BEYOND AESTHETICS OF SPACE & LEARNING: OSMOTIC SENSORIA, A TRANSITIONAL-LEARNING SPACE

Niberca Polo
Parsons, The New School for Design, New York, NY. United States.
llubn623@newschool.edu

"The significance of the learning environment cannot be underestimated. The brain learns faster in challenging, creative, accommodating, and healthy environments. To provide for the growing, learning brains of our children, we must not forget that the environments we design have a major influence in building smarter brains."
Chan and Petrie[1] (Chand and Petrie, 1988)

ABSTRACT

In the midst of the 21st century education is still concerned with the transmission of information rather than nurturing an expansive way of thinking, giving the most value to information retention. Creative capacities are lost when children, in the process of being educated both in the home and at school, are encouraged to memorize over thinking, to follow directions over searching for their own answers. In order to enhance brain capacities and flexible thinking for resilience—and ultimately nurture students' full potential through thinking and acting—we need to reframe education as the means by which to stimulate all types of intelligences—of cognitive styles; understanding intelligences as interactive, ever-changing, and adaptive cognitive processes that involve sensory stimuli (information input), brain interactivity (learning), and bodily movements (behaviors/actions). I argue that in the same manner that our real- world environment rewires our brain, the space of instruction informs—and trans-forms—our learning experiences, and consequently, fosters a form of implicit learning, one that can be achieved through multisensory environments. However, current models of education use learning spaces as containers with no agency, as opposed to acknowledging the space as a mediator of the learning experience; spaces where the interactions of students with—*instead of* in—*the space, could potentially propel their full potential—spaces with agency. Furthermore, imagination, creativity and independent thinking have to become the academic backbone that uses design[ing] to stimulate brain circuits within learning spaces as a way to nurture creative capacities. The Osmotic Sensoria seeks to demonstrate that a multi-sensorial learning environment——could potentially provide the conditions that enable the production, absorption, and retrieval of tacit knowledge through an organic, osmotic process. The desired outcome is a pedagogy that propels cognitive flexibility and everyday creativity for resilience, through self-regulation, positive emotions, and intuition; playfulness is combined with multisensory stimulation via textures, visual projections, oral narratives, smells, oxygenated air, and kinetic play in order to stimulate the whole brain.*

Keywords: creative insight, cognitive flexibility, everyday creativity, learning through play, multisensory stimuli.

[1] Tak Cheung Chan and Garth F. Petrie, "The Brain Learns Better in Well-Designed School Environments 1998, vol2, no. 3. *http://www.ascd.org/publications/classroom_leadership/nov1998/The_Brain_Learns_Better_in_Well-Designed_School_Environments.aspx*

1 Introduction

Traditional—constructivist—education has been, for too long, a passive transference of information from teacher to student, deeply rooted in the strains of wartime—especially World War I and II—and the need to quickly train young veterans as white-collar workers in a nascent and evolving industrialized society of the 19th and 20th centuries. This educational model is grounded in theories of behaviorism—such as psychologist Ivan Pavlov's "conditioned reflex" experiment of 1903—and connectionism—like that of Edward Lee Thorndike learning theories of habit formation and the *Law of Exercise*—premised on the idea that practice allows the learner to make progress towards perfection. Constructivism is based on direct-explicit teaching and passive learning, and modeled from past knowledge to fulfill present needs with little regards in aiming to create our own preferred future; it tends to strive for homogeneity by instilling social norms and cultural beliefs; and sets inflexible power relations based on exercising control through fear tactics of extrinsic motivations, such as testing and grading systems, used as assessment tools. Furthermore, this educational model creates enclosed spaces that inscribe hierarchical structures between teacher and students by designing classrooms in grid systems that subscribe students as passive receivers and teachers as power figures, as the sole holders of knowledge. In addition, the space of instruction is used as a container with no agency—a place for gatherings.

