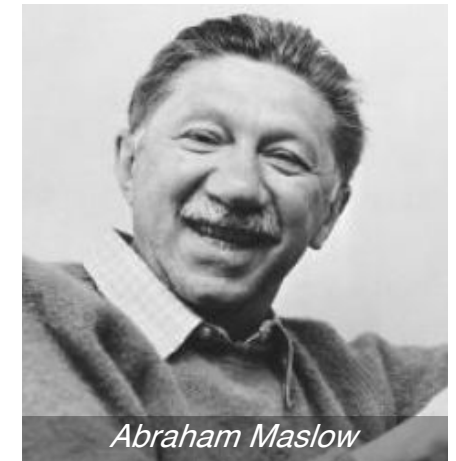
drivers of change speak so passionately about? For as one driver of change said, “The future belongs to a very different kind of person with a very different kind of mind – creators and empathizers, pattern recognizers and meaning makers. These people – artists, inventors, designers, storytellers, caregivers, consolers, big picture thinkers – will now reap society’s richest rewards and share its greatest joys.”⁴⁸



Raffi Cavoukian



Albert Einstein



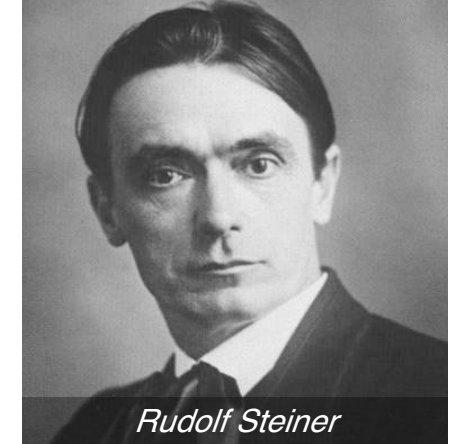
Abraham Maslow



Jean Piaget



Maria Montessori



Rudolf Steiner

I left Sir Ken’s lecture inspired more than ever before and began asking what could I – as an industrial designer – do to contribute to this forward movement that he and other

47. Barkley, Russell A. “Behavioural Inhibition, sustained Attention, and Executive Functions: Constructing a Unifying Theory of ADHD.” *The University of Massachusetts Medical Centre*, vol. 121. no.1 (1997). 65-94.

48. Pink, Daniel H. *A Whole New Mind: Why Right Brainers will rule the future*. Riverhead Trade, March 7, 2006.1.

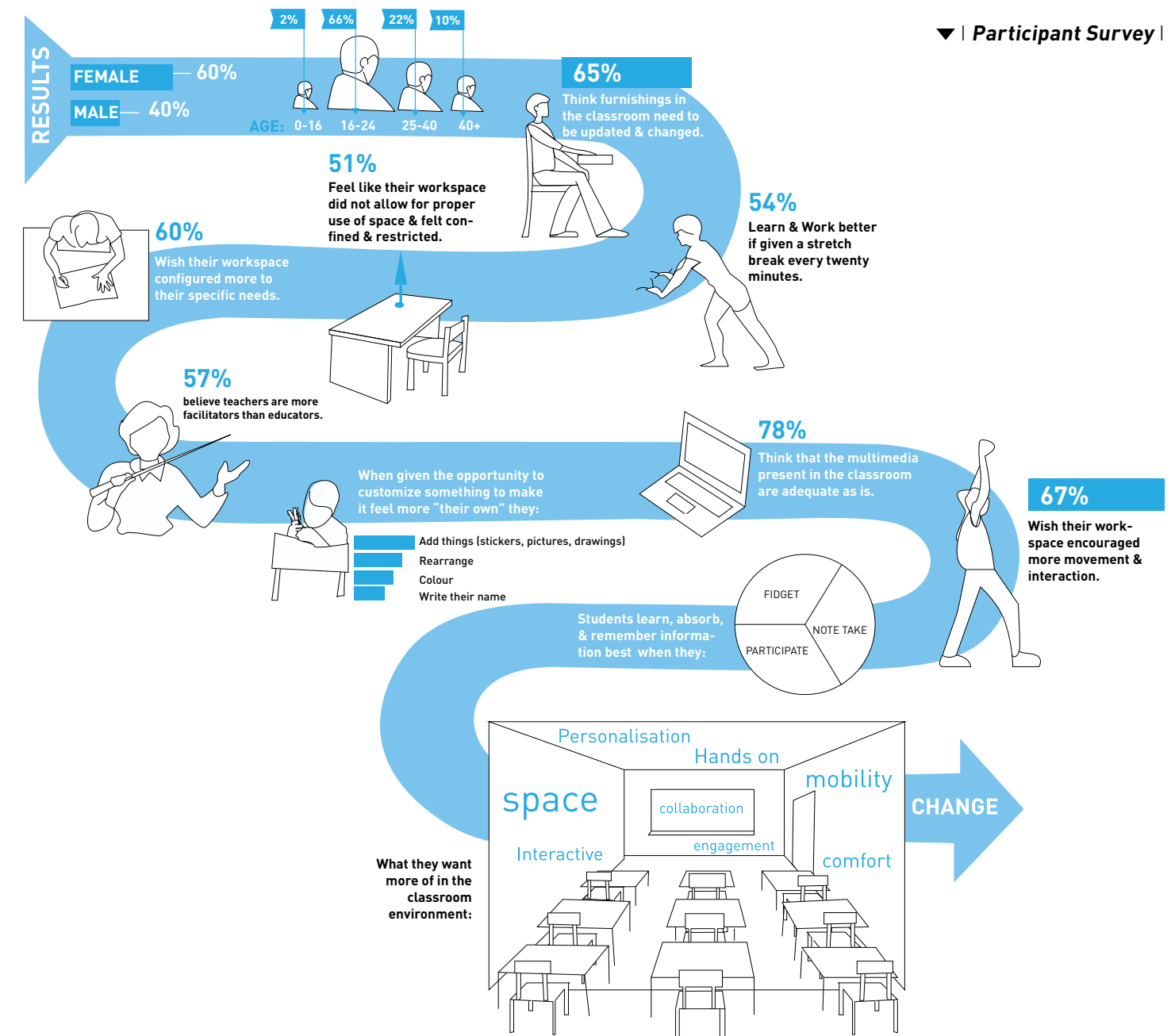
PARTICIPANT SURVEY

The survey results directed my research toward a specific age group. That age group is what I refer to in this paper as the target audience.

Briefly the target audience includes children age seven to nine, in particular those with ADHD or other learning and cognitive disabilities. The survey results are analyzed with respect to the target audience in detail below. Before delving into the analysis, however, the survey itself must be discussed.

According to the information graphic derived from the survey, I was able to evaluate more than seventy-five students' perceptions of the learning atmosphere. With the investigation into these students' early childhood educational development and experiences, a pattern of similarities was derived and used as criterion variables in my

research aimed at identifying possible classroom furnishing designs. Those surveyed believed that for the most part, classroom electronics were efficient, but furnishings were often outdated or did not satisfy their needs. The lack of personalization and individualization of the learning experience along with the desire to increase physical activity and movement while in the classroom was obvious. These findings coincided with some of the previously found arguments held by the drivers of change; people such as Rudolf Steiner, Maria Montessori, and Dr. Deiter Breitheckir. But who would benefit most from a furnishing design that responded to their learning experience?



▼ | Participant Survey |

Target Audience. The focus of this thesis was directed toward a specific ADHDer age group. According to the Adolescent Peak Hypothesis, a stereotype of intellectual growth, a child reaches peak performance in early adulthood/adolescence with a plateau for the majority of the individual's lifetime. Conformity to peer norms and pressures tend to peak in early adolescence and decline over time.⁴⁹ I want to reach those individuals who may not yet be aware of their individual behavioural norms because, with intervention, those individual norms can be realised and supported before "conformity" pressures interject and the ADHDer's intuitive nature is tarnished.

In Piaget's four classic stages of Developmental Theory, his Concrete Operational Stage (ages seven to eleven) states that brain and nervous system development allows for more complex behavioural and cognitive abilities as the central nervous system matures. Children are able

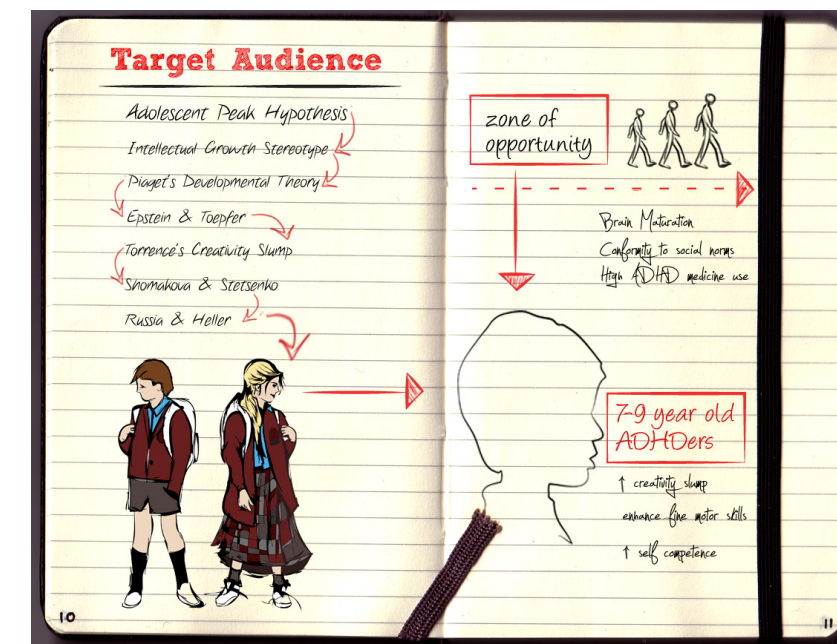
to engage in increasingly difficult cognitive tasks, develop fine motor skills and achieve a sense of self-competence and confidence to do these skills.⁵⁰ Epstein and Toepfer affirm: "[I]n perhaps of 85% of all youngsters between ages twelve and fourteen, the brain virtually ceases to grow . . . but there is a peak in fluid intelligence around age eleven (presumably when the brain is growing)".⁵¹

Torrence (1968) also identified a slump in creativity at the age of six, a finding also confirmed by Shoumakova and Stetsenko (1993).⁵² Russia and Heller stated (1994) that there was a reduction in creativity with the increase in schooling.⁵³ This could all be an effect of the school system's inability to diverge from its conventional structure and facilitate creativity through accommodation of different learning modalities.

Prior to the age of brain maturation and conformity to social norms (age twelve according to Piaget's concrete operational stage) and during the ages of high use of medication to treat ADHD (ages nine to twelve) there is a zone of opportunity where, in an effort to boost the creative slump that Torrence speaks of and enhance a student's

fine motor skills and self-competence, I determined that my thesis would focus primarily on discovering a furnishing design targeted to ADHDers ages seven to nine. These individuals are just starting the educational process and it is more likely that they are not yet as "conditioned" to conventionality as older individuals.

▼ **Target Audience.**



49. Berndt, T. J., & Keunho Keefe. "Friends' Influence On Adolescents' Adjustment To School." *Society for Research in Child Development*, Blackwell Publishing. vol. 66 no. 5 (Oct 1995): 1312-1329.

50. Piaget, J. *The Origins of Intelligence*. New York: W.W. Norton & Company, Inc., 1936, 1963.

51. Epstein, HT & CF Toepfer, "A Neuroscience Basis For Reorganizing Middle Grades Education," *Educational Leadership*, vol. 35, no. 8 (May 1978), 656-8.

52. Cropley, *Creativity In Education & Learning*, 87.

53. *Ibid.*

LEARNING ENVIRONMENT STUDIES

In early education years, ADHD is usually identified by off-task behaviour, negative impact on self-esteem, poor academic performance, disorganization, sloppy handwriting and work, disruptive or daydreaming behaviour, and social interaction difficulties. The consequences of having ADHD are multifaceted, but do not have to do with intellectual ability. Instead, they include activity limitations in daily living skills, academic challenges, diminished socialization skills, and motor difficulties.⁵⁴

ADHDers are often labelled as Kinaesthetic learners because they are active and fidgety. These students love to be physically absorbed in learning; actively exploring and moving around. They have trouble sitting for long periods of time and become bored or distracted when they are not “doing.” They are hands-on, tactile learners and when they are allowed to move they are more fully engaged in the learning process. According to Rory Stern, kinaesthetic

54. Brossard Racine, Marie, Annette Majnemer, Michael Shevell, & Laurie Snider. “Handwriting Performance in Children With Attention Deficit Hyperactivity Disorder [ADHD].” *Journal of Child Neurology*, vol. 23 no. 4 (April 2008). 399-406.

learners benefit from being permitted to work standing up or holding something in their hands to fidget while they are doing work.⁵⁵

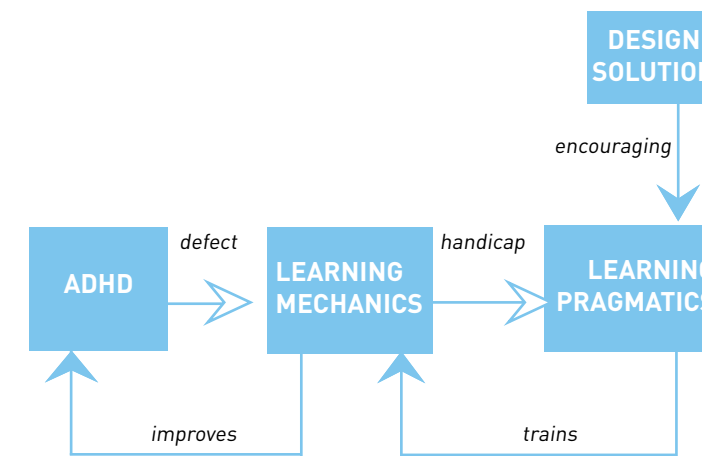
ADHD makes it difficult for people to inhibit their “spontaneous responses,” causing concentration, memory, and cognitive organization problems.⁵⁶ It can be thought of as a defect in the mechanics of learning resulting in a learning-handicap. An ADHDer’s mechanics affect the quality and quantity of learning material acquired while being taught in a standardized environment.

Mechanics includes an ADHDer’s sensory and motor capacity, perceptual skills, memory, direct-selection attention, and associative learning. Pragmatics are defined as the knowledge and skills that result through interactions with a particular environment.⁵⁷ Acquiring skills and enhancing learning experiences through training (pragmatics) would help the child’s mechanics in the classroom environment.

55. Low, Kieth. “Understanding Your ADHD Child’s Learning Style. Helping Children with ADD or ADHD Learn.” *About.com*, March 25, 2008. <http://add.about.com/od/childrenandteens/a/learningstyles.htm>
56. Mostafa, Anna, Dip HCM, PhD. “What is ADHD?.” *The Doctors Blog*, 2011. <http://psychologistbahrain.com/home>.

Creating a design solution that assists an ADHDer in acquiring skills and enhances their learning experience may affect the development of their pragmatics through the interaction they have with the design solution. This in turn could aid the student in learning through auditory stimuli (i.e., information being taught) and further encourage the development of the student’s individual learning style.

▼ Pragmatics, Mechanics, & ADHD.



This study explores the nature of the existing classroom environment in order to further understand and illustrate the myriad applications of classroom furnishings. This section

57. Wikipedia. “Treatment Of ADHD Through Working Memory Training.” Last modified November, 2011. http://en.wikipedia.org/wiki/Treatment_of_ADHD_through_working_memory_training.

considers six types of research objectives: (1) evaluation of existing furnishing innovations, (2) teachers’ perceptions of the classroom furnishings, (3) associations between classroom movement and classroom setting, (4) student behaviour and classroom furnishings, (5) determinants of classroom furnishings, and (6) use of qualitative research methods.

