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RETHINKING HOW TECHNOLOGY IS USED IN EDUCATION

CLASSROOM TO CAREER: 3D PRINTING HELPS STUDENTS MAKE THE LEAP

MORE UNIVERSITIES USE 3D TO TEACH STUDENTS CAREER SKILLS TO PREPARE THEM FOR THE REAL WORLD.

ACCESS TO 3D printing is on the must-have lists of more engineering students these days when they're selecting a college or university. With that in mind, competitive institutions are looking for more ways to incorporate 3D printing technology into courses and career paths.

There are many exciting and innovative ways in which higher education is using 3D printing. It can make the choice of institution difficult for prospective students. Here are just a few ways universities are using 3D printing in cost-effective and clever ways to teach career skills in the classroom:

Rochester Institute of Technology: Mechanical, industrial and manufacturing engineering students at the Rochester Institute of Technology in western New York line up to take a popular course from Professor Denis Cornier. His course is dedicated to exploring what 3D printing offers and what's ahead for the exciting, relatively new technology.

Students put design skills and ingenuity into practice in Cornier's hands-on course. One student team recently built a working, four-color ukulele. Jeet S. Mehta, a graduate student pursuing a master's of science in mechanical engineering, said the course has a definite real-world component. "We now have the exposure to advanced and innovative techniques that we could use in the future," he says.

Rutgers University School of Engineering: At Rutgers in New Jersey, an engineering student and his professor recently created a way to print sophisticated, durable 3D Braille maps of a local training center for the visually impaired. According to an article on the web site 3Ders.org, senior mechanical engineering student Jason Kim and assistant professor in the Department of Mechanical and Aerospace Engineering Howon Lee created maps about the size of a computer tablet. They placed them in a binder for ease of use. Each tactile map represents a different floor of the training center, and includes a Braille guide, something paper maps lacked.

During the process, the student and professor met with people who rely on the center and learned a few practical realities. Paper Braille maps break down very quickly. Wooden maps are clunky and awkward. "It was a very fulfilling experience. I learned a lot," says Jason Kim. "The most difficult part was trying to imagine what it would be like to be blind myself so I could better tackle the problem, and it opened my eyes to the whole visually impaired and blind community." The pair's next project is a 3D-printed tactile map of the Rutgers campus, and the city of New Brunswick, in which it's located.

Berea College: At Berea College in Kentucky, a private liberal arts college for promising students from Appalachia with limited economic resources, the class uses 3D printing to grasp on-the-job concepts like rapid prototyping, working backward from a finished object.

Professor Brad Christensen's goal is to teach students the entire engineering design process. Using an inexpensive 3D printer purchased with grant money, a recent class designed and built boat propellers. Once they were complete, they tested them on a nearby ice-crusted lake (where they performed quite well). The real-world implications are clear from the start, says Christensen. "When students print a part, they are instantly confronted with [any] lack of attention to detail early in the process. They learn that one-sixteenth of an inch really matters. The 3D printer adds a new level to what we teach. It is a new avenue for learning. The students are actually seeing if something works or it doesn't."

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BEYOND THE CLASSROOM: EXPANDING THE REACH OF 3D PRINTERS

UNIVERSITIES AND EDUCATIONAL EXPERTS SEE 3D PRINTING AS A KEY COMPONENT FOR PRACTICAL EDUCATION.

AS PART OF a decade-long shift toward emphasizing more hands-on learning in higher education, 3D printing is looming large. Indeed, it has been repeatedly identified by institutions such as EDUCAUSE as an important development in educational technology.

EDUCAUSE predicted a rapid escalation in 3D printers on campus, commenting in 2014 on a project at the University of Nevada, Reno. "Higher education's need for 3D printing services could be both substantial and broad-based across disciplines."

Industry is getting behind the idea as well. The New Media Consortium, a group of hardware manufacturers, software developers and publishers working to get multimedia-focused products into higher education, has also repeatedly extolled the idea of widespread adoption of 3D printing in higher education. With the EDUCAUSE Learning Initiative and other groups forecasting just a few years until widespread adoption of 3D printing, competitive higher education institutions need to move quickly to develop plans to offer the sort of 3D printing services that students may soon come to expect.

For colleges and universities, embracing 3D printing often comes down to working out cost-effective plans to provide the technology to an increasingly wide range of students. As 3D printing becomes more popular and widespread, the types of disciplines that can make use of it go far beyond traditional engineering students. In order to reach more students from different educational disciplines with a single printer investment, libraries can be excellent locations.

As Patrick Colegrove, head of the DeLaMare Science and Engineering Library at the University of Nevada, Reno (UNR), points out in an EDUCAUSE article describing his 3D printing project, "Libraries have always provisioned community access to rare and sometimes expensive technology for the common good."

