

**DESIGN IS OUR NATURE
DISSEMINATING DESIGN PRACTICES IN K12 EDUCATION**

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“Since new developments are the products of a creative mind, we must therefore stimulate and encourage that type of mind in every way possible”.

George Washington Carver

DESIGN IS OUR NATURE: DISSEMINATING DESIGN PRACTICES IN K12 EDUCATION

ABSTRACT

Creativity and innovation matter in today's global economy. Yet diversity of human creativity is lost as students drop out of school and disengage from our educational systems. To ensure responsiveness and resiliency, teacher education needs new pedagogy to connect students' tacit knowledge with the essential skills necessary for productive and purposeful lives. Teachers need adaptable assessment methods and agile approaches to contemporize curriculum to retain human creativity. Design connects traditional subjects with real practices and integrates individual's creativity with possibilities. It delivers motivation and passion with productivity. Design As Nature Workshops support teachers as designers with introduction of hands on activities, new 21st century STEAM skills and eLearning virtual field trips, digital interactivity and global connections. The eLearning designopedia, NEXT.cc, disseminates design opportunities networking k12 to college nurturing imagination, enhancing learning moments and improving outcomes.

Keywords: Creativity, Innovation, Design Education, Teacher Education, 21st Century Learning

DESIGN IS OUR NATURE! DISSEMINATING DESIGN PRACTICES IN K12 EDUCATION

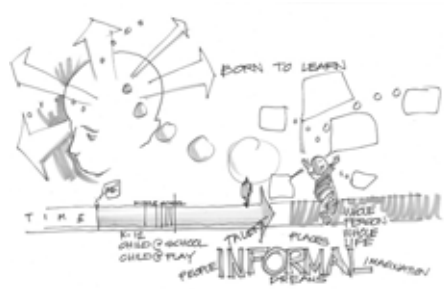


Figure 1: We are born to learn. NEXT.cc 2014

WE ARE BORN DESIGNERS

We are born to learn. We are born to create. We are born designers. Our brains through 7 million years and 350,000 generations have been wired with over one hundred billion neurons set to learn 24 hours a day. Inside we hold the repository of everything human- the skills that have developed and the music, writing, dance, art and stories that have been told. All of this is ready to be awakened in our imagination. Scientists now know that parts of our brain lie waiting to be triggered in certain stages of our life by certain events; if we miss these triggers much of the potential to awaken this imagination disappears. Before children sit in desks in school to learn, they trigger imagination through everyday play, exploration and problem solving. They learn on their own through *informal learning*, or the tacit knowledge that each of us brings to light by who we are, the talents we have, the people we know, the places we visit, the music we listen to and the dreams we dream.



Figure 2: Nine Scales of Human Intention, NEXT.cc

WE ARE ALL CREATIVE

Our research celebrates education's need to nurture curiosity and imagination with a mandate to connect children's informal learning with directed instruction to motivate life long learners and engaged citizens. It is founded on the fact that creativity is an inherent human trait that knows no specific, race, creed, age or income. It respects education's intent to support each individual's potential for a life of purpose. This approach, prefaced years ago by Dr. Howard Gardner demands that teachers be equipped with a variety of strategies and techniques to choreograph learning for each individual (Gardner 1983). Design is human intention and forms the basis for how humans evolve, create and coexist in the world. Most people live in designed worlds. Many people spend ninety percent of their lives indoors surrounded by designed objects, leaving to take a designed object to another environment designed by someone, somewhere, sometime. Our research aims at increasing awareness of the necessity of design learning and disseminating design opportunities (curriculum, pedagogy and assessments) to reach teachers (and their students). As Herbert A. Simon, pioneer of computer science and artificial intelligence writes, "Everyone designs who devises course of action aimed at changing existing situations into preferred ones." This, for most of us, is a life of purpose.