Ethics. Classroom study driven research unearthed a vast amount of material. The research presented here addresses the core findings discovered in various classroom settings. Though specific details were observed, such observations are generalized in this thesis so that the findings may be applied more broadly. These generalized data are the result of video analysis of classroom environments and teacher interviews. In sum, the data seeks to generate knowledge and greater understanding of the role furnishings play with students’ interactions. This study makes no claim for traditional validity as it was designed according to its experimental “quasi” guidelines.

Evaluation of existing furnishing innovations

- In New Zealand, there was a mix of plastic and Bodyfurn (made by furnware) chairs.
- In the United States, Classrooms had the same four-legged hard plastic chairs.

Teachers' perceptions of the classroom furnishings

- Too heavy to lift
- Have to move it around everywhere
- Cant fit more than one chair under the desk
- Feet get in the way
- Cost too much for a classroom set

Class movement & classroom setting Associations.

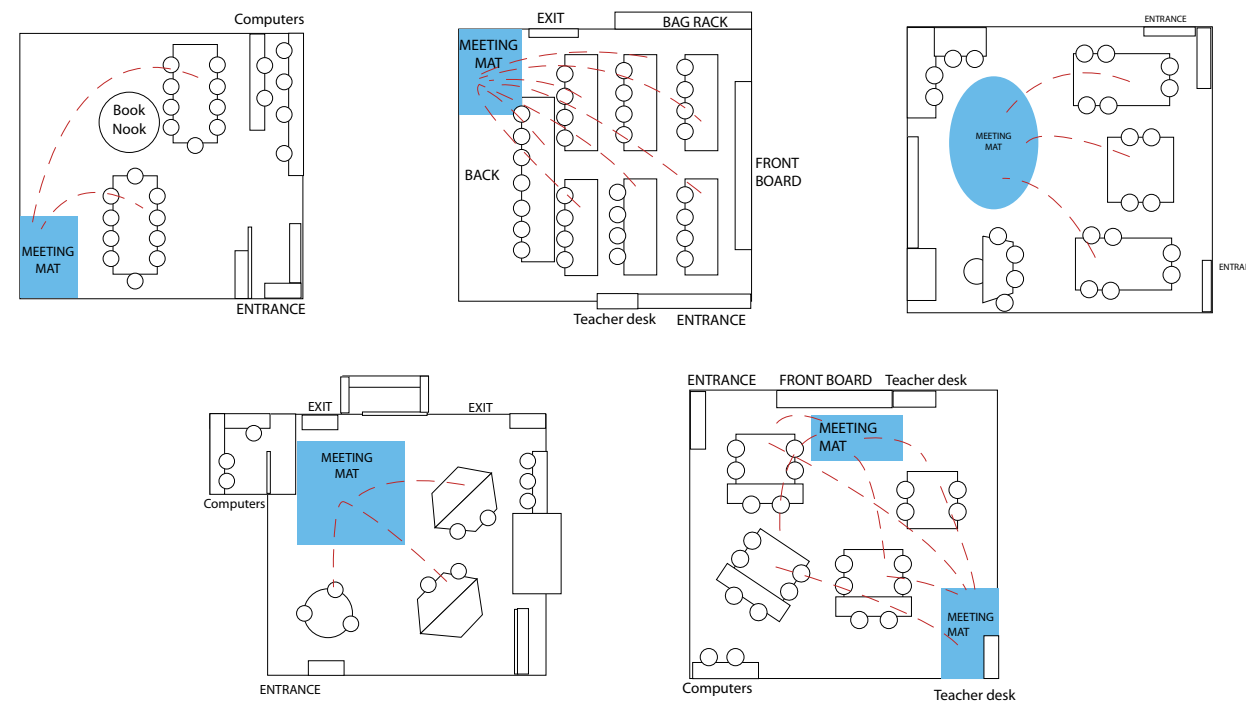
By creating "movement maps," I was able to visually comprehend the flow of various classes. Each map became an expression of movement and representative of a class's unconscious daily motions. The maps communicate spatializations and information about the relationships classrooms can have with its inhabitants that may otherwise go unnoticed.

From these maps I was able to observe that, on average, every ten to fifteen minutes the entire class moved from their desk to the floor, or from the floor to the desk. One teacher explained to me that she believed this was related to the "attention rule of thumb." That rule states that if one takes the age of a child and adds or subtracts 5 from it, the result is the amount of time that a student could stay still without losing focus; e.g., if the child is nine, they have a four to fourteen minute attention span.

school chairs ▼



▼ movement maps



Understanding a classroom's infrastructure, led to a deeper understanding of the traditional design's functions, drawbacks, and potential design solutions.

Can I develop a design solution that interacts with the child during their typical school day while also engaging their senses in order to enrich the ADHDer's classroom learning experience?

I find that sometimes the simplest movements inspire us to see differently. When I tracked the movements of the class as a whole, I started thinking:

Since classroom movements were generally the same, were individual student movements also similar?

Student behaviour and classroom furnishings. I began by studying a sample group of students. On an individual student basis I found that no two students were alike, but

generally each student's individual movements tended to be fairly predictable. Further, the longer a teacher's discussion wore on, the more overt a student's movements became. *(see "students' body motions next page).*

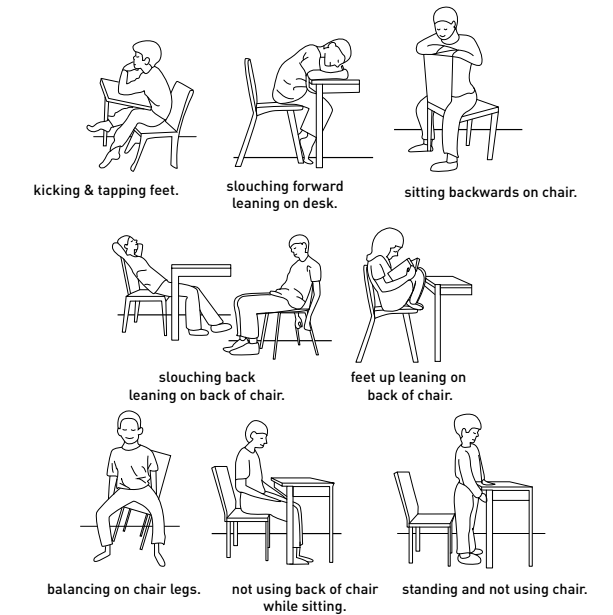
Determinants of classroom furnishings. What I found most interesting was how the students and teachers oriented themselves around the classroom furnishings. It was fairly clear that the furnishings did not work effectively for the students or teachers. Moreover, it was also clear that neither the students nor the teachers were even aware of the ineffectiveness. Their movements, so innate and unconscious, had morphed into daily routine habits. The good news is, "Bad habits are easier to abandon today than tomorrow."⁵⁸

How could I as a designer make the classroom more inviting and accommodate both individual and class movements? And can it be done unobtrusively & less restrictively?

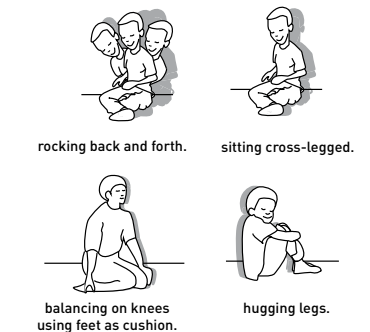
Considerations. Undoubtedly, a design solution that is conducive to a student's unique "learning" style can provide a meaningful "experience." Linked to this "learning experience" is contemporary individualism. A sensory design furnishing may be influential in aiding ADHDers. Allowing students to individually choose to enhance or reduce stimuli and sensory inputs may help to develop coping mechanisms, modify behavior, encourage focus, and foster memory development.

▼ students' body motions

MOVEMENTS OBSERVED WHILE AT THEIR DESKS

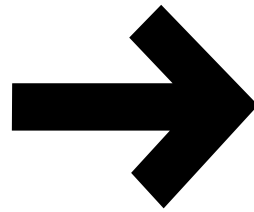


MOVEMENTS OBSERVED WHILE ON THE FLOOR



*Fidget with waterbottles, hair, glasses, face.

58. Yiddish Proverb.



search for ideas // developing contextualisation

“If we knew what it was we were doing; it would not be called research.”⁵⁹

A deeper inquiry proved necessary to further direct the design development and ideation process of this study. This deeper inquiry focused around case studies of the various schools currently experimenting with encouraging movement and avant-garde learning techniques.

VISUAL PRECEDENTS

Finding a way to integrate movement into the classroom not only helps those with learning disabilities (ADHDers), but also helps facilitate a class’s incredibly diverse group of learners. Current research shows that regular physical activity helps children perform better in school.⁶⁰ Movement

encourages holistic learning. When “the whole-brain” approach is utilized students can form interconnected neural highways for memory (Piaget 1963; Buschner 1990).⁶¹ The brain craves novelty, stimulation, and change – it craves movement. In adding movement to learning, the brain re-orient itself to the change and returns to more holistic function (Hannaford 1995; Promislow 1999).⁶²

59. Albert Einstein. ThinkExist. “Albert Einstein Quotes.” <http://thinkexist.com/search/searchquotation.asp?search=If+we+knew+what+it+was+we+were+doing+%3B+it+would+not+be+called+research>. (July 2011).

60. Kuczala, Michael S., Traci Lengel, & The Regional Training Center. *The Kinesthetic Classroom: Teaching and Learning Through Movement*. 2010.

61. Clancy, Mary Ellen. *Active Bodies, Active Brains: Building Thinking Skills Through Physical Activity*. Bonnie Pettifor & Bethany J. Bently: Versa Prints, 2006. 6-7.

62. *Ibid*, 7.

Moorsbridge Elementary Portage, Michigan, USA

Students can stand & chew gum during lessons, stretch putty, squeeze small, squishy balls to help them learn. Allow children to use their natural tendencies to fidget in order to focus, concentrate and learn. "If you need to stand to learn, you stand to learn."⁶³



63. Aupperlee, Aaron. "Teachers Use Movement To Keep Fidgeting Students Alert In Classroom." *MLive.com*, August 2009. http://www.mlive.com/living/kalamazoo/index.ssf/2009/08/teachers_use_movement_to_keep.html.

BCSE School Furniture Masterclass (British Counsel For School Environments)

"Bodies in Motion" by Dr. Dieter Breithecker explains the thinking through furniture and the importance of it in school design.⁶⁴



64. Breithecker, Dieter. "BCSE school furniture masterclass bodies in motion: an ergo-dynamic concept for holistic learning and human development." PowerPoint, 2010. <http://www.slideshare.net/IFordham/school-furniture-masterclass-bodies-in-motion>.

Perspectives Charter School Chicago, Illinois, USA

Did "attention endurance tests" which recorded the students' attentiveness and ability to concentrate. They found that rocking, swiveling, and rolling, while seated increased levels of concentration during test taking.⁶⁵



65. Steelcase. "The Classroom of the Future: How does space influence Learning?." *A Steelcase Knowledge Paper*, October 2008. <http://www.steelcase.eu/en/resources/knowledge-library/documents/the%20classroom%20of%20the%20future.pdf>.

Steelcase Int'l & Ludwig-Maximilian University Munich, Germany

In this case study, while standing more mobile positions both accuracy of thinking and idea innovation were higher than when sitting down, even though students felt marginally less comfortable working in a standing position. As a group, however, correct decisions were made 40% more often.⁶⁶



66. Breithecker, Dieter. *Workplace School Demands on Ergonomic School Furniture for Today's Classroom*.

Saarland University Germany

Investigated how movement effects body temperature. They concluded that with dynamic seating, higher body temperatures occur, which in turn increases blood circulation allowing for more oxygen to enter the brain and contribute to easier concentration.⁶⁷



67. Aeris Pulse Furniture. "Sitting Still Makes You Ill And Leads To Bad Posture: At Last More Movement For Children When Sitting!" Swoppster, November 2008. www.swoppster.de.

Case Of The Pink Stool

"It is used by one of my students (let's call him gregory) in lieu of a chair. I noticed early in the year that he had difficulty sitting still for any reason. The stool changed everything. "Hey gregory, I notice you're always jiggling. . . & moving in your chair. Wanna try kneeling on this stool instead?" "Ya sure, mr. Lee, Oh mi-god! I love it!"⁶⁸



68. Lee, Royan. "The Little Things." *The Spicy Learning Blog*, May 19, 2011. <http://spicylearning.wordpress.com/2011/05/19/the-little-things/>.

Sedley Place Tom Wates, Max Chair

This chair prevents school children from toppling backwards. For many people the rebuke of 'you'll fall and hit your head will bring back memories.'⁶⁹



69. Pytel, Barbara. "Chairs and Other School Hazards: Rocking In Chairs Leads To Accidents." *Educational Issues*, Suite101, February 24, 2008. <http://barbara-pytel.suite101.com/chairs-and-other-school-hazards-a45694>.

SAFCO

Has developed a stand up desk; Their motto: stand up for learning. They state that "the benefits of standing are enhanced mental focus, increased caloric expenditure, improved body ergonomics, better handwriting, just to name a few..."⁷⁰



70. Saulny, Susan. "Students Stand When Called Upon, and When Not." *The New York Times*. February 24, 2009. A1. <http://www.nytimes.com/2009/02/25/us/25desks.html?ref=todayspaper>.

Squizits

Children with a way to release excess energy through repetitive hand motions & various fidgets.⁷¹

Mayo Clinic

Researchers have designed a chairless classroom that they say may cut down on childhood obesity even as it helps children focus on learning and being happier in school.⁷²

Teachers in Minnesota & Wisconsin, USA

Say they know from experience that the standup desks help give children the flexibility they need to expend energy and focus better on their work rather than focusing on how to keep still.⁷³

BodyFurn

New Zealand's Furnware Company has developed classroom furniture and reports that "a higher proportion of students said they lost concentration more easily prior to Bodyfurn than with Bodyfurn."⁷⁴

Toa Payoh Sensory Playground Singapore

The theme for this playground is 'Play with Your Senses'. From the theme, it encourages the users to use their five senses when playing at the playground.⁷⁵

Protac Myfit Vest

A sensory stimulating vest with a weight helps to calm and improve the body awareness. The special design of the vest produces distributed point pressure on the body, thereby stimulating the sense of touch through muscle and joint sensation; it is ideal for those with Autism, ADHD, Learning Disabilities, and Dementia.⁷⁶

Material Teddy

Is made of various untreated natural materials that allow children to play and stimulate their senses to encourage the development of a healthy and balanced cognitive system. It reintroduces children to a rich sensory experience by stimulating the five senses.⁷⁷

◀ **other inspirations.** Finding new design developments created for those with sensory issues proved to be an important area to explore in order to help both under-responsive ADHDers & overloaded ones. The designs to the left helped to visually translate the tools used in connecting mind & body stimuli. Please see Appendix B for further examples of furniture designed to increase active movement.



71. Turner, Troy, March 29, 2011. Squeezits designed by Lavinia Chu. *Yanko Design Blog*. <http://www.yankodesign.com/2011/03/29/squizits/>.



72. Olsen, Kay, September 13, 2006, "Chairless Classroom Creates Spatial inequality." *Alas Blog*, WordPress. <http://www.amptoons.com/blog/2006/09/13/chairless-classroom-creates-spatial-inequality/>.



73. Saulny, Susan. "Students Stand When Called Upon, and When Not."



74. Furnware, Bodyfurnsystem. <http://www.furnware.co.nz/>.



75. HDB'S Corporate Newsletter. "A Treat for the Senses." *House Word* (2009): Nov/Dec issue. <http://houseword.sg/newsletter/200911/articles.php?aid=6>.



76. Kingcraft, Protac Equipment. "Protac MyFitVest." <http://www.kingcraft.co.uk/solutions/children/protac-sensory-equipment/protac-myfit-vest.html>.

