



REDESIGNING HEALTHCARE

SKMC Program Fosters 'Out-of-the-Box' Approach to Medicine

By Sari Harrar

STORY SUMMARY

- Jefferson has launched three “design thinking” initiatives aimed at introducing this creative problem-solving method to medical students, residents and faculty.
- Design thinking involves understanding a problem from the inside out, testing solutions in real-world situations and collaborating across disciplines. Proponents say it can help transform healthcare.
- In 2014–15, Jefferson launched the nation’s first four-year design program for medical students — the College within a College Design Track. The university also opened a design hub, MEDstudio@JEFF, and started the Innovation & Design Application (IDeA) Program @Sidney Kimmel Medical College, which offers early admission assurance to qualified Princeton University undergraduates pursuing fields of study not traditionally tied to medicine.

The average wait time in an American emergency room is a frustrating — and often scary — four and a half hours. But Ludwig Koeneke-Hernandez, a Sidney Kimmel Medical College student and member of the college’s first-in-the-nation, four-year Design Track program, has an app for that.

“I’ve always dreamed of inventing something that would make things better for people,” says Koeneke-Hernandez. “When I heard about the ‘College within a College’ [CwiC] design program here, I dove in. I was looking for a place where I could tackle problems in a creative, unconventional way. I found it.”

The Design Track launched in February 2015 with 15 first-year students. The focus: applying design thinking — a “human-centered” method of problem-solving that’s as creative as it is practical — to medicine. “It’s like majoring in medicine and minoring in design,” explains CwiC-Design co-director Bon S. Ku, MD, associate professor in SKMC’s Department of Emergency Medicine. “Students will make medical devices and redesign healthcare systems, services and spaces. They’ll look for fixes in fresh, new ways that focus on patients’ real needs.

To our knowledge, we’re the first medical school in the U.S. with a cohesive design curriculum that spans all four years of a student’s training.”

The program is one of three new Jefferson initiatives aimed at promoting design’s “out-of-the-box” point of view, moving the university to the leading edge as a growing number of medical schools, major medical centers and feisty start-ups explore the intersection of design and medicine in search of healthcare advances. The effort also includes:

- MEDstudio@JEFF, which began in mid-2014 with a series of provocative lectures and workshops featuring experts in wearable technology, architecture and virtual healthcare. “Great ideas come from collaborations between experts from fields that may seem totally unrelated — like medicine and architecture or textile design or even gardening,” says MEDstudio founder and director Peter Lloyd Jones, PhD, who is planning hands-on design workshops as well as thought-provoking talks for students and faculty this year and beyond. “Radical collaboration holds real promise for rapid advancement and change.”

- The Innovation & Design Application (IDeA) Program @Sidney Kimmel Medical College, which offers early assurance of admission to SKMC for qualified Princeton University undergraduates who are pursuing non-traditional “pre-med” majors. The first IDeA scholars, from Princeton’s sophomore class, were selected in March 2015 and will begin medical school with an eight-week immersion in summer 2017. “We want to attract creative, ‘right-brained’ thinkers and encourage them to pursue intellectual interests such as engineering, architecture, computer science, design and the humanities as undergraduates,” notes Ku, who also directs IDeA. “These students can lead the way in problem-solving in healthcare for the 21st century. We want them to come to Jefferson.” (Read more about IDeA on page 21.)

The ferment around “medicine + design” at Jefferson traces to SKMC Dean Mark Tykocinski, MD. As he frames it: “Cross-cutting knowledge domains and higher-order thinking skills will be what distinguishes the physician of the 21st century. Design thinking is one of those foundational elements that offer a route for purposefully cultivating creativity. Our unique CwiC-Design, IDeA and MEDstudio programs are vehicles to this end.”

A Lightbulb Moment

For Design Track students, the city is their classