Autodesk University 2012

Kid Architecture Workshop: A Case Study Demonstrating How Young People Learn 3D Design

Jon Daniel Davey Ph.D., A.I.A., Professor of Architecture – Southern Illinois University
Janice Miller, Secondary Education Program Manager – Autodesk, Inc.

ED3679

The Kid Architecture Workshop offered by Professor Jon Davey in Southern Illinois provides young students with a great foundational experience and appreciation for design as a lifelong career. This workshop has been in operation for the past 25 years, providing insights into how students learn about spatial design, building materials, visualization techniques and using digital technologies to create design solutions. It also provides a solid foundation for students to pursue design or architecture in their post-secondary academic life. The workshop offers valuable data and insights on how learners successfully combine traditional experiential techniques with computer tools when approaching design problem solving. This session will present the Kid Architecture Workshop, followed by a panel discussion to find ways of assimilating and applying its findings to other areas of teaching design for a secondary audience.

Learning Objectives

At the end of this class, you will be able to:

- Demonstrate an understanding of the Kid Architecture Workshop, its reasons for success, and the data collected on experiential learning.
- Discuss what motivates young learners to explore three dimensional design as an area of interest
- Adopt real-world examples that inspire students' passion for design visualization.
- Interact with faculty peers who have implemented new ideas in teaching design related activities to secondary students.

About the Speakers

Dr. Jon Daniel Davey – Dr. Davey is an Architect, Registered Interior Designer, Professor, Founder and Director of Kid Architecture and Le Petit Grand Tour d'Architecture. Kid Architecture was developed for young people age 9-18 dealing with the design of the built environment with special interest in architecture for the last 31years. His academic experience includes a Ph.D., a MS in Education, MED in Environmental Design, a Stage D'Architecture et Dessin D'Interieur, Ecole De Beaux-Arts, Paris, a BS Architectural Studies an AAS Architectural Technology & a Certificate of Education from the Jose Marti Institute, Havana, Cuba. He has design experience in architecture and engineering as his own firm, Prairie Design Studio. Professor Davey has developed and conducted 65 travel/study programs internationally. His present research is in Neuroscience in Architecture. He has taught AutoCAD since version 1.3, has been a Teacher Trainer & has also earned the AutoCAD Top Gun award.
jdavey@siu.edu

Janice C. Miller – Janice is the Education Program Manager for Secondary Education within Autodesk, where she executes scalable programs while maintaining a keen ear to the needs and challenges students and faculty face today. She most recently launched the Autodesk Simulation Workshop at www.autodesk.com/simulationworkshop. Janice has held roles in both the Manufacturing Industry Group and Worldwide Education at Autodesk, focusing on global projects. She served as Director of Education at an M&E ATC in Florida, where she developed custom training programs for partnerships including Boeing, Lockheed Martin, NASA, Herman Miller, and Disney. Early in her career Janice was a DVD Author and Producer, and also worked as a freelance Audio Engineer. She earned a Master of Arts degree in Telecommunication from Michigan State University with a specialization in Interactive Design & Technology, and spent four years teaching in the department where she discovered her passion for working with students. janice.miller@autodesk.com

Kid Architecture Workshop

What is it?

- Summer Workshops & Camps introduce young people to the design of the built environment: architecture, urban design, landscape design, interior design and industrial design.
- Kid Architecture websites:
  - http://mypage.siu.edu/ashfaq/KidArch/
  - http://kidarch.siu.edu/
  - http://dtoasm.org/work/davey-thu/index.html

How did it Begin?

- Frustration with our educational system and with incoming freshmen: students not equipped with design, problem solving and critical thinking skills

References/Inspiration

- Horace Mann's adoption of the Prussian education system (social obedience of citizens through indoctrination) http://www.intellectualtakeout.org/library/dewey/horace-mann-and-american-education-reform
- *"Network of Learning for a Pattern Language"* by Christopher Alexander: http://www.scribd.com/doc/99522247/18/NETWORK-OF-LEARNING (large file)
- *"Deschooling Society"* by Ivan Illich: http://www.preservenet.com/theory/Illich/Deschooling/intro.html

What are the Objectives?

- The goal is to take four years of architecture education and do it in a week!

What is the Pedagogy?

References/Inspiration

- *Emile* by Jean-Jacques Rousseau: http://www.gutenberg.org/ebooks/5427
- *How Gertrude Teaches her Children* by Johann Pestalozzi: http://studentzone.roehampton.ac.uk/library/digital-collection/froebel-archive/gertrude/index.html
- Friedrich Froebel, inventor of kindergarten and the Froebel Gifts: http://studentzone.roehampton.ac.uk/library/digital-collection/froebel-archive/
- Maria Montessori: http://www.montessori.edu/
- *The Block Book* by Elisabeth S. Hirsch: http://thechildreninmind.com.temp.realssl.com/DevelopmentCurriculum/AdviceIdeas/tabid/70/articleType/ArticleView/articleId/47/The-Block-Book-Elisabeth-S-Hirsch-Editor.aspx

- *Frames of Mind* by Howard Gardner: http://howardgardner.com/multiple-intelligences/
    - This book challenged the traditional psychological view of intelligence as a single capacity that drives logical and mathematical thought. Instead, Gardner proposed that all individuals possess seven independent intelligences, which revolutionized the worlds of both education and psychology. Gardner's theory of multiple intelligences includes: Linguistic, Logical-Mathematical, Musical, Spatial, Bodily-Kinesthetic, Interpersonal, Intrapersonal and Naturalistic.
- Review of *In the Mind's Eye Visual Thinkers, Gifted People with Dyslexia and Other Learning Difficulties, Computer Images and the Ironies of Creativity* by Thomas G. West (pdf): http://coe.csusb.edu/centers/documents/ReviewofBooksbyVisual-MediaLiteracyAuthorThomasWest.pdf
    - This book revealed that conventional ways of learning and teaching do not always reach all students. In fact, some of society's most creative minds may be overlooked because we fail to understand or develop the unique strengths of students who see the world from different perspectives. Mr. West showed us that people with learning differences often see original solutions that might not occur to someone who "knows a vast reservoir of facts, but can't visualize or use that information to take the next step."
- *Inventing Kindergarten* by Norman Bosterman: http://www.brosterman.com/publications.shtml
- Paper – "*Bodies of Knowledge"* by Guy Claxton, Bill Lucas and Rob Webster (pdf): http://www.edge.co.uk/media/16982/bodies_of_knowledge.pdf
- *"Metaphors We Live By"* by George Lakoff and Mark Johnson**:** http://theliterarylink.com/metaphors.html
- Review of *The Craftsman* by Richard Sennett: http://www.nytimes.com/2008/04/06/books/review/Hyde-t.html?pagewanted=all
- Essay - *Dangerous and Daring Books for Boys and Girls: Artifacts of the Changing State of Childhood* by Dorothy Justus Sluss (pdf): http://www.hasbro.com/common/instruct/45079.pdf

What are the Activities?

- Walking historic architecture field trips
- Architecture history slide discussions
- Environmental behavior studies discussions (How the built environment affects our behavior)
- Architecture history slide discussions in costume
- Design process, application, generation of solutions and critique
- Sketching and rendering
- Small scale construction projects

- Visiting constructions sites
- Casting concrete
- Model building
- Spatial projects
- Computer graphics and CAD
- Structural projects
- Field trip to St. Louis Architecture or other sites

Who Sponsors it?

- Southern Illinois University Carbondale, Illinois (25 years)
- The Southern Chapter of American Institute of Architects (25 years)
- Mitchell Museum Mount Vernon, Illinois
- Edwards Place Springfield Art Association Springfield Illinois
- Tap Roots School of the Arts, Missouri Youth Extension, Saint Louis
- University of New Mexico Architecture + Children
- Smithsonian Institute Washington D.C.
- National Building Museum Washington D.C.

What are the Results? (Statistical)

- Starting 25th year
- Over 100+ camps and workshops conducted
- 2500+ participants
- Many participants have gone on to pursue Architecture as a career 25%-30%

What are the Results? (Honors)

- R. Buckminster Fuller Award, American Institute of Architects Illinois
- Citation, American Architecture Foundation, Washington D.C. 2007, 2009
- Presidential Award, Southern Illinois Chapter of the American Institute of Architects
- Citation of Honor, American Institute of Architects AIA Illinois

- Connections Award, Illinois School Board
- Children's Environmental Advocacy Award of Distinction, The Urban Network
- Chapter Education Award St. Louis Chapter of The Construction Specifications Institute
- North Central Regional Education Award of The Construction Specifications Institute

What are the Results? (Pedagogical)