Design education is similar in many ways; students act as receptacles of the teachers' knowledge—a learning experience limited by the teacher's own knowledge and experience, and by students' willingness, if any, to receive such knowledge.[2] Similarly, some design education models of the *studio-based craftsmanship*, like *learning by doing*, still current today—such as the Bauhaus pedagogy—also employ principles of Pavlov's conditioning and Thorndike's *Law of Exercise*. These educational models of the 19th and 20th century are still current in many design schools while losing relevance in the ever-changing landscape of a post-industrial world. Although successful in teaching practical hands-on skills, these models fail to consider the learner as an active contributor to the production of new knowledge, concentrating more on the acquisition of skills that can easily become obsolete because of the fast-paced technological advances in today's world. Moreover, many art schools still keep the traditional classroom setting, even when their curricula have evolved to accommodate new technology. For instance, Walter Gropius, the founder of the Bauhaus School in 1919, believed that the arts were the means by which society could improve human life. His call for a creative revolution fostered ideas of cognitive flexibility and adaptability to new situations. Although forward-looking in its approach, and conceptually relevant today, the practical application of Bauhaus pedagogy falls short in the 21st century because it teaches a set of skills relevant today, as opposed to a flexible way of thinking that can be adapted in various scenarios of unforeseen futures. The Bauhaus approach to a constructivist methodology is effective in that students are producing things—it is about making—but deters the learning experience since students are being fed information, and mimic others, instead of producing their own knowledge through perceiving and interpreting the world they live in. Today, technologies are in constant flux and require fast and independent thinkers who can adapt to new conditions, and who are able to absorb, transform, and produce new knowledge; the broader the learner's interests and experiences in the world—a sense of curiosity and wander—the better chances they have to excel in problem-solving and achieving their full potential—a genius' mind—[3] by intuitively knowing where to find knowledge and how to apply it in any given situation—as opposed to becoming passive receptacles of limited, and sometimes obsolete, information. Furthermore, this pedagogy that arose during the era of industrialization

[2] Rivka Oxman, 2003. "Think-Maps: Teaching Design Thinking in Design Education." Design Studies 25 (1): 63e91
[3] Mihaly Csikszentmihalyi. *Creativity: Flow and the Psychology of Discovery and Invention.* Harper Collins, 2009.

lacks adaptation mechanisms to emergent technologies in a design landscape that requires constant reformulation of new skillsets, which restrains students from becoming independent thinkers and innovators, which are attributes of upmost value in this technological era.

Nowadays, most scientists think that the influence of nature versus nurture on brain development is a 50-50% split; genetic imprint and environmental factors could, at any given moment in live, become triggers that ignite new pattern formation. This finding supports my idea of the space as an environment with agency as it affects the learning experience. I argue that in the same manner that our real-world environment reshapes our brain, the space of instruction informs, and reshapes, our learning experiences and that, even though the relationship between inner (classroom) and outer (real-life) environments is important, there is more to explore in the confinements of the classroom space as an active participant in the learning experience. In consequence, learning spaces have to become active agents in this symbiotic relation, aiming to naturally stimulate students' whole brain. In line with this research, the *Osmotic Sensoria* seeks to provide a new pedagogy of flexible curricular instruction and a built-learning space that can be adapted regardless of disciplines, in order to enhance human innate capacities. Using the space of instruction as a mediator of the learning experience, it facilitates interactions amongst students *with*—instead of *in*—the space, propelling self-discovery and serendipitous thinking, and becoming an igniting element to achieve students' full potential via multi-sensory stimulation.

In order to enhance brain capacities and flexible thinking for resilience, and ultimately nurture students' full potential through thinking and acting, we need to reframe education as the means by which to stimulate all types of intelligences—of cognitive styles; acknowledging intelligences as independent from "what it is known," and instead understand intelligence as interactive, ever-changing, and adaptive cognitive processes that involve sensory stimuli (information input), brain interactivity (learning), and bodily movements (behaviors/actions). In addition, education needs to embrace design[ing] [4] (design ability) as an innate form of intelligence.[5] Imagination, creativity and independent thinking have to become the academic backbone that uses design[ing] as a way to stimulate brain circuits engaged in learning via multi-sensory spaces. In this process, design schools have to be frontrunners in becoming spaces for serendipitous exploration, reflection, and action that strive to transcend the limits of the classroom by imbuing in students a new way of thinking—one that allows them to find and implement solutions to unforeseen, real-world problems in highly-creative ways.