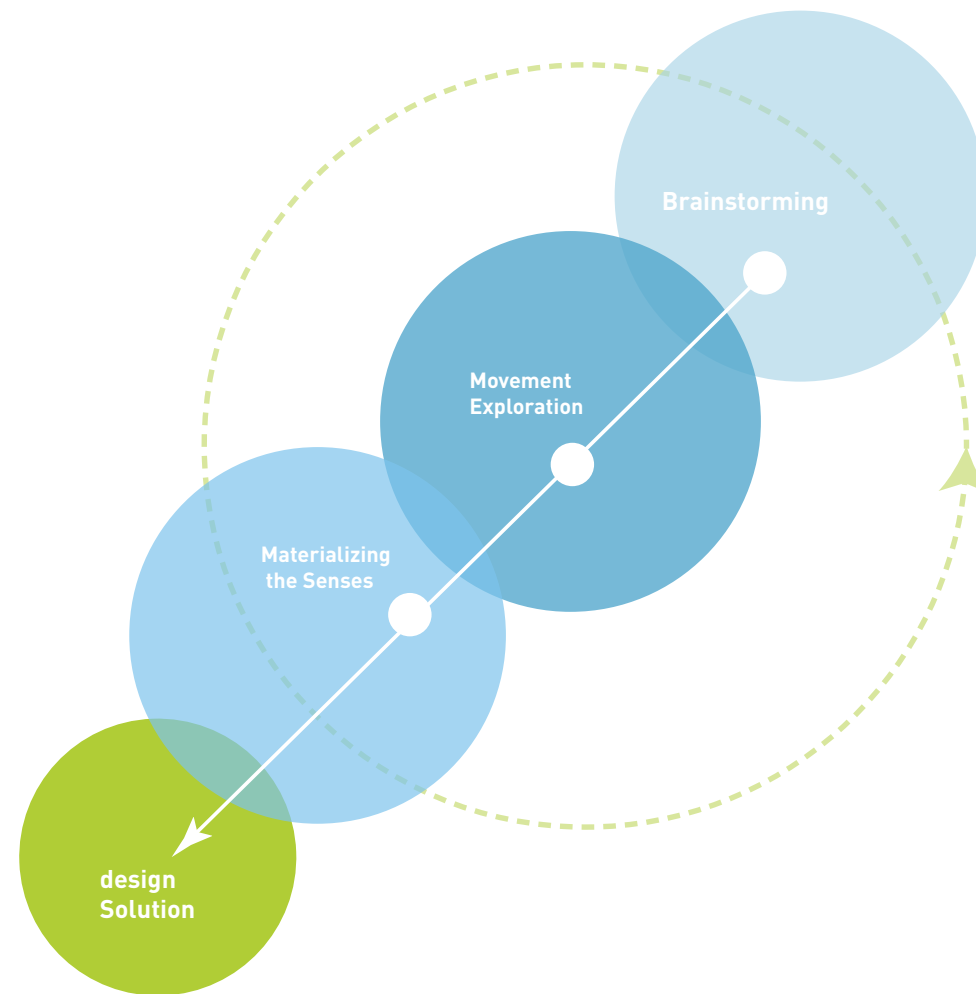


77. Shinoda, Makikoshinoda. "Material Teddy." Shinoda Studio, 2011. <http://www.makikoshinoda.com/products/material-teddy/>.

| Creative Methods |

Objectives

Remain curious & aware
 Reflect
 Defer judgment (incubation)
 Make connections
 Tolerate ambiguity
 Accept contradiction
 Recognize emotions
 Take note of behaviors
 Go beyond the verbal

**creative methodologies //**

Creative behavior is that which demonstrates uniqueness and value in its product. Thus, creativity is a function of knowledge, imagination, and evaluation. Without knowledge there can be no productive creativity.⁷⁸ Hence, I too had to perform a research role and explore specific elements of interaction and sensory stimulation most appropriate for a design solution – this exploration required active participation. The following explorative activities, (Brainstorming, Movement Exploration, and Materializing the Senses) were not undertaken sequentially rather they were done collectively. Through the rhythmic interplay of exploration and evaluation, these processes informed my final design.

INTENT

- Analyze the various response mechanisms of the classroom environment stimuli in order to gather information necessary to perceive the classroom through the sensations of an ADHDer.
- Develop aesthetics of interaction that will improve an ADHDer's decision-making and alter their cognition in an influential and meaningful way.
- Increase a student's interactive engagement through the implementation of new actions by means of a design solution that generates an output of emotional, motivational, and brain-focused sensory response to the classroom environment stimulus.

78. Parnes, S.J. *Creative Behaviour Guidebook*. Scribner Inc., January 2000.

BRAINSTORM

“Research is only as good as its interpretation.”⁷⁹

ADHD has long been connected to giftedness.⁸⁰ According to the Myers-Briggs type indicator, many of the personality traits (e.g., daydreaming, sensation seeking, playfulness, deficient social skills, etc.) of creative persons are also present in ADHDers.⁸¹ ADHDers are also energetic, productive, and have the ability to hyper-focus. Hyper-focusing is a type of mental concentration, a sort of “tunnel vision” where outside distractions are blocked out. An ADHDer’s ability to see things clearly and imaginatively is their gift – unfortunately, it is also their curse.

Dabrowski’s “Theory of Disintegration” formulated in 1960 expresses those persons born with “over-excitabilities” have greater developmental potential than others. Holly A.

White from the University of Memphis and Priti Shah of the University of Michigan, published an ADHD and creativity study showing that “adults with ADHD showed higher levels of original creative thinking . . . and higher levels of real world creative achievement, compared to adults without ADHD.” They also found that faced with a problem most people prefer to study the problem or refine ideas, ADHDers on the other hand prefer to generate new ideas.⁸² The ADHDer is usually right-brain dominant in their information processing and learning style. In order to get in touch with my creative right-brain side, I participated in a week-long brainstorming exercise. I set aside all worries, emphasized making “designer-like drawings,” and gave myself the freedom to just scribble, jot, doodle, and draw any and all visual ideations of furniture designs. Not taking into consideration the look of my drawings or how they would appear to the outsider was freeing. I let my hand do the talking and approached the exercise without reservation.

Juxtaposed to a verbal language, drawing only has meaning through interpretation; yet, drawing can reveal a language of expression that is a uniquely different way of observing the world. One’s trajectory of experience is a matter of a viewer’s input, perspective, and their ability to step outside

of themselves.⁸³ To my surprise, this unconventional practice unlocked many ideations that could be individually interpreted and analyzed. Visualizing various design iterations in picture form helped direct and align the next stages of analysis.



79. Ann Burdick in Laurel, *Design Research, Methods and Perspectives*, 82.

80. Wilson, Charles. “ADHD Health.” Last modified 2010. <http://www.adhd-health.com/adhd-causes/gifted.php>.

81. Mehl-Madrona, Lewis. “Conventional, Innovative And Alternative Therapies For The Treatment Of ADHD (Attention-Deficit Hyperactivity Disorder).” *Forum*

on Alternative and Innovative Therapies, ADHD Treatments, 2008. http://www.healing-arts.org/children/ADHD/treatments.htm#College_of_Medicine.

82. Green, Rick. “ADHD and Creativity: A double-Edged Study?” *Attention Deficit Disorder Association [ADDA]*, 2010. http://www.add.org/page/a_double_edged_study.

83. Cross, A. “Intelligence: The Use Of Codes And Language Systems In Design.” *Design Studies*, vol. 7, no. 1 [1986]. 14-19.

MOVEMENT EXPLORATION

“True enjoyment comes from activity of the mind and exercise of the body; the two are united.”⁸⁴

Movement helps a child’s working memory and information retrieval process. Long-time ADHD researcher Mark Rapport supervised a forthcoming study in the *Journal of Abnormal Child Psychology*. In the study, Rapport, a professor at the University of Central Florida in Orlando, notes that a person’s activity level — how much one moves around in everyday situations — is one of the most fixed parts of a person’s personality. If you are a fidgety kid you will be a fidgety adult, even if you learn to manage your movements with caffeine, stress-reduction, a personal trainer, or other adult accoutrements.⁸⁵

Often in classroom settings where sitting quietly is expected, the various symptoms of ADHD materialize. For example, a student might be constantly fidgeting, squirming, moving around, climbing, always “on the go,” or have difficulty playing quietly or relaxing. There is a constant struggle for the student to feel at ease in their surroundings. Thom Hartman’s Hunter versus Farmer Theory of ADHD explains that these symptoms are because of ADHDers’ hunter ancestors. ADHDers are highly adaptive “hunters” and therefore more impulsive in nature. This gives them a thirst for excitement and an inability to be sedentary like the so-called “normal” people (i.e., Farmers). Hartman believes that ADHDers do not have a disorder, but just need to find their ‘niche’ in our modern western society.⁸⁶

Learning to manage the process of learning involves being aware of what one is doing. John Flavell has termed

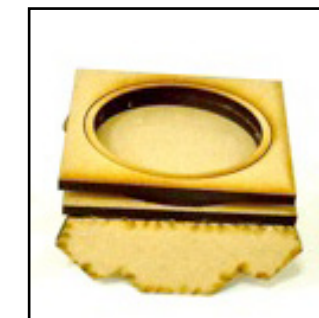
such an intuition of one’s mental processes as “metacognition.”⁸⁷ Aiding a learner in intuitively managing their learning behaviours can prepare them for times when learning difficulty intervenes.

Experimenting through feeling.

“Design isn’t merely about the object, but the extensions of the object through its communications with the end user.”⁸⁸

A classroom furnishing can have both direct and indirect impacts on an ADHDer’s stimulation. Furnishing can either be used as an object that aims and prepares the child for later skills in life, or can damagingly impair the child’s learning and developmental potential. By experimenting through feeling, I grew aware of the various emotional connections and movement embodiments of the ADHDer; these emotional discoveries helped influence original design concepts.

In order to mimic the interactions a child might have with my potential furnishing design (on a small scale), I created mini mock-ups of objects, which provided a range of test movements. I then reflected on my personal experience of these movements by asking questions like, “What was I feeling when the frictional force of gravity and my hand interplayed? Did I like it? Was it a new feeling?”



84. Alexander von Humboldt in Thompson, Catherine R. *Prevention Practice: A Physical Therapists Guide To Health, Fitness, And Wellness*. SLACK Inc., February 1, 2007. 23.

85. Cloud, John. “Better Learning Through Fidgeting. Kids With ADHD May Seem Distracted, But All That Wiggling Can Help Them Focus.”

86. Wilson, Charles. “ADHD Health.” Sec. ADHD Theories: Hunter Vs. Farmer Theory.
87. Triolo, Santo J. *Attention Deficit Hyperactivity Disorder in Adulthood: A Practitioner’s Handbook*. Brunner & Mazel, New York, January 1999.

88. Stacey Purpura in Laurel, *Design Research, Methods and Perspectives*, 63

As we perform ourselves through an interactive design process, we seek understanding through intuition, observation, and critical theory. In the construction of what we call 'me' are several different characters.⁸⁹ Designer, daughter, sister, vintage shopper, yoga enthusiast, ADHDer; these are just some of my characters. My performances are created through the context of these characters.⁹⁰ I immersed myself into a performance exercise using the identified student movements discovered in the classroom study as a foundation.⁹¹ Actively participating in this performance increased the likelihood that I would design a furnishing that

would enable students to perform traditional classroom actions with greater pleasure and ease.

The importance of ensuring that movement did not overstimulate became apparent through the experiment. Even the smallest changes in angular rotation or frictional force can help rouse the vestibular system (our sense of balance, coordination, and eye movements). However, when the forces become too great movements can be interrupted with either discomfort or fear. Such interruption occurred, for example, when the wooden board is was using smashed my hands.



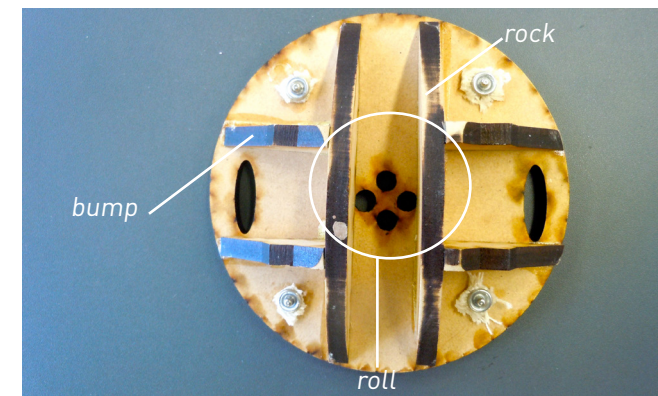
89. Laurel, Design Research, *Methods and Perspectives*, 49.

90. *Ibid.*

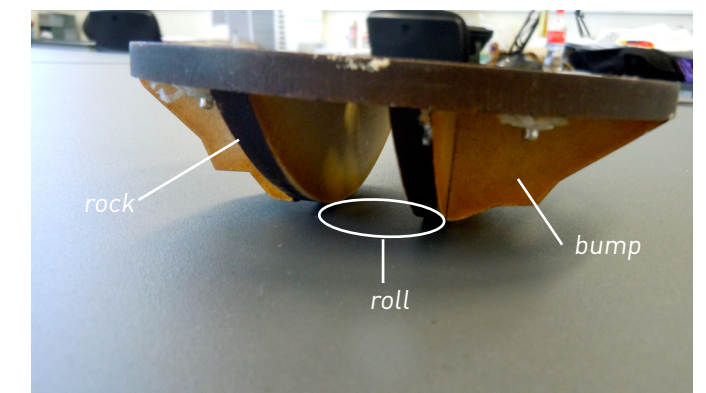
91. Figure. "Student Movements" p. 40.

↪ **Rock.** Designed to calm the ADHDer, this smooth rocking motion rhythmically soothes the ADHDer's tendencies to squirm.

⚡ **Bump.** Designed as an intervention tool, the bumping motion increases a student's tolerance to stimulation. This distinctive movement delivers an unusual sensation that potentially has the ability of decreasing a student's possible hypersensitivities to the classroom environment.



↔ **Roll.** Together, rock and bump form a rolling motion intended to help ADHDers keep their balance and work on coordination moves. Through the use of this object, the user can be aware of where their body parts are and how they are moving. These movements encourage the body to readjust itself towards a state of harmony and well being; ultimately encouraging learning to transpire. The tangible results from these tests established desired movements to further improve upon.



◀ *By trial and error, I experimented, practiced, and played around until I developed an object that provided the most comforting and salient sensations. These three engagements came to be known as a "Rock, Bump, and Roll" movement.*

MATERIALIZING THE SENSES

Often, ADHD students use all of their five senses for learning, but usually favour one sense over another. The ability to attend to a task depends on the ability to screen out, or inhibit, nonessential sensory information, background noises, and visual distractions.⁹² Sensory processing disorders are also often associated with an ADHD diagnoses.⁹³ Like how the eye responds differently to bright light versus darkness by adjusting the aperture of the pupil, so too should the acuity of sensory processing fit other sensations. However, with some ADHDers, their senses respond with delay or with sub-optimal levels of effectiveness.⁹⁴ ADHDers need a deliberate, conscious interplay between their short-term and long-term memory in order for facts to be absorbed. Accommodating various learning styles and developing sensory skills can lead to this.⁹⁵

Investigating “through the senses.” ADHDers are hypersensitive beings. It is not unusual for an ADHDer to feel both emotionally and physically hypersensitive. Those with attention disorders may be highly sensitive to sights, sounds, or tactile sensations. The use of their senses: touch, taste, smell, sight, and sound (a child’s nervous system) maybe disturbed by sensory overload in a classroom, which may cause an ADHDer to “shut down.”⁹⁶ This “shut down” can effect their imagination (or lack thereof), their communication skills, and also their spatial perception. Hypersensitivities can also be major distractions; if one does not like the texture of their classroom chair or desktop, their attention will be focused on that and not the lesson at hand. Taking into consideration that ADHDers are emotional beings, singling out ADHDers from non-ADHDers is discouraged. The negative labels associated with ADHD can cause

ADHDers to feel more sensitive to the comments made from non-ADHD students and ultimately make them more nervous and anxious about learning and classroom participation.