Motivation of Three Dimensional Design Thinking

Having an understanding of how the brain works

- Paper – "*Exploring the neurological basis of design cognition using brain imaging: some preliminary results"* (pdf): http://www.icn.ucl.ac.uk/executive_functions/pubs/alexiou%202009%20design%20studies.pdf
  - "The paper presents a pilot interdisciplinary research study carried out as a step towards understanding the neurological basis of design thinking. The study involved functional magnetic resonance imaging (fMRI) of volunteers while performing design and problem-solving tasks. The findings suggest that design and problem solving involve distinct cognitive functions associated with distinct brain networks."
- Article – *"Corridors of the Mind"* by Emily Badger: http://www.psmag.com/culture/corridors-of-the-mind-49051/
  - This article explores the new interest in neuroscience relating to architecture and design.
  - "Today, the near 10-year-old Academy of Neuroscience for Architecture believes that neuroscience could make science's greatest contribution to the field of architecture since physics informed fundamental structural methods, acoustic designs, and lighting calculations in the late 19th century."
- Symposium – *"Minding Design: Neuroscience, Design Education, and the Imagination,"* held at Taliesin West: http://wright-up.blogspot.com/2012/11/recent-events-at-taliesin-west.html#!/2012/11/recent-events-at-taliesin-west.html

Inciting a Passion for Design Visualization

The use of metaphor in design thinking

- Book – *Creative Thinkering* by Michael Michalko: http://creativethinking.net/WP01_Home.htm
  - "This book shows that in every field of endeavor our natural creativity is limited by the prejudices of logic and the structure of accepted categories and concepts. Through step-by-step exercises, illustrated strategies, and inspiring real-world examples," this book

shows how to synthesize dissimilar subjects, think paradoxically, and enlist the help of the subconscious mind to liberate thinking and expand imagination.

- Article – *"The Role of Metaphor in Information Visualization"* by John S. Risch: http://www.researchgate.net/publication/1773232_On_the_role_of_metaphor_in_information_visualization

  - "The concept of metaphor, in particular graphical (or visual) metaphor, is central to the field of information visualization. Information graphics and interactive information visualization systems employ a variety of metaphorical devices to make abstract, complex, voluminous, or otherwise difficult-to-comprehend information understandable in graphical terms. This paper explores the use of metaphor in information visualization, advancing the theory previously argued by Johnson, Lakoff, Tversky et al. that many information graphics are metaphorically understood in terms of cognitively entrenched spatial patterns known as image schemas."

Implementation of Design Visualization

Embodied cognition, hands-on, teachable moment, problem/project based learning

- Reading Notes for Book – *Descartes' Error: Emotion, Reason, and the Human Brain* by Antonio Damasio: http://www.stanford.edu/~tylers/notes/emotion/Damasio_2006-1994_Schnoebelen_reading_notes_5-23-11.pdf

- Blog – *"Taking It Literally: Testing How the Body Processes Information"* by Catherine Hutchings and Holly Epstein Ojalvo: http://blogs.scientificamerican.com/guest-blog/2011/11/04/a-brief-guide-to-embodied-cognition-why-you-are-not-your-brain/

  - "What is embodied cognition, and how does research in the field describe the way our bodies and minds process language and metaphors? How might this research provide insight for teaching and learning? In this lesson, students act out common metaphors that convey abstract ideas. They consider embodied cognition research on how we process information and abstract ideas, then design and conduct their own cognition experiments. Finally, they present their findings and reflect on how their research might be applied."

- Hands-on – Dr. Wilson, the founder of the Fermi Lab America's particle accelerator, would build small sculpted models of his proposed accelerators first, even before any analytical studies.

- Roundtable – "*Left Behind: Academic Segregation at the Expanding History Education Deficit"* by Michael Long: http://teachinghistory.org/issues-and-research/roundtable-response/25333

  - Academic segregation and the teachable moment

- Paper – "*Educating Design Intuition: A Survey of Problem Solving Methods used in Architecture and Interior Design Studios"* by Jon Davey (pdf): http://wed.siu.edu/Journal/VolIIInum1/Article_2.pdf
    - "The scope of this research aims not only to define and explore the strengths and limitations of humans' "sixth sense" intuition, but also to discover how it can be improved in design thinking and better understood during the maturation of a design student. Intuition is aligned with, among other things, automatic, tacit and unconscious processing, implicit memory, and procedural knowledge. …This study conducts a survey of the design pedagogy, in particular the problem solving methods taught to undergraduate architecture and interior design students. It is hypothesized that the problem solving method of intuition is not addressed. Observations as to why intuition is not addressed as a design problem solving method are provided in order to assist faculty in developing opportunities for such to occur."
- Dissertation – "*A Theoretical Model of Learning Employing Constructivism, Phenomenology and Neuroscience: Constructivist Neurophenomenology"* by Jon Davey (pdf): http://gradworks.umi.com/3498133.pdf
    - "The purpose of this research study was to propose a new learning theory for career and technical education with a foundation in philosophy and neuroscience. It purports to combine constructivism, phenomenology and neuroscience into a proposed learning theory entitled 'constructivist neurophenomenology' embedded in embodied cognition, that is, the formative role that the environment plays in the development of cognitive processes. The theory represents a trinity of constructivism's genetic epistemology manifesting itself in (a) accommodation, (b) phenomenology' intentionality, that is there is always something there for consciousness, and (c) neuroscience cell assembly. These three actions of the brain construct consciousness, memory, and learning via metaphorical thinking."