2 Spaces for Playing, Learning & Creating: a Premise

"…Break the chains of your thought, and you break the chains of your body, too…."
Richard Bach, Jonathan Livingston Seagull, 1970; p.75

Research on creativity has shown that emotions and gut feelings are integral to the development of students' intellect, multiple intelligences, and innate capacities, as well as essential to the production and storage of new knowledge.[6] Psychologist Barbara Fredrickson, of the University of North Carolina at Chapel Hill, says that positive emotions expand our way of thinking and learning, enhancing information retention and creative thinking, while negative

[4] I use the term design[ing] through this text as "the act of creating something new."
[5] Howard Garner, *Frames of Mind: The Theory Of Multiple Intelligences* (*NY: Basics*, 1983); p. 041.

[6] Peter Gray, Psychology Today,. May/June 2013. "The Enemies of Innovation", pg. 78-87, May/June 2013. Psychologytoday.com

emotions reduce the foremost mentioned due to an extreme focus on external stimuli, such as being evaluated, or being afraid of the consequences of failure. In studies of creativity, conducted by psychologist and educator, Teresa Amabile, participants who didn't know were being tested, proved to be more creative since they were *playing* instead of being concerned with external judgment or rewards.[7] I believe that if students learn implicitly in a multisensory space that embraces failure as part of the learning experience, challenges students' creative capacities, and fosters positive emotions through play, then creative insights and, consequently, innovative thinking and a growth mindset[8] will be achieved. Using this idea as premise, I propose a form of learning that enables the production, absorption, and retrieval of *tacit*—unspoken, implicit—*knowledge,* which has been proven to be more resilient than explicit knowledge,[9]—a form of learning through osmosis.[10] The *Osmotic Sensoria*, a form of a *transitional-learning space,* provides the conditions to enhance creative capacities by naturally stimulating the whole brain through an implicit learning experience of unconsciously absorbing and processing information—*osmotic learning*—through play, serendipitous thinking, positive emotions, relaxation, self-regulation, and sensory stimuli; this form of implicit learning takes into account both curricula and space of instruction. "Enhanced capacities" are measured by the amount and quality of creative insight shown in the work that students produce.

American journalist, Jonah Lehrer, explains how creative insight—the Aha! moment of creative enlightenment—is a combination of idea incubation, tacit knowledge, relaxation, positive emotions, and *de-focus attention.* Scientists have argued that when we are in a relaxed mode, attention is de-focused and goes inwards, creative insight is augmented[11]. Similarly, when tired, the brain is not able to sustain focused attention, and it is less efficient in remembering learned patters and connections between ideas and concepts—this state allows for more lateral, divergent, thinking. When less focused we are able to consider more information, random connections and diverse interpretations hence fostering innovation and creative insight. Also, researchers at Leiden University in the Netherlands found that focused-attention meditation did not help creativity but open-monitoring meditation perform better in ideation.[12] Google and 3M are two tinkering incubators that use these concepts of relaxation, de-focused attention, and daydreaming to augment productivity of their employees. These companies provide employees—from engineers to scientists, and designers—with public spaces designed for resting and play as a way to encourage time for leisure; these spaces become areas that foster collaboration and strengthen a community of innovators;[13] their models reflect scientific findings about the positive effects of play, relaxation, positive emotion, de-focused attention, and daydreaming in creative insight.[14] Based on these findings, the *Osmotic Sensoria* is envisioned as a multisensory, shared,

[7] Ibid.

