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Becoming a Maker Educator

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By Jackie Gerstein

The Maker Movement is a "global do-it-yourself (DIY) movement of people who take charge of their lives, solve their own problems and share how they solved them" (Roscorla, 2013). This movement is gaining traction in the educational sphere, in both formal (public and private K–16 schools) and informal educational environments (after-school programs, community makerspaces, libraries, museums, etc.). As such, there has been a corresponding increase in the number of articles about the Maker Movement and Maker Education in professional journals, as well as increased attention to the topic within school-related professional development activities and education conferences.

The convergence of several current-day trends—the DIY movement, affordable technologies, a focus on bringing STEM/STEAM (science, technology, engineering, arts and math) into schools, an abundance of information via the internet and a sharing economy—are also contributing factors to the growing interest in Maker Education (Gerstein, 2016a).

Some of the characteristics of Maker Education include:

- Hands-on, experiential learning, with learners being engaged intellectually, emotionally, socially and physically.
- Participation in and engagement with authentic tasks.
- An integrated and interdisciplinary focus that often combines STEM, as well as art and Language Arts.
- Learner choice and decision making within the learning process.
- Personalized learning based on unique interests and passions.
- Learner-centric meaning-making based on constructivist principles.
- A focus on the process of creating, innovating and learning; the process is as, or even more, important than the product.
- Educational experiences which include "success, failure, adventure, risk-taking and uncertainty, because the outcomes of experience cannot totally be predicted" (Association for Experiential Education, n.d.).
- Getting immediate feedback when projects work well, work somewhat, or do not work at all. Assessment becomes a personal, natural and immediate process.

Being a Maker and a Maker Educator

Maker Education is not about the "stuff," the high-tech tools (robotics, low-cost computer components, 3D printers and other digital technologies), that can sometimes overshadow the reasons for being a maker and a maker


Thinking
Space
Good Idea
idea
Engineering
E=mc²
Invent
Knowledge
ecology
Innovation
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Renewable energy
Study
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40% DATA
30% DATA
60% DATA
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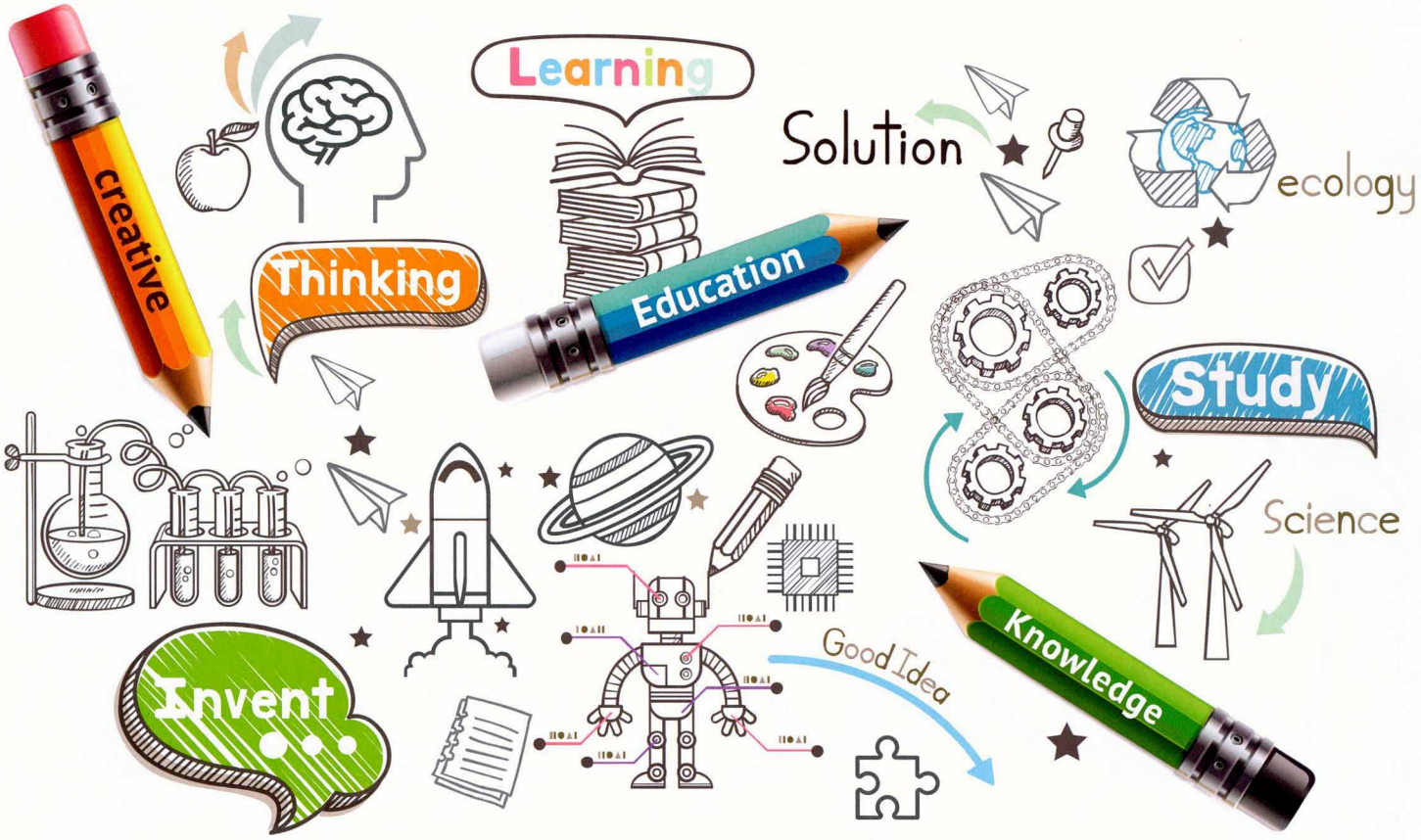
10% DATA