Colegrove's project at UNR stands as an excellent example of what is possible. In early 2012, the university library began offering 3D printing and scanning support as a library service available to all its students, faculty and staff, as well as members of the public. It was one of the first academic libraries in the U.S. to do so.

Colegrove describes users from numerous different disciplines and organizations across campus quickly adopted the service. The university's new 3D printers operated at or near capacity throughout the first year. For institutions looking for a way to build opportunities for hands-on learning, and link that education to practical training for real-world careers, 3D printing seems to offer boundless possibilities.

To introduce 3D printing relatively quickly, there are plenty of course materials and files already developed and available. Stratasys, a well-known name in 3D printing, offers a free semester-long curriculum for institutions interested in offering a course on 3D printing. The course lays out 14 weeks of lecture and lab time, four to six hours a week. It focuses on how to make something that moves something else, and delving into the various aspects of manufacturing and design.

Stratasys also provides stand-alone modules designed for the K12 market, although some colleges and universities have used them as well. The modular design means they're more project-based and fit into a finite amount of time or an existing curriculum, such as a manufacturing or engineering class.

Wentworth Institute of Technology in Boston offers the full Stratasys curriculum as an interdisciplinary course teaching 3D printing skills to a range of students, from engineering and architectural design to construction management and beyond. "3D printing is important to today's students because they're tomorrow's employees," says Stephen Chomyszak, the assistant professor who teaches the course. "3D printing is going to be a vital skill in the workforce, now and into the future."

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3D PRINTERS MOVE BEYOND ENGINEERING SCHOOLS

IN THE LAST THREE TO FIVE YEARS, MORE SCHOOLS ARE USING 3D PRINTERS TO TEACH A VARIETY OF HANDS-ON SKILLS.

FACED WITH THE challenge of engaging students through hands-on, project-based learning, colleges and universities are looking at new and different ways to apply 3D printing technology. 3D printers are becoming a fixture in engineering schools because they provide an effective hands-on route to understanding manufacturing and design. Now educators are also using them in libraries, bookstores, design centers, and other less-obvious locations.

"Students who graduate from high school have now had access to 3D printing for three, four, even five years; sometimes since middle school," says Jesse Roitenberg, the North American education manager for Stratasys, a worldwide leader in 3D printing in education and industry. "We're now seeing a demand from business schools, design schools, and the medical world."

The nature of 3D printing—which "prints" objects using a machine that gradually lays down layers of plastic or other materials—teaches engineering-related skills like problem-solving, design specifics, computer modeling, and the importance of careful planning and measurements.

"What you learn from a 3D printer is how to be a better problem-solver," says Roitenberg. "It's like learning a different language—designing for an additive process instead of a subtractive process. It's allowing students to be immersed in the problem-solving world, the real world."

Roitenberg says attrition rates go down when students are engaged in the kind of hands-on education that 3D printing involves. They get to apply their knowledge and produce something real. For that reason, he says, a variety of institutions, including the University of Minnesota and the University of Illinois, are starting to use 3D printers for first-year students.

"We're seeing courses where freshman are doing and making and developing, instead of just sitting in calculus classes and physics classes. And [institutions] are seeing massive changes, because the students are so engaged," says Roitenberg.

Real World Learning

Another interesting trend in using 3D printing in higher education, says Roitenberg, is an increase in collaborative projects involving engineering, business, and design students. "We're seeing more students work together in groups. You get different outlooks and skills intertwined into one project," he says. This is perhaps a glimpse at what students will encounter after graduation. The team process might involve developing an idea, going through thoughtful processes to see if it's feasible—whether there are competitors in the market already, for example—then determining how to design the object, and the manufacturing costs.

As anyone who has watched the popular TV show "Grey's Anatomy" can attest 3D printers are also gaining huge popularity in the medical world. Medical students working with 3D-printed objects "can touch and feel and interact with 3D-printed parts that are [exactly based on] an MRI or a CAT scan, or something out of a catalog," says Roitenberg. "Medical students can really see it, touch it, hold it, and understand it."

Educational activities are moving from simply academic to more real-world. "We used to talk to CEOs and heads of engineering about touching and feeling a product before they go to manufacturing," he says. "Now we're going to doctors and med students and saying, touch it and feel it, because you're going to have to build a procedure around how to remove it."

"The ability for students to engage and do really helps them remember what they've learned," says Roitenberg. Universities have traditionally been about theory, but the success of 3D printers is expanding that approach. It pushes all sorts of courses and specialties toward more hands-on learning. In doing so, they are better preparing students for the very real, hands-on processes and projects they will encounter after graduation.