[8] Carol S. Dweck, *"Even Geniuses Work Hard*. *Educational Leadership* 68, no. 1 (2010) : 16-20.
[9] Bernard Neville, *Educating Psyche: Emotion, Imagination and the Unconscious in Learning* (Melbourne: Flat Chat Press, 2005).
[10] I use the term *Osmosis* as the process of gradual or unconscious assimilation of ideas, knowledge, etc.
[11] Jonah Lehrer. *Imagine: How Creativity Works*. Houghton Mifflin Harcourt, 2012.

[12] Colzato, Lorenza S., Ayca Szapora, Justine N. Pannekoek, and Bernhard Hommel. "The impact of physical exercise on convergent and divergent thinking." *Frontiers in human neuroscience* 7 (2013).

[13] "Looking for a Lesson in Google's Perks," The so-called Truck Pit, one of the four cafeterias in Google's East Coast headquarters, James B. Stewart. Published: March 15, 2013. http://www.nytimes.com/2013/03/16/business/at-google-a-place-to-work-and-play.html?_r=0; "How 3M Gave Everyone Days Off and Created an Innovation Dynamo." http://www.fastcodesign.com/1663137/how-3m-gave-everyone-days-off-and-created-an-innovation-dynamo

[14] Stewart Brown, *Play: How It Shapes The Brain, Opens The Imagination, And Invigorates The Soul*. Penguin, 2009; Jonah Lehrer. *Imagine: How Creativity Works*. Houghton Mifflin Harcourt, 2012; David Brooks, "The Heart Grows Smarter," The New York Times Opinion Pages. Published: November 5, 2012, http://www.nytimes.com/2012/11/06/opinion/brooks-the-heart-grows-smarter.html?_r=0

space of retreat from the constant, outside, information overflow of modern life. However, this sense of isolation from the outside world does not remove the learning experience from cultural manifestations since students imbue culture tacitly in the space, sharing their personal experience both implicitly and explicitly when working collaboratively.

During the 1960s, the Psychedelic Movement—also known as the Space Age—flourished. Utopian spaces of retreat were envisioned, diluting the boundaries between art, architecture and everyday life[15] and "…self-taught architects who created free-form asymmetrical structures with curving walls and womb-like interiors were working in direct defiance of the white picket fence suburban culture they felt was toxic."[16] Drugs were used, and often abused, to alter consciousness as a way to connect with that "secret mind of the self"—the unconscious mind—believed to enable people to envision unimaginable possibilities. "Psychedelic explorers of the early sixties noted a transformation of conventional space into vibrating space. Edges softened. Corners vanished. Boundaries dissolved along with the simultaneous dissolution of ego."[17] Recent efforts to create more active learning spaces can be found in contemporary architecture for public spaces and school-design such as The New Settlement Community Campus, Manchias Elementary School, REED Academy, St. Albans School, Frank Sinatra School of The Arts, and the Mori Art Museum, amongst others. Even though these buildings were intended to dilute the boundaries between inside (the school setting) and the outside world in order to enhance creative thinking while negotiating social relations within the space, these buildings neither foster transparent and democratic practices per-se, nor enrich learning experiences; instead they speaks to a mode of quasi-experiential learning where the constant visual interactions between inside and outside are exploited in creating an illusion of openness, freedom, and diversity.

In order to stay away from the use psychotropic drugs to artificially manipulate students' brain chemistry, the *Osmotic Sensoria* seeks to stimulate students' natural chemistry via multisensory stimuli—sound, image projections, oral narratives—instilled in the space while students work collaboratively. The space stimulates students' whole brain—left and right brain equally, in both conscious and unconscious levels—in order to augment innovative thinking by awakening intuition and gut instincts, engaging students in both implicit (through the stimuli) and explicit, metacognitive[18] (through the curricula) learning. Along with multisensory stimuli, physical movement is an integral part of this new pedagogy because it is through movement that we perceive, experience, and act in the world. In moving to explore the space while playing—activating the motor cortex—innovative thinking can become imprinted in the reptilian brain—the oldest and less evolved part of our brain that automatizes motor skills to transform them into unconscious reflexes. Once this new way of *thinking* is imprinted and automatized—like learning how to ride a bicycle—students will become innovators naturally, in an organic process of osmotic, ongoing, unconscious learning. **Physical activity** is essential to developing mental functions; spinning, crawling, rolling, and jumping strengthen the basal ganglia, the cerebellum, and the corpus callosum (mass of nerves connecting both hemispheres). Exercise also helps produce more oxygen in the body to be sent to the brain, enhancing synaptic connections;[19] through movement we experience the world. The body registers exercising as a stressful situation, and the fight-or-flight instinctual response is activated, making our bodies hyper-alert