Awareness and understanding of various sensitivities can allow the ADHDer to better deal with their disorder. When sensory stimulations are acted upon, organized, and coordinated effectively, learning is more likely to occur. With the use of simple aids, sensory stimulation can be well managed and a child can engage in multiple senses at once (e.g., listening, reading, and writing) enhancing their kinaesthetic, visual and auditory learning skills (Stern, Rory).⁹⁷ By exposing ADHDers to various physical hypersensitivities in small amounts over time, their stress, anxieties, and/or fearful responses will be alleviated as their awareness of them increases.⁹⁸

I now set out to answer the question, what materials would positively influence the sensory functionality of this design solution?

Through acquiring various materials ranging in texture, colour, and feel, I experimented with the sensory and emotional connections associated with each material.



92. Stephens, Linda C. "Sensory Integrative Dysfunction in Young Children." *AAH-BEI News Exchange*. Vol. 2, No. 1 (Winter 1997).

93. Scherer, Priscilla. "Is It Sensory Processing Disorder (SPD) or ADD/ADHD? Understand The Difference Between Sensory Processing Problems And Attention." *ADDitude Magazine* June/July (2004). <http://www.additudemag.com/adhd/article/793.html>.

94. Gozal, David & Dennis L. Molfese. "Selective Attention and ADHD." *Attention Deficit Hyperactivity Disorder: From Genes To Patients*. Humana Press Inc. 2005. 269-270.

95. Novak, Joseph D., & Bob D. Gowin. *Learning How to Learn*. 1st ed., Cambridge University Press, September 28, 1984.

96. Cook, Larry, & Deborah Merlin. *Victory Over ADHD*. *EcoVision Communications*, March 10, 2006. <http://www.thenaturalguide.com/adhd-index.html>.

97. Low, "Understanding Your ADHD Child's Learning Style. Helping Children with ADD or ADHD Learn."

98. Matlen, Terry. "Managing Hypersensitivities in Children with ADHD." *HealthCentral.com*. Health Central, August, 2008. <http://www.healthcentral.com/adhd/c/57718/36468/hypersensitivities>.

At one point, I created a set of textured seats. At first I thought this would be most desirable for ADHDers, however, I soon found that these seats could be more detrimental than beneficial. Some were soft; some were hard; some gave off feelings of discomfort, whereas others provided a sense of pleasure and peace of mind (soft, furry, bumpy, rough, smooth, cold). What I preferred one day changed the next. My own experience and reaction to the various materials became a very personal matter and was entirely different than others who also touched and played with the various seats. I realised that one's hypersensitivities and

desired sensory stimulants could vary on an individual and daily basis.

Clearly, then, providing predetermined textured seats was not the answer. In fact, each ADHDer needs to develop a sense of autonomy, the sense of being separate, to individualize their own sensory exploration and be allowed to alternate their own sensory stimulation desires. Providing the opportunity for individual alteration proved to be a better solution than forcing sensory stimulations.

Mechanical Questions

- Could I positively reinforce a child's ability to hyper-focus through the interplay of their senses by introducing them to new sensations?
- Could I develop something that could accommodate both the ADHDer and non-ADHDer?
- Is there a way to help an ADHDer relax and self-medicate their behaviour to potentially reduce the emotional sensitivities associated with having ADHD?



- What was the simplest way to accommodate an ADHDer's sensory fidget needs and wants?
- How could I accommodate changing and varying sensory stimulation needs?

Functionality Objectives

- Involve the ADHDers in the interplay of their nervous system and creative ability
- Allow ADHDers to be apart of the design process
- Provide individual appeal and alteration
- Enhance fine motor skills
- Satisfy fidget desires

Physicality & Usability. The importance of individualized sensory stimulation cannot be overemphasized. As proven in this part of the design process, the proposed design solution must be conducive to varying ADHDers' sensory desires and provide sensory stimulation and fidgeting opportunities on an individual level.

To find the best way to accommodate different ADHDer sensory and fidget needs and wants, without singling out the ADHD student, I salvaged a plethora of materials (taking both fidgeting and various tactile sensations into consideration) and created miniature seat covers that could potentially be created or reproduced by the ADHD child, if they desired. After experimentation, I found that a stretch fishnet fabric molded to a seat cover was the best "fidgety sensory stimulator" because it provided the opportunity for one to create an individualized furnishing by adding on any accessories the ADHDer might choose, and, alternatively, because it could also be left "as is" if one so desired. Both the ADHDer and non-ADHDer could design and re-design their cover using their hands or a large plastic needle to sew on ornaments, fidgets, fabrics, etc.



SYSTEM DEFINED

Check-list.

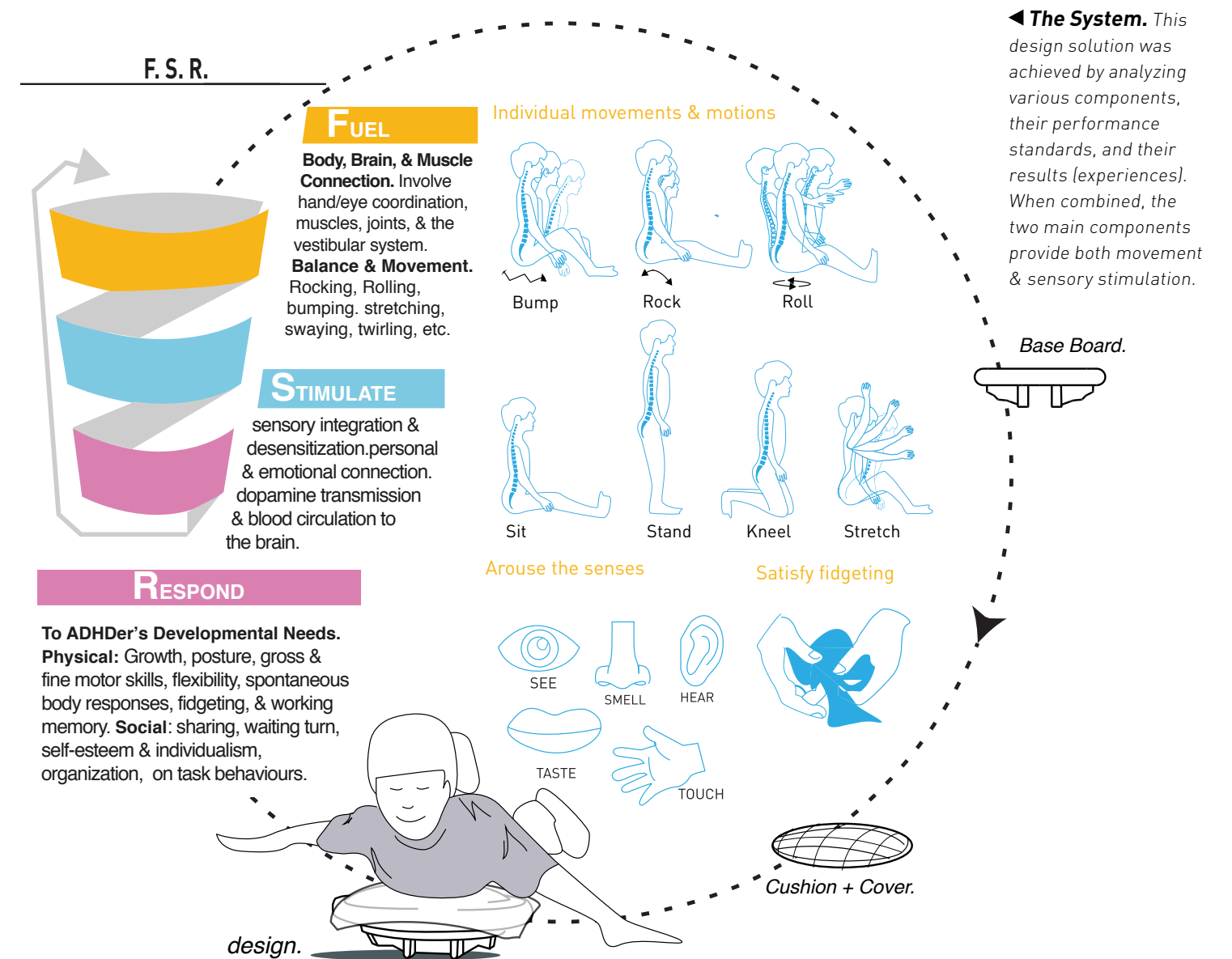
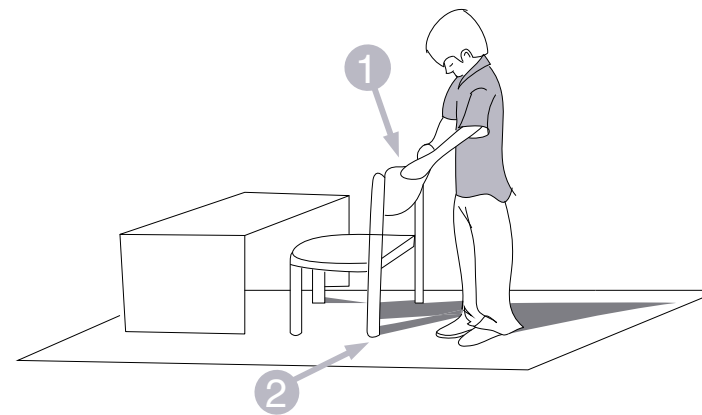
- Use at least two sensory modalities (vision, touch, hearing, etc.)
- Communicate and connect emotionally to the design process
- Emphasize the ADHDer as a source of inspiration for innovation
- Provide behavior modification & enhance mobility
- Have a experiential, physical, and social interaction
- Satisfy the ADHDer by drawing upon their various needs

By increasing reasonable accommodations for ADHD students, through a furnishing that is responsive to the ADHDer's learning experience in the classroom environment, learning and development of ADHDers can happen

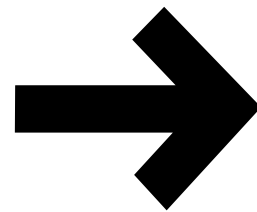
in "the right way." This is ultimately achieved by Fueling, Stimulating, and Responding to the ADHDer's learning, developmental, & social needs.

In a child's interaction with a furnishing there are two key sensory input "hot spots" that produce a range of sensory reactions and motor outputs, they are:

1. How the child interacts with the furnishing itself.
2. How the furnishing interacts with the ground on which it is placed.



◀ **The System.** This design solution was achieved by analyzing various components, their performance standards, and their results (experiences). When combined, the two main components provide both movement & sensory stimulation.

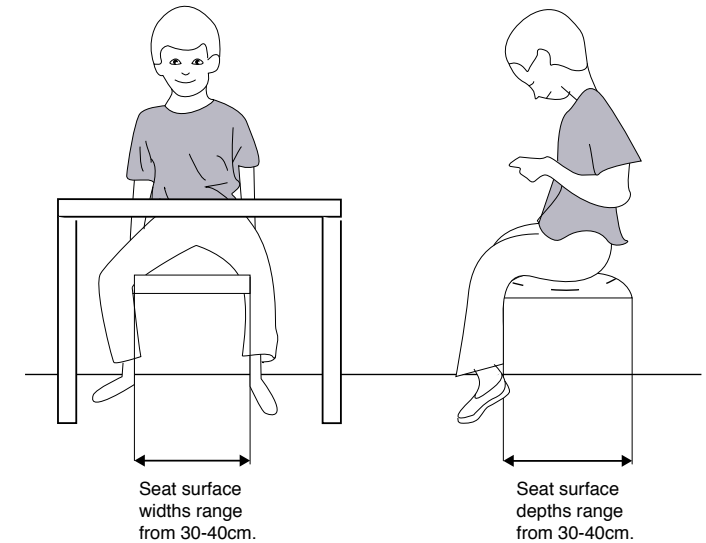


search for solutions // testing process

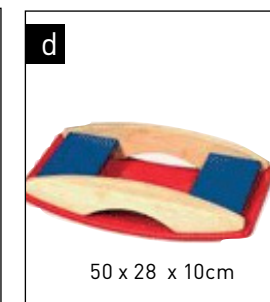
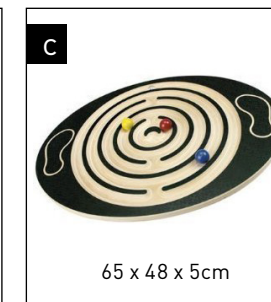
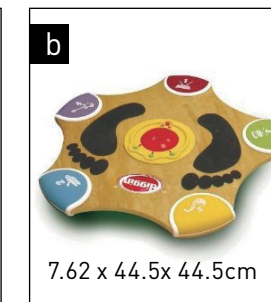
In order to fine tune and optimize the performance of the proposed design solution, a comprehensive inquiry into the nature, origin, and fabrication of the design was necessary. That inquiry led to discovering a nexus between prior research and the self-monitored participatory design process I engaged in, offering further support for my design.

Firstly, the anthropometric dimensions of students and the design solution's dimensions must have a sound relationship.

▼ I looked at various furnishing dimensions (seat surface width and seat surface depth) already used in the classroom environment for children ages 7-9.



▼ Existing balance boards used by children in this age group were also duly noted. See Appendix C for an indepth analysis.



GENERATED OUTCOMES

Three-dimensional drawings & free-form fabrication.

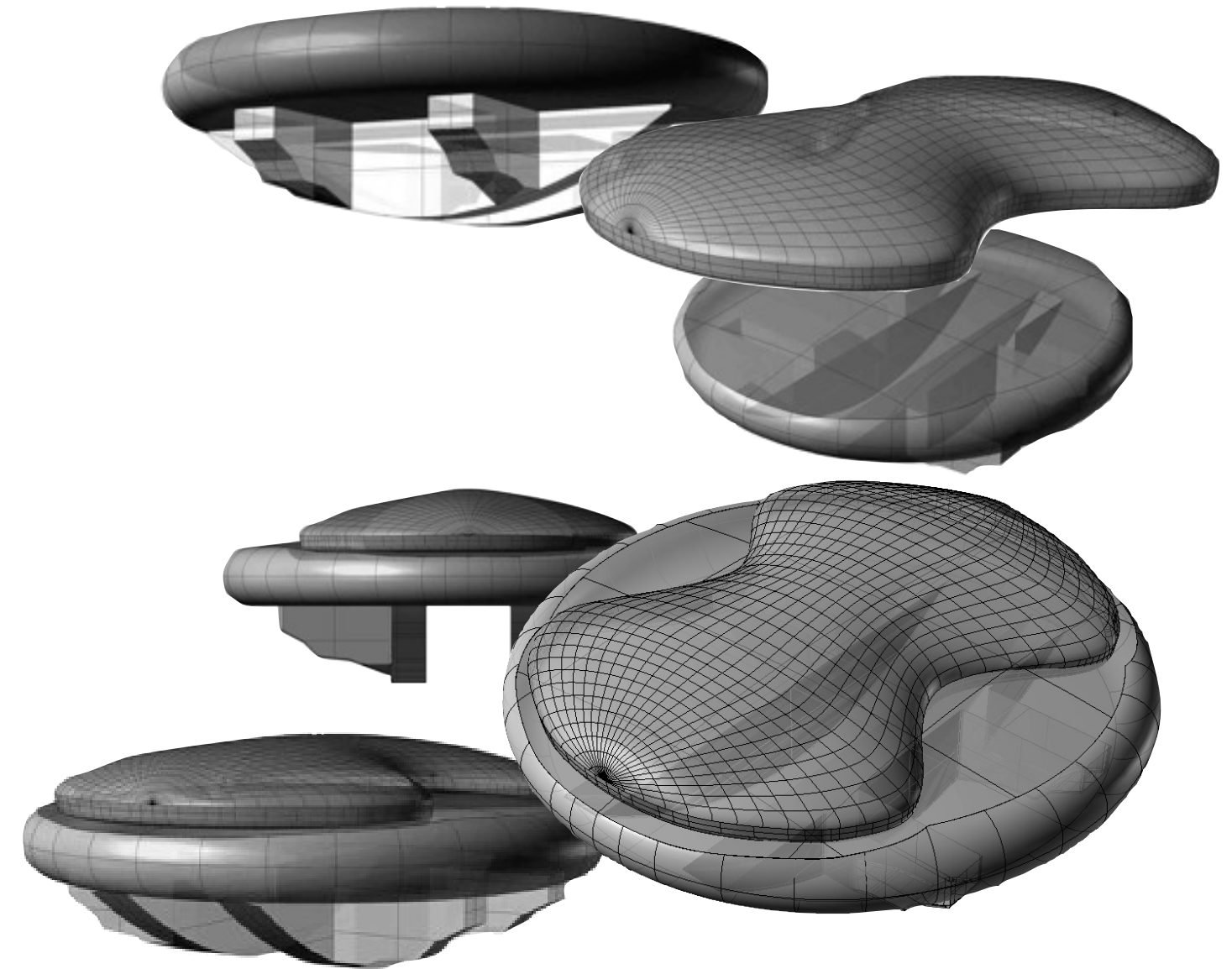
I developed an analytical prototype using free form fabrication technologies (Computer Aided Design or CAD). This enabled a more realistic view of what my potential design could look like and allowed me to superimpose a variety of new formations.

