You can be an Inventor and Teacher of ~~Visual Things~~, too!
the Human Experience

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www.artinventionlab.com - full of student work and downloadable resources she makes for others,
www.currentlab.art.vcu.edu - full of curriculum and resources to teach video game design, or
www.mkcosier.com - a neglected website of her artist portfolio and hints of her personality.

There will never be enough time to share interesting things.

Seriously, you have a lot going on these days. Since I can't vocally share every piece of the puzzle in 40 minutes and you cannot possibly write as fast as I talk, I've made these notes for you. You're welcome.

Things worth knowing about how *Art Lab* came to be…

My interest in STEAM started with Dr. Ryan Patton's Currentlab (VCU) and the Smithsonian Associates Summer Camp (in DC). I started teaching 4th-8th graders video game design in 2012 and helped further develop Currentlab resources shortly after. I began creating a variety of maker camps with the Smithsonian and teach there every summer.

I teach K-6 Fine Art in Fairfax, VA at Bucknell Elementary and Silverbrook Elementary. Bucknell is a Title 1 school with 270 students; 80% on Free/Reduced Lunch, and 55% English proficient. Silverbrook has 800 students; 9% on Free/Reduced Lunch, and 93% English proficient.

Art Lab started as a grassroots effort at Bucknell in 2014 with no budget, constraints, or long-term plans. I had an extra session with each class once a month and gave myself permission to have non-assessed construction adventures with the students. I made a Donor's Choose "grant" that paid for the Makey Makeys and some materials- the rest was creatively working with whatever was around. Student response was amazing and everyone I work with took notice. I am currently working on developing a STEAM lab room for our new building at Bucknell.

In 2015, Silverbrook choose to start a STEAM program, supported by the PTA and additional budget, taught by the 3 art teachers to each class once a month. I've now taught STEAM labs to the entire spectrum of student populations, both with and without money for it.

STEM, STEAM, STREAM… MT. SLAP 'EMS

I say STEAM to describe what I do out of convenience. Sometimes I say STEM because my ego isn't tied to an acronym. I've seen a new wave of effort to include Reading into the STEAM initiative. If we need a new acronym before we've truly established STEM nationwide, my vote is MT. SLAP 'EMS.

Math, Technology, Science, Literacy, Art, Physical Education, Engineering, Music, Social Studies slapped together into the mountain pile of crumbling educational framework. Kids don't ask for a label of what they're learning, adults give it to them.

I approach STEAM without seeing the boundaries of subject matter and teach through the arts. I teach the human experience through creating. Yes, I teach art, but I also teach my kids how to code, how the human eyeball functions, how to work with others they don't like, how to use materials to share the visual in their head, how the world is bigger and older than they can currently conceive, how to use their body, and when to use their words. I'm not afraid to explain a parabolic curve to third grade or tell a child, "I don't have the answer, but share it with me when you find out."

Art is not more important than any other subject, but I can teach the human experience through it. With that, I support students to choose for themselves where they find their passion and interests.

STEAM helped shape my teaching practices, and I'm growing constantly with my students as we create. The excitement and energy has bled into our more typical art classes. You want to pull the wonders of other subjects into your lessons? *You have to get out of the art making bubble.*

All the other initiatives, education hot topics, and acronyms!

21st Century Education is a hot mess of connections. The teaching experience wouldn't be complete without a laundry list of initiatives battling for importance. Do keep in mind that I have simplified explanations and I personally pull want out of each of these into my own teaching. What I have included in my presentation has a structural relationship to STEAM and what I am trying to accomplish with my students. They are all about finding ways to replace traditional education under 21st Century Skills.

Tradition Education — *Replacement*
Understand and Communicate — *Apply and Demonstrate*
Testing Content Over Abilities — *Testing Abilities with Content*
Literacy and Fluency in Language — *Literacy and Fluency in Technology and Language*
Prep for Work Force — *Prep for Unknown Future Careers*

The 4 C's: Critical Thinking, Communication, Collaboration, and Creativity: Specific skills deemed most important in the development of 21st Century Skills by the NEA.

Constructivism vs. Constructionism: Both of these are *theories of learning*, not pedagogy. Constructivism is a Jean Piaget theory that knowledge is constructed by combining experiences with prior knowledge. Constructionism is a Seymour Paper theory that knowledge is constructed by active engagement in meaningful activities using prior knowledge. I think of them as an umbrella for these initiatives that investigate the relationship between passive and active learning.

