Spring 2020

Brücke: Bridging Bauhaus Lessons to the 21st Century

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bridging Bauhaus lessons to the 21st century
reinaldo correa
BRÜCKE
bridging the Bauhaus to the 21st century

a creative component that investigates lessons from the Staatliches Bauhaus...

Iowa State University | College of Design | 2020.
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"If your contribution has been vital there will always be somebody to pick up where you left off, and that will be your claim to immortality."

~Walter Gropius | Figure 1. Walter Gropius-1919 (Held c.1939)
Why the Bauhaus? I believe there are several reasons why I have considered this to be the foundation of my research. As I later describe in further detail, I find myself at an intersection of being a student, teacher, and practitioner. Somehow, this over 100-year-old model continues to have an impact on these 3 facets of my life. This journey has allowed me to grasp an invigorated understanding of this school, its teachers, their ideas and philosophies, the educational influences of the time and the relationships between material and technology. It has also allowed me to ponder and project into the future of design education and the process of designing as a whole. In the next few pages, I wish to share the lessons learned. I want to thank all of my colleagues, friends, and family who gave me the most precious gift of them all “their time”. Thank you for challenging my thoughts, your encouragement, and your support.

This is just the beginning...
How does one begin to rethink the appropriateness, applicability, and validity of a well-grounded century year-old design pedagogy? An important question that does not follow a straight path, substantial in its scope and typically controversial in its outcomes amongst scholars. Currently, I stand at an intersection of examining such a design pedagogy from a multifaceted perspective as a student, educator, and practitioner. The student side wonders about the school of thought, and mental models within, underlying what is currently being taught in the classroom. Where do the foundation of these teachings come from, its theoretical premises, and its validity? Whereas, the teacher measures their own methods and practices of teaching and their relevance to today's design school needs. Meanwhile, the practitioner examines the application of this newly acquired knowledge and experiences and their ability to meet industry needs. I wonder if rather than reinventing a new pedagogical design wheel, this investigation can strive to explore pedagogical lessons from a previous model that has been successful in the past, while considering 21st-century design education needs. The Staatliches Bauhaus, more commonly known as simply Bauhaus (Siebenbrodt & Reissinger, 2000), a German art school operational from 1919 to 1933, happens to be at the intersection of this conversation and is currently impacting many design schools in America, including my current institution.

Lately, while celebrating its 100 year old anniversary, the Bauhaus has experienced unprecedented levels of attention. This reinvigorated interest has been one that has been puzzling me for the past four years. I first heard about the Bauhaus school in 2003 during my undergraduate studies in architecture. I remember learning about the ground-breaking approaches of this school aiming to reunite fine arts and functional design, through a pedagogical approach concerned with intellectual and theoretical approaches through the expression of material craft and technology. Its teachers, considered by many to be masters of their respective disciplines, revolutionized the way design was being taught at the time. These included the likes of Anni and Joseph Albers, Johannes Itten, Marcel Breuer, Mies van der Rohe, Wassily Kandinsky, and Walter Gropius, among others (Westphal, 1991). Their contributions went beyond the classroom with their theories expressed in the development of their students and also in their creative practices, spreading to the art and design schools in America during the late ’30s (Fiedler, J., Feierabend, & Ackermann, 2000). I recall the claims of my history professor at the time stating how the school and its philosophy were avant-garde for its time and continued to expound on its relevance in design schools today. Howard Dearstyn, a Bauhaus student from 1929 to 1933, in his book Inside the Bauhaus speaks about schools in America, like Columbia University, during the ’20s were still looking back to ancient Greece and the Renaissance for inspiration, while the Bauhaus school in Germany was approaching design from the point of view of discovery and experimentation (Dearstyn, & Spaeth, 1986, p. 23). I wonder if this statement has gone full circle where perhaps the Bauhaus is the new ancient Greece and Renaissance or if there are truly lessons that should continue to pass on.

In the Fall of 2015, I reached a crossroads in my professional career. I was yearning for what educators had shared with me - an opportunity to teach in order to understand the significance of impacting students’ lives. I had a desire to pass along the knowledge and experiences I had acquired through my years of professional practice in art, design, and architecture, to a new generation. That year, I was granted the opportunity to teach at Iowa State University as part of the preliminary course (Fig 10). In later years, the project exercise had evolved to using paper as the material for form investigation, a reference also to Albers (Fig 11). Another of the introductory projects of the studio course was focused on “Color Theory.” (Fig 4 & 12). In this project, instructors for the course were asked to teach students about the basic science and perception of color, its visual effects, interaction and mixing of color, psychology, and meaning of colors, among other conceptual theories. The project, comprising of four phases, started with an exercise titled “Joseph Albers Exercises”—a direct correlation to the pedagogical development of Albers’s use of color aid paper as a tool for understanding and learning about color theory, specifically the interaction of colors. These influences were not just limited to our Design Studies 102 Courses but I also noticed them in our coordinated Architecture 200 level studios. In the Spring of 2019, we started doing something very similar to our Design Studies 102 30-20-10 Project (Fig. 5-8). Similar to a Johannes
Itten, founder of the Bauhaus Preliminary Course, exercise, students were asked to study images and begin to trace and discover abstract connections and relationships within the "data" provided in the image. In the case of Itten, photos of works of the great artistic masters and nature were utilized for the exercise. In our studio’s discoveries through observation, nature, landscape & architecture became the starting points. It made me examine whether many of my colleagues were aware of the pedagogical background of these projects and about their thoughts on its relevance and appropriateness for our 21st-century design school.

My attempt to rethink design pedagogy and its impact on 21st-century design education and the design process comes from a framework of understanding a past model that was successful and revolutionary for its time, which continues to influence today. The model became known for its innovation in teaching strategies, the understanding of materials and technology of its time, innovation in product development, bridging gaps between academia and industry, marketing, and the selling of products. I reflect on, what lessons can be learned? What concepts might be applicable today or just plainly irrelevant? What impact can it have on current design methodologies? As Walter Gropius, a German architect and founder of the Bauhaus School once said: “If your contribution has been vital there will always be somebody to pick up where you left off, and that will be your claim to immortality” (Gropius, N.D.)

Project evaluates the quality and extent of image subject matter and the ability to frame/recognize/capture abstract patterns. These patterns in subsequent phases translate into the understanding of pattern through the means of drawing. Drawings evolve to meet an enlarged scale, quality of observation and translation, experimentation with line weight, and composition. The understanding and representation of all 10 design principles, inventiveness of translation from drawing to collage, attention to surface and texture, understanding of figure-ground relationships, composition and craft.
why bauhaus?

preface | DSN S102 Project 30-20-10 | Iowa State University Fall 2015-2019

12" X 12" Ink Drawings | Mitchelle Choeun

Figure 6. Design Studies 102, Fall 2015-2019 | 30-20-10 Project
The project begins with a source image. By deconstructing the compositional elements, the image starts to become less of a building and more of a textural playground, displaying the aging effects of weathering. Breaking down these textures into patterns allows the beauty of the marks to become a source for experimental mark making.
einführung:

why bauhaus?

preface | Architecture 202, Spring 2019 Exhibition

Figure 8. Architecture 202, Spring 2019 | ARCH 202 Exhibition
The Bauhaus pedagogical approach was groundbreaking for the time. It led to some of the most influential teachers of the time whose influences are still present in design schools today. It aimed to reunite the art and functional design, through intellectual and theoretical approaches in materials, craft, and technology.
The Bauhaus school, a 100-year-old educational model, was driven by an artistic movement considered by many a design academy that was groundbreaking for its time. Its pedagogical concepts developed during this period still resonate successfully in current design schools, but others seem to come short of considering many of the design educational needs of students today. Currently, many design schools in America continue to teach these principles as part of their foundational design courses. Should design schools continue to adopt these practices, is there still any relevance in today’s teaching or should we do what the Bauhaus previously did, start anew? (Dearstyne & Spaeth, 1986)

An extensive amount of research has been done regarding the historical significance of the Bauhaus school. Therefore, the investigation here presented will focus primarily on the theoretical frameworks and educational backgrounds that helped shape the ideas behind the Bauhaus Model. Educational backgrounds—such as John Dewey and the application of theory in schoolwork, The Montessori Method, Education Sloyd, The Werkbund, ideas of Pestalozzi, Froebel and others (Cross, 1983.)—It is thought that these were the influential foundations for developing some of the pedagogical ideas behind the Bauhaus, specifically the Preliminary Course (Lerner, 2005). We will also identify some of the pedagogical lessons that were present in the teachings of the so-called masters of the Bauhaus. Lessons like the tabula rasa, learning through play, basic design principles, color theory, form follows function, and others. We will then follow on by looking into 21st-century design education and some of the ideas and theories being considered today. Material and technology will be also covered from a 21st-century point of view with the understanding of the fundamentals of material, material technique and strategies, and the relationship to technology.