This helped to narrow down feasible parameters and instigated an individual examination of each component.

Now that I could see what it “might” look like, I was left with the probing questions:

- What does it feel like?
- Does it feel like I want it to?
- Does it act like I want it to?

Analytical Prototype	CAD Design Examination
Purpose	Reversing (play with where parts go; handles along the edge(?) place detail; change size & scale; experiment with parts (less/ more /hidden/ integrated); decrease complexity; manipulate & play with materials
Plan	Develop and refine design concepts into one tentative design prototype.
Question & Concerns	Are measurements right? Does this form actually work? Is the component placement correct?
Unanticipated Detrimental Phenomena	Learned a lot more about the dimensions & size of design concept. Gave way to a more cohesive directional aesthetic appeal. Initiated material exploration, and concept testing.

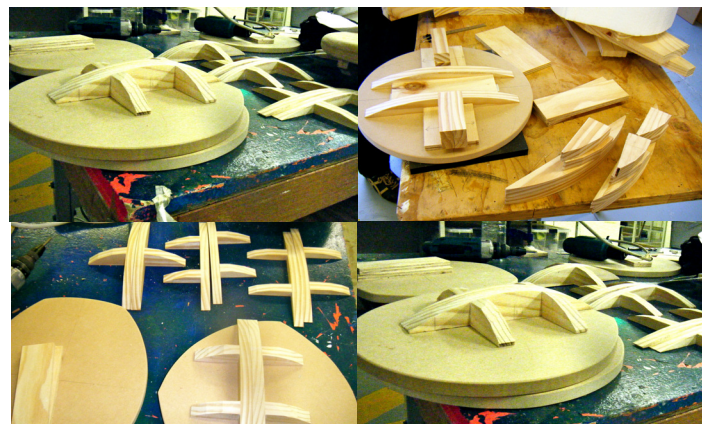


100. Modified Source: Ulrich, Karl, & Steven Eppinger. “Planning Template for Test Prototypes” in *Product Design and Development*, 5th Ed., McGraw-Hill/Irwin, New York, July 13, 2007, 303.

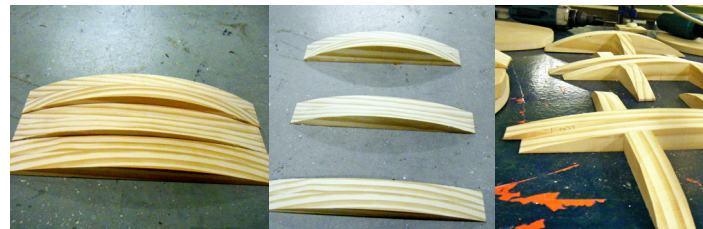
COMPONENT EXAMINATIONS

Analytical prototypes can serve as a tool for detecting unanticipated detrimental phenomena that may arise in the final product . . .[but] they can never reveal phenomena that are not part of the underlying analytical model on which the prototype is based.

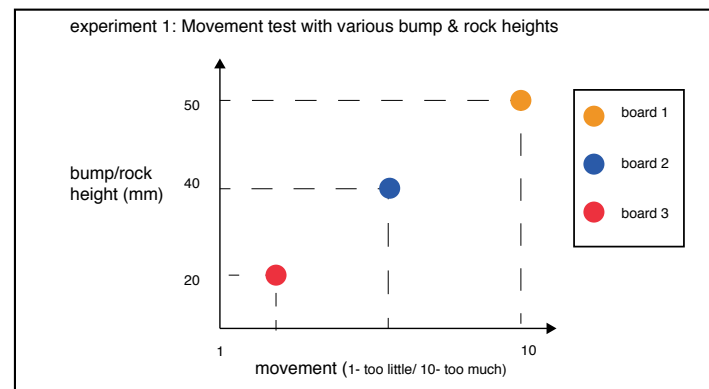
For this reason the development of a physical works-like prototype became vital. Through a cognitive walkthrough approach, I conducted a series of usability experiments. I was able to fine-tune my analytical prototype and confirm the design. I wanted to test possible design flaws and the design's ease of use, two things that are critical for a product's success.



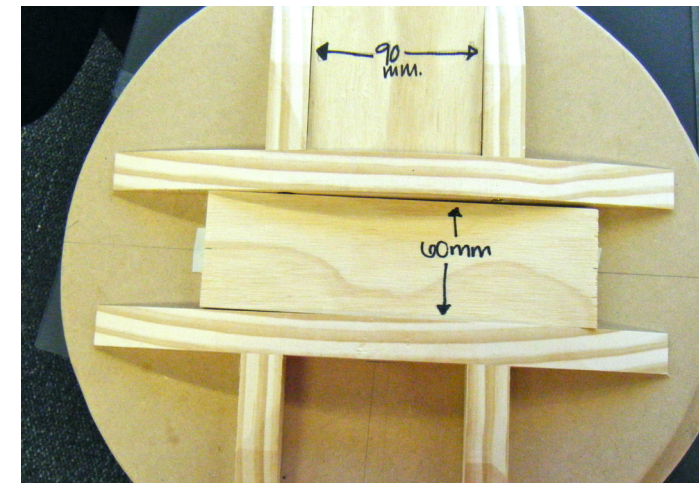
THE BOARD



Movement test 1. This primary test was done with the first three boards developed. These boards consisted of various rock and bump heights. I played with these boards: I stood on them, sat on them, kneeled on them, so on and so forth, until I was able to determine which board allowed for the best movement quality, felt the safest, and gave the most sensory salience. Board #2 with a rock and bump height of 40 millimetres provided the best movement.



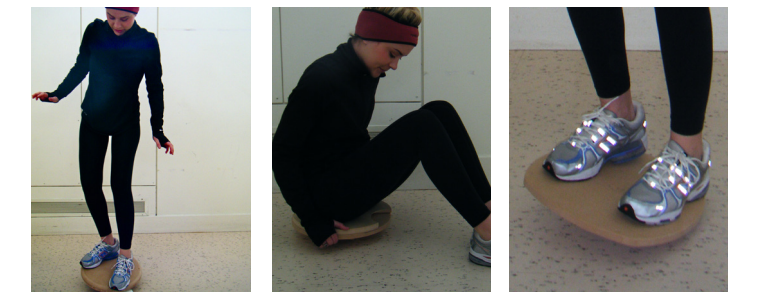
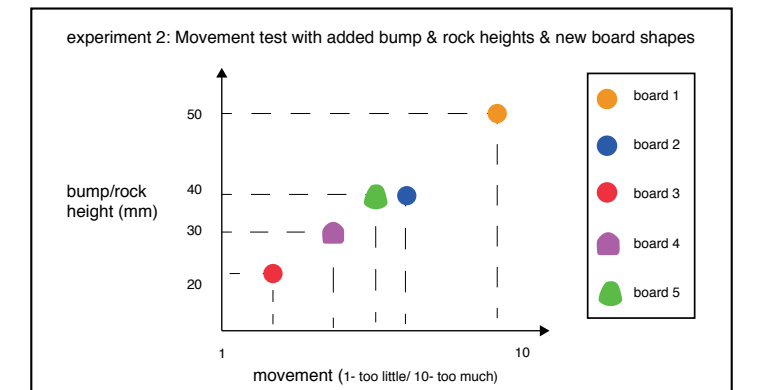
I also determined the proper placement of and distance between the bumpers and rockers. A closer distance between the pairs made a harsher circular movement, whereas a larger distance allowed less freedom of movement. Using data drawn from experimentation with the rockers 60 millimetres apart and the bumpers 90 millimetres apart, I arrived at an optimal distance for motion function.



How does the shape of the board effect its movement? Would a different rock & bump height allow an even better movement? Did I need both pairs of rockers & bumpers or would one of each suffice?

Movement test 2. I made two new board shapes with differing rock and bump heights and tested them out just like I did in the initial movement test.

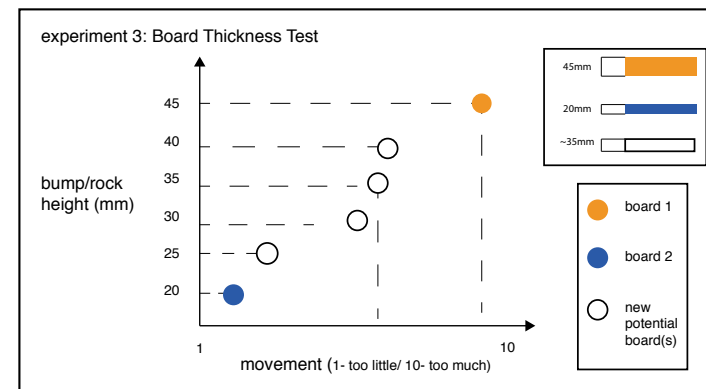
I found that the more square the board was, (1) the less I was able to move about, (2) the more difficult it became for me to go side to side, and (3) movement became more rigid. Movement was also less desirable when the rocker and bumper did not have their corresponding pair.



This test confirmed that Board #2 with the rock and bump height of 40 millimetres was most suitable.

What about the thickness of the board? What is too thick or too thin? What is the easiest thickness to hold onto? What thickness allows for the best hand grasp with least likelihood of them getting smashed?

Board Thickness Test. For my hand grasp, Boards #2, #3, #4, & #5 all seemed to be a bit too thin, whereas board #1 seemed to a bit too thick. I needed to find a board thickness that would satisfy the user's needs.



Using an experimental method similar to the one used to determine the appropriate rock and bump height, I discovered that a board approximately 35 millimetres thick proved to be the best solution. More than 30 millimetres and less than 40 millimetres seemed to be a good range. From the boards tested within that range, there was no significant difference in board movement allowance and hand grasp comfort.

Conclusively, a round board around 35 millimetres thick with both pairs of rock and bump at a height of 40 millimetres proved to be the best performance solution.



THE HANDLE(S)

After deciding what I wanted to test, and compiling the desired requirements of this component, I mapped out possible placements for the handles and tested various handle placements.

Flexible handles under board. I liked the ability to move with the board, but did not like how they flapped over and it was a bit of a nuisance when sitting.



How could I get these handles to somehow fold in/under? Was there a better solution?

Pocket protective handles. This idea was generated to avoid the incident when my hand got smashed in-between board and floor. I really liked the easy grip and protection it gave my hands when rocking and bumping. It also looked aesthetically pleasing.



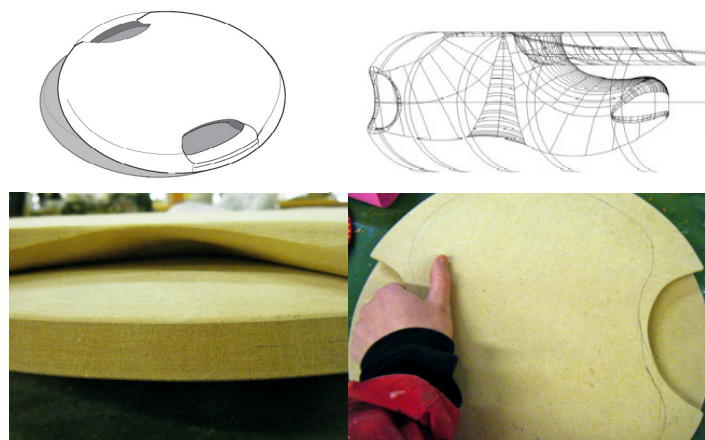
When I started experimenting with other types of handles and placements, I realised that if design was going to be placed into a chair frame, its bottom parameter needed to be kept clear.



Re-examination. If I placed handles on the bottom of the board, they needed to be placed farther inwards. When done however, it disturbed the movement of the board and had an uncomfortable reach.

If handles were to be put on side of board, they could not be placed upward and outward facing, otherwise they would interfere with sitting both directions. Thus, they needed to be placed level to the top of the board.

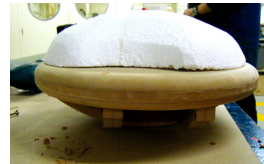
Resolution. A set of dual-pocket handles satisfies all criteria. One can easily move about with their hands protected and can easily take the board out of its provided frame.



THE CUSHION

Three Styrofoam shaped cushions were created. I placed these cushions on the board and sat on them in various directions while using the board (sitting, kneeling, etc).

Rounded Cushion. This initial cushion felt like I was sitting on a top of a hard, round rock.



Flat Curved Cushion. This cushion was better than the first, but it was still not as comfortable as I wanted.



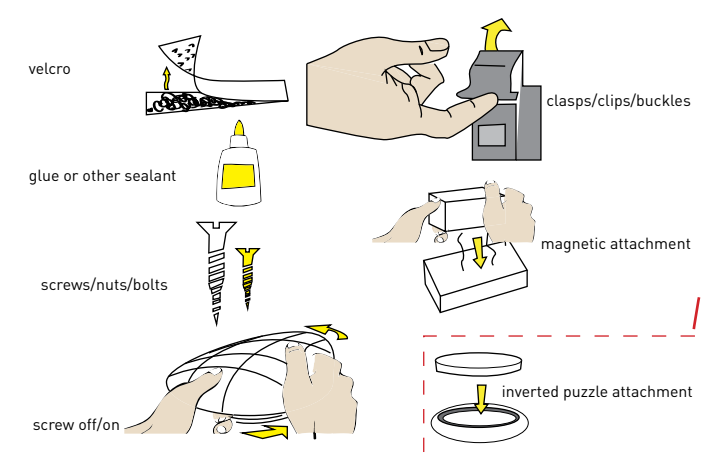
Indented Cushion. This cushion worked like a saddle, I could sit both ways comfortably and move about easily. This proved to be the best practical solution.