[15] Rossi, 2008; Alastair Gordon, *Spaced Out: Radical Environments of the Psychedelic Sixties*. Rizzoli, 2008.
[16] Ibid, 2008.
[17] Alastair Gordon, *Spaced Out: Radical Environments of the Psychedelic Sixties*. Rizzoli, 2008.

[18] I use *Metacognition* here as the awareness and understanding of one's own thought processes.

[19] Palmer 1980; Brink, 1995. As cited by Tak Cheung Chan and Garth F. Petrie, 1998, vol2, no. 3

to external stimuli; concomitantly, endorphins are released to fight stress, and relax the body. This type of kinetic learning is illustrated in *Ring Around a Tree* an unconventional, Kindergarten school in Tokyo, Japan, whose curriculum is based on kinetic learning to stimulate all the senses; this type of *learning through play and discovery* in a group promotes social ties as a community and develops cognitive flexibility. The classrooms have no chairs, no desks, and no walls, and are always connected by sound and sight. Unlike other pedagogies, the structure of the built space prescribes playfulness and exploration, becoming an active participant in the students' learning experience. The act of play helps us learn about our innate and acquire capabilities, exercising such capabilities enhances our capacity to adapt to our environment, builds confidence through practice, helps develop social skills, problem-solving, and tinkering. Flexibility is part of play, since it is through negotiations with others that play can work out. Play reframes failure, embracing failure and mistakes as part of a learning process that helps achieve an ultimate goal; it values both the process and the final product, always driven by intrinsic motivations of "success." With the intention of building a space that entices play, curiosity, and exploration—and also a more democratic space with no grid and no head—I drew inspiration from soap bubbles. The structure of the *Osmotic Sensoria* aims to give a sense of playfulness and serendipity exploration in order to drift away from the feelings of restraint that spaces with corners might provoke, since we, as humans, react more positively to curves than straight lines.[20] The intimate atmospheres—achieved by modulated lighting and temperature, sounds, and the playfulness of the space—enable a deep connection with one-self, emotions, and intuition—and mediate the conversation between the bilateral brain and the cognitive unconscious because the intimacy of the space is conducive to positive emotions by overcoming doubts and fears, of being wrong, and of failure—in this process, introspection is key. The ultimate goal is to empower students to practice this new way of thinking when acting in the world, in everyday life experiences.

3 A Transitional-Learning Environment for the 21st Century

Drawing inspiration from soap bubbles—in their interlocked structure, amorphous shapes, and translucent qualities—the structure of the *Osmotic Sensoria* is created by multiple, interconnected, chambers of various sizes constructed in an array of translucent materials that provide various sensory stimuli—textures, smells, augmented or canceled sound—and which enable visual projections on the walls coming from LCD projectors. The interconnected spaces encourage a kinetic experience of serendipitous exploration as a collective—an interaction that I refer to as *synchronized atmospheres.*[21]

When exploring the space, visual projections will deliver academic content in the form of visuals, oral narrative and text, that will loop several times; for instance, design theory, geometry, or biology, will be implicitly delivered and explained as projections of images (static and/or moving), text, and oral narrative. The teacher is responsible for putting together the delivered information and then becomes a moderator in the space. EEG technology, also known as Neuro-feedback technology of real time, self-regulation systems, will be used to track electrical activity in students' brain as a way to both collect neural field potential data and provide feedback for self-regulating students' emotional states. Self-regulation is achieved by making brain electrical

[20] Fast Company, 2013 "Why Our Brains Love Curvy Architecture" http://www.fastcodesign.com/3020075/why-our-brains-love-curvy-architecture