educator. Maker Education is about a mindset—those thoughts and actions related to creativity, innovation, ingenuity, out-of-the box thinking and self-directed learning.

What's more, adopting the mindset of a maker educator means switching traditional roles in the classroom from content expert and deliverer to one of lead learner. This role and mindset translate into learning alongside and with students, as well as being intentional in sharing with learners the processes and metacognitions associated with learning.

This mindset also entails directly modeling the characteristics of Maker Education discussed earlier, e.g., authentic tasks, experiential learning, a focus on the process of creating, etc.

To develop skills as a maker, along with developing a maker educator's mindset, professional development for teachers needs to model and reflect best practices similar to those expected and exhibited in highly functioning and effective Maker Education programs.

Teachers and their administrators need ongoing and repeated occasions to tinker, explore, share, discuss and connect in resource-rich environments, which include an abundance of interactive and hands-on materials; a variety of easily accessible paper and online tutorials; and materials and resources to reflect on their learning and to share these findings with their face-to-face and online professional learning networks.

Integrating Maker Education Into the Curriculum

As Maker Education receives more attention and support, educators should keep in mind that making takes on many forms. In his Bay Area Maker Faire speech earlier this year, Adam Savage from *MythBusters* stated:

> What is making? It ... is a new term for an old thing. Let me be really clear, making is not simply 3D printing, Art Lino, Raspberry Pi, LEDs, robots [and] laser and vinyl cutters. It's not simply carpentry and welding and sculpting and duct tape and drones. Making is also writing and dance and filmmaking and singing and photography and cosplay. Every single time you make something from you that didn't exist in the world, you are making. ... (Lomasney, 2016).

Educators should keep this broader perspective in mind as they consider if and how they can bring making into their classrooms.

If you're on a tight budget or work in a low-income school, there are ways to incorporate Maker Education into your curriculum without breaking the bank. One of the exciting developments of the Maker Movement is that there are a host of affordable technologies at your disposal (Google "robot kits" for example), as well as a variety of low-cost and free materials already at the tip of your fingers. Cardboard boxes and recycled objects, simple art materials, objects from nature and sewing materials are accessible and provide a host of opportunities for making.