The overall goal of this study is to explore pedagogical lessons from the Bauhaus and reflect on its appropriateness to 21st century design education. Have we been fixated on ideas that are no longer relevant? Is it time to adopt a new approach? Are there still pedagogical lessons worth pursuing in today’s design education? In order to determine this, the first step will consist in understanding the theoretical frameworks and educational backgrounds that formulated the ideas behind the Bauhaus. Secondly, explore how these translated into the methods and practices of teaching of the Bauhaus and its relevance to 21st-century design education. Additionally, given the current changes in materials, technology, and design processes, in what areas do the Bauhaus design principles fail to accommodate the needs of today’s design education? Ultimately, this work aims to derive pedagogical lessons from the Bauhaus model that could be applied to the current 21st-century design education needs, potentially resulting in relevant recommendations.

Research Questions:
1. How far are the pedagogical principles, methods and practices of teaching of the Bauhaus relevant and applicable to 21st-century design education?
2. Given the current changes in materials, technology, and 21st century design education, how far do Bauhaus (design) principles accommodate the needs of today’s design education?
3. How might we bridge the pedagogical lessons of the Bauhaus with current and future design school changes to create a new and improved educational model?
“Good teaching is more a giving of right questions than a giving of right answers...”

~Joseph Albers | Figure 13: Joseph Albers teaching
The Bauhaus, founded in Weimar Germany in 1919, was only operational for 14 years. In such a short amount of time, its influences were not only distinguished in the design of products but also in the development of design education throughout the world. As previously established, many design schools throughout the world have adopted similar basic design courses that implement many of the theories and philosophies that originated from the 100 year old school model. Existing literature has focused on the history of the Bauhaus, its founders, teaching masters, the preliminary courses, and workshops, but the literature is limited in detailing out theories and philosophies that helped formulate the ideas behind the Bauhaus. Cross (1983), focusses on the educational process that prevailed in the late nineteenth century and early years of the twentieth century which she believes were theories and philosophies that were influential in the amalgamation of ideas found in the Bauhaus educational model.

The author refers to a speech by founder Walter Gropius at Weimar, where he expanded on the historical development of concepts that had led to the founding of the Bauhaus and the educational thoughts and ideas that were being proliferated throughout Germany at the time. In this speech he states how the Bauhaus was not an experiment, nor, was it, an original idea of a single individual. Rather, it was an educational reform venture that had become indispensable, and that had serious and solid foundations. Gropius also claimed that what was evident in the Bauhaus was also happening in many other institutions all over Europe and cited many distinguished educators and academics involved in similar reform ventures. The author does not go into any details regarding this. (Cross, 1983, p.43)

Cross believes that the Bauhaus was influenced by many of the general trends within society and educational experiments, experiences, and reforms that were happening at the time. She argues that where this is perhaps most notable is in the Bauhaus preliminary courses where there was a desire to liberate students from some of the preconceived notions of art and design by being able to explore basic ideas behind materials, colors, textures, form, structures, and composition. She goes on to describe, some in more detail than others, the eleven educational influences around this period. Cross also reviews some of the principal experiments in education that were taking place at the time which she believes must have influenced Johannes Itten, one of the core teachers of the Bauhaus who was previously a kindergarten teacher, approach in formulating the preliminary course. On this matter, Fern Lerner in the journal National Art Education Association states: “The history of the Vorkurs (Preliminary Course) is reviewed, from its pedagogical roots in Froebelian ideas, to its establishment and modifications between 1919 and 1933, to the continuing visions of present-day theorists.” (Lerner, 2005, p.2). Brosterman (1997) talks about how the Bauhaus had been influenced by the kindergarten concept, which had been impacting European culture for more than 80 years. Masters like Johannes Itten, Josef Albers, Wassily Kandinsky, and Paul Klee demonstrated kindergarten influences through all levels of the school`s experimental, philosophical and practical coursework. The author goes on to state that Itten designed the basic course along with Froebelian principles. “People learned by doing, and experimentation was an end in itself; nothing stood in isolation, but rather every texture, color, and form was paired with its antithesis to increase comprehension of both; design exercise were mingled with physical exercises as students stretched and flailed their arms to loosen up before work; reality was exposed in “play” with simple materials” (Brosterman, 1997, p.2).

In the next few pages, let us examine these philosophical ideas, theories and models that served as a foundation to some of the pedagogical influences of the Bauhaus.
“Education is not preparation for life; education is life itself.”

~John Dewey

John Dewey
Born: October 20, 1859 Burlington, Vermont
Died: June 1, 1952
Background: philosopher, psychologist, and educational reformer

- American philosopher, psychologist, and educational reformer whose ideas have been influential in education and social reform.
- (Cross1983) describes two contributions to educational thought and practices that might have influenced the Bauhaus.
  - First, application of theory in school work.
  - Second, the amalgamation of philosophies of industrializing countries of the nineteenth-century and early twentieth century.
    - Hagel & Marx = Impact of organizations and institutions upon the historical developments of man.
    - Darwin = The evolutionary--progressive interpretation of life and development.
    - Pestalozzi, Froebel & Herbart: Came his conviction that systematically pursued public education was of great social significance.
    - Science: Came his belief that the experimental method could be applied not only in relation to ‘matter’, but also to the solution of social problems
- The Chicago Experiment = Testing of ideas (1896-1903)
The Dalton Laboratory Plan is not a system or a method… It is not a curriculum… It is an educational reorganization which reconciles the twin activities of teaching and learning. When intelligently applied, it creates conditions which enable the teacher to teach and the learner to learn.”

~Helen Parkhurst

The Dalton Laboratory Plan was conceived and developed between 1908-1913 by Helen Parkhurst in America. Its aim was to achieve a balance between a child’s talent and the needs of the community.

- Reorganization of school life, giving each student the responsibility to conduct his/her learning program at his/her own pace. (Adaptability & Flexibility)
- Classrooms became ‘laboratories’ in which specialist teachers would advise and supervise students.
- Dalton Plan offered a simple economic way for a school to function as a community.

**The Dalton Plan's Three-Part Structural foundation adaptation in Tokyo**

**HOUSE**
The House is a home-like classroom, similar to a general homeroom in Japan. The teacher in charge of a House is known as the House Advisor. A House is a center for the various activities that go on in the school, and House advisors are not just in charge of the Houses but serve as coordinators who facilitate smooth relating among students, parents, specialty teachers and others.

**ASSIGNMENT**
The Assignment is a contract (commitment) between a student and teacher that both elicits the student's desire to learn and fosters independence and planning ability. Age-appropriate topics are assigned, and children bear the responsibility for honoring their commitments by the appointed times. They simultaneously learn how to effectively use their time and how to plan what to do when, and how much to proceed.

**LABORATORY**
The Lab (“laboratory”) provides students with important opportunities to study specialty subjects more deeply. In the lower grades, teaching is centered on the House advisors, but as children proceed to the higher grades, their involvement with teachers who specialize in certain subjects increases. Ultimately, children conduct specialized research on themes that match their individual interests for learning experiences that are genuinely “lab-worthy.”

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**Helen Parkhurst**

**Born:** March 8, 1886 Durand, Wisconsin

**Died:** June 1, 1973

**Background:** American educator, author & lecturer.
“The hand is the instrument of intelligence. The child needs to manipulate objects and to gain experience by touching and handling.” —The 1946 London Lectures

~Maria Montessori

Maria Montessori
Born: August 31, 1870 Chiaravalle, Italy
Died: May 6, 1952
Background: Italian physician and educator.