[21] I use the term *synchronized atmospheres* as the learning experiences happening simultaneously in the inter-connected chambers of the Osmotic Bubble; experiences not being governed by laws of cause and effect but indirectly feeding each other by students collaboration with one another, sharing knowledge. See Carl Jung's theory of synchronicity for more details.

activity visible (e.g., LED light changes in color patterns). Students will be asked to doodle ideas as they come to mind wherever they feel like it, on the surfaces of the structure, using provided materials: markers, paint, etc.—the brainstorming[22] and mind-mapping steps of the creative process. The use of Exquisite Corpse pedagogy to render collective hand-drawn sketches, psycho-geographic maps, and pictorial mindmaps will allow students to share pre-verbal/verbal ideas. Afterwards, prototyping and testing will be a process of individual, introspective, exploration, when students can retrieve to chambers for quiet, reflective, time.

The concept map shown below (figure 1), visualizes my approach to the *Osmotic Sensoria* as a new model for education. It covers the WHAT, WHYs, and HOWs of my project, which I have broken down as follows:

What: *Exercise cognitive flexibility and intuition,* ***Why:*** *to develop students' innovative thinking and everyday creativity, through constant adaptation/dishabituation[23] to the space.* ***How:*** *Creative insight in every day life, what Ruth Richards calls 'everyday creativity', entails creativity, originality, intuition, emotion and divergent thinking. As a result of developing flexible ways of thinking, intuition and self-regulation also develop. This will be achieved by multisensory stimuli (walls combined materials for texture, sound augmentation/cancelation, smells) in a self-regulated space (wireless EEGs worn by each student to modulate color-coded LED lights for students' self-regulation, and overall space temperature).*

What: *Propel positive emotions and relaxation, and embrace failure, as part of the learning experience,* ***Why:*** *as a way to create a sense of a safe atmosphere, known to enhance creative insight, and reduce latent inhibition.* ***How:*** *Using the act of play by integrate brain games printed on the walls of the Osmotic Sensoria explored through physical movement, students will exercise visual and lateral thinking, spatial relations, and memory, (i.e. an interpretation of the 9-dot puzzle: 9-dots added as scattered protuberances on walls, and large-scale sticks, thread, and markers, to create combinations).*

What: *Promote both individual thinking and collaborative work,* ***Why:*** *to engage different cognitive styles[24] and explore both psyche and collective unconscious* ***How:*** *by doodling on all surfaces: as individual brainstorming, and Exquisite Corpse[25] sketching exercises as collaboration.*

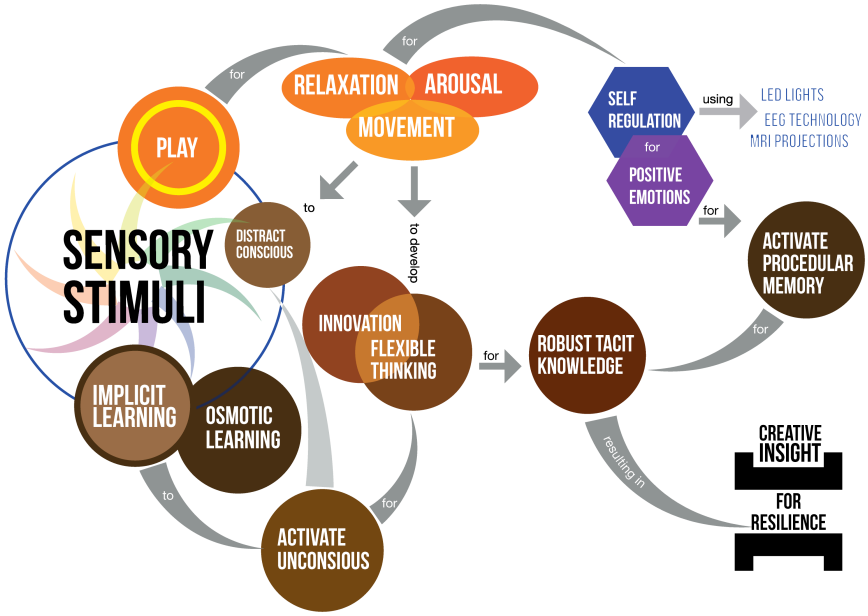

Figure 1 ***Osmotic Sensoria Concept Map;*** analysis of elements, technology, and brain circuits integrated in the Osmotic Sensoria pedagogy (Source: © Polo, 2014, *"The Osmotic Bubble: Creative Insight by Dint of Synchronized Atmospheres"* p.56)