Having a space for creating, i.e., a makerspace, is fun, but it is not necessary to the beauty of making. On his blog, *Intentional Innovation,* A.J. Juliana (2016) states: "I hope the message we are giving to our students is not one that they need a maker space in order to be a maker. Students can be makers in any classroom, in any grade level and in any subject."

Maker Education can be easily integrated into current lesson activities. Some suggestions for integrating maker activities into the curriculum include:

- Make origami to teach geometry.
- Engage in a design challenge, such as building a tower out of spaghetti and marshmallows or a bridge out of toothpicks, in order to teach and reinforce STEM skills.
- Create a setting for a story out of natural materials found outdoors or within a diorama to reinforce Language Arts concepts.
- Transform the classroom into a historical setting by using simple art materials to make history come alive.
- Make music with recycled materials.

Stages of Maker Education

The world in which learners are growing up often revolves around viewing and interacting with screens rather than interacting directly with real-world objects, as was characteristic of kids' play in the past. This creates the need for scaffolding the maker activities so that students can be successful makers. When you're setting out to determine how to scaffold maker activities, it is helpful to look at this process in the form of stages as shown in Figure 1: copy, advance, embellish, modify and create (Gerstein, 2015).

Copy

In this age of information abundance, there really is an unlimited number of DIY resources, tutorials, YouTube videos, online instructors and instructions on making all kinds of things. These resources provide a good beginning for acquiring some foundational skills and knowledge for learning how to make.

Advance

During this stage, the maker learner, who desires to learn more about a given skill, project or product, gains more advanced skills and knowledge by exploring additional and more advanced resources and by using these resources to create more advanced "makes."