- Developed by Italian physician Maria Montessori, is a child-centered educational approach based on scientific observations of children.
- Based on self-directed activity, hands-on learning, and collaborative play.
- In Montessori classrooms, children make creative choices in their learning, while the classroom and the highly trained teacher offers age-appropriate activities to guide the process.

Cross (1983), The techniques of the method are divided into three broad areas:

Motor Education:
The primary movements of everyday life (walking, rising, sitting, handling objects), personal care, management of the environment, gardening, manual work, the gymnasium and rhythmic movements were all considered to be aspects of living to which motor education had reference. For this reason, furniture, tools and equipment were scaled down to correspond more approximately to the size of small children than was usual.

Sensory Education:
This relied upon the greater use of ‘didactic material’, the aim being to bring about a process of ‘auto-education’. The child should train himself to observe, should be led to make comparisons between objects, to form judgements, to reason and to decide. Visual training involved the use of solid rods, cubes, prisms and cylinders. These objects were graded according to the degree of ease with which they could be handled and also to the degree of intellectual complexity involved in their specific use.

Language Development:
Many of these preliminary exercises designed to develop the senses also extended vocabulary, developed language skills and prepared the child for more complex intellectual tasks. The child is encouraged to bring all his faculties simultaneously into play and to reach for a concrete understanding before such understanding is transposed into an easily manipulated abstraction.
“Architects, sculptors painters, we all must return to the crafts! For art is not a ‘profession.’ There is no essential difference between the artist and the craftsman. The artist is an exalted craftsman.”

~Walter Gropius | Figure 22. Uno Cygnaeus (Wikidata)

**Education Sloyd: Uno Cygnaeus**

**Born:** 12 October 1810 Hämeenlinna, Finland,  
**Died:** 2 January 1888  
**Background:** clergyman, educator, and chief inspector of the country’s school system.

- It is a system of handicraft-based education started by Uno Cygnaeus in Finland in 1865.  
- The word “sloyd” is derived from the Swedish word Slöjd, which translates as crafts, handicrafts, or handiwork.  
- (Cross 1983) believed that Uno Cyganeus and his Education Sloyd was very likely to have been influenced by the father of kindergarten Friedrich Fröbel.  
- By teaching peasants some form of domestic industry in their school years, he hoped to provide them with the means of supplementing their incomes from farming. (Trade Training)  
- As the system underwent modification it became associated more with the presentation of opportunities for self-directed learning and creativity in manipulative skills.

Figure 23. The Design and Craft subject is a combination of Sloyd and technology education developed from Lindfors and Thorsteinsson 2002 (Olafsson, & Thorsteinsson, 2009)
“Design is not about decorating functional forms - it is about creating forms that accord with the character of the object and that show new technologies to advantage.”

~Peter Behrens | Figure 24. 1914 exhibition poster Peter Behrens (Wikipedia)

**The Werkbund**

*Founded:* 1907 founded by Olbrich, Peter Behrens, Richard Riemerschmid, Bruno Paul and others.

*Periods:* 1938, Werkbund closed by the Nazis and in 1949, it was reestablished

- The Werkbund was formed in 1907 by a group in response to a widespread feeling among educated Germans that the rapid industrialization and modernization of Germany threatened German culture. Comprised of artists, architects, designers, and industrialists.

- Reestablished relationships between designer and producer, and creating a link between art and industry.

- It aimed primarily to inject a much needed artistic and ethical spirit into German economic life, and it hoped to do this through organization, education, and creative work.

- The Werkbund was less an artistic movement than a state-sponsored effort to integrate traditional crafts and industrial mass-production techniques, to put Germany on a competitive footing with England and the United States.
Play is the highest expression of human development in childhood for it alone is the free expression of what is in a child's soul."

~Friedrich Fröbel

Friedrich Fröbel

Born: 21 April 1782 Schwarzburg-Rudolstadt in Thuringia. (Near Weimar)
Died: 21 June 1852
Background: German pedagogue, a student of Johann Heinrich Pestalozzi.

- In 1837 Friedrich Froebel founded his school and called it “kindergarten,” or the children’s garden.
- Froebel studied architecture, but later on, a friend convinced him to pursue education, which eventually helps influence the realms of art, architecture, and design.
- Early encounters with nature like becoming a land surveyor, botanist, and forestry inspired many aspects of his work. The science of crystallography, a study of crystals, and the works Cristian Samuel Weiss become critical ideas in his future educational development. These interests provided an understanding of crystal molecular structures and patterns.
- Early on, he started teaching under the guidance of Pestalozzi. In Architecture in Play, Tamar Zinguer describes how, while Pestalozzi focused on using 2D drawing as a teaching tool, Froebel was able to evolve and explore more in the three-dimensional realm. These ideas translated into the invention of the gift and occupational toys. The toys became a pedagogical tool to help children learn. Specialized table desks were also invented with a grid top to help create abstract relationships.
- Through the invention of kindergarten and ideas of “self-play,” children were introduced to the garden of children. These gardens foster all aspects of growing, harvesting, preparing nutrition, producing, real-world application, and math concepts.
- His pedagogy centered around child-centered learning, manipulation of materials, sensory development, creativity within the child, and self-play.
- Froebel education believes that play is purposeful and not idle, and that meaning is created through hands-on play activities. Children can only learn what they are ready for.
- Play meets the biological need to discover how things work.
- Brosterman (1997) Believes that Froebel influenced the Bauhaus and many modern artists, designers, and architects. Individuals like: Johannes Itten, a kindergarten teacher, Paul Klee, Vassily Kandinsky, Piet Mondrian, Fran Lloyd Wright, Buckminster Fuller, and others through the gifts and occupation.
Bauhaus Pedagogical Lessons:

1. Tabula Rasa (Reboot): (Johannes Itten)
   Student were taught to erase their minds of preconceptions to explore their own responses to relationships to the worlds about them. (Froebel)

2. Learning through Play: (Itten, Maholy, Albers)
   Understanding of materials and design through play. (Froebel-Children Garden., Montesorri)

3. Understanding of Basic Design Principles: (Kandinsky, Itten, Maholy, Albers)
   point, line, plane, etc. Vorkurs sentiment that there was a simple methodological path to the ABC’S of spatial learning. (Pestolocci, Froebel)

4. Study of Pattern: (Itten, Maholy, Albers, Anni, Gunta Stölzl)
   The use of crystallographic patterns. Interconnecting all the parts to a larger whole. (Pestolocci, Froebel)

5. Color Theory: (Itten, Maholy, Albers)
   Itten`s contrast of color, Albers’s color comparison. (Dewey, Montesorri)

6. Pedagogical Sketchbook: (Klee)
   Learning thorough drawing. Image of the artist, designer, theoretician, researcher, teacher. (Pestalozzi)

7. Space & Form: (Maholy-Nagy, Itten, Maholy, Albers)
   Use of basic materials as a form of discovery. (Frobelian)

8. Nature & Masters as teacher: (Itten)
   Learning thorough observation and abstraction. synthesis. (Frobelian)

9. Material Experimentation: (Maholy, Breur)
   Understanding the properties and capabilities of material. (Frobelian)

10. Form follows function: (Mies)
    Workshops, creations of products & architecture

11. The Grid: (Itten, Mies)
    Use of the grid for the establishment of relationships. (Frobelian)

12. Typography:
    Montesorri-Language development.

13. Duo Teaching: (Montesorri, Dalton Plan)
    Master Form & Master Craft (Specialized Teaching)

“He who wants to become a master of color must see, feel, and experience each individual color in its many endless combinations with all other colors. Colors must have a mystical capacity for spiritual expression, without being tied to objects.” ~ Johannes Itten | Figure 28. Portrait of Johannes Itten, photo: Paula Stockmar. (bauhaus100)
Every work of art is the child of its age and, in many cases, the mother of our emotions. It follows that each period of culture produces an art of its own which can never be repeated. Spiritual expression, without being tied to objects.” ~ Wassily Kandinsky | Figure 29. Portrait of Wassily Kandinsky (wassilykandinsky.net)
21st century education
experiential, reflective, design thinking, speculative design, co-creation,

Reflective Learning
Donald Schon 1991

Reflective Cycle
Gibbs 1988

Reflecting as something happens
- Consider the situation
- Decide how to act
- Act immediately

Reflecting after something happens
- Reconsider the situation
- Think about what needs changing for the future

Experiential Learning
David Kolb 1984

Kolb’s learning styles

Diverging:
Individuals of this kind of learning style look at things in a different perspective. They prefer watching to doing, also they have strong imagination capacity, emotional, strong in arts, prefer to work in groups, open minded to take feedback and they have broad interests in different cultures and people. The learning characteristic is of concrete experience and reflective observation.