Maker Education: The main principle is that each person should be a creative, inventive, productive individual and that we learn through making. Attached to the DIY (do it yourself) culture, Maker Ed. is self-directed learning through experimentation. Makers build communities and value collaboration and sharing of knowledge. The Maker Culture has abundant resources for teachers.
**Learn more at www.makered.org

Regio Emilia: A preschool curriculum that believes class activities should be "child originated and teacher framed." There is a emphasis that classrooms should be designed around a child and all materials are meant to be child accessible. Developed by Loris Malaguzzi in Reggio Emilia, Italy in the 1940's. There are *certified* Reggio Preschools in the USA, but many are simply, "Reggio inspired." Reggio Emilia certification is only available through Italian programs.
**Learn more at http://www.education.com/magazine/article/Reggio_Emilia/

Computational Thinking: Breaking complex problems into smaller questions that can be solved with computer stylized critical thinking strategies. Addresses 4 processes that students should be able to navigate: Decomposition, Abstraction, Pattern Recognition, and Algorithms.
**Learn more at https://www.google.com/edu/resources/programs/exploring-computational-thinking/

Engineering Design Process: An flexible, iterative process that can be applied to most projects for a meaningful, tangible product. Starts with a problem or challenge, explores materials or established information, design the solution, create your design, test it out, and make it better (Design, Create, Test, repeat). Steps are also listed as Ask, Imagine, Plan, Create, and Improve. *EDP ends with a modified product and the process can be utilized in a single class session.*
** Engineering Design Process is similar to the "Scientific Method," but there is no single universally accepted process. There are many models which can be found if you google images, "Engineering Design Process." My favorites are the "Carson-Dellosa STEM Bulletin Board Set" ($8-$12) and The Works Museum poster (Free), www.theworks.org/educators-and-groups/educator-resources/

Design Thinking: A design process of human-centered innovation, drawing from engineering and design, combined with ideas from the arts, social sciences, and the business world. Similar to the Engineer Design Process, but main focus is on ideation and morphing ideas into solutions for human concerns. There are 5 stages: Discovery, Interpretation, Ideation, Experimentation, and Evolution. *DT ends with a web of interconnectivity serving a purpose and often, a modified prototype, service, or product. DT requires multiple sessions but is applicable to any subject/challenge.*
**There is a Free Educator Toolkit on Design Thinking provided by IDEO, much of it the result of Rolf Faste (Professor, Stanford) and David Kelley (IDEO Founder) collaboration and research and application in schools. Download one at www.designthinkingforeducators.com/

Project Based Learning/Problem Based Learning (PBL): The most structured approach to replacing traditional education practices. In this teaching method, students gain knowledge and skills by working for an extended period of time to investigate and respond to an engaging and complex question, problem, or challenge. There are established models and teacher education training available if you Google it.
**Learn more at http://www.edutopia.org/project-based-learning-guide

The impact is real, the effort is worth it.

You want better critical thinkers? Stop giving them the answers to their problems. You want students to be fearless creators? Judge their products on functionality over appearance and whether or not it honestly represents their ideas. You want them to be open collaborators? Make them talk through construction, relying on each other more than you. You want them to try their best? Show them your worst and let them fail.

Failure is a good thing. I model laughter as a remedy for frustration and recovery from mistakes. I make construction and art technique modeling ugly, quick, and raw because I don't want to see my ideas regurgitated. Students delight in pointing out the terrible flaws and short falls in my incomplete teacher examples. My classroom is about growth and you can't facilitate meaningful growth without backing off.

You are here to GROW as a creative thinker who can solve problems while having fun.

That's what I expect out of my students and what I expect out of life. Not perfection, not talent, not always aesthetically pleasing. You can't grow without effort and failure, without running laps between ideas and process.

Focus on ideas, not product. Sell questions, not answers. This is how you make your kids grow.

Applications and Projects I shared in this FABULOUS TALK

Free Create Center: *The Rules: Share the Materials, No Weapons, Stop and Clean Up When It's Time To, Don't Take What You Didn't Make.* The Materials come from upcylcing centers and the school community. I have a list of what we like and ways I use it on AIL website.

Construction Toys: I spoke about 3: Straws and Connectors, Keva Planks, and Toobers & Zots. I use them as meaningful challenges to fill holes in my planning and as Free Choice Art options. Keva has a curriculum resources for educators at www.kevaplanks.com/lesson-plans-challenges-games-activities/

Geodesic Domes and Tower Challenges: Why is a triangle so special? Straws can be attached with pipe cleaners running through for geodesic domes and tower challenges can be limited by materials. My students had 30 straws, a yard of tape, and scissors.

Newspaper Pyramids: Adapted from http://www.pbs.org/parents/crafts-for-kids/forts-for-kids/ with the challenge of making it large enough to fit inside. You can create geodesic domes this way, too.