CUSHION ATTACHMENT

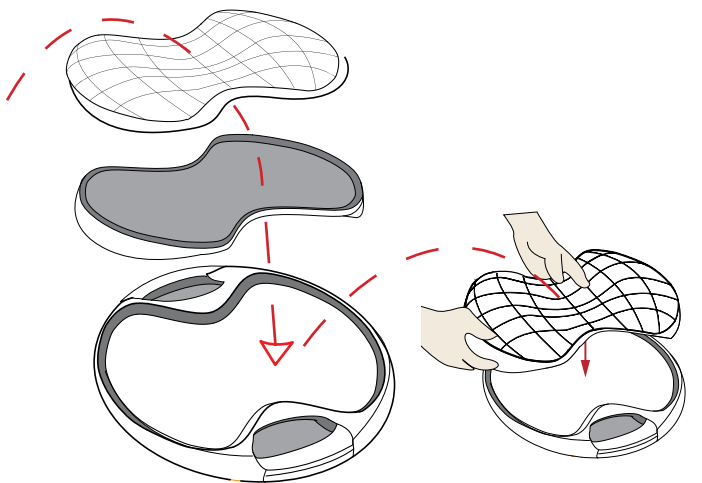
- Minimal level of physical energy invested into the product
- durable & long lasting
- Least amounts of parts possible

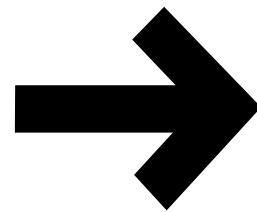
The inverted chamber-puzzle attachment has no moving parts so it is more durable and longer lasting. It can provide a snug fit if done correctly, and it is less permanent than any sealant or glue. Its parts can neither get loose



nor break (this design also eliminates the possibility that a student might choke on hazardous materials). Moreover, this solution is more cost effective than other alternatives because it requires fewer parts and provides accurate performance without degradation to safety, reliability, and maintainability concerns.

If the cushion is to be over-moulded onto a plastic inverted groove component with an outer rim lip, this attachment could easily be placed into the baseboard with more security and a tighter fit.





search for meaning // logical reasoning

Finalized Design & Reflections. Standing at the threshold of the new and unknown, my inspiration was derived from what became known through this design process.

After a yearlong research practice, an initial idea developed into a highly supported design phenomena. The analysis of an in-depth study into classroom furnishings in regards to ADHDer use is conveyed through this design solution. It wasn't until I started researching, actively participating, collaborating, and experimenting that unanticipated phenomena were realized and accounted for.

My design solution responds to how a classroom environment can cater more towards the ADHDer's individual needs holistically and positively. Through my range of design research modes, the semiotic concepts of denotation

and conation occurred; the commonsense and obvious interpretation became visible. My finalized design concept evokes other ideas and associations and provides techniques to understand further messages transmitted from my own design searching experience.

Yes, there is room for debate, but on balance this design provides an opportunity of renaissance of classroom furnishings with hidden profundity and intricacies that even it's potential users may not know the underlying reasons as to why they are participating in particular actions and movements. But it doesn't matter because they are doing it and at the same time their senses and bodies are being stimulated simultaneously.

Through this design practice, I can conclude that I have provided a furnishing, supported by my research and

participatory gathering of facts, that accommodates the movements, sensory stimulation, and fidgeting that ADH-Ders are known to desire and crave, but that the conventional classroom environment fails to accommodate. I did so through an active participation process, thorough investigation, performance and experimentation, and responsiveness to the ADH-Ders possible preferences and needs.

In its entirety, this research was a process of “doing.” My searching consisted of creating, making, and doing “things.” I was able to achieve a furnishing design that responds to the ADH-Der in the classroom environment; however, I cannot call this the “final solution.” I cannot call this the end because there is never an end as long as my ambition remains. Yes, this solution may have potential to do what I desired it would do, but its journey is just beginning.

My search is “to be continued.” This research process has provided well-based direction towards a new uncommon fascination with pens- I am now enticed to use them while

managing future design research projects and employing the rich mode of design I have used through carrying out this investigation. To manage research projects not only involves patience, efficient search, and the consolidation of ideas-tasks already expected by traditional design researchers, but also involves ensuring the continuations of linking together produced concepts and resources with the deluge of newly found design research methods and approaches being created, interpreted, and published on a daily basis.

Through the use of a variety of pens it can be noted that design research embodying the core use of an object is labour intensive, but through a collaborative effort, an innovative result can undoubtedly emerge. The pens in this case, or rather (to stick to the metaphor), are idealistic symbols of my whole project and ethos. From here I go forward looking for opportunities to take my research further. More confident in my abilities as a project manager & design researcher, I plan on continuing my relentless searching and pen collecting.

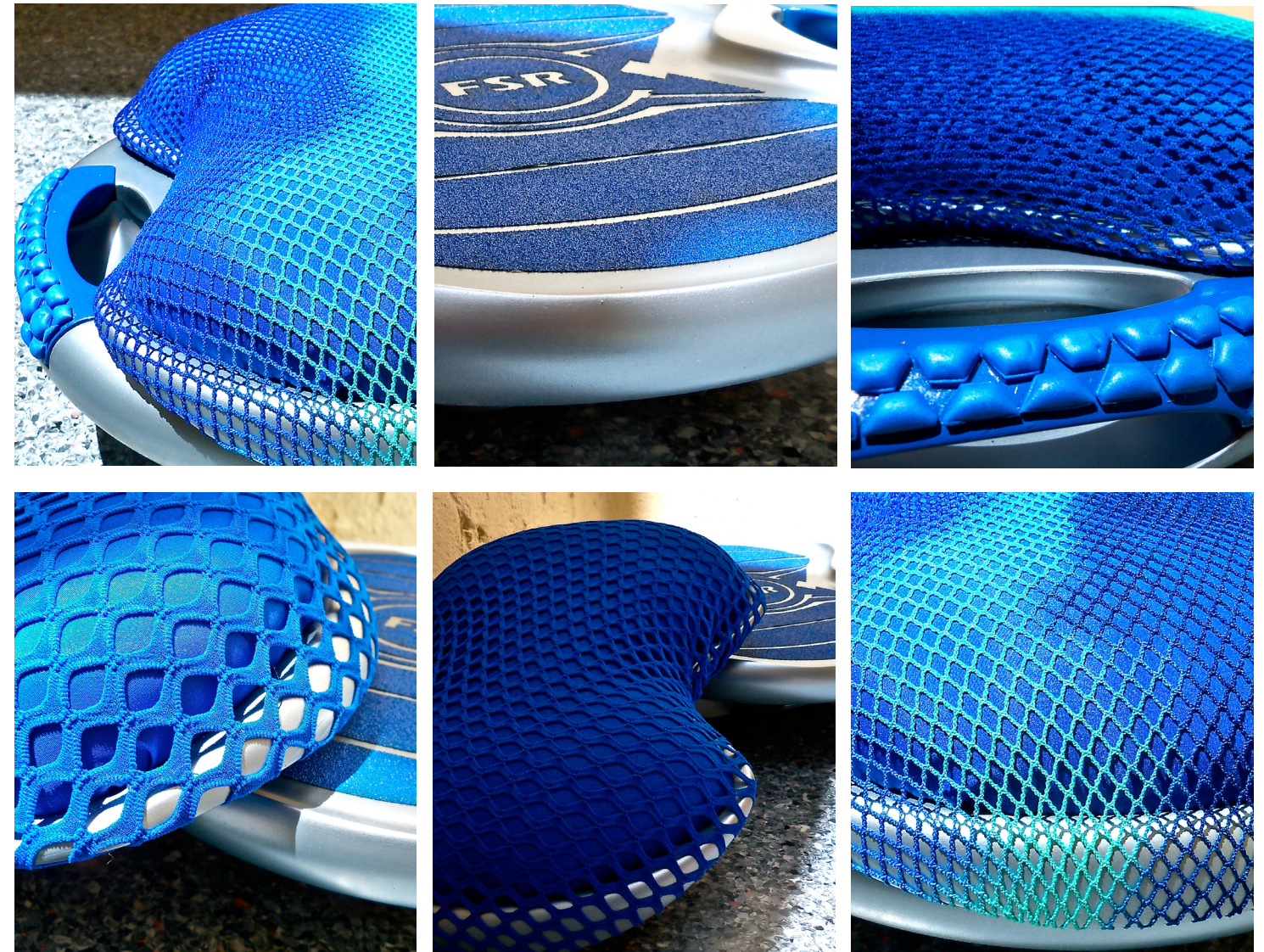




IMAGE REFERENCE

Unless otherwise specified, all images, charts, & designs are the work product of the author, Brigid Burnham.

Drivers of Change

in order of appearance, left to right, pages 26, & 31.

Sir Ken Robinson. Photograph courtesy of TED CONFERENCES, LLC. Available from [www.ted.com archive](http://www.ted.com/archive). JPG, http://www.ted.com/speakers/sir_ken_robinson.html.

Raffi Cavoukian. Photograph courtesy of ArtinBase.com. Available from "Artist in Our Database archive." JPG, <http://www.artinbase.com/artist/23715/Raffi/>.

Albert Einstein, 1948. Photograph courtesy of Yousuf Karsh Fonds (photographer). Available from Library and Archives Canada, Yousuf Karsh Fonds. JPG, http://www.knowledgerush.com/kr/encyclopedia/Yousuf_Karsh/.

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A. Sir Ken Robinson

Lecture Notes

Sir Ken Robinson lecture- worlds foremost innovative creative thinker.

The Element- how finding your passion means everything. (Book)

Creativity is a force to be reckoned with.

Why should we be creative?

Why do adults not think of themselves as creative?

I like how he looks down and thinks and formulates what he says before he says it. Has points that makes and well spoken.

"Issues are fundamentally important; globally important."

"Why? And what does it mean for practical actions?"

- *"President Obama's state of the union address- I was very struck by it for a couple of reasons. "Revolution" that is a correct word to use. We are living in an age of that. He talked a huge amount about innovation and how it is the key of the future and how promoting creativity is key...USA has been going through tough times. The whole American dream has been tarnished. Obama said the real pillar of this country is education and evolving it. To promote and support teachers and invest in our education system. All is right, but the only disciplines he mentioned are science, technology and math...aggravating and exasperating. Of course we should be promoting these, but it's this obsession with these disciplines to the exclusion of everything else that it has become a problem of everything else. The concern is firstly, what about all those kids in our schools and teachers and communities who real passions are for something else. Whose passions are humanities, arts sports and other disciplines? The implicit message all the time is that you don't really count. Also bad for the four other disciplines, making connections through interactions of other fields of work.*

The septic focus

A Friend named Dav: 13-14 pints a day of Abbot Ale (a powerful drink). 15 years ago having a drink with him and had just gone to the doctor and his doctor referred him to a kidney specialist. "A renal problem" doctor said "Yes inflammation in the kidneys" Dav said, "What could be the problem?" The doc said, "Do you drink?" Then Dav said, "Yes, I do. 14 pints a day." The Doc said, "You have to stop drinking." Dav said, "change to spirits, that will help you with your kidney." But what about my liver?" Doc "Well, you came here to for help with your kidney, not your liver..."

Story demonstrates: "You can't fix the symptom without looking at the cause. The government goes into moral panic of certain types of achievement. Shanghai has the highest scores of mathematics. The people who are responsible with these results, but we pay a price for it, the price is our kids spend all their time in "Rote learning" Can't think creatively nor work in teams. Promoting creativity and innovation is the key to our success but cant do it because we don't have time. Well in USA, people go into moral panic of these particular problems. Finland doesn't obsess about these things and is another country with high scores.

You can't solve a problem by taking it out and singling it out. Many of our policy makers go into

1

Command control mode" which is funny because they have hardly any experience in education at all.

Themes: we are living in times of revolution. "A different quality however" living in times that are unprecedented. The younger you are the more familiar you are with "digital natives" older generations are not as relaxed as younger people. One window open and I am happy with it. Kids nowadays are "Running an empire" multitasking is getting even faster.

Our worldview is very different as we travel more than ever before. A revolution is when things you think are obvious turn out not to be. Things that you take for granted seem not to be.

The singularity- we will merge with computer systems. Computers will be connected into us. Implanted into us to improve our own processing problem.

...Work, culture, our connection with ourselves, and each other- the pace of technological change and its unknown capabilities...

How Many Human Beings Have Ever Lived? Nobody knows because no one has counted since the dawn of history- all based on statistics. The figure that comes up is 80-90billion people lives. 10% are on the earth currently. 10% of the human stock is on the earth at the same time. There is no more fuel, fresh water as there ever was. Look at all the events all around the world- there is a climate crisis. We are fueling ahead in innovation with fuels etc.

David Attenbara- "How many people can live on earth"

Every life comes into being with aspirations to live a life of meaning and to survive. How many can we support? If everybody on hearth consumed water food energy at the same rate as the average person in Ramada the earth could sustain a population of 15billion. North America consumption- 1.2 billion.

The whole thing about culture- the course of it is unpredictable. Human culture is diverse by human dynamic. If we are to meet this future we need to dig into our resources and rethink.

The other climate crises- Human Resources

The Element- finding your passion means everything. In my experience; many adults don't enjoy the lives they lead. They don't like the work that they do. Human intelligence/talent is immensely diverse- we are organic creatures. We are different than other lives on earth- but were not. Our lives are relatively short and co-dependent. Quite like other lives on earth however we have a power like no other species- the power of imagination-The ability to step outside the present moment and bring about the present moment. Rethink and redevelop the past. You can put yourself in other peoples' shoes- empathy. It gets lost in times of conflict- shut down imagination. You can imagine the future but you can't predict the future. Human beings cannot predict how things will turn out.

"if you have a dog and a child" if you take a small baby and take them outside and show them the moon the baby looks at the moon. The dog would just look at your finger. And wonder what it is that your doing. Many powers shut them down. To me it's a tragedy inhibiting their own humanity.

To be in your element: You're doing something for which you have a natural feel/capacity/aptitude for.

2

"Bart Connor- 40s. Oklahoma. At age 6 walk on hands just as easily as his feet. Socially diverted from a young age. At 8 his mother arranged to take him to the gymnastics center and Bart said "I will never forget the moment I walked into this gymnastics center: A mixture between Santa's grotto and Disneyland. It was intoxicating" is that how you feel when you walk into a gymnasium? Not me. I need to get intoxicated..."Get me away from here" 10years later he went on to be the most decorated gymnastics representative of USA."

3

If you love something your good at, you'll never have to work again. For the most part, we override and ignore the diversity in our education system. Obsessed with particular academic ability.

Las vegas- Elvis chapel to get married. Typifies imagination and wellspring of human culture. Creativity is a step up. To be creative you have to do something.

The key to transformation- proposing that our education system model of 19th century reflects industrialization, regularity and standardization and age group. Developing national policies on supply and demand. In every respect resemble a factory- may have worked at that time but not for the future. We have to reshape them into a different metaphor. I believe that creativity should be at the heart of our education system. Make it deliberate and systematic. Teach them to be more creative. To do that we have to be clear about what we are talking about: imagination & creativity.

Creativity- practical process- process of having original ideas that have value.

Three misconceptions

Only special people are creative=not true.

Human beings are born to be creative- we all have it in us, it comes in the kit.

Creative is about special "things" or a few disciplines

Can be anything that involves your intelligence.

Not all about the arts or design

Uncompromising advocate for arts in school.

It's a tragedy and mistake that schools are doing it.

The art of creativity is not confined to the arts.

Implications

Curriculum- typical embodies math, sciences, technologies with art at the bottom.

One of the great deficits is that it marginalizes those whose talents are in the marginal subjects.

Balance between all of the subjects needs to be found.

Discipline versus subjects

Discipline= coming together of information and a ways of thinking.

Heart of education is a learner and a teacher.

What has happened over time is we have accreted so many things which are in the end not education but have accumulated around it. *We need to get back to basics. You cannot improve education without looking at the quality of education.*

National standards are helpful, but confusing raising standards and standardizing is different.

- Ex. Catering- two different methods of quality
- Fast food- you know what your going to get. The same everything
- Common denominator.

Bart's mom could have said, "Stop with the hand thing" but she didn't. She encouraged him and could see that this thing that Bart could do somehow defined him...but even though she encouraged him she could not have foreseen the outcome of the journey.

4

Life is not lineal its organic. Stand outside our current situation and cultivate the possibilities.

I am not what has happened to me, I am what I chose to become.- Carl young.

If you look at the management chart at schools/organizations- a wiring diagram. All suggests that human organizations are made up of people. Feelings and values and from that point of view they are like organisms- have to live in synergy with their environment. Successful organisms adapt and enrich their environment. Internal culture has to be in sync with internal and external structure. Leadership and values and modes of being that the school celebrates is what is important. We need to cherish diversity not constant linear movement.