What is the future?

- Legacy: "Who are your disciples?"
    - There needs to be a continuation of good and productive learning experiences for young people.

Resources

- **CUBE** Center for the Understanding of the Built Environment: http://www.cubekc.org/index.html
    - Started by Ginny Graves, "CUBE brings together educators with community partners o effect change that will lead to a quality built and natural environment, one and interdependent."
- YouTube video – **Architecture and Children Project** – Dr. Anne Taylor, University of New Mexico School of Architecture: http://www.youtube.com/watch?v=0773ADUPc8Y

- The Architecture and Children Project is an interdisciplinary, integrated educational program teaching basic skills to children in a new way, promoting skills for the 21st century. The curriculum teaches new ways of thinking by presenting students with ways of creative problem solving, visual thinking, and the use of basic skills in an applied way – demonstrating how math and science really work to solve real-world problems.
- About Dr. Taylor: http://schoolzoneinstitute.org/author.html

- **A + DEN** Architecture plus Design Education Network http://www.adenweb.org/
  - A+DEN's mission is to advance public interest and education in design and architecture. This web resource lists organizations, programs, lesson plans, resources, conferences and workshops.
- ***Kid Architecture:*** *Stories and Projects for Young People about the Built Environment*, Southern Illinois University (coming soon!)
  - Forthcoming new book containing stories of architecture and related projects that young people can complete or teachers can use.

Modern Students Learn Differently

Digital Tools in the Secondary Classroom

Improve Student Achievement	Develop 21st Century Skills
Improved standardized test scores	Improved core education skills (e.g., math, science, language arts)
Increased application and production of knowledge for the real world	Improved digital literacy (e.g., technological, cultural, global awareness)
Increased ability for students to manage learning	Improved inventive thinking skills (e.g., creativity, problem solving, higher order sound reasoning)
Increased ability to promote achievement for special needs students	Improved effective communication and interpersonal skills (e.g., writing, public speaking, teamwork, collaboration)
Improved access to information that increases knowledge, inquiry, and depth of investigation	Improved productivity skills (e.g., create high quality products)

Source: CEO Forum on Education and Technology

Additionally, the 2012 New Media Consortium recently released an extensive report on the impact of emerging technologies on teaching, learning, and research in STEM education over the next five years. This extensive study, called the "Technology Outlook for STEM+ Education 2012-2017: An NMC Horizon Report Sector Analysis" describes the significant impact emerging

technologies are likely to have on education around the globe. You can find the report here: http://www.nmc.org/pdf/2012-technology-outlook-for-stem-education.pdf

You can connect these new technologies to the learning methods discussed in today's session, and think about how to apply new tools to make learning more engaging for your students.

Autodesk Workshops and Free Curriculum Resources

- Autodesk Education Community www.autodesk.com/edcommunity
    - Free software for students and teachers
    - Curriculum content and teaching materials, forums, tutorials, contests, more!
- Digital STEAM Workshop www.autodesk.com/digitalsteam
    - Curriculum for K-12 STEM education inspiring creativity and design – leverages Design Thinking process
    - The curriculum focuses on developing essential 21st century skills - critical thinking, creativity, innovation, and problem solving. The Digital STEAM Workshop was awarded the ISTE (International Society for Technology Education) Seal of Alignment for Proficiency. After rigorous review of the curriculum, ISTE determined the Digital STEAM Workshop supports their Student NETS (National Education Technology Standards) so teachers can feel confident in the quality of this curriculum meeting these standards.
    - Digital STEAM Workshop:
        - Teaches Autodesk software through the design process
        - Engages students in STEAM through projects developed by industry experts and teachers
        - Projects include a 3D real-time project viewer, datasets and step by step technical videos
        - Includes comprehensive teacher resources including lesson plans, project briefs, design criteria worksheets, assessment tools, and rubrics
        - Free resource available to anyone and does not require a login, with the exception of the teacher resources - which is restricted to teachers only and requires that you have an Autodesk education community login
- BIM Workshop – www.autodesk.com/bimworkshop
    - Instructor guides, presentations, tutorials, assessment questions to incorporate into lesson plans
- Sustainability Workshop – www.autodesk.com/sustainabilityworkshop
    - Download teaching tools to develop sustainable products, design Net Zero Energy buildings and more