The need for design learning is great. Design learning connects potential of each student with purpose or opportunities for successful contribution to the world. Unfortunately the majority of United States population is denied design. It is not introduced in K12 education (Davis, 2008). Currently only three states have art and design standards (Wisconsin, Michigan and New Jersey). Most teachers have never been exposed to the creative design fields that make up the built environment. Meredith Davis, author of *Design As A Catalyst for Learning* reports that design education is (was) basically non existent in the US (Davis, 2008). Her NEH study discovered that K12 educators were not trained to introduce design as an investigative research tool critical to human ecology. Design, if it was introduced, was simply aesthetic and formal rather than the messy confluence of investigation and iteration, trial and error. Less than half of middle school students have access to art, much less design, instruction. Music, drama and art budgets are among the first to be cut in terms of time and budgets. In addition, almost half of US children are bussed to school and bussed home afterwards omitting exploring the out doors except in diminished short spurts during recess on denatured asphalt playgrounds. Where is responsibility for the built and natural environments, human well-being and sustainable future cultivated? Where and when is all education environmental(Orr, 2004)? Where and when in schools is creativity nurtured and allowed to flourish?

Every day thousands of students in the United States drop out of school. Our current educational system, forged in the 19th century, is based more on directed instruction than on connection to informal learning or each child's interest, talents and potential. Teaching emphasizes assessments and grades rather than on nurturing passion to learn, play and create (Wagner, 2012). Education is, in its current common core state, with all good intentions, flattening human creative potential and diversity to solve problems facing our sustainable future. Other countries such as New Zealand are shifting effective teaching from delivery of instruction to make learners fit into a system of testing assessment to building an education system and curriculum around the potential of the learner (Bolstad & Gilbert, 2012). In addition, learners develop desire and aptitude for continuous learning even after school. They are equipped with cultural and linguistic diversity in preparation for global practices.

Americans for the Arts report that if a child fails even one class in middle school they are 50% more likely to drop out of high school making the middle school years formative to success in school and possibly in life. In support of nurturing creativity, they report that students who take art in middle school are four times as likely to be successful in high school (AFA, 2012, p. 03). Students with creativity education are more likely to attend college. They are more likely to succeed in the workplace and in life. Education needs to embrace creativity allowing students to use what they know (AFA, 2012). In addition, 93% of Americans believe that the arts are key to a well-rounded education (AFA, 2005, p. 23). As or more important is the finding that 72% of employers site creativity as an important ingredient for new hires (AFA, 2012, p.13).

Sir Ken Robinson in *Changing Education Paradigms* (RSA Animate, 2011) reports that while almost all young children claim to be creative the numbers drop off drastically by middle school and high school. In addition Americans for the Arts report that arts education is declining most rapidly in underserved populations (AFA, 2011). Our research in over one hundred workshops with teachers reveals what IDEO founders, Tom and David Kelly, and many Design Thinking Entrepreneurs report, “We’ve been so excited to find at IDEO and the d.school at Stanford that it turns out people are all kind of wildly creative.” (O’Leary, 2013). Moving learning from directed instruction to student led inquiry raises ‘the need to know’ and creates motivation in the classroom. Project Based Learning, another active learning strategy, cultivates student responsibility, ownership and choice in selecting projects to develop.



Figure 3: People of all age, income, race and creed, are creative. NEXT.cc 2014

DESIGN IS 21st CENTURY LIBERAL ARTS EDUCATION

Design introduces creativity and critical thinking. To be a designer, one naturally develops criticality. A charming example is presented in Expeditionary Learning’s Video, Austin’s Butterfly: Building Excellence in Student Work-Models, Critique and Descriptive Feedback (Berger 2010). First grade children are shown giving feedback about a student’s butterfly drawing. This process shows the ability of children to look more closely, form perceptions, offer critique and realize differences and excellence. Design is the continuous cycle of looking, developing perspective, forming feedback, changing course. It develops conceptualization, critical thinking and resilience. This introspection and careful looking of youth can be nurtured at any age.

More challenging is creativity and its messy, yet rigorous, investigation. It does not fit neatly into 50 minute periods that then must shift to another topic. Creativity flourishes on melding information from diverse fields and approaches, experimenting, exploring, testing and trialing. Designers call this ‘informed design’. New Next Generation Science Standards ask teachers to integrate engineering and technology into science education. While this is an exciting move for design, few teachers are equipped to work fluidly between physical modeling and testing and creative use of the broad band of new and emerging digital tools. This is the practice of STEAM by Design. The designing mind connects Dr. Howard Gardner’s *Five Minds For The Future*- Respectful, Synthesizing, Creative and Ethical (Gardner, 2006). Gardner writes about acquiring mastery in a discipline taking ten years; this matches with Gladwell’s “ten thousand hours” for innovation (Gladwell, 2011). Design is always redesigning itself, looking to new tools and new ways of knowing. It demands continuous learning. Design attaches itself to ever changing situations demanding resilient responses. Design incorporates creativity and critical thinking, messy investigations, material testing and construction of ideas and solutions. Design opens minds to life long learning.