Assimilating:
People of this kind of learning style prefer good clear information, they can logically format the given information and explore analytic models. They are more interested in concepts and abstracts than in people. Characteristics include abstract conceptualization and reflective observation.

Converging:
Converging type of learners solve problems. They apply their learning to practical issues. Also, they prefer technical tasks, and they experiment with new ideas. They tend to be unemotional. The learning characteristics are abstract conceptualization and active experimentation.

Accommodating:
Individuals with this kind of learning style prefer to do things practically. They are attracted to new challenges and solve problems intuitively. The learning characteristics are concrete experience and active experimentation.

Rolf Faste expanded on McKim’s work at Stanford University in the 1980s and 1990s, teaching “design thinking as a method of creative action.” Design thinking was adapted for business purposes by Faste’s Stanford colleague David M. Kelley, who founded the design consultancy IDEO in 1991.

DIGITAL LITERACY!

Figure 30. Mindmap: 21st century educational models
“Let us guide our students...from materials, through function to creative work...we must understand the motives and forces of our time and analyze their structure from three points of view: the material, the functional, and spiritual.”
~Ludwig Mies van der Rohe

Figure 31. Portrait of Ludwig Mies van der Rohe (farnsworthhouse.org)
Materials and technology we’re at the epicenter of the Bauhaus schools desire for the mass production of modern products (Dearstyne, 1986). Gropius in his book The New Architecture and the Bauhaus states “The Bauhaus workshops we’re really laboratories for working out practical new designs for present-day articles and improving models for mass production.” (Gropius, W., 1965). These ideas of material experimentation which started in the preliminary course and gained influence in the workshops during the Weimar period, 1919 to 1925, but further development could be seen in the application of technology and product production during the Dessau period (1925 to 1932) due to the connection and proximity to industry (Rowland, 1988). These workshops were taught by two master teachers, a form master, who focused on the ideas of form and theory and a crafts master who taught in the understanding of the handicraft and material. These materials were severe wood, metals, textiles, color, glass, clay, and stone.

Today, the library of materials and technology in the realm of product development is significantly substantial in contrast to the Bauhaus. Materials like plastic, biomaterials, composites, foam, concrete, nanomaterials, and even arguments of light as a material should be carefully considered in the design process of the 21st century. With respect to technology and its relationship to materials, it has truly allowed for innovation and has reached new boundaries in the way we think about the creation of our future products. Technologies like 3d printing and its expansive capabilities have allowed for printing in a wide range of exotic materials like wood, metals, cement, rock, marble, wax, sand, glass, paper, ink, food, organic materials, clay, plastics etc. Laser technology provides the ability to utilize digital data such as Computer-Aided Design (CAD) as a tool to precisely cut or engrave materials. Computer Numerical Control (CNC) robots, routers and mills allow for machines to graph precisely controlled movements to carve, cut, or automate a process using digital technology. Several other technologies should be considered but as a starting point, the previously mentioned, provide an understanding of some of the new capabilities that are available in the current design processes. Moreover, it should be considered what frameworks could be utilized in order to further understand these relationships between material and technology in the design process.

Thompson, R. (2007) Expresses concern for today’s designers becoming detached from manufacturing as a result of CAD, globalization, and design education. His book deals with the idea of restoring the balance between hands-on approach to design and production. He unfolds a framework that it is worth exploring, while understanding materials and technology in the manufacturing process of creating products. The framework consists of understanding material fundamentals from its basic premise such as: What it is? Where does it come from? How is it made? Transitioning into its application in products. Followed by demonstrating different production techniques and their relationship to technology. Finally, the use of case studies is utilized to further understand its application.

Lisa Iwamoto and her book Digital Fabrication: Architectural and Material Technique presents another point of reference in this matter (Iwamoto, 2009). Her ideas on digital fabrication as a way of making through digital data to control a fabrication process is a framework that, for the past five years, we have been experimenting with in our architecture department. She discusses 5 material techniques that have been emerging since 1994. These are: sectioning, tessellating, folding, countering, and forming. Each of these principles is further defined and demonstrated by case studies of practitioners, who also have experience teaching and bringing these concepts into the classroom.

The following pages deal with a catalog of these ideas which I have divided into 4 parts: material fundamentals, production technique, technology, and material strategies. For purposes of this document I have only included the investigation on the topic of woods. Similar investigations were done for metal, textiles, color, glass, ceramics, stone, plastics, and light.
WOOD

/ˈwʊd/ noun

1. The hard fibrous material that forms the main substance of the trunk or branches of a tree or shrub.

2. an area of land, smaller than a forest, that is covered with growing trees.

"a thick hedge divided the wood from the field"
## Pine

**Distribution:** Western N. America

**Tree Size:** 100-165ft

**Appearance:** Heartwood is reddish brown, sapwood is yellowish white

**Grain:** Straight grained with medium

**Common Uses:** Veneer, plywood, sheathing, subflooring, boxes, crates, posts/poles, interior trim, cabinetry, and construction lumber.

### Ponderosa Pine

(Pinus ponderosa)

### Canadian Hemlock

(Tsuga canadensis)

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## Spruce

### Norway Spruce

(Picea abies)

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## Hemlock

**Distribution:** Eastern North America

**Tree Size:** 65-100ft

**Appearance:** Heartwood is light reddish brown. Sapwood may be slightly lighter in color but usually isn’t distinguished from the heartwood.

**Grain:** Grain is generally straight, but may be interlocked or spiraled. Has a coarse, uneven texture.

**Common Uses:** Boxes, pallets, crates, plywood, framing, and other construction purposes.

### Canadian Hemlock

(Tsuga canadensis)

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## Douglas Fir

**Distribution:** Western N. America

**Tree Size:** 200-250ft

**Appearance:** Can vary in color based upon age and location of tree. Usually a light brown color with a hint of red and/or yellow, with darker growth rings.

**Grain:** Grain is generally straight, or slightly wavy. Medium to coarse texture, with moderate natural luster.

**Common Uses:** Veneer, plywood, and structural/construction lumber, and construction lumber.

### Douglas-Fir

(Pseudotsuga menziesii)

---

### Pine

**Distribution:** Northern and central Europe

**Tree Size:** 115-180ft

**Appearance:** Norway Spruce is typically a creamy white, with a hint of yellow and/or red.

**Grain:** Norway Spruce has a fine, even texture, and a consistently straight grain.

**Common Uses:** Paper (pulpwood), construction lumber, millwork, crates, Christmas trees, and musical instrument soundboards.
Slabs of lumber hand selected for grading and testing
Honduran Mahogany

- Felling the wood
- Transport wood
- Soak Wood
- Debarking
- Cut wood
- Heat to 2300F
- Sort sizes
- Stack Wood
- Dry wood
Wayne Street Row House
Jeff Jordan
Materials: Pinewood Cabinetry

House Feurstein
Innauer-Matt Architekten
Materials: Spruce Cladding

Kohtei Pavillion
Sandwich
Materials: Japanese Cypress Shingles

Arch for Arch
Snøhetta and Local Studio
Materials: Bent Larch

Slat Bench in Douglas
Ten10
Materials: Douglas fir

House 22
MacKay-Lyons Sweetapple Architects
Materials: Hemlock facade

Quindici
Ronan and Erwan Bouroullec
Materials: Ash Wood

Oxymoron Table
Hengave
Materials: Walnut Wood

SWISH
Architecture office Carlo Ratti Associati
Materials: Cherry Wood

Yen London
Sybarite
Materials: Maple Timber

Atrium Tower Lobby
Oded Halaf and Crafted by Tomer Gelfand
Materials: 9000 meters of poplar wood

Solar Egg (interior)
Bigert & Bergström
Materials: Benches made of apen wood
Use the right ply thickness for the type of wood used

Apply glue on thin strips of wood and stack them together

Place stack of wood on to form and clamp it
Lengths of golden oak loaded into the steamer

Oak wood ready to be steam bent around jigs

Solid oak is bent around a Green Range jig to achieve a complex 3D bend

Wood intended to become a Merryn Floor Planter is slotted into its carefully made jig

Clamped, secured and ready to be taken to our drying room
Layer wood and glue each piece to each other.

