Essay 10

Firetrucks on Ivory Towers

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Seymour Papert, the late mathematician, computer scientist, and founding faculty member of the Massachusetts Institute of Technology (MIT) Media Lab, cared deeply about designing technology that children could use to learn mathematics.

But instead of designing a better Algebra textbook, he envisioned a world in which children would learn math in the same way they learn French if they grow up in France. To me, that is a compelling starting point for a discussion about the future of learning and education—thinking about the world and the systems we could design that would allow all of us to learn this way.

However, the more common approach to exploring the future of education looks at traditional forms of education and attempts to improve them. This strategy of incremental innovation has led to dramatic improvements in access to and quality of schools around the world. But it is not the best way to imagine what a fundamentally different system of education could look like. And given the fact that mobile phones and increasingly ubiquitous connectivity are radically changing how we create and share knowledge, this might be a good moment to allow ourselves to think beyond the incremental improvements. With that in mind, I would like to extract some principles from a range of stories about how people learn at MIT in the hope that they provide some inspiration to what new systems of learning might look like.

The first story starts on a September morning in 2006, when the MIT community awoke to the sight of a bright red fire truck on top of the MIT Dome, arguably the most stately building on campus. The backdrop to graduation speeches, to age-old academic rituals, and, occasionally, to the MIT Media Lab soccer team's practice games. And now, a 150-foot high parking ground for a fire truck. Who had placed the truck on top, how had they managed to do it, and why?

I came across the story of the "fire truck hack" during a series of interviews the Media Lab Learning Initiative conducted to find out *How MIT (really) Learns.* We spoke with people from across the MIT community—including an admissions officer, a professor who spent his entire career at MIT, the Dean of the undergraduate research opportunities program, and current and former students. We asked participants a few simple questions, including "What was your most memorable or meaningful learning experience at MIT?"

One might expect the stories of how MIT learns to include great classes, well-designed classrooms, inspiring professors, and challenging exams. In fact, those things almost never came up. The stories we heard were a lot more surprising and interesting.

The thing that stood out about the fire truck hack was that it was at once an act of disobedience, breaking the rules (and potentially some laws), and at the same time a significant and deeply meaningful accomplishment. The undergraduate student who had orchestrated it said, "Without a doubt, the most important learning experience I have had at MIT, and the achievement I am most proud of, is putting the fire truck on top of the MIT dome."

What may not immediately sound like a learning experience, was actually a marvel in organization, coordination, and engineering. Let's consider the logistics. The MIT dome is 150 feet high. The fire truck was assembled out of 57 parts, the heaviest of which weighed 150 pounds, and the largest spanned 12 feet. A team of 40 students from different academic programs spent three months carefully designing, planning, testing, and practicing. Finally, they executed a precision installation that took place in total darkness and was completed in less than 30 minutes.

Not only did the students demonstrate technical prowess, teamwork, and ingenuity, they also showed a lot of responsibility. In the process of installing hundreds of pounds of material, they made sure that nobody got hurt (or caught) and they left detailed instructions for the disassembly of the fire truck—possibly because they weren't sure the actual fire brigade would be as careful as they had been. The installation was deemed so reliable that campus safety officers left the truck up for a few extra days. They were confident it did not pose a risk.

In short, the students displayed all the competencies and skills we would

hope to see in a graduate from an engineering program at a good university. For anyone interested in learning and education—that is a puzzling result. If at one of the best universities in the country, the most important learning experience a student can have, is not part of the curriculum, not endorsed by the university—in fact, it is both illegal and dangerous—and it can never be listed on a transcript or cited by other researchers, then what inspiration could we take from this story to redesign the rest of the education experience?

How do we know the fire truck hackers really learned something in the process, and were not just demonstrating the things they had learned already—maybe even while sitting in a classroom? We did not try to calculate a score for the students' ingenuity, creativity, or ability to motivate others (using such sophisticated technologies as cookies and pizza), but we did collect rich evidence of their learning processes. We asked what they themselves considered their most meaningful learning experience rather than offering a list of possibilities and then followed up with questions about the process and the outcomes that made it so meaningful. While open-ended interviews do not give us easily quantifiable data, they allow for deeper reflection and introspection and may surface learning outcomes that standardized measures would miss. We not only heard about what the students did, or what they thought they had learned, but also how they felt about the experience, and why they chose a particular path. For example, we learned that the fire truck hackers sought out knowledge and resources that went well beyond their coursework, such as the Massachusetts amendments to the International Building Code 2009 (IBC) or the CMC Rescue catalog of equipment for rescue professionals. We also learned some of the competencies the students felt they had developed through the project including ingenuity, motivating teams, persistence, and engineering skills. In other words, in addition to the visible achievement of having successfully placed a fire truck on top of a very tall building, the students showed the type of metacognitive skills that correspond to executive function and other abilities that are often correlated with high-performing learners.