Figure 4: The designing mind connects Gardner’s five minds for the future. NEXT.cc 2014

Design builds a work ethic. Design, in its approach to looking at the world, proposes the need to investigate, experiment, test and share ideas over a period of time with diverse audiences. It moves the imagination fluidly from divergent to convergent thinking conceptualizing ideas, responding to diverse criteria, synthesizing information and driving to share ideas and see ideas realized. The design process by its very nature builds perseverance and focus.

Design learning melds teaching with student led inquiry. As FutureLab and Microsoft's Enquiring Minds report states, "...it is a distinctive approach to teaching and learning which takes seriously the knowledge, ideas, interests and skills that students bring into school" (Morgan, J., Williamson, B. Lee, Tash & Facer, K., 2010, p. 9). Design introduces systems thinking, or the connection and influence of at least the next smaller and next larger scale in subjects. Systems thinkers expand specific empirical knowledge to local and then global practices, pulling learning from a point in time to a horizontal stretching of information, association and understanding. Design introduces systems thinking as it considers complex information from diverse fields as interconnected.

Design employs dynamic processes that exercise imagination, challenge critical thinking, develop and mature skills. Design in K12 leads to many areas of expertise for life long learning and practice. Some emerging design fields employ high school graduates directly. Some design professions require additional schooling and internships. Design practice becomes a life long acquisition of knowledge and expertise.

Design cultivates engagement. As teachers and students become engaged in projects they communicate and collaborate. They learn together. Teachers become facilitator and life long learners. Learning together builds community. As students invest in projects, they want to share their projects and activate change. Design, by necessity, is the 21st century liberal arts education. It moves from what one knows to what one can do with that knowing. The Design Learning Network started by Doris Wells-Papanak draws upon Dr. Betty Garner's cognitive research in "*Getting to Got It!*". For K12 learning they both calls this the "Learn Think Do" approach. This approach, spread out over interconnected steps of exploration, experimentation, conceptualization, ideation, iteration, prototyping, etc., is the core of design.

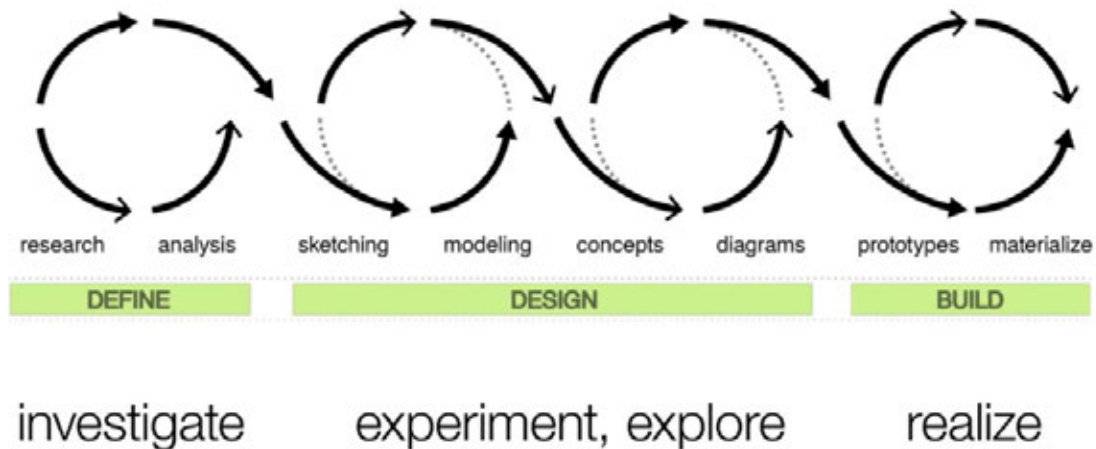


Figure 5: The define, design, build process. NEXT.cc 2014

Design opens the environment, both the built and natural, as fertile exploration and experimentation ground for 21st century K12 pedagogy. Drawing upon Dr. Howard Gardner's *Five Minds for the Future*, design integrates the disciplinary mind, the respectful mind, the synthesizing mind, the creating mind, and the ethical mind (Gardner, 2006). Introducing what design is, what design does, and why design is important with place based activities draws individuals informal learning knowledge together with K12 directed instruction to establish the foundations for life long learning (Keane & Keane, 2009).

A 2012 National Governor's Association Report promotes the importance of design linking art with science with the environment for cultural sustainability. *New Engines of Growth: Five Roles for Arts, Design and Culture (NGA, 2010)* presents the importance of art and creativity education in K12 as a driver to produce students who will be better prepared in the workforce. They also predict that art, culture and design will form creative knowledge clusters that can catalyze cultural districts and initiate community revitalization. Designing design education to nurture imagination across broad bands of population strengthens the collaborative culture of communities with direct affinities to specific places and specific schools.

DESIGNING TEACHER EDUCATION

Designing education changes teacher education, assessment and curriculum. The Grattan Report details how countries that score the highest in PISA standards have revamped teacher education (Grattan Institute, 2012). To educate for resiliency, adaptability and creativity, teacher education needs design pedagogy, new assessment methods and new approaches. The report finds that the top four ranking countries have created a “strong culture of teacher education, research, collaboration, mentoring, feedback and sustained professional development” (Grattan Institute, 2012). Not surprisingly, this sounds very much like the culture of a design studio, where aspiring students collaborate, research, receive and give mentoring and feedback and begin sustained professional development!

The Partnership for 21st Century Skills Framework (Partnership 2009), asks that global themes such as the environment, health and well-being, and the economy be presented with traditional school subjects challenging application of students’ baseline knowledge to global issues. These complex issues face society today and need to be present in everyday teaching. Developing a personal affinity with place and continued exposure to site specific outdoor experiences are key in developing 21st century eco literacy. Designers are involved in mediating human interactions with constructed systems in the natural environment.

Dr. Yong Zhao’s book, *World Class Learners: Educating Creative and Entrepreneurial Students*, champions the importance of second language instruction. Second languages introduce students to other cultures and other economies. The Fulbright Program, founded by the late Senator William Fulbright in 1946 requested cross cultural pollination and exchange; encouragingly, the percentage of students studying abroad has grown to 10% of the US College Student population in the last few years. Design offers avenues to become acquainted with other cultures through study, travel, and work abroad. Design offers access to international individuals and practices that are responding to specific culture, place and climate. Teachers (and their students) given the opportunity to take virtual field trips, play geography games, ‘travel’ to other other cities, meet careers and classes on the opposite side of the globe, expand curiosity about other while broadening understanding of human diversity.



Figure 6: 21st century learning introduces systems relationships between our economy, culture and environment. NEXT.cc

In addition, a growing awareness of our planet’s changing climate charges the need for heightened environmental skills and sensibilities. Digital tools and methodologies of inquiry can be incorporated in the classroom and outside of on the school campus. New tools for making and learning contribute new ways of knowing. Design practices are continuously involved in developing and utilizing new tools for research,

iteration and construction. With ubiquitous cell phone use and home computers on the rise, schools need to be wired to allow access to learning online. Teachers can be empowered to use technologies with friendly, non-intimidating introduction to creative incorporations of technology in everyday instruction.

The EU Open Discovery Space (ODS) project addresses the challenge of modernizing school education by connecting teachers, students, parents and policymakers in creation of a pan-European e-learning environment. Their goal is to promote more flexible and creative ways of learning to improve the way educational content is produced, accessed and used. Opening up institutional learning to the public, with free access to tools, knowledge and systems, is a step in the right direction to nurturing creativity. The power of the web can deliver high quality learning curriculum directly to individual teachers and students. The Internet of Things (for children) asks collaborators to share openly resources, methodologies, strategies, digital knowledge and curriculum to introduce everyday use of technology in humane ways. Design of learning systems is a way of facilitating open and generous sharing of knowledge.