Apply clamps for pressure and uniformity.

Set out to dry.
The Andes Range is our natural frontier to the east, running from the northern border of Chile to Santiago. Imaginary Geographies proposes a geometric and material reconstruction of this icon. The project’s starting point is an audio composition of the sound of the mountain range mixed with the verses of “The Imaginary Man” by the late great poet Nicanor Parra. In this poem, Parra describes the relativity and transformation of the territory in landscape according to man’s feelings. This profile or cross-section represents the information of the sound at a certain time of the recording. A new line can then be drawn, consecutive to the previous one, corresponding to a different ‘slice’ of the recording.
Check 3d model in 3d printing software, the one shown is Ultimaker Cura

3D print wood at a low temperature

Sand 3d print to your liking

 Origami Vase
 MinimumDesign
 3d printed wood

https://www.etsy.com/listing/503786016/geometric-and-minimalist-vase-origami?ref=shop_home_active_22&ep_click=1
Create vector pattern

Upload vector file to lasercutter

Layer each laser sheet of laser cut wood
materials & technology
Vacuum Forming

Apply glue on each piece of wood and layer on over the other

Placed layered wood over form

Have the machine suck the air out of the space to apply pressure

Check if the form is fully formed over its form

Remove laminated wood

Inactivity chair
Benoît Malta
Back is vacuum-formed from laminated beech
According to Gelfand, the stair structure is composed of two interlocking parts: a skeletal metal staircase and a sculptural wooden envelope. Together, they rise as an expressive tornado from the reception desk - conceived at the ground and rising up to the first-floor mezzanine, fourteen meters above.

Welfand began by implementing an MRI-type scan to the skeleton, cutting vertically through the structure and generating sections in the width of the given wooden profile. The resulting number of cross-sections, each exported with a different radius requirement, produced a seemingly-endless number of arches. In order to deal with this, Gelfand narrowed it down to 'master-arches' - devised by calculating the wooden profile's average bending tolerance, which dictated the radius and angle of the 'master-arches'.

Next was creating the radial profiles from the material itself: a total of 9,000 linear meters of tulipwood was cut by CNC machine to create the stock for the master-arches, each coded and marked to fit precisely in the grand scheme. As no single piece was interchangeable, every measurement had to be taken in advance to ensure the success of the final installation. For example, each of the connecting points between the modules was completed with a reverse radius.
Iwamoto’s initial 5 Digital Fabrication Techniques:

**Sectioning:**
The use and understanding of orthographic projection in both plan and section as the tool of creation.

**Tessellating:**
A collection of shapes or motifs that come together for the formation of a plane or surface.

**Folding:**
The transformation of a flat surface into a three-dimensional one.

**Countouring:**
Typical flat material that through a subtracted process is sculpted to create contours or dynamic surfaces.

**Forming:**
The use of a tool or a process like molding to form an “object”.

New Digital Fabrication Strategy Considerations:

**Connecting:**
The use of joints or connectors to unify components. (ie. 3D printing custom connectors)

**Eroding:**
The use of technology to dematerialize a material surface. (ie. Narrative cut-pattern)

Future Exporations:

Tensile
Adding
Bending
Weaving
Packing
Tiling
Being creative is not so much the desire to do something as the listening to that which wants to be done: the dictation of materials.
~ Anni Albers
The Brücke Model which stands for "Bridge Model" is a design process model that looks back, not only at the lessons learned from the Bauhaus, but it also examines what I call "the foundations before the foundation" meaning the theories and philosophies from the late nineteenth and early twentieth-century that may have shaped and influenced the ideas behind the Bauhaus, discussed in chapter one. It also takes into consideration some of the 21st-century design education models that have been implemented in education and practice today (refer to mind map in chapter two). These 21st-century education models consisted of a series of methodologies that were not present back in the Bauhaus. For instance, the interactive design method called user-centered design, which allows designers to focus on the user and their needs throughout the entire design methodology, would have been beneficial in the design process of many of the products at the Bauhaus, for example, the Wilhelm Wagenfeld lamp (Rowland, 1988). The Bauhaus goal of creating products for the ordinary person at affordable prices was a mark that was quite far off and could have potentially benefited from a design process like this. The Brücke Model also takes into consideration this four-part understanding of materials and its relationship to technology, discussed in chapter three. These were material fundamentals, production techniques, 21st-century technology, and material strategies.

Figure (insert once update figure) illustrates how the design process works. At the core center of the three concentric rings lies the source for the existence of a physical product, "M" for the material. The designer, through this experiential learning experience, must decide upon which material does he/she wish to investigate. Throughout the process, the four-part understanding of the material would be investigated. The second concentric ring consists of four quadrants with 4 letters ("RETO" Spanish for challenge). On the top left corner is "O" for observation. This component similar to ideas of "design thinking" becomes the gathering of insights through observations. Nature becomes the source of inspiration and it is examined similar to Froebel and Montessori with an attitude of play. This parameter could be easily interchangeable to observations of artistic masters, similar to the approach of Johannes Itten or simply with the use of case studies. On the top right corner is "E" for the experiment, which consists of what I called "brücke boxes". These bridge boxes establish the framework for the experiment. Similar to the Froebel kindergarten desk, it is a grid-like parameter that establishes a volume of space to experiment with. Depending upon the selection of parameters of the user, he/she can define how much of the grid will be utilized. This particular quadrant calls for a material strategy to be implemented within this framework. The third quadrant on the bottom right is "R" for reflection. Ideas of David Kolb and his theories of reflecting in and on action are utilized throughout the entire process. These reflections are encouraged through writing, questioning, and drawing. The fourth quadrant is technology, which not only takes into consideration 21st-century technology but it provides the user with a more intimate relationship with the tool and adapts to the different learning styles of the individual. This flow throughout the quadrants is not necessarily cyclical but determined by the correlation between the user and the experiences during the design process. The third concentric circle deals with the ideas behind speculative design. Different from other design process methodologies that approach design from a problem-solving standpoint, the Brücke Model is interested in the experiment leading into future projections. In other words, how can the process and experiment inform and lead to new possibilities.

Several attempts were implemented to examine the workflow of the Brücke Model. In the subsequent pages are 6 completed examples of some of the parameters that were experimented with and the speculative product results.
1. Material
2. Observation
3. Experimentation
4. Reflection
4. Technology (21st century)
* Speculative Design. (future Opp.)
**GITTER**

grid parameters

6 x 9 x 18 grid = 972 inches\(^3\) (Experiment Framework)

**MATERIAL**

material parameters

Building beyond the original 7 Bauhaus Materials
boxes
speculative discovery
first round iterations
Material:
Wood

Observation:
Study of Nature: Nodes in nature
Ie. Branch to Leaf
(Internode, Nodes, Petiole to Leaf)

Experimental Material Strategy:
Connecting / Connectors

Technology:
3D Printing Wood
Overview:
The icosa lamp exhibits the beauty behind geometry. Inspired by the icosahedron, a polyhedron with 20 faces, this lamp truly becomes a focal point in a room. The faces are framed with wooden dowels and nodes that serve as the framing point for an LED Edison Light bulb.

Materials:
Wood Dowels, 3D Printed Wood pla NODES, and LED Edison bulb.

Dimensions:
ø: 30 in | H: 30 in | 10 ft Cord
The concept for this design was inspired on some of my earlier research of Frobelian and Bauhaus ideas of the “grid” and “nodes”. I started noticing these principles of geometry in relationships to plants. I had developed a series of prototype models, called “bridge boxes” not knowing how they can be implemented in the creation of furniture. Eventually, my studies and observations lead me to look closer into geometry specifically the study of geometric solids with specified number of plane faces known as hedron. I thought that a good starting point of pushing my earlier model would be to start with an Icosahedron as the lamp form that in its epicenter framed a contemporary Edison bulb.
One of the greatest challenges of this design was figuring out the relationships of the frame member to the nodes. It is fascinating to discover that there are relationships to the length and the sizes of the faces. In other words, the geometry is not random by no means. The second challenge, experienced was figuring out the right size of the node in relationship to the frame member.