Angry Bird Physics: Build a catapult and geometric forms to play multiple real Angry Bird Levels. There is a full post about the lab and downloadable lesson resources at http://artinventionlab.com/2015/12/21/angry-bird-physics-3rd-grade/

Mazes: I came up with this idea from several Pinterest posts. It is on my roster of blog posts to make. Mainly uses the zipper tab cut paper walls, a ping pong ball, and straws.

Animation and Foley: I used "Stop Motion" free app on iPads with found materials to learn software. I teach foley with Youtube videos and found materials that they record sound. I should make a post of this on my website soon.

Makey Makey: I have several posts at www.artinventionlab.com on student Makey Makey projects with examples and teacher tips.

Video Games Design: Come to our talk at 9 AM Saturday in room N230b McCormick Place or see the curriculum at http://currentlab.art.vcu.edu/modules/

Unplugged Game Design: Teach programming skills without computers. Google "Unplugged Programing Kids" and take a look at the Currentlab Tabletop Game Module online at http://currentlab.art.vcu.edu/module-nondigital-games/

Projects I didn't share because 40 minutes is not enough, and you got questions, right?

3D Anaglyphs: http://prezi.com/wvso-ilgrsfa/?utm_campaign=share&utm_medium=copy&rc=ex0share or search in Prezi "Anaglyph Glasses and 3D Effects." I bought 100 glasses off Amazon and end my year with this low materials, high engagement lab.

Roller Coaster Physics: I adapted my 4th grade lesson from www.teachengineering.org and made a post outlining how I did it on AIL.

Unplugged Programming: Teaching programming without a computer. Start with www.csunplugged.org/ My favorite is Tinkersmith's *My Robotic Friends* www.csedweek.org/files/CSEDrobotics.pdf

Coding: There are some many ways to teach kids code. I made a downloadable pdf for my classroom on AIL about all the websites I use with students. I like www.playcodemonkey.com the most. If you have never taught code, start with Hour of Code's resources at www.hourofcode.com/us and www.code.org

More resources, less words.

Shameless Promotion
http://artinventionlab.com/just-for-teachers/ for downloadable materials I've made
currentlab.art.vcu.edu for Video Game Design, Unplugged Game Design, and Makey Curriculum

Online Things
http://makeymakey.com : For Lessons and How-to
Bitsbox Digital PDF, $20 a month: 30 new coding app challenges each month for 6+ years old
madewithcode.com : Google Free Coding Activities similar to code.org from Hour of Code
playcodemonkey.com : Coding for 3rd grade and up, 30 Free Levels without sign up
tinkercad.com : Free 3D modeling online software, can be used with 3D printers
buildwithcrome.com : Free 3d modeling with Legos

Awesome Teacher Reads
Invent to Learn: Making, Tinkering, and Engineering in the Classroom by Martinez and Stager

The Invent to Learn Guide to Fun by Burker (Classroom Technology Project Guide)

The Art of Tinkering by Wilkinson and Petrich

http://www.edutopia.org/project-based-learning Edutopia is fantastic for ANY education topic

Awesome Reads for Students (and Teachers)
Thing Explainer: Complicated Stuff in Simple Words by Munroe

How to Code in 10 Easy Lessons by McManus

Kinetic Contraptions: Build a Hovercraft, Airboat, and More with a Hobby Motor by Gabrielson

Stomp Rockets, Catapults, and Kaleidoscopes: 30+ Amazing Science Projects You Can Build for Less
than $1 by Gabrielson

Make: Paper Inventions by Ceceri

Make: Getting Started with Processing by Reas and Fry

My Crazy Inventions Sketchbook: 50 Awesome Drawing Activities for Young Inventors by Regan
Make Magazine and *Popular Mechanics* Magazine

Toys, Gadgets, and Cool Stuff to Help Teach the Human Experience Through the Arts

Construction Toys:
Legos, Keva Planks (Citiblocks are Cheaper), K'nex, Q-Ba-Maze Marble Run, Toobers & Zots, Zolo,
Straws and Connectors, Blocks, Make Do Connectors, Tinkertoy

Games:
Extrodinares Design Studio, Code Master, Create a Maze, Swish, Whatchama Draw It, Zombie Dice

Gadgets:
Makey Makey, $50 kit: No software, USB based, Conductive interactive circuit keyboard
The Verve2 $45-100 kits: Free Software, Sensor interactive Keyboard and Mouse
LittleBits $90+ kits: Senors and Circuitry without soldering or programming
Squishy Circuits $25: LED and motor kit to play with conductive salt dough circuity

No money solutions:
Hold a lego donation drive, borrow from classroom's math and science manipulative (you wouldn't
believe the stockpile I got from helping our science lead clean out the school closet), cut Dollar store
sponges into shape stackable blocks, build straws and tape (or modeling clay, marshmallows, pipe
cleaners), collect Toilet/Paper roll tubes. Google solutions- they are out there!