DISSEMINATING DESIGN OPPORTUNITIES

While education seems to separate art as creativity education from traditional subjects such as language, math, science, etc., global design practices work cohesively across subjects to create systems, products, experiences and environments. Architecture is an integrating discipline that does not separate art from science, language from health, math from the environment. Design fields, or fields that produce what humans needs, use and celebrate, do not treat creativity as an elective.

Next Generation Science Standards' new focus on engineering practices is transformative. The integration of engineering and technology into the structure of science education will raise engineering and design to the same level as scientific inquiry. Design, like engineering, imagines the future through an iterative process with parameters. (NEXT.cc).

Our research builds upon our design experience teaching art, architecture and design students at the undergraduate and graduate levels at The School of the Art Institute of Chicago and the University of Wisconsin Milwaukee. As architects, trained and experienced in design that includes science with art, technology with engineering, the natural with the built, a trans disciplinary approach to teaching and learning is our nature. We started a Young Architects Club at the University of Wisconsin Milwaukee where inner city youths were bussed to the campus for a Saturday workshop. We drew with them, introduced vocabulary, tested materials and explored modeling and building. We introduced built environment education in elementary, middle and high school career days in local public school districts. Quick subject introduction followed by hands on activities spurred curiosity, interest, and excitement about project based learning (outside of the art room). In addition, when a local school referendum called for maintenance and replacement, we worked with students, teachers and community professionals to raise awareness of reusable energy sources, best storm water management practices, urban agriculture beds, outdoor learning experiences and the importance of prioritizing the environment across the curriculum. Our high school received a Green and Healthy School Certification for installing solar panels, photovoltaics, bioswales and a water filtering athletic field.



Figure 7: Project based workshop for ESL students without access to art instruction.

DESIGNING ACCESS TO DESIGN THINKING AND MAKING

“A good education system should provide all who want to learn with access to available resources at any time in their lives...” Illich (1971)

NEXT.cc is an eLearning designopedia created by principals, teachers, architects, artists and college art, art education, design and architecture students (MIT, Harvard, NYIT, CCAC, Parsons, SAIC, UWM). Available 24/7, it introduces informal learning curriculum connected with art, design, science and environment practices to design denied teachers (and students) in remote classrooms. Participants move from the computer into the community and learn about themselves, their neighbors, and their friends as they engage history and culture of place and explore sustainable design possibilities (NEXT.cc, 2014).



Figure 8: NEXT.cc introduces TOOLS, LANGUAGES, DISCOVERY, DESIGN Opportunities.

Blurring learning with play, work and fun, NEXT.cc’s Journeys offer TOOLS, LANGUAGES, DISCOVERY and DESIGN activities connecting across the consilience of nine connected scales - nano, pattern, object, space, architecture, neighborhood, urban, region, world. Mixing standards assessed disciplinary core ideas, which previously dominated instruction, with science and engineering practices and cross cutting concepts allows students to generate personalized responses, test ideas and learn from convergent and divergent thinking. Self directed exploration of journeys awakens curiosity and supports imagination at work in creative applications in the classroom, on the school campus and out in the school community. Journeys link topically with virtual field trips, museums, institutions, and contemporary global practices bringing creative economies to remote classrooms all over the world.

Since 2007, we delivered over one hundred teacher and student workshops in the Midwest. We learned with the teachers the need to introduce digital tools in non-intimidating ways. We learned to connect design journeys and activities to required Art and Design and North American Environmental Education Standards. We connected Next Generation Science Standards to correlate with 21st century skills. We created cluster models of curriculum for schools. Cluster models create curricular opportunities for teachers of different subjects to join together to work as facilitators in assisting student led projects .