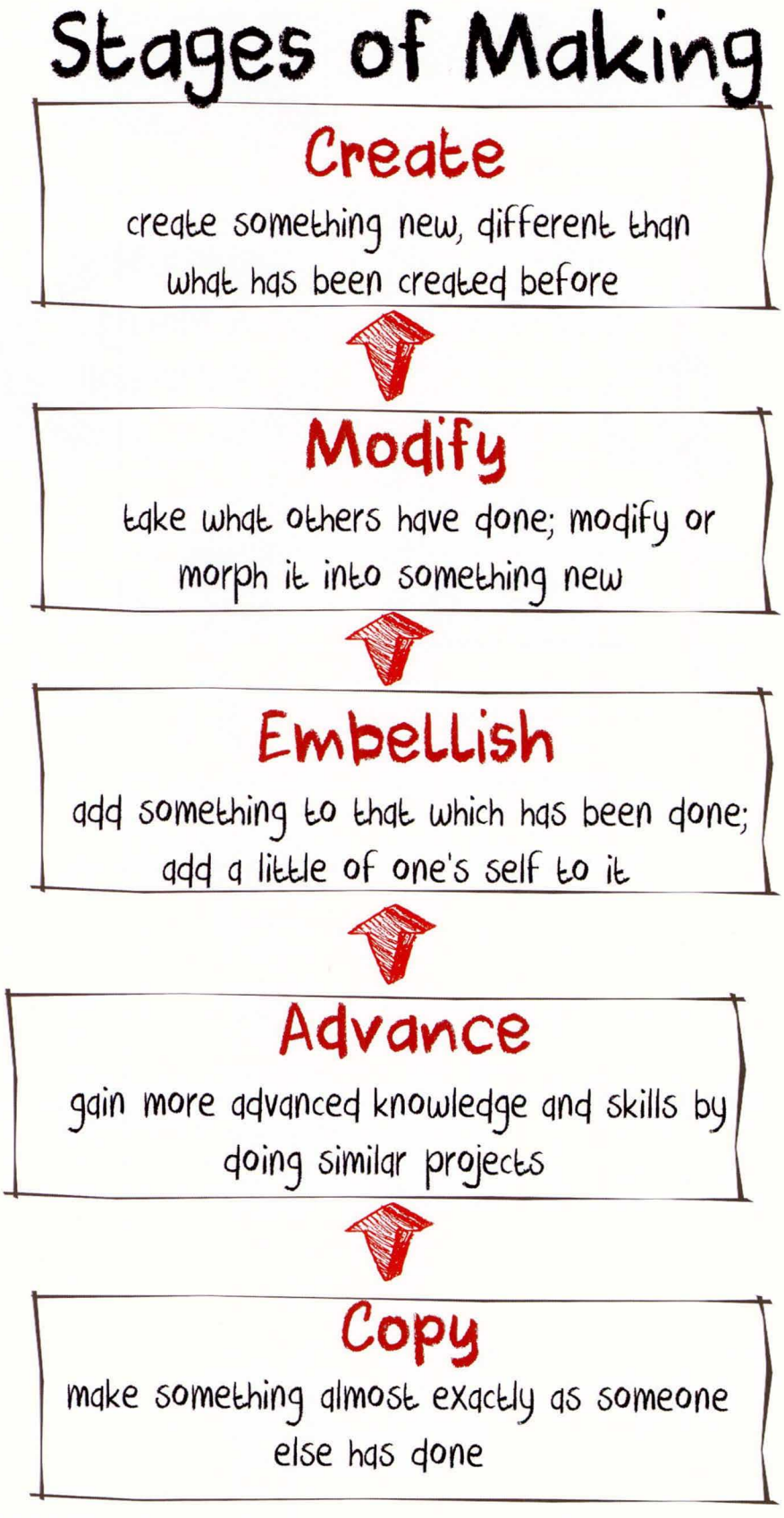
Embellish

When embellishing, maker learners extend their copied projects to include their own ideas. It can be as simple as learners adding their color choices and adornments.

