

Design in Mind Learning™ @ The Tech

The Tech began its formal journey to establish a unifying learning model for its visitors soon after opening the doors of the new museum in the fall of 1998. What began as pedagogy for science teachers advocated by the Noyce Center for Learning, based on the Design Challenge approach, (and drawing from lessons learned from the annual Tech Challenge competition,) has developed into The Tech's signature learning model—*Design in Mind Learning™*. We are now on a mission to strengthen these design-based learning programs, evaluate their impact, and more deeply root them throughout the museum and in the community, especially in middle schools and community-based youth organizations.

Why Design?

The focus of The Tech is on current technology and innovation. So, why focus on design? All technology has been designed. By definition, technology is human-made, and thus is the result of human intentions and human decisions. Some designs are more successful than others, some have unintended consequences, and some might even constitute innovative thinking. Design is a process by which innovation may happen.

We believe that focusing on design is a particularly wonderful way to motivate and support learning about technology and innovation. The topic of design invites the visitor to participate in more ways than just as a user of technology.

Many different kinds of activities support a design approach. Even experiences that are merely created to allow visitors to “explore technologies affecting our lives” can focus visitors on the design decisions inherent in those technologies. As long as these kinds of activities keep “design in mind”, they can support the ultimate goal of visitors becoming innovators themselves.

What is *Design in Mind Learning™*?

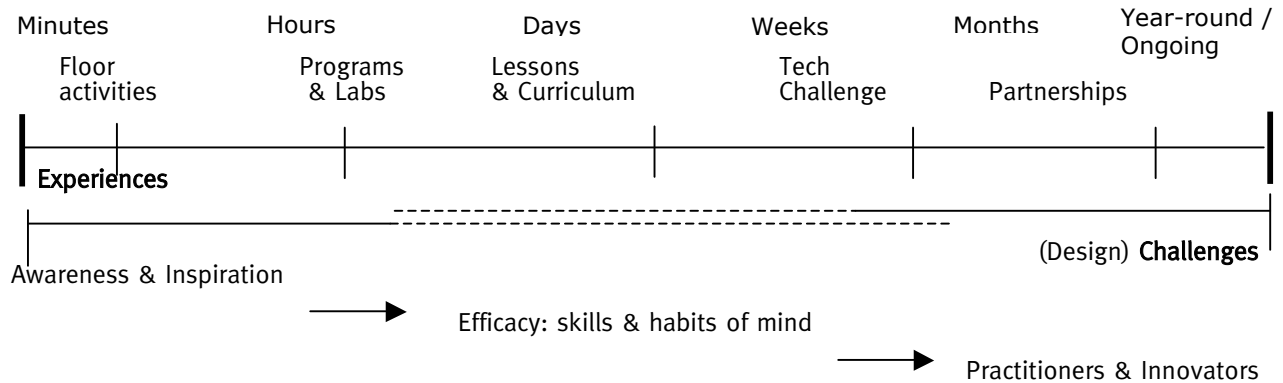
Design in Mind Learning™ is a motivational, design-based method for learning science, technology, and other subject areas, and for appreciating and developing the skills and habits of mind of an innovator. Through this approach, content knowledge is not just acquired, but rather is applied by participating in the process of design in order to solve real-world problems. Design is one of two fundamental approaches—Inquiry being the other—prescribed in national science standards documents crafted by the American Association for the Advancement of Science and the National Research Council for teaching and learning science.

As an approach, Design in Mind Learning™ falls within the Design Challenge family, as part of both a national movement—particularly at Georgia Tech University and MIT, The Boston Museum of Science, and the Massachusetts State Department of Education—and an international movement—most notably in Great

Britain and Singapore, among others—to infuse more design activities in formal and informal educational institutions. *Design in Mind Learning™* is principally derived from constructionist learning theory. Constructionism asserts that people learn best when placed in the active role of a designer or builder. Given a real-world problem to solve, the individual, or preferably groups of individuals, must apply existing knowledge, and acquire new knowledge to construct practical solutions to be shared with an audience.

The scope of *Design in Mind Learning™* is best represented as a continuum ranging from brief, spontaneous design experiences to longer, more structured Design Challenges. Typical gallery floor activities are brief—such as a one-minute, hands-on encounter or a 20-minute design and build activity. Design Challenges take longer—an hour-long lab, the four-month long Tech Challenge, or a year-long curriculum, for example.

