After watching a room of students working and learning via a maker project, one can't help but be awed by the level of engagement. There's a low hum as students buzz around, helping one another troubleshoot problems and figure out next steps. They suggest improvements and model skills for one another. Groups are working on distinctly different projects; some are engaged with wood and electronics, while others are programming, sewing, and drawing. Yet despite the wide variety, they're all so focused that a classroom visitor attracts nary a glance. Their teacher leads, supports, and educates, all by taking a step back.

Maker education is being increasingly integrated into classrooms of all grade levels. It's an approach that draws upon philosophies and pedagogies of the past (constructivism, constructionism, inquiry, hands-on, and project-based learning) and integrates methods from the present (design thinking, effectuation). It reimagines a progressive approach to learning through modern affordances. It democratizes the tools of creativity and empowers the learner. It develops a maker mindset that that has been described as "playful, asset- and growth-minded, failure positive, and collaborative" (Martin, 2015).

Traditional direct instruction focuses on content knowledge, while maker-centered learning orients around the learner's context. It's a framework for learning that can be applied to any content. It allows the learner to actualize his or her own ideas. In any subject area, with any materials or equipment, maker education is a tool or vehicle for learning that focuses on the how: the process, the social-emotional skills, and the application of problem solving, collaborating, and persisting. Yes, there is absolutely content, but maker ed creates a meaningful context for students to engage with content on their own terms.
Anyone who works with young makers sees this level of engagement, collaboration, and creativity. Indeed, there has been an explosion in the number of makerspaces in schools. But as with any new education model -- particularly one with roots outside of education -- there are serious questions that arise:

1. Does maker education raise test scores?

We don’t know this definitively -- yet. Ongoing research and evaluation efforts are under way to understand the effects, effectiveness, learning outcomes, and related results of maker-centered education. As this educational approach continues to engage students while deepening their learning, we must continually ask ourselves:

- How might we ensure that students are getting the learning, skills, and abilities they'll need in life?
- What experiences do we want to create for our children? What is the utility of schooling in the modern era?
- What's worth measuring in the first place?

We know that maker-centered education is not only engaging students at new levels, but also giving them valuable skills that traditional education does not. We hear stories of students who:

- Felt completely disengaged, discovered making, found new meaning in school, and are now recognizing their academic ability for themselves
- Honed their skills through making and are starting an entrepreneurial venture
- Are teaching others or taking on leadership roles in their schools or communities

So while the research on test scores is only anecdotal, the work of maker-centered education is broader and more holistic.

2. What is a maker curriculum, and how might we align it with standards?

Maker-centered learning is not a one-size-fits-all curriculum. The cookie-cutter template does not currently work across the educational system, so why recreate it in maker-centered learning? We have the opportunity and responsibility to design engaging learning experiences that address the needs of our youth, and maker education is easily accessible, widely applicable, and highly adaptable to educators and learning environments of all kinds. At its best, a maker curriculum is interactive, hands-on, youth-driven, and open-ended.

Within that, standards certainly fit and align. The question is not necessarily whether we can or do align standards. It's more about whether we can and will provide the time and space for learning to happen in relevant, applicable ways. Perhaps some memorization of key facts is necessary, but we must set our sights beyond box checking and move toward connection with peers, toward empathy, problem solving, and working through frustrations in pursuit of a deeper, richer understanding of both content and self.
While making is often thought of as STEM-focused, it can easily be integrated across all subjects. Maker Ed's Resource Library has a section on Projects and Learning Approaches, which includes many cross-curricular project ideas.

3. How can I assess making?

Making innately provides evidence of learning. The artifact that results, in addition to the process that a student works through, provides a wealth of evidence, indicators, and data of their learning. Overall, though, assessing making comes back to the original (and difficult) question of what learning outcomes we're seeking. Assessment is critical for understanding the scope and impact of learning, as well as the associated teaching, environment, culture, and content.

Assessing 21st-Century Skills

Currently, the common form of assessment focuses on only one learning outcome type: content. Practices, ways of thinking, and 21st-century skills often fall by the wayside. But which indicators provide evidence of students growing as problem-solving, empathetic, creative collaborators? In Albemarle County, for instance, assessing lifelong learning competencies takes priority over simply raising test scores. The district's Seven Pathways -- one of which embraces making -- helps them get there.

Digital Portfolios

Along with a continuum of other formative assessment tools (performance assessments, for one), the digital portfolio is a promising model for genuine assessment of deep, multi-layered learning. Maker Ed's Open Portfolio Project aims to develop a common set of practices for open portfolio creation, sharing, and assessment. Just as making isn't about hitting standards, making can't necessarily be evaluated by tests.

Why maker portfolios? Portfolios can showcase a student's abilities, interests, voice, and thinking in a way that test scores and grades cannot. Particularly for students who may not excel at traditional academic assessment or high-stakes testing, portfolios are a means of sharing their skills and contributions. Innate to portfolio creation is the process of self-reflecting, curating what's most appropriate for the intended audience, and designing an artifact to articulate that evolution of learning and making. These are the critical thinking processes that we strive to develop in youth, and maker portfolios automatically spark the making of the meaning.

Consider how we assess artists or athletes, or more importantly, how they assess themselves. We don't have to limit ourselves, or our children, by traditional assessment. In fact, if we do, we're not equipping them with the skills to navigate a future world.