How can we connect this kind of exploratory, messy, disobedient way of learning with the structure and predictably of schools and universities? At the Media Lab, we use a simple framework called creative learning. It comprises of the four Ps: projects, passion, peers, and play. We cannot take credit for the fire truck hack, but it is a great example for creative learning: Students working on a Project they are Passionate about, with their Peers, and doing so in a Playful manner.

Not only is creative learning a framework to design engaging learning experiences, it may also help students develop the skills and competencies they may need most. There is now widespread agreement that many of the jobs that are currently filled by humans, will be performed by computers and robots in the future. The easiest jobs to replace are those built around clear sets of instructions, because computers tend to be better at following rules than humans. But there are another class of jobs that will be harder to replace: Jobs that involve creativity, collaboration, and empathy—the types of skills the fire truck hackers demonstrated. And beyond jobs, in these turbulent times, the importance of questioning authority and developing better solutions—technical, social, political—rather than waiting for others do it, cannot be stressed enough. Yet, much of our school and university curricula reward those who demonstrate they can follow the rules instead of encouraging experimentation and risk taking. This may be even more true in earlier years of schooling than in university. Is our education system preparing students for the kind of jobs that computers will be doing in the future?

However, the institutional structures of education were not designed to nourish, foster, and support the type of constructive disobedience that the fire truck hackers displayed. Some of the other stories we came across as part of the *How MIT (really) Learns* project may offer a starting point for changing that. Kim Vandiver, Professor of Mechanical Engineering, and for many years the head of MIT's Undergraduate Research Opportunities Program (UROP), told us about the MIT students' solar car team, who wanted to travel to Australia to participate in the very first solar car race. Driving a car built by students through the desert in Australia is an inherently risky undertaking. And in fact, traveling at 50 mph, the MIT car flipped over and rolled during the race. But due to careful planning by the MIT students, it was also the only car with a roll bar and a seat belt and so nobody got hurt. It wasn't clear if Professor Vandiver told us this story as an example of a learning experience he had mentoring students or a learning experience the students had, but we suspect it was a bit of both.

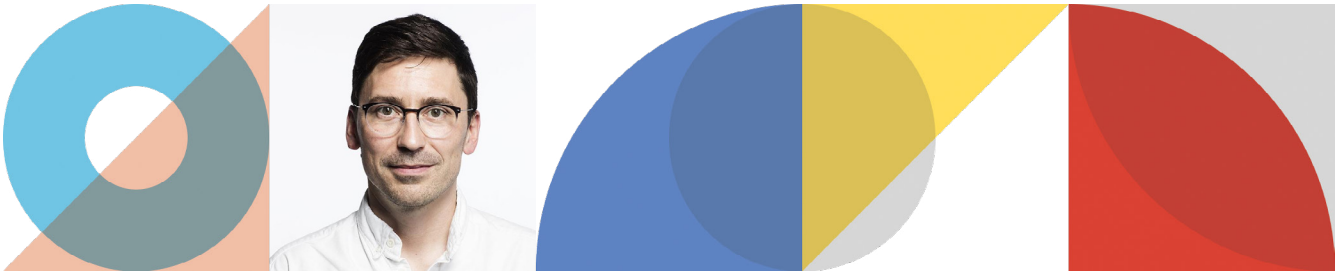
Chris Peterson, from the MIT Admissions Office, who travels around the world trying to convince the most talented students to come to MIT, calls this approach "crash pads rather than training wheels." It is OK to crash, in fact, the importance of failure and overcoming it have been established as essential parts of the learning process, as long as it is safe to do so. For the university, this may mean creating more spaces for stu-

dents to take risks and ownership of their education, but making sure it is safe to do so. The good news is that small changes can go a long way. For example, MIT makes it safe for students to experiment with different subjects during the first year of their undergraduate experience because no record of failed classes will appear on the final transcript.[1] Failing a class is still a difficult experience, but MIT has put in place the crash pads needed to make it safer.

To find other inspiration for structuring education to support creative learning, we may have to allow ourselves to open the doors and windows of our classrooms and look on top of buildings. Rather than focusing too much on measuring, predicting, and managing education we might be well served to create more open spaces for students to follow their own curiosity, allowing them to seek solutions to problems they care about, preparing them to use technologies with creativity and responsibility, and instilling in them the confidence they need to overcome hard challenges. In other words, let's make schools and universities the places where students can develop the types of skills and competencies needed to place a fire truck on the MIT dome. Because that may be our best strategy to prepare them for the uncertain future they are growing up in.

ENDNOTES

1 "Freshman Grading." MIT Registrar's Office. Accessed July 7, 2017. http://web.mit.edu/registrar/reg/grades/freshmangrading.html



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