The gift of human imagination- if we invest properly...we will see a harvest of human innovation unable to see its future.

Act differently.

Create new solutions

Free the Slaves- physically free vs. mind liberated is completely different.

Forms of creative education/Social justice.

Training teachers- how we train teachers is critical to our education system. *Take creativity seriously.* There are skills and techniques that we can learn and teach which enable teachers and kids to be more creative.

General versus personal creativity- skills and techniques that anyone can learn about creativity- the process of

creativity- there are two interweaving strands of process of creativity- *generating ideas and value to it, making judgments to it.* Sorting out with the good ones versus the bad ones. What's the better word/not quite the right harmony. We get weak versions of it; brainstorming isn't the right way to develop...*to make judgments you have to know the relevant criteria.*

Personal- being in your element. The ways in which personal creativity manifests its way through personal creativity. "We can't teach it because they haven't thought about it."

USA- 1/3% dropout rates in high schools. One in 30 adults are in prison.

Two keys:

Creative thinking

Practical skills of improvisation

B. Interactive Furniture Exploration

The T-Stool

The Sensory University

The T-Stool is ideal for working on balance reaction, stability and trunk control for all ages. It is also good for children with focus and fidget problems.¹

Orfi

Dr. Cappelen

"Consists of 26 triangular cushions with wings of varying sizes...they contain small computers and speakers. The cushions can be attached to each other, like LEGOs, and can be used to create many different figures" Dr Cappelen explains. "The aim is to learn how interactivity and music can be used to improve health."²

Color Changing Furniture

Japanese researchers

"The Fuwapica furniture uses sensors embedded in the table-top to work out the colour of items placed upon it. The colours of the stools then change to match the colour of whatever has been placed on the sensitive table-top. The stools' sensors work out the weight of anyone sitting on them - heavier people are treated to darker shades."³

Trioli Chair

MAGIS, me too collection

"... Can be a high chair, a low chair, or a horse, a rocket or whatever. I wish I was a little designer kid."⁴

BULL children furniture

Ander Lizaso

"... In essence it's a tiny chair with the backrest being a "giant" spinning wheel. That allows it to be used as a basket or a trolley, and given the kid's imaginary and Bull's evocative shapes it may easily become a toy itself."⁵

Peanuts

ZET buba/SITONIT buba

"Create your own sofa with these square sitting elements...it is practicle and changeable over and over and over again."⁶

Snowflake

caro peña design

A New Zealand educated designer created "a self-regulating therapeutic aid that addresses the needs and likes of children with Sensory Processing Disorders. It is made of individual barrels that when linked together form a barrel system that youngsters can use to rollover or enclosure their bodies. These actions provide children with tactile, vestibular and proprioceptive sensory stimulation."⁷

Rock on my Special Baby

Rock On is a special rocking chair meant for the students who are not being taught, for the moment, by the teacher and are waiting for their turn. This rocker also has different activity boards to keep these students calm and engaged. This is done by satisfying their need for other kinds of sensory stimulations, on top of vestibular stimulations.⁸



1. Toys for Autism, "T-Stool." The Sensory University, <http://www.toysforautism.com/t-stool.html>.



2. Nano Patents & Innovations Blog Spot, "Singing Furniture To Enhance Quality Of Life, Plus an Interface Between Toys and Furniture," June 20, 2011, <http://nanopatentsandinnovations.blogspot.com/2011/06/singing-furniture-to-enhance-quality-of.html>



3. Spluch Blogspot, "Color Changing Furniture," 11 august, 2007 at 6:38pm, <http://spluch.blogspot.co.nz/2007/08/color-changing-furniture.html>



4. Magis, 2009, "Trioli," <http://www.magismetoo.com/products.php?id=163>



5. Ander, Lizaso, Product Design, BULL children Furniture, <http://www.anderlizaso.com/#1541671/BULL-children-furniture>



6. Zet, "Peanuts," <http://www.sitonit.be/>



7. Caro Pena Design, "SnowFlake," <http://www.caropena.com/snowflake.html>



8. Yanko Design, "Rock On," <http://www.yankodesign.com/2010/09/13/rock-on-my-special-baby/>

C. Balance Board Analysis

“After many hours of research on this I came across a single Internet post about using balance boards to help kids with ADHD, so I decided to give it a try, after a month I do see a lot of improvement- maybe there is something more to this than we all think. I’m no expert so I wouldn’t know, but I can tell you it has helped with both of my girls. By the way if anyone wants to know of a good place to order from, I got mine from www.bambambalancers.com they have balance boards you can get with your child’s name on it. I thought I’d go that route, to entice them to use them more. It actually worked too. We use them every night for about 30 minutes. And I can tell a difference in them.”¹

Balance boards can help brain development. It can aid in the recognition of spatial awareness by stimulating the areas of the brain responsible for projecting auditory and

visual space. Some think that balance and other bilateral exercises help the cerebellum transfer messages within the brain at a faster rate. In “Delivered from Distraction” by Edward Hallowell and John Ratey, it states that balance board training helped some kids with their ADHD symptoms; However, the majority of boards are presented as toys and not as therapy devices.²

In my investigation, there were very few balance boards that aimed themselves specifically towards ADHDers.



The Belgau Balance Board³

(Balametrics)

ADHDer; making learning more inviting and interactive.

Helps with brain process-

ing based learning problems like ADHD, Dyslexia, auditory processing difficulty.



Gross Motor Balance Base⁴

(Guidecraft USA)

“This Gross Motor Balance Base requires concentration skills in order to coordinate both sides

of the body to be able to balance on it. The base rocks back and forth and may be good for children with sensory issues or ADHD because of the amount of movement it requires.”

All other boards were aimed towards specific developmental growth factors to be used in a playful fashion.



Wobble Deck⁵ (Diggin)

Encourages gross motor and vestibular orientation.



Large Rotation Board⁶ (Weplay)

Balance board with handles for gross motor in arms and hands, with vestibular balance.



See-Saw Balance Board⁷ (Weplay)

Directed as a game, “the players not only need to keep their balance, at the same time they need to watch out for the movement of the ball, offering a more interesting method and challenge to the children.”

None of these boards include tactile stimulation along with movement. They only offer a rocking and/or balancing motion. Not only is it important for ADHDers to be spatially aware, but it is also important to desensitize them to unfamiliar unusual sensations. Taking these factors into consideration, it became evident that there is a gap in the balance board market. An active educational tool/furnishing that aids the ADHDer in growth development, sensory stimulation, and desensitization to touch sensations can be sought. Through such product interaction, the classroom environment can become more tolerable and playful to the ADHDer; making learning more inviting and interactive.

1. Marie Collins, February 04, 2006 (2:41pm), comment on ADHD and Balance Boards, “ADHD from a teachers perspective,” *Liz DitzBlog*, February 01, 2006, http://lizditz.typepad.com/i_speak_of_dreams/2006/02/adhd_from_a_tea.html

2. Hallowell, Edward M. & John J. Ratey. *Delivered from Distraction: Getting the Most out of Life with Attention Deficit Disorder*. January, 2005.

3. Balametrics, <http://www.balametrics.com/>.

4. Guidecraft USA, Gross Motor Balance Base. Better Quality Living and Learning, http://www.betterqualitylivingandlearning.com/content-product_info/product_id-2047/guidecraft_usa_gross_motor_balance_base.html.

5. Diggin, Wobble Deck. Fat Brain Toys, http://www.fatbraintoy.com/toy_companies/diggin/wobble_deck.cfm.

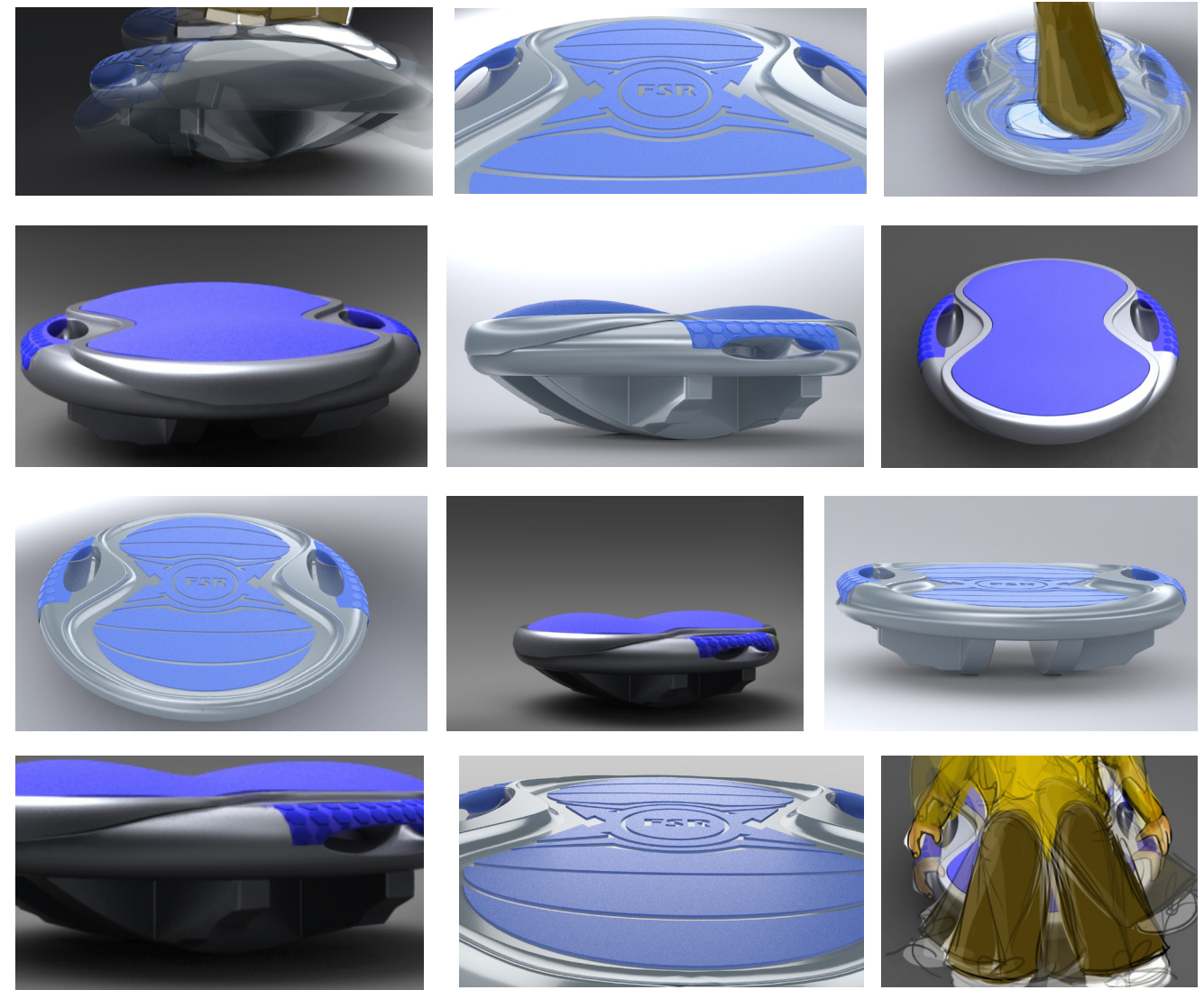
6. Weplay, Large Rotation Board, <http://www.amazon.com/Large-Rotation-Board/dp/B0018QLRA2>.

7. Weplay, See-Saw Balance Board, My Family Exercise, <http://www.myfamilyexercise.com/rocking-see-saw-review.html>.

D. Model Development Photos



E. Renders



F. Final Product

In-Depth Proposition

2012 Fuel Stimulate Respond (FSR)

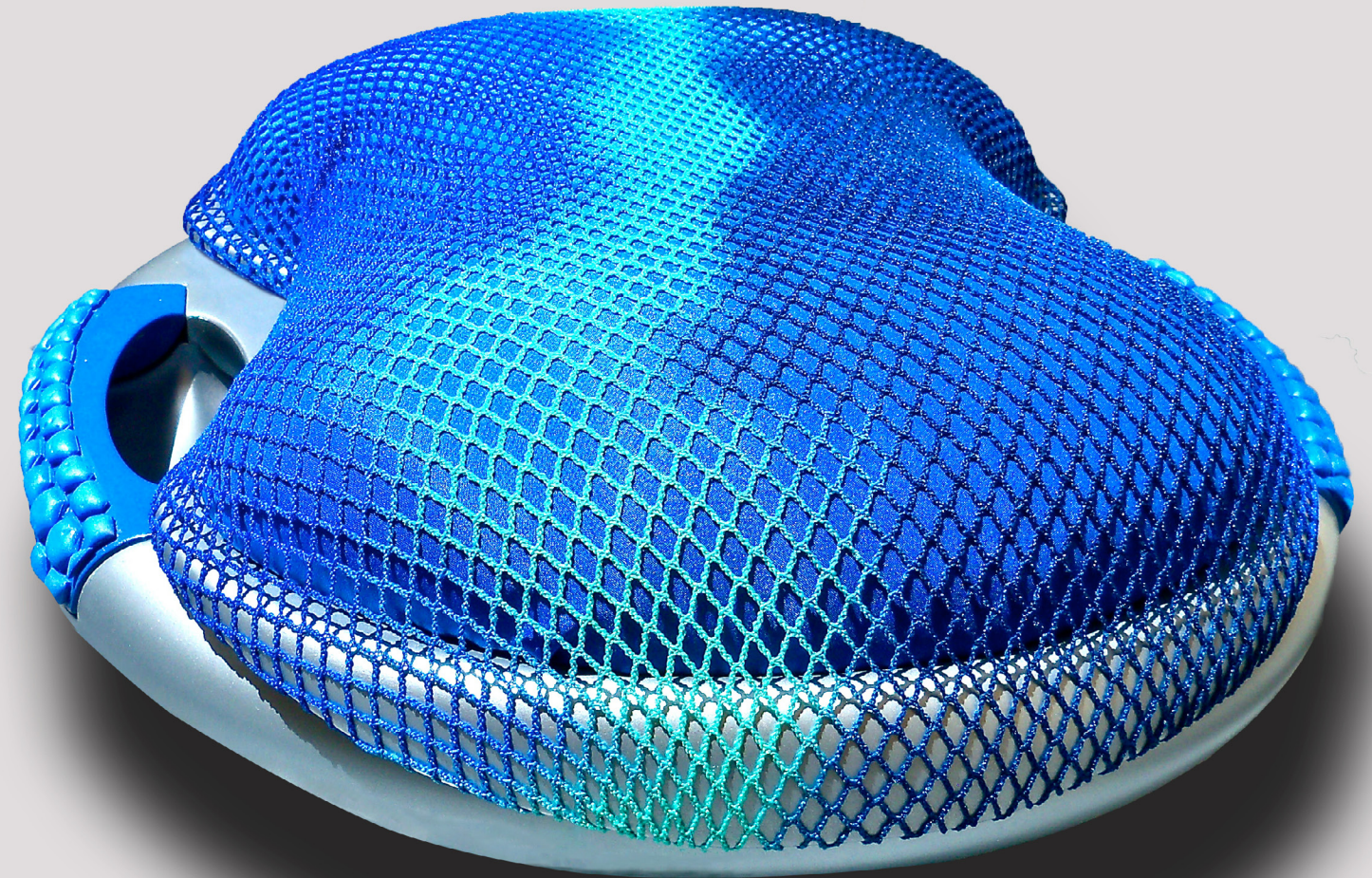
Experience the classroom of the future

The FSR is the first school furnishing in history to be designed specifically for ADHDers that offers positive behavioral support. It's integrated mobility, transportability, & fidget-ability, all nest together to allow for full sensory stimulation and productive "play" capacity.

Its also 100% tested, designed, and developed by an ADHDer, so rest assured your learning will come easier.