[22] Coined by the Alex Osborn, a partner in the advertising agency B.B.D.O., in the late nineteen-forties. After 1958, it has been used for many, both designers and non-designers, to get creative juices flowing.
[23] Philip M. Groves, and Richard F. Thompson. "Habituation: A Dual-Process Theory." *Psychological review* 77, no. 5 (1970): 419.
[24] Look up: Howard Gardner's Multiple Intelligences, Michael Kirton's Adaptors-Innovators; Paul Brocca's hemisphericity.
[25] Look up: http://www.exquisitecorpse.com/definition/About.html

What: *De-focus attention from a problem that needs to be solved,* ***Why:*** *to explore non-verbal ideas inwards, as a way to retrieve tacit knowledge accumulated through life experiences;* ***How:*** *Delivered information/class content implicitly, in the form of various visual projections—text and images—on walls and oral narrative during the exploratory play (the first 20-40 min.). The exercise is given after exploring space for 35-50 min., and solution needs to be delivered in 10-20 min. (i.e, deliver a lecture on color theory in the projection, and then ask students to create a piece with "high contrast (complementary colors), or harmonies (simultaneous colors).*

What: *Encourage the ability to imagine as a powerful tool to create desirable futures.* ***Why:*** *To produce an array of unconventional, and unexpected solutions using synthesis instead of analysis.* ***How:*** *Define goal-oriented exercises that frame open-ended problems where the act of "design[ing]" is an integral part of the solution. Practice both the solution-driven approach (synthesis) used in design, and the problem-driven approach (analysis) used in science. (i.e., invent a devise to produce fresh air).*

Essential elements to *optimal learning*[26] directly related to proper brain functioning, that are also implemented in the *Osmotic Sensoria* are: **oxygenated air**, as tiny holes on the walls that contract and expand—like if breathing—in order to take air from the outside and purify it on its way inside; the air will be in constant circulation in-and-out; these holes mimic the shape and functioning of fish fins for breathing. **Modulated lighting,** since it has been shown that poor lighting, and certain colors, in learning environments could cause fatigue, exhaustion, and stress; both quality of light and appropriate color combinations improve relaxation, visual processing, and thinking.[27] LED mini lights will be embedded in the *Osmotic Sensoria* surface; using a pattern of red, green, and blue controlled by students' brain waves collected by wireless EEG devices. The intensity of the light will also fluctuate from high to low, in which case the temperature of the room will also be affected, changing slightly from warm to cool; never cold (hibernation) or hot (exhaustion). **Natural sounds**, produced by students moving on the space through chamber of different materials and textures. These sounds are meant to sometimes enhance awareness, and sometimes help retreat to a personal space. **Scents** from different materials applied to the surface of the structure (coconut fiber, metal, etc.), as a way to open up olfactory circuits—the hippocampus at the "back" end and the olfactory sensory cortex at the "front" end—to entice participants to explore different areas, and also as a way to stimulate memory formations because memory and smells are closely tied.