- DIY Projects for Everyone on Instructables – www.instructables.com
    - The Autodesk Instructables site is the most popular project-sharing community on the Internet, and part of the Autodesk family of creative communities.
    - Instructables provides easy publishing tools to enable passionate, creative people to share their most innovative projects, recipes, skills, and ideas. Instructables is the home to over 70,000 projects covering all subjects, including crafts, art, electronics, kids, home improvement, pets, outdoors, reuse, bikes, cars, robotics, food, decorating, woodworking, costuming, games, and life in general.
    - It's a great resource for your students to share their projects and ideas and access a variety of projects to bring learning home.
- Apps for Everyone
    - Apps available on the web and/or mobile devices are a great way to get students engaged and interested in STEM subjects – having fun while learning!
    - Autodesk has MANY apps available – do a quick search on any app store, or directly link to the following apps, which are of particular relevance to this session today:
    - **Autodesk® Homestyler®** (Windows)
        - Design your dream home – create, furnish and share home designs
        - http://www.homestyler.com/
    - **Autodesk® 123D®**
      For exploring and making in 3D - http://www.123dapp.com/
        - **123D Design** (Windows, Mac, Web, iPad)
            - Approachable tools for designing makeable 3D models.
            - http://www.123dapp.com/design
            - https://itunes.apple.com/us/app/123d-design/id567821620?mt=8
        - **123D Catch** (Windows, Web, iPad/iPhone)
            - Convert ordinary photos into extraordinary 3D models
            - http://www.123dapp.com/catch
            - https://itunes.apple.com/us/app/123d-catch/id513913018?mt=8
        - **123D Make** (Windows, Mac, Web, iOS)
            - Slice 3D models into cut patterns for artful creations.
            - http://www.123dapp.com/make
            - https://itunes.apple.com/us/app/123d-make/id515318186?mt=12
        - **123D Sculpt** (iPad)
            - Start with a shape and sculpt and paint it into whatever you imagine
            - http://123dsculpt.com/
            - https://itunes.apple.com/us/app/123d-sculpt/id446119510?mt=8

- **AutoCAD WS** (Windows, Mac, Web, iPhone/iPad, Android)
  - View, edit, and share AutoCAD® drawings with anyone, anywhere
  - Visit the website here
  - https://www.autocadws.com/web
  - https://play.google.com/store/search?q=autodesk+ws
  - https://itunes.apple.com/us/app/autocad-ws/id393149734?mt=8

- **Autodesk® SketchBook®** (Windows, Mac, iPad/iPhone, Android)
  - For everyone who loves to draw
  - https://play.google.com/store/search?q=autodesk+sketchbook
  - https://itunes.apple.com/us/app/sketchbook-mobile/id327375467?mt=8

- **MIMI**™ (Web, iPhone)
  - Get Inspired! See what the world is sharing.
  - http://www.mimistudio.com/
  - https://itunes.apple.com/us/app/mimi/id513025963?ls=1&mt=8

- **Pixlr®** (Web, iPhone/iPad, Android)
  - Photo editing for the rest of us
  - http://pixlr.com/
  - https://play.google.com/store/search?q=Autodesk+pixlr&c=apps
  - https://itunes.apple.com/us/app/pixlr-express/id526785970?ls=1&mt=8

- **Autodesk® TinkerBox**™ (iPhone/iPad)
  - Opens a world of fun onto physics and engineering
  - http://tinkerboxnews.com/
  - https://itunes.apple.com/us/app/tinkerbox-hd/id415722219?mt=8

The Future of Young Designers is in YOUR Hands!

We hope you have found this session valuable, and have been inspired to apply new teaching methods involving experiential learning to your own classes. You are the key to inspiring our youth!

- Use Kid Architecture methodology as a blueprint for teaching/learning
  - Workshops or curriculum integration to promote digital literacy
- Inspire young learners to get interested in design and creation
  - Modern students learn differently
  - Apps as gateway to grab student attention/interest – new technology tools
- Go beyond the textbook to show direct application of STEM subjects
  - Hands-on, project-based experiential learning