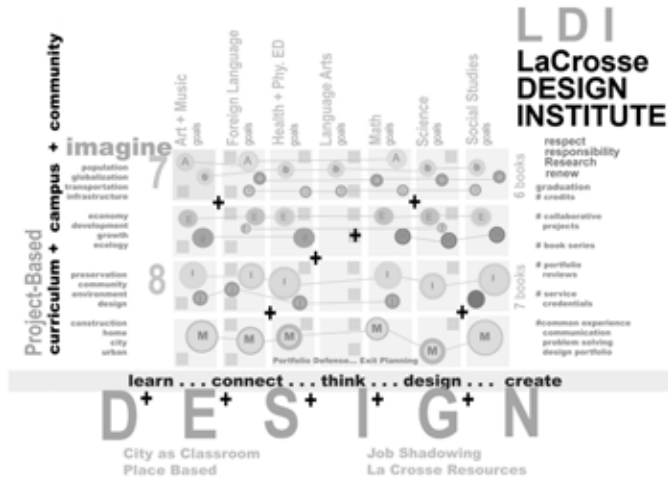


Figure 9: Design introduces trans disciplinary project learning that clusters work from two or more classes In projects connected to the community. NEXT.cc & DLI 2009.

Teachers became empowered to use creative digital tools to spark interest, play games and awake attention and build motivation. Teachers invested in place base project learning and raised appreciation of the value of connecting their teaching with the school community’s culture, economy and environment. Teachers became life long learners and move from directed instructors to collaborative facilitators of students led inquiry. As follow up, we work with teachers to develop projects on the school grounds that introduce sustainable practices. We work with teachers to inspire projects specific to school communities that strengthen school culture. NEXT.cc’s topical links generate excitement, raise enthusiasm and increase 21st century aptitudes. Teachers coordinated new journeys to expand their instruction and alternative assessments for short, medium and long-term projects. Teachers changed the choreography of the classroom.



Figure 10: Teachers are introduced to phased STEAM projects that blur the boundaries of learning, work, play and fun. NEXT.cc & ASM 2013.

NEXT.cc’s integrative journeys deepen project research and connect real world careers for students. NEXT.cc combines visual, digital and hand skill development with vocabulary acquisition maturing students’ abilities to create, communicate and collaborate. NEXT.cc becomes a weekly eLearning exploration of possibilities and practices informing student inquiry. Teachers and students continue free access to the design resources of NEXT.cc during homeroom, after school clubs, conservation and enrichment clubs. NEXT.cc is assigned over the summer for portfolio development.

TEACHERS ARE INVIGORATED WITH DESIGN PRACTICES

Teachers need first hand experience of design projects to gain confidence as creators, makers and problem solvers. Teachers need opportunities to find, analyze and apply knowledge from a range of curricular subjects to generate solutions to complex problems. Teachers need encouragement to connect classroom teaching with careers and industry partners in the school community. Teachers need introduction

to easy to learn digital tools and techniques to stay one step ahead of their students. Teachers need practice at developing design assessments for project based learning. The shift from grading correct answers to reflecting on outcomes and evaluating design takes practice. Most teachers have critical eyes and insights and can easily engage in critique of each others work. They understand and appreciate design's role in connecting with community and with current issues. They see that design allows for active learning opportunities.

After experiencing high energy hands on workshops with a series of design challenges, teachers report that they understand the relevancy in design learning. They enjoy the range of activities integral to thinking about design, brainstorming ideas, testing ideas and constructing ideas. They learn basic tools for initiating design thinking, comparing approaches, empathizing with users, evaluating outcomes. They can communicate their concepts and ideas. They are excited to use new digital tools and to become skilled in using them. Teachers move quickly from choreographer of instruction to coaches of learning.

CONCLUSION

Education plays a highly important role in creating a sufficient and sustainable economy. Design education, specifically, encourages teachers to look at their creative side and develop an innovative approach to their teaching. Teaching design encourages learning from the world, engaging the world and finding ways to improve the world. Using design as K12 methodology channels student led interest and experiences into ideas that inform the content and daily process of teaching and learning. A commitment to personalised learning, embracing diversity, rethinking learners' and teachers' roles, forging new partnerships — all fueled by disciplined innovation and new technologies — are identified as the key dimensions of a redesigned, connected and coherent 'learning system'. Teaching teachers and children design principles builds basic knowledge and confidence to become an involved citizen. Design for students involves not only a visual, artistic approach, but also a hands-on, **tactile** way of learning that puts students out into the world connecting with their interests and informal learning capabilities in the built and natural environments. By creating common knowledge of design, individuals evolve into educated adults that can confidently take part in designing their community through collaboration in addressing local and global issues.

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