- Stop resisting your impulse to move.
- Bring an end to sensory neglect.
- Stimulate learning through coordination, balance, & movement.

It's time to make a move, its time for **FSR**.



Overview

Form

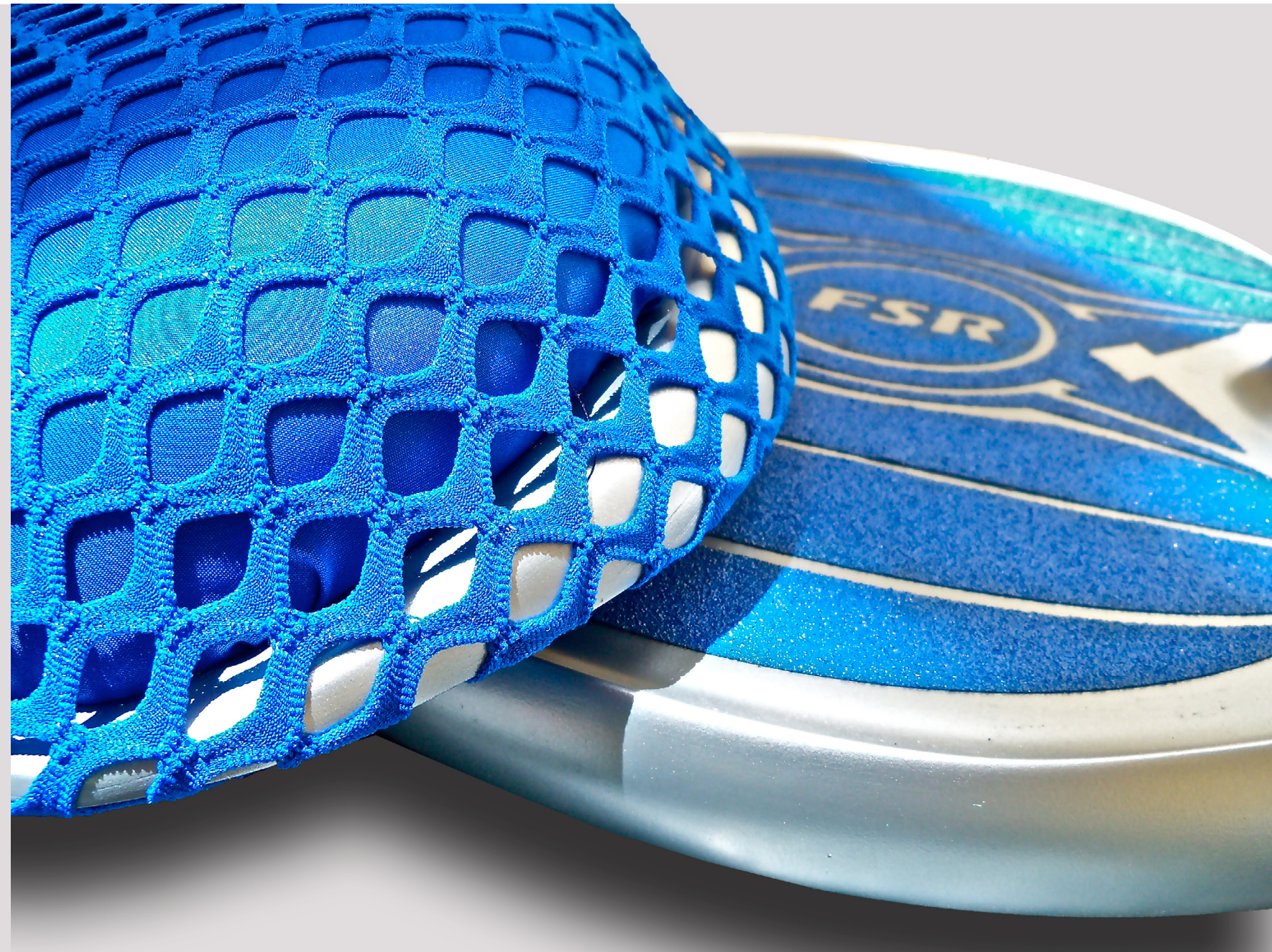
The simple, yet innovative FSR is ergonomically shaped to cater to both female and male ADHDers and non-ADHDers alike. Suitable to children, ages 7-9, its side-to-side flexibility and well-fit form accommodates different body profiles.

Dual Handle

Brings the experience to a whole new level. Providing easy lift, grip, & pocket protection; we want you to enjoy every bit that FSR has to offer.

Personalization

Each FSR allows for personal modification, satisfying individual sensory stimulation and fidget needs.



Stance

FSR's purpose is set as contrast to formal reference of conventional school furniture.

Performance

Through rigorous testing, this spherical base is the switchboard hub to cognitive activity. Delivering salient rock, bump, and roll action designed to keep any ADHDer entertained for hours.

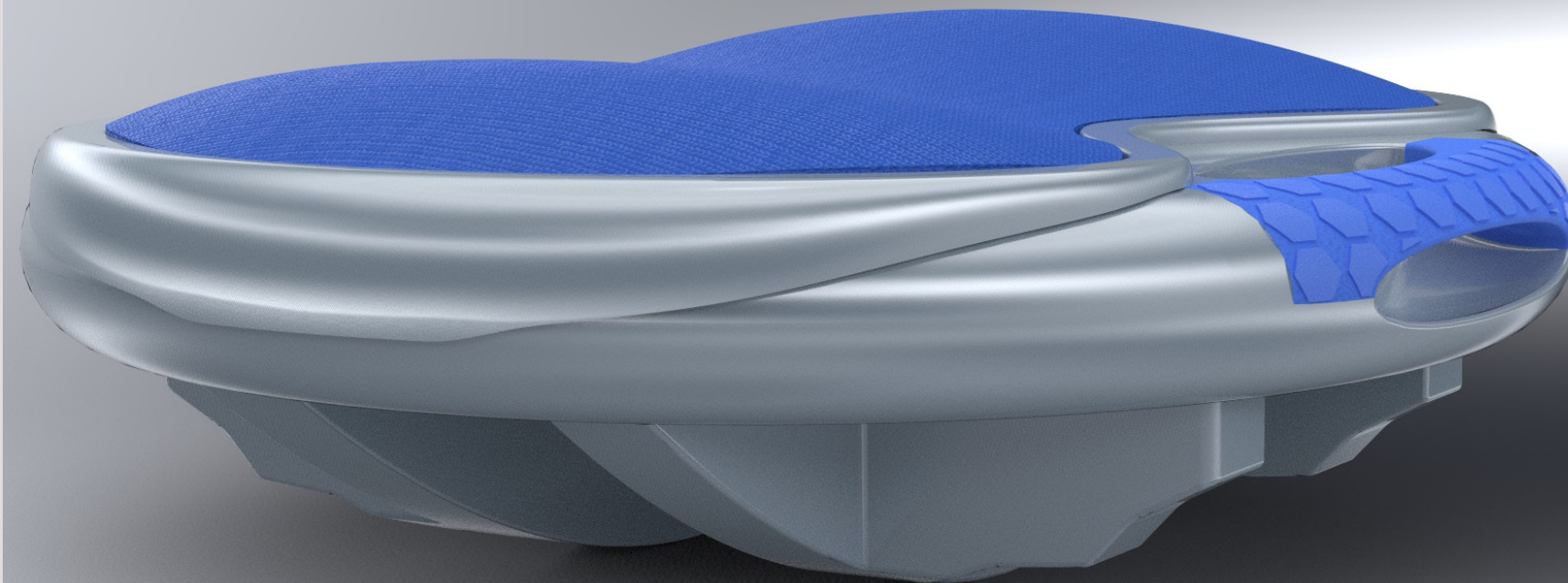
100% Guaranteed

With a design twist, FSR has been modified, tested, & developed by an ADHDer herself, so you can rest assured this will truly provide an individually intimate learning experience.

Positive Behavioural Support

FSR's designer, an ADHDer herself, understands an ADHDer's behaviour tendencies and struggles in a classroom setting. Supportive to the function of these behaviours, their existence, and what purposes they serve for the ADHDer, FRS focuses on making the classroom environment more conducive to the ADHDer.

FSR, a multifaceted furnishing, improves the circumstances of the ADHDer through positive reinforcement of misjudged actions by accommodating their behaviours in an indirect manner.



Rock

Designed to calm the ADHDer. This smooth rocking motion rhythmically soothes the ADHDer's tendencies to squirm.

Bump

This motion increases a student's tolerance to stimulation. This distinctive movement delivers an unusual sensation that potentially has the ability of decreasing a student's possible hypersensitivities to the classroom environment.

Roll

Together, Rock, and bump form a rolling motion intended to help us keep our balance and work on coordination moves.

Movement

Linking the mind and body, FSR triggers cognitive activity. With an ADHDer's urges to move, FSR's special design features three salient motions that help channel one's physical energy into constructive activities.

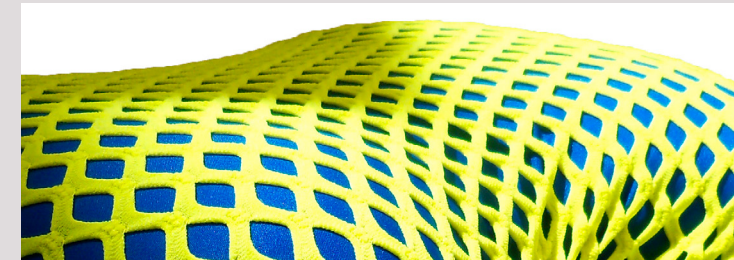
By informing the user of where their body parts are and how they are moving through proprioceptive stimulation, these movements encourage the body to readjust itself towards a state of harmony and well being. Perfect for learning to transpire.

Classroom Presence

Thanks to its mobility and transportability, The FSR has a greater presence than any conventional classroom furnishings currently used. Designed to encourage a collaborative working space, the classroom is transformed into a multi-purpose room promoting entire spatial utilization.

FSR's sculpted base is both compact and streamlined, which provides the opportunity for it to be used solely on its own and/or to be placed into a support frame.

An entire classroom can be furnished with FSRs without singling out ADHDers at the expense of non-ADHDers.



COVER COLOURS



Personalization

Whenever you are at school, you will feel good knowing that your workspace feels more like your own. One's senses can be further developed through recognition and desensitization of hypersensitivities.

Quite simply, FSR allows for personal alteration. Its stretch nylon cover was designed specifically sensory stimulation that can be personally altered to one's unique stimulation needs.

Passively or actively, touchy-feely objects can be added on at one's own discretion. Add a collection of objects ranging in texture, shape, roughness, hardness, softness, scent and furriness or...not- it's up to you!

Relieve your fidgety and tactility urges. FRS will provide an endless variety of stimulus to arouse the senses.

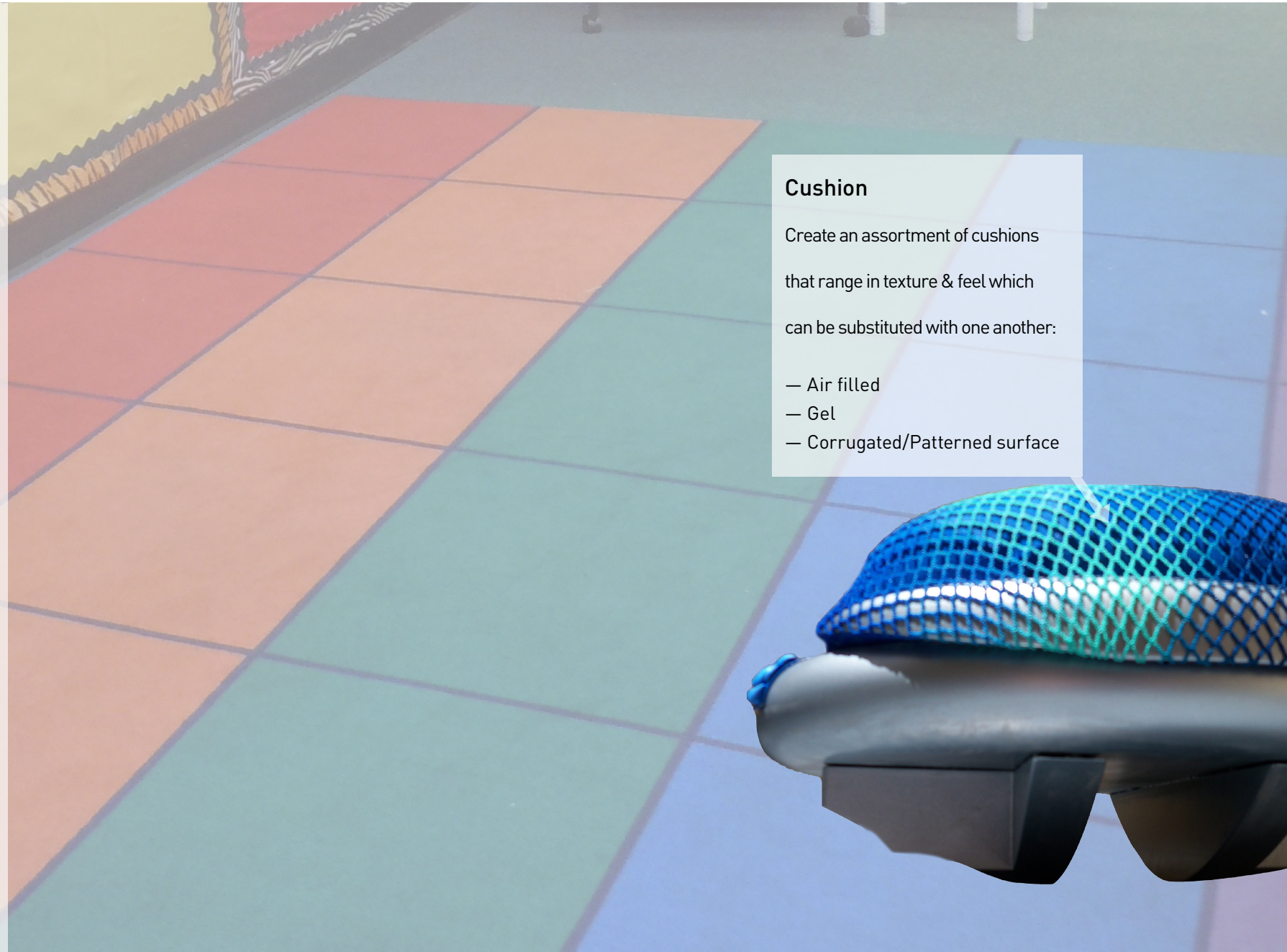
Research & Development

FSR is eager to assist in creating an educational environment that inspires learning.

Implementing FSR in Specialty schools who work specifically with ADHDers will help raise awareness of FSR's potential and prove once and for all that movement, sensory stimulation and meeting a child's specific needs will productively and positively heighten their learning experience.

FSR was designed to be durable, affordable, and cost effective. Over time, furniture is bound to go through wear and tear, but FSR was expertly designed to have replacement parts making it a better investment in the long run.

With FSR's added learning benefits, its long-term benefit outweighs its short-term monetary cost.



Cushion

Create an assortment of cushions that range in texture & feel which can be substituted with one another:

- Air filled
- Gel
- Corrugated/Patterned surface

Rock & Bump

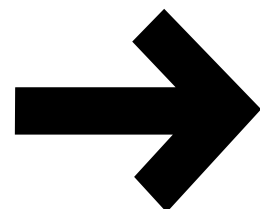
Provide a range of alternate bottom components that allow for varying motions & sensations:

- Spinning
- Vibrating
- Bouncing

FSR, The Evolution Continues

Introducing the newly expanding line!

Dedicated to making furnishings more conducive to the ADHDer, uniquely added features & attachments to FSR will provide even more opportunities. Future developments will offer varying support, flexibility, and movement to the learning environment.



make a move. . .