Engineering, Go For It
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Lehigh University’s integrated degree in engineering, arts, and sciences (IDEAS), the collaboration between the Rhode Island School of Design and Brown University, and similar programs at other colleges produce graduates who are versatile, capable, and passionate about their work. These students study combinations of engineering and music (to design instruments), visual arts and microbiology (to make art exhibits from living cells), and animation and neuroscience (to create amazing optical illusions and study the brain)—just to name a few projects. They may find careers in everything from data visualization to movies, creating things that are beautiful and functional. The only limit is their imagination.

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Today, more people than ever realize that the arts and sciences are—or should be—inseparable. Joined by a common denominator—creativity—a STEAM movement combining science, technology, engineering, arts, and mathematics is growing. Calculus, physics, code, and 3-D printers are just some of the tools that STEAM artists use to make their creations come to life. For people who are most comfortable with paintbrushes, equations might seem scary—until they see how math can make their ideas work. Dance is physics in motion; geometry makes sense when drawing perspective.

A ballerina floats across the stage on the tips of her toes, swooping, gliding, turning, leaping. Then the music stops. Backstage, the dancer pulls off her pointe slippers in pain. Calluses and blisters, bruised nails, and bloody toes are the price she pays for an illusion of weightlessness in performance. But does it have to be that way?

The Dance Theater of Harlem and engineering students at the City College of New York (CCNY) set out to find an alternative. Could they build a better pointe shoe? Is there an exercise device that would help with strengthening? In this new partnership, students consult engineers with dance experience, test dancers’ movements with sensors, and analyze the data to design instructional videos and simulations to cut down on injuries.

When en pointe, dancers bear their full weight on the tips of their toes. That force can increase tenfold when jumping. Toe shoes are designed to absorb some of the shock. Biomechanical engineers have improved protection and durability by using elastomers—a material that can deform and return to its former shape.
Ever since Thomas Bradshaw introduced his steam-powered merry-go-round in 1861, engineers have been putting fun into motion at fairgrounds and amusement parks. And the rides get more spectacular all the time. Take the latest roller coaster from Canada-based Dynamic Structures. Unlike conventional roller coasters that haul a passenger vehicle to the top of an incline and then let it descend through various twists and turns powered by gravity, Dynamic Structures’ Formula Rossa catapults passengers from one pit stop to another along a journey through tunnels and domed theaters that is equal parts thrills, chills, and magic.

Powered by a propulsion system that uses superconducting magnets – the same technology that the U.S. Navy is testing to launch jets from aircraft carriers – the ride was developed as a star attraction for the Ferrari World amusement park in Abu Dhabi. From a standstill, the nine-passenger cars can slingshot up to 149 miles per hour. The track is hidden from view, giving riders the feeling of being suspended in space. At one of the stations, the car comes to a dead stop and the track turns into a gigantic teeter-totter inside a 40-foot-high dome with video and projections that give riders the illusion of falling through space. At another station, the car arrives on a gyroscopic table that can rotate while rocking passengers up and down.

The whole journey is united by a story in which video and projections are perfectly synchronized with the physical effects generated by the ride. “This creates an immersive experience that basically suspends reality. You’re not even aware you’re on a roller coaster,” says David Lo, the project manager at Dynamic Structures. Graduating with a master’s degree in civil engineering from the University of British Columbia, Lo previously worked on such projects as building a robotic vehicle for the U.S. Navy to rescue submarine crews stranded on the ocean floor. He also helped create a simulated Quidditch match for the Harry Potter and the Forbidden Journey ride at Universal Studios Hollywood, where riders feel they are actually with the young wizard as he flies over a field. Says Lo: “Engineering principles apply no matter what you’re working on. It’s amazing how you can adapt them across various fields. You just need to tap into the body of knowledge and build upon that – whether it’s for a bridge, a dam, a telescope, or a theme park ride.”