Initially, I wanted to use ¼” oak dowels, but due to the nature of the geometry the members at this scale where intersecting creating undesired intersections collision with members inside the nodes. Eventually, the scale of the dowels was reduced to 1/8” and the nodes became larger in order to avoid these unwanted results. A color system was develop in order to easily assemble this geometric frame system. 3D printed Wood PLA was used for the nodes.
vier: methodology
translation to product
Material:
Light via (PLA)

Observation:
Study of Nature: Atmosphere
(Stella Evolution, Rain, Snow, Clouds)

Experimental Material Strategy:
Tiling

Technology:
3D Printing
Overview:
Stella a contemporary atmospheric design expression, this one-light mini pendant illuminates any kitchen island, dining table, or grand foyer in flair. Made of PETG, this 3d printed pendant creates a beautiful play of light with custom internal baffle designs for your specific desired mood.

Materials:
PETG, Chrome Grommet, LED

Dimensions:
8 in x 6 in x 8 in | 10 ft Cord
Concept

The Stella pendant was inspired by the atmospheric phenomena of the skies. The faceted nature in which stars have been portrayed and the complexities in geometrical shapes we find in snowflakes in conjunction with their translucent and transparent qualities was of great value in the creation of the design. This motif was then further explored in order to understand its properties and lighting capabilities in the form of pendant lighting, desk lamp, and sconce lighting.
During the prototyping phase of the project a series of tests were implemented in order to better understand the technology in relationship to the design form. The first test, consisted of 3D printing the design completely hollow with no supports. Unfortunately, due to the amount of bridging needed to finalize the piece, the print resulted in failure (Top left image, green filament). This initial outcome, resulted in looking into an alternate solution of creating an internal structure. Interestingly enough, when testing different lighting solutions, the internal structure started working as lighting baffles. It was in this moment that I began to think of “lighting as a material.”

On the top right corner of the page are some of the experiments that followed. These series of “lighting blocks” comprised of an internal structure, operating as lighting baffles, created very unique effects. I began testing a series of different infill patterns and density that began to manipulate the light in unexpected ways and resulted in the soul of the project. Amongst some of the infill parameters investigated where honeycomb, rectilinear, wiggle, gyroid and triangular patterns ranging from a density of 5%, 10% and 20%. Not only did the infill patterns begin to bend and manipulate the light but due to the translucent quality of the filament it became a part of the aesthetic of the piece once the light turned on. In other words, these intricate patterns would be revealed once the lights are turned on.
The pendant design uses a LED candelabra style bulb. As seen in the prototype section image the pendant is comprised of two 3D printed parts. These two halves are joined together with pocketed magnets on all major points of contact. A series of magnet test were conducted in order to confirm the right force of magnet. I found that 2 lbs- 3.8 lbs of force worked well in this application. By slightly twisting one of the half section of the design the magnetic field between the magnets is interrupted allowing for the two parts to separate and provide access to the internal shell of the pendant. A small steel grommet serves as the transitional piece between the PETG material and wiring cable of the design.
Stella Sconce

Overview:
Stella a contemporary atmospheric design expression, this sconce illuminates any bathroom, hallway, or any area in need of a lighting accent. Made of PETG, this 3d printed sconce creates a beautiful play of color light with custom internal baffle designs for your specific desired mood.

Materials:
PETG, Wood Backing Color Changing LED (16 colors)

Dimensions:
10 in x 14 in x 3.5 in | no required electrical
1. Lighting Cover (3D Printed)
2. Top Magnets
3. LED Control Puck Light (16 colors)
4. Bottom Magnets
5. LED Pocket
6. Wood Base
7. Magnet pocket holes
Overview:
The Stella desk lamp is a contemporary atmospheric lamp that helps create an inspiring working environment. Made of PETG, this 3d printed lamp creates a beautiful play of color light with custom internal baffle designs for your specific desired mood.

Materials:
PETG, Wood Base, LED

Dimensions:
11 in x 8 in x 15 in
Material:
Metal

Observation:
Study of Nature: Leaf Erosion

Experimental Material Strategy:
Eroding / Dematerialization
Narrative Pattern

Technology:
Laser
The night of the incredible experience with my son I was extremely inspired. Once the family was asleep, I went into my office to sketch ideas. As I was enjoying a cup of coffee, the thought of using this beautiful eroded leaf as a statement surface came to mind. It was one of those rare moments in art and design that it all come together fairly quickly. From my sketch, I followed up by beginning to detail the art piece and then modeled it in three dimensions. Through my ideation process, I experimented with various forms, dematerialization of the pattern in multiple surfaces and plausible materials choices.

In the weeks that followed I contacted several fabricators to assess the cost to create such a piece. To my surprise, the cost to fabricate such a piece was outrageous. After several attempts, I was discouraged and abandoned the efforts. I am so thankful to this new opportunity that has allowed me to look at the challenges that I had previously faced with new vigor and perspective. My approach this time around was rather than outsourcing the fabrication of the artwork, was to be fully invested in the making of the art piece.

Table Top Form Explorations:

- Round Form (30" x 34")
- Oval Form (30" x 40")
- Leaf Form (30" x 34")

Scheme Iterations:
vier: methodology

translation to...
vier: methodology

translation to product
vier: methodology
translation to product
vier:
methodology
translation to product
Material: Wood & PLA

Observation: Study of Nature: Flower Blossoming

Experimental Material Strategy: Bending & Adding

Technology: Laser
Bloom

Overview:
Illuminate your space with this contemporary style pendant lamp that fuses the old with the new. Crafted of wood veneer pedals that frame a dimmable LED vintage T10 tubular Edison bulb. The elegant oval shape of the lamp is comprised of two wood veneer skins that help diffuse and create an atmospheric soft lighting condition while revealing the elegance of the historic bulb.

Materials:
Wood veneer, PLA hubs, chrome hardware, Acrylic, Steel Cap and LED Edison bulb.

Dimensions:
ø: 24.75 in  | H: 14.5in h | 10 ft Cord
The inspiration for the lighting pendant came about reflecting upon my walks in nature with my children, especially my middle daughter Estella. It is fascinating to witness what aspects of nature capture the attention of children. I was reminded of her fascination with flowers and seeds. I began to think about the seasonal point in which flowers begin to bloom and the beauty behind the unfolding of the petals that allow us to peak into the mysterious seed inside. I wondered about the possibility of a lamp that aesthetically functioned as petals which mysteriously began to unveil the beauty within, a historical bulb that spoke about the advancement of human innovation.

**Concept**

The inspiration for the lighting pendant came about reflecting upon my walks in nature with my children, especially my middle daughter Estella. It is fascinating to witness what aspects of nature capture the attention of children. I was reminded of her fascination with flowers and seeds. I began to think about the seasonal point in which flowers begin to bloom and the beauty behind the unfolding of the petals that allow us to peak into the mysterious seed inside. I wondered about the possibility of a lamp that aesthetically functioned as petals which mysteriously began to unveil the beauty within, a historical bulb that spoke about the advancement of human innovation.
Sketch Models
One of the greatest challenges experienced in the project was the creation of the double skin veneer structure. In the design development phase, I was confronted with having to develop a system that would help structurally support and hold in place both the internal and external skin. A one to one cardboard prototype model was developed to help understand the relationships of these components while also testing the laser cutting technology on the wood pedal veneer shapes.

After almost giving up on the internal veneer structure of the lamp, I looked across my table and saw one of my earlier sketch models that had an internal 3D printed funnel. This became a turning point, that inspired me to create a custom 3D printed hub, similar to the funnel and made out of PLA, that would allow for all the necessary attachments. This part of the process, became a precedent for the rest of the semester.
1. Acrylic Lighting Bracket (Laser)
2. S.S. Barrel Screw Set
3. PLA Hub-A Connector (3D Printed)
4. Internal Wood Veneer Fins (Steam Bent)
5. External Wood Veneer Fins (Steam Bent)
6. PLA Hub-B Connector (3D Printed)
7. S.S. Barrel Screw Set
“If today’s arts love the machine, technology and organization, if they aspire to precision and reject anything vague and dreamy, this implies an instinctive repudiation of chaos and a longing to find the form appropriate to our times.”