The outcomes from *Design in Mind Learning™* follow a parallel continuum. Ultimately, all experiences aim to support learners in becoming innovators and innovative practitioners in the real world. Extended design experiences such as labs, lessons, and Tech Challenge promote a sense of efficacy to innovate by encouraging innovative skills and habits of mind. Brief experiences are created to build awareness and inspiration in visitors, but can also promote efficacy to innovate.



Design in Mind Learning™ Experiences

Every experience in the galleries (both in programs and exhibits) should keep “design in mind.” While not all learning programs put the visitor in the role of a designer, they do support a focus on design intentions, decisions, constraints and more. We call these sorts of learning experiences *Design in Mind Learning™* Experiences.

There are many ways to focus visitors on design. *Design in Mind Learning™* Experiences in exhibits and programs can

- Encourage people to notice and critique the design choices made by the creators of the technologies people find around them daily.
- Point out the intentions of technology designers and explore the outcomes—intended or not—of those technologies on our world.
- Explore real-world constraints faced by technology designers or the tools they use.
- Put visitors in the role of the designers through a design challenge activity, helping them to practice the skills and habits of mind of innovators. These skills include risk, perseverance, and learning from failure.

In order to be effective in the free-choice learning environment of the museum, each visitor must find something that inspires them personally. This can be a unique, only-at-The-Tech exhibit experience with unfamiliar technology, a conversation with a volunteer that shows them a new way to look at the technology that’s in their own homes right now, or a low-tech program that encourages them to explore the science behind the constraints that technology designers face. All these experiences need to keep the topic of design at the fore and give visitors an opportunity to get excited about thinking about these issues. *Design in Mind Learning™* Experiences can be targeted to every audience segment, from panel discussions for adults, to take-home kits for families. Through this wide variety of experiences, we can ensure that each person finds something that speaks to them.

Design Challenge

To date, the Noyce Center for Learning has focused its efforts on establishing and elaborating the Design Challenge portion of the continuum and implementing Design Challenge in The Tech's Teacher Professional Development Program, curriculum development for grades 4 through 8 in District Partner schools, and outreach to community based youth organizations. Design Challenge Learning represents an essential aspect of The Tech's *Design in Mind Learning™* pedagogy where students engage in the design process to solve a relevant, authentic, real-world problem. Student teams apply and reinforce their Science as well as Mathematics, Social Studies and Language Arts content knowledge, through an open-ended design process that results in an original solution. Design Challenges are framed by a problem statement, list of materials, and constraints. Learners do not follow a linear path from problem to solution, but rather weave in and out of conceptualizing, constructing and testing, and acquiring knowledge, all the while applying multiple skills and habits of mind of innovators.

The diagram below represents the phases of Design Challenge learning:

Conceptualizing

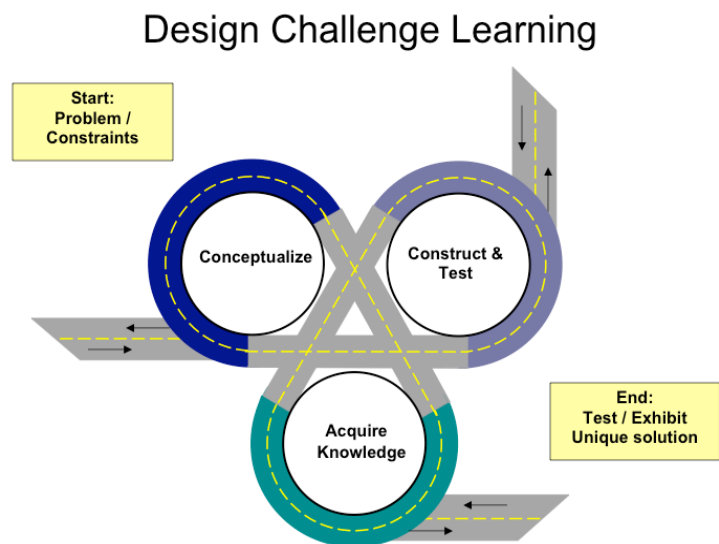
- Identify problem, materials & constraints
- Brainstorm ideas and possible solutions

Constructing & Testing

- Select a solution
- Design and Construct
- Prototype
- Redesign or modify
- Retest

Acquiring Knowledge

- Research
- Share solutions
- Reflect and discuss



Through the phases of Design Challenge learning, students have the opportunity to build broad skills useful throughout their lives, regardless of the specifics of the challenge. In using this open-ended approach that leads to the creation of numerous designs, students are challenged to apply their domain knowledge, personal experiences, interests and talents to the process of creating an inventive, team driven solution. This approach creates a powerful learning experience, where students are intrinsically inspired to learn and have pride in achieving a goal as a team.