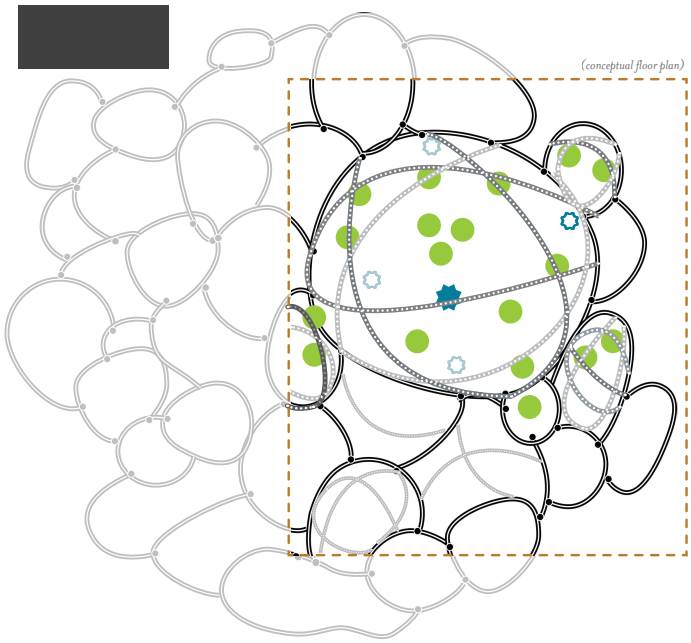

Figure 2 Osmotic Sensoria floor plan, Niberca Polo ©2014.

[26] Optimal learning occurs when the brain is appropriately challenged.
[27] Birren, 1977

4 Conclusion

The *Osmotic Sensoria* seeks to harness human innate capacities through a new pedagogy of flexible curricular instruction within a built learning space that can be adapted to various age groups, regardless of disciplines. By means of integrating multi-sensory elements on a space (visual projections, oral narrative, textures, scents), different kinds of perceiving will develop ways of knowing—of learning—will help produced different types of knowledge[28] that speak to an array of cognitive styles and personalities. As shown in the literature, the left/right brain dichotomy is a social construct, of cultural biases, with no scientific grounds. The aim of the space is to stimulate students' whole brain—left and right brain equally, in both conscious and unconscious levels—in order to enhance their brain's innate capacities of creative, innovative thinking; the ultimate goal is to empower students to practice this new way of thinking in everyday life experiences. The *Osmotic Sensoria* as a space gives a sense of playfulness and openness, away from feelings of restraint and entrapment experienced in rectangular and square spaces and the intimate atmospheres harness a sense of security and equality amongst students and teachers. ***The built space allows:*** *Playfulness (various, interconnected chambers, of different sizes, to entice exploration): to achieve relaxation and positive emotions; multisensory experience (walls made of combined materials for various textures, sound augmentation/cancelation, smells): to stimulate higher and lower brain functions, brain hemispheres, and the unconscious; self-regulation (wireless EEGs worn by each student to control color-coded LED lights and overall space temperature): to enhance students' resilience, and robust adaptation, to unforeseen changes.*

Today, society is embracing ideas of collaboration amongst disciplines. President Obama's BRAIN initiative (acronym for *Brain Research for Advancing Innovative Neurotechnologies*) opens up new possibilities, not only for scientists in the quest of answers but also for educators in general. Technological advances of new tools to study the brain, such as CLARITY (acronym for Clear Lipid-exchanged Anatomically Rigid Imaging/immunostaining-compatible Tissue hYdrogel), allow for a better understanding of the learning circuits of the brain. Neuroeducation as a contemporary teaching and learning theory uses as premise research from neuroscience, and psychology at the core of instruction, and The Learning and the Brain Society embraces collaboration amongst neuroscientists and educators—and calls both disciplines to join forces in the quest for better education practices; the neuro-educators have been called to the front. This is time for a paradigm shift in education that creates new learning environments that foster growth minds. The *Osmotic Sensoria* is not aiming to be an instrumental intervention to change human behavior and capabilities by affecting the brain's built systems but instead, it is a model for educational spaces of instruction that harness the brain's innate capacities, while empowering students in being active participants, and co-creators, of their learning experience; a space sensible to individual differences, cognitive styles, and cultural and geographical contexts.

[28] Daniel Tammet "Different Ways of Knowing." TED Talk, 2011; 10:53. Filmed March 2011. http://www.ted.com/talks/daniel_tammet_different_ways_of_knowing

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