~Oskar Schlemmer
This investigation has allowed me to acquire a synthesis of knowledge that consists in the ability to identify pedagogies not only in the Bauhaus but also in the earlier theories and philosophies that help shape these ideas. New understanding of materials, technologies, and strategies have helped provide a new framework of possibilities in design within academia and practice. Learning about 21st-century design education helped clarify current design education needs such as the earlier implementation for digital literacy, the importance of learning styles, adaptation of reflection as pedagogy, and the use and understanding of technology. New design methodologies like user-center design, participatory design, design thinking, and speculative design have demonstrated some of the gaps and aspects that the Bauhaus failed to consider in their design process.

I must acknowledge that not all Bauhaus lessons in my opinion are obsolete. Ideas of basic design principles, certain concepts of color theory, experimentation, experiential learning, learning through play, abstraction, understanding of space and form, among others still have a place in the 21st-century design education classroom. Today, as I approach design as a student, teacher, and practitioner there is a foundational theoretical backing that helps support my process. As a teacher, I am reminded of “Nature of the Game” an outreach project with Iowa State University Reiman Gardens that focused on educational toys and games inspired by ecology. It was here where many of the ideas and lessons were first implemented and helped shape my ideas for the Brücke Model. From ideas of the Werkbund and the use of an interdisciplinary team, to Frobelian ideas of using toys and games as a tool for teaching, Montessori with the use of motor, sensory, and language educational tools, to Dewey’s ideas of learning through doing. The process allowed us to also experience the importance of participatory design and design sensitivity towards the end-user. Other aspects such as universal design became part of this complex equation. The newly acquired understanding of materials and technology allowed my team and I to work and implement these transitions from ideas, to fabrication to installation.

The experimentation with the model showed how it is evident that the model not only “works” for the user, but actually “works with” the user. In other words, the user, his/her knowledge, perceptions and experiences work in unison with the model in order to develop a solution or discover a design opportunity. In the future, I hope to be able to further test with design students, potentially even faculty, either in a classroom setting or workshops on the Brücke Model. I am interested in this idea of speculating towards future toys and games and testing a sequence of parameters to measure results and discover areas that can be improved upon in the model. I believe this is just the beginning and the journey demands future testing and questioning. In the words of Friedrich Frobel “To learn a thing in life and through doing is much more developing, cultivating, and strengthening than to learn it merely through the verbal communication of ideas.”

1. How far are the pedagogical principles, methods and practices of teaching of the Bauhaus relevant and applicable to 21st-century design education?

2. Given the current changes in materials, technology, and 21st century design education, how far do Bauhaus (design) principles accommodate the needs of today’s design education?

3. How might we bridge the pedagogical lessons of the Bauhaus with current and future design school changes to create a new and improved educational model?
Project Profile:

**Title:** “Nature of the Games”  
**Location:** Ames, Iowa  
**Client:** Reiman Gardens, Iowa State University  
**Completed:** 2019  
**Size:** Eight Interactive exhibits, dimensions vary.  
**Medium:** Materials Varies

**Narrative:**

Back in Fall of 2017 Reiman Gardens send out a Request for Qualifications to create their 2019 Traveling Exhibit called “Nature of the Games”. The exhibition challenged artist/designers to recreate a series of interactive exhibits than can be easily transportable to other gardens, for the next 5 years, while seeking inspiration from well know Lawn Games. Each concept was to embrace an ecological theme that was develop in collaboration with the Garden staff team.

In the Summer of 2018, I was selected as the artist/designer to develop the exhibit in collaboration with the Institute for Design Research & Outreach (IDRO). I assembled and hired a interdisciplinary student team to help in all phases of the project. My team was comprised by students in architecture, industrial design, mechanical & structural engineering. This project became the starting point of testing and experiencing with many of the principles previously described. In May of 2019 the exhibition opened to the public and as of 2020 it has moved to Leu Garden.
Scavenger Hunt:

The goal of the scavenger hunt is for the individual to explore different Biomes in the United States and learn about the plants and animals that live within those biomes. The game would be comprised of 5 biomes art pieces: The Sonoran Desert, Great Smoky Mountain, Florida Everglades, Midwest Prairie, High Plains Alpine.
Scavenger Hunt
Sonoran Desert

The Sonoran Desert covers much of the southwestern United States and parts of northwestern Mexico. This biome is extremely hot and dry, receiving very little rainfall which evaporates quickly. Nutrient-rich soils support a great diversity of specialized plants like short woody trees, shrubs, and columnar cacti, with equally unique animal life.

How to Play:
Can you spy some of the animals that call this biome home?

Quail  Prairie Dog  Road Runner
Falcon  Rattlesnake  Elf Owl  Jack Rabbit

Find all 5 biomes spread throughout the garden

#NatureoftheGame
Morphing Morphology:

Inspired by a cryptex, or even just your common bike lock, the morphing morphology piece intends on allowing visitors to match the components of plant morphology. There are five wheels which each one containing a different element, tree range, leaf, flower, seed and overall tree/name. Each wheel has eight images that align by color and plant species. The wheels spin and different colored acrylic allows the user to know they have the right combination. The game intends on teaching anyone who plays what parts make up eight distinct yet common trees in North America, these trees are bur oak, cottonwood, eastern white pine, flowering dogwood, palo verde, sabal palmetto, sugar maple and tulip poplar.
How to Play:

Rotate each wheel in this puzzle to line up the elements of 8 common but distinct trees in North America. Each slider represents the morphology (structure and form) unique to that tree, from its range to its leaf, flower, seed, and finally the complete tree with its name.

Plant morphology can help you visually identify trees and other plants. How many plants in the garden can you identify based on their morphology?

#NatureoftheGame
Photosynthesize:
Photosynthesize is inspired by balance ball, a team based game where the strategy is to work together to pivot a ball on a platform ultimately trying to balance the ball in the designated holes.

In Photosynthesize, we incorporate a learning curve to help educate the user on the six required elements to complete the cycle of photosynthesis. These elements include carbon dioxide, water, sunlight, chlorophyll, oxygen, and glucose. To complete the cycle in Photosynthesize, you must balance the ball and maneuver through an organic maze to reach all six checkpoints of which are marked with a different element. This maze form is inspired by the path of the veins of a red maple tree leaf viewed at a microscopic level. The red maple was chosen due to its existence nationwide making it a very recognizable tree.
How to Play:
1. Gather around the maze. Its pattern is inspired by the veins of a red maple leaf viewed under a microscope.
2. Working together, tilt the maze to move the ball around.
3. Starting with carbon dioxide, move the ball to stop at each step in the process of photosynthesis.

Photosynthesis is the process by which plants convert sunlight into energy. During photosynthesis, plants take in carbon dioxide (1) and water (2). Light energy from the sun (3) is absorbed by chlorophyll (4) and converted into oxygen (5) and chemical energy in the form of glucose (6).

How fast can you follow these 6 essential steps to help the red maple photosynthesize?
Cause & Effect:
Chess has been a game since ancient times and has crossed borders in being one of the few first international games. This version of chess includes a twist which follows that the pieces represent animals from the different parts of the food chain. Once the game starts however, one goes through multiple food chains and thereby creates a food web.

King - Grey Fox
Queen - Red Tailed Hawk
Bishop - Painted Turtle
Knight - Praying Mantis
Rook - Stink Bug
Pawn - Dandelions, Clover
Food Web Chess:
Tile puzzles are often used in the form of small hand held mechanisms that usually depict an image, phrase, or ordered number set when completed. The puzzle pieces side from side and are usually contained within the frame of the device.

Our abstraction of the sliding tile puzzle would draw connections to different biomes and their biggest threats. The puzzles would be sized up and have different difficulty levels for different ages of users. Making the puzzles double sided gives the cause and effect of the game. If one side is completed, the other side is scrambled. This way when one biome is fully visible, its threat is diminished. Thus teaching the user that more of a threatening factor yields less of its corresponding biome and vice versa.
**Consequence:**

Consequence is inspired by the well known game of Kurplunk. In our reinterpretation it is a representation of human impact on the environment. The balls have relief patterns of endangered plant and animal species while the polls of the game have engraved negative human actions. As the individual removes each poll the balls begin to tumble down. The consequence of human activity in an environment results in the destruction of the ecosystem.
How to Play:

1. Adjust the forest quadrants so all the species orbs fall to the bottom, then lock the quadrants into place.
2. Raise the rotator so the orbs are set at the top. (Some might fall, but that’s okay.)
3. Insert all the human activity rods through the middle of the rotator.
4. Each player selects a quadrant of species orbs to protect. In turn, each player positions their quadrant over the large hole, then displaces one rod, representing a negative action.