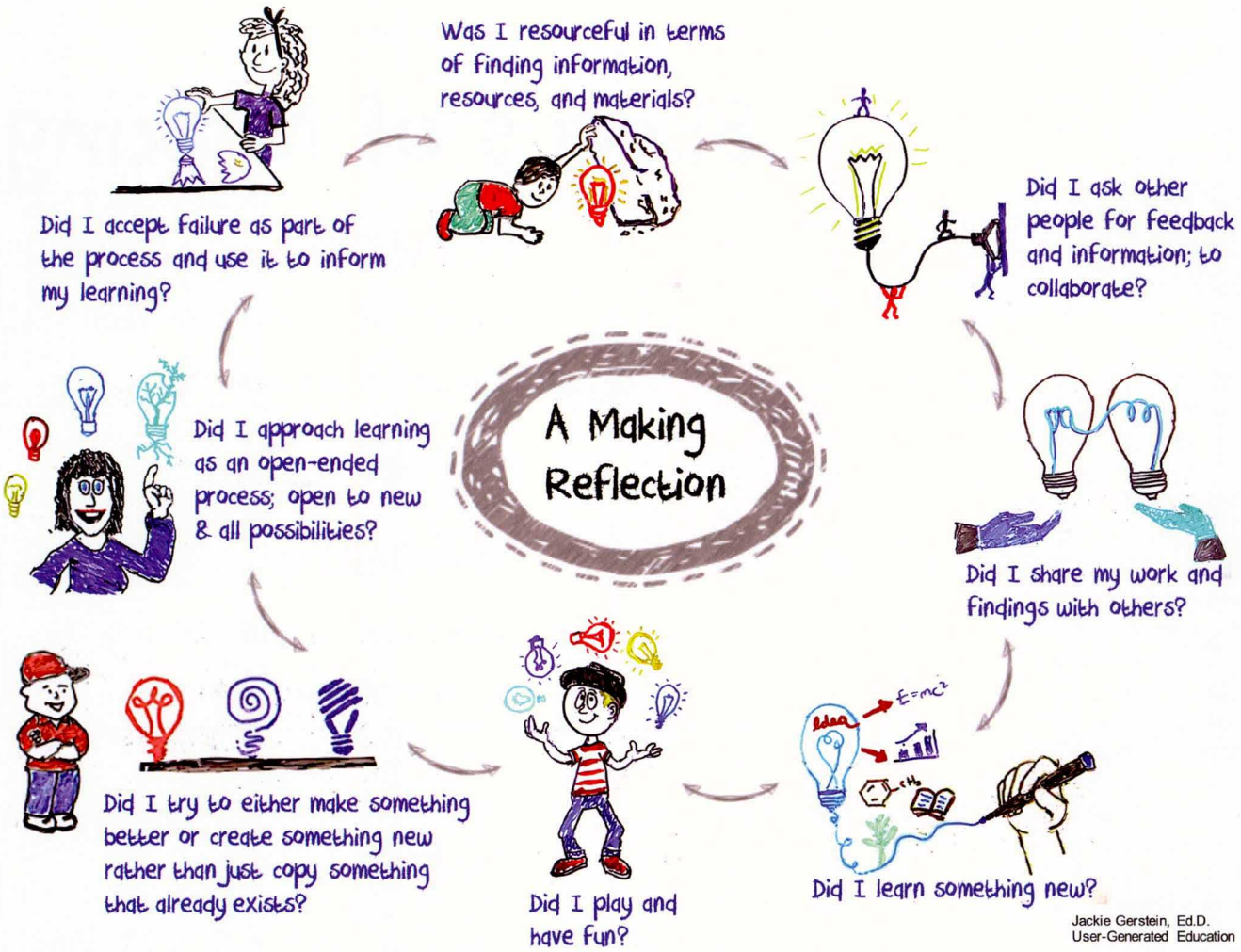
Modify

When modifying, maker learners take something that has been created before and tweak

[FIGURE 1]



Jackie Gerstein, Ed.D. – User Generated Education



[**FIGURE 2:** Reflections on Making]

it to make something new. An example is the Cardboard Challenge where kids, who have been inspired by a nine-year-old's dream to build a cardboard arcade, built their own cardboard creations (**http://imagination.is/our-projects/cardboard-challenge**).

Create

When creating, maker learners create something new, unique and different from what has been created before. A simple example is when kids (and adults) take apart toys and use those parts to create new kinds of toys. A more complex example is the individuals who created prosthetic arms using 3D printers.

Creating a Framework for the Making Process

If the hands-on maker activities are performed without providing a context, then learning is left to chance. Provide a context for making by framing or frontloading the activities prior to implementing them, followed by a time of reflection.

According to Dan Miller, Steve Simpson and Buzz Bocher (Institute for Experiential Education, n.d.), "Frontloading is making clear the purpose of an activity prior to actually doing it." They posit, "if participants clearly understand the purpose or lesson upfront, that lesson will repeatedly show itself during the action component."

Here are a few strategies for frontloading and framing Maker Education activities:

- Specify the specific standards and/or essential questions the maker activity is addressing.
- Set up a scenario telling students they've been hired to create a new toy, sneaker or invention for a third-world country.
- Ask questions to help with scaffolding and sequencing the activities. For example, "In this next activity you will be asked to do _____. What skills did you learn in the previous activity that will help you do _____ in this upcoming activity?
- Ask questions related to personal skills. For example, "The following maker activity will draw upon your imagination, creativity and innovative mindset. What do you consider your strengths in this area that can be used during your maker activity? (Gerstein, 2016b)

Reflecting on Maker Education Activities

John Dewey famously stated, "'We do not learn from experience ... we learn from *reflecting* on experience." Reflection should be intentionally built into the process of making, spending as much time on it as the making itself. Some general key questions to ask yourself, and your students, include (Figure 2):

- Was I resourceful in terms of finding information, resources and materials?
- Did I accept failure as part of the process and use it to inform my learning?
- Did I approach learning as an open-ended process—open to new and all possibilities?
- Did I try to either make something better or create something new rather than just copy something that already exists?
- Did I ask other people for feedback and information?
- Did I share my work and findings with others?
- Did I play and have fun?
- Did I learn something new?

Reflection can occur through many means—through ways that make sense to the learner and provide them with the choices that are the hallmark of Maker Education activities. For instance, consider having students engage in discourse with each other or experts either face-to-face or via Facetime, Skype or Google Hangouts. Or, ask them to write a journal or blog entry; create a video, podcast and/or photo essay; and/or post their reflections on social media.

As Maker Education continues to evolve, continuous reflection on best practices will help ensure that it best serves the learner, the educator, learners' families and the larger community. Tech

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