Earth’s ecosystems rely on a sustained balance of interdependent living (biotic) organisms and non-living (abiotic) factors within a habitat, where energy and materials cycle easily and there is little waste. Changes in abiotic factors like sunlight, temperature, and moisture can greatly impact an ecosystem. Human activities like waste production, habitat destruction, and deforestation can disrupt this delicate balance.

Each quadrant represents one of four types of forests in North America. The orbs within are imprinted with living organisms tied to each forest:

<table>
<thead>
<tr>
<th>Forest Type:</th>
<th>Species:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boreal Forest</td>
<td>White Spruce</td>
</tr>
<tr>
<td>Temperate Rainforest</td>
<td>Licorice Fern</td>
</tr>
<tr>
<td>Temperate Deciduous Forest</td>
<td>Eastern Hercules Beetle</td>
</tr>
<tr>
<td>Montane Forest</td>
<td>Mourning Cloak Butterfly</td>
</tr>
</tbody>
</table>

What human activities have a positive effect on ecosystems?

#NatureoftheGame
BEEed Maze:
Bead mazes are commonly found in waiting areas like doctors offices. They offer simple amusement to children as they push small beads around twisted and warped metal rods. We have adapted this simple toy into a much larger and educational piece. The BEEed maze will use the overarching theme of bees to teach about pollination while maintaining its true identity as a toy. The warped poles will line up to form a flower from a certain vantage point. Bees and other insects will be pushed around the flower as they “pollinate”. The form of the BEEs maze will be sized to be able to be used by all ages.
How to Play:

Move each BEEd through the flowers!

As bees, butterflies, flies, and other pollinators reach a flower in search of food, they pick up a little pollen from the center of the flower. They visit the next flower, and some of that pollen transfers inside the new flower, fertilizing it to produce food and make more flowers.

Help the BEEds fly through and pollinate the flowers in our maze.

Did you know that cross-pollination by bees and other insects keeps 30 percent of the world’s food crops and 90 percent of our wild plants alive?
Connect Food:

Connect Food is based off the original game connect 4. Each player has to align 4 of his/her disks. In habitat one player is a moth and the other is a butterfly. Each player has to align 4 disks, on each disk it has a different marking of water, food, insect, or habitat. In order for the player to win he/she has to align all the needs of their insect.
The Mississippi River - the second-largest drainage system on North America continent does not only protects but also provides connections between human and natural elements. The Saylorville Lake and Terra Park share these characteristics with the Mississippi River. While the Saylorville Lake mainly protects the residents of Johnston City from flooding, the Terra Park acts as a central access for people to meander and enjoy different activities and experiences.

Water as we know it is vital for all forms of life, it is a place of embedded and created memories. Both Saylorville Lake and Terra Lake have provided “ripples” of these created memories. Stories like fathers and mothers teaching their kids to fish along the boardwalk and pier, or families having a picnic lunch at one of the open shelters, of course the great times of boat sailing on these waters, or even perhaps the peaceful stroll along the shore to encounter a gentle tail flap of the infamous largemouth bass fish. These are the subtle “ripples” that will forever be cast in our minds.
conclusion

chapter 5: brücke practitioner

Neddles Nashville, TN: Credits: RDG Dahlquist Art Studio.
About the 11 miles upstream from the city of Des Moines resides the Saylorville Lake acting as a guardian protecting over the city of Johnston. The lake shares the additional storage to help reduce the flood crests on Mississippi River and Des Moines.

The Terra Park is one of the most crucial locations in Johnston City. The park provides spaces for variety of outdoor activities. The fishing lake is the central location where most people would go and delight in its treasures.

**LIVING SPECIE**
Saylorville Lake has been a home for the Largemouth Bass Species after the dam was built.

**ACTIVITY**
The lakes provide a variety of recreational activities. One of which is the popular recreational fishing.

**BONDING TIME**
The lakes record the memories generated by the families and individuals who have visited. One of my profound memories of learning about fishing happened in one of these amazing water bodies.
Chapter 5: Brücke Practitioner

The infographic illustrates different types of species that travel or are near the Sylvania Lake. Several of these can be also found in nearby Lake and even Big Creek. LOCAL FISH DATA

Conclusion
*The diagram analysis the usual swimming pattern of the bass fish in the water. Which inspire the organic movement and flow of the artwork.

**BASS MOVEMENT STUDY**

The diagram records the frequency of the ripples when the fish weight is shifted to the Caudal Fin (Tail) to swim. Depending on the amount of weight the bass put on the tail, the water ripples shift from dense areas to more equal areas. “Ripples” become the metaphor of the impact of the community of Johnston. Years of planning, devotion and dedication have culminated in the creation of the New Johnston Town Center a destination were families not only from Iowa will come in laughter, joy, and memories.
FISH SCALE DESIGN

Inspired by the Bass Fish scales, the sculpture embraces a dynamic kinetic character. The sculpture exhibits rows of metallic oval pieces. When the wind blows through these pieces, they will move and create a ripple effect.

This performance will become the epicenter for great photo opportunities but also the atmospheric performance. Viewers will not have the static typical sculpture experience but rather one that is always changing, provides a spatial experience to look from within and performs with the sails of the future ice rink and splash pad.
NOTE:

THE KINETIC FISH SCALES COMPLEMENT THE WIND PERFORMANCE OF THE SAILS. IT WILL BECOME A DYNAMIC EXPERIENCE AND COMPLEMENT THE SPACE.

"ripples" or "big fish" | concept 3B
Fabrication Inspired by Wood boat construction.

Inspired by the movement of water “ripples” generated by the ergonomics of the fish. Community Metaphor...

Inspired by the kinetic aspect of the way water flows through the fish scales. Sculptural Performance

"ripples" v2 or "big fish" | NOTE: Fabrication technique is similar to boat building.
chapter 5: brücke practitioner

conclusion

NOTE:
FABRICATION TECHNIQUE IS SIMILAR TO BOAT BUILDING.

"ripples" v2 or "big fish"
"RIPPLES" OR "BIG FISH" | CONCEPT ELEVATIONS

**NOTE:**
Contingent upon scale of artwork, viewers could potentially see the "belly" of the fish, you can see the kinetic performance of the scales from within.
"ripples" or "big fish" | concept 3b

dematerialized

notice:
study of dematerialization of the fish during the winter months
view from the ice ring.


- Figure 1. WalterGropius-1919 (Held c.1919)
- Figure 2. Pedagogy at 3 Intersections
- Figure 3. Design Studies 102, Fall 2015 | Topography Projects
- Figure 4. Design Studies 102, Fall 2015 | Color Interaction
- Figure 5. Design Studies 102, Fall 2015 | 30-20-10 Project
- Figure 6. Design Studies 102, Fall 2015 | 30-20-10 Project
- Figure 7. ARCH 202, Spring 2019 | Mark Making Space
- Figure 8. Architecture 202, Spring 2019 | ARCH 202 Exhibition
- Figure 9. Bauhaus Mind Map
- Figure 10. Assessment of work from Albers’s Preliminary Course, 1928–9
- Figure 11. Jose Albers teaches color theory at Black Mountain College, New Haven, 1946 (photograph by Genevieve Naylor)
- Figure 12. Josef Albers teaches color theory at Black Mountain College (1940).
- Figure 13. Joseph Albers teaching.
- Figure 14. Diagram Inspired on “The Educational Background to the Bauhaus” (Cross 1983)
- Figure 15. John Dewey, bust portrait (U.S. Library of Congress Prints & Photographs division under the digital ID cph.3a51565).
- Figure 16. Learning by doing by John Dewey.
- Figure 17. Helen Parkhurst Portrait (alchetron 2018)
- Figure 18. Dalton Plan School Tokyo Adaptation (Dalton School Japan)
- Figure 19. Dr. Maria Montessori (Wikimedia Commons)
Brücke Model

bridging the Bauhaus to the 21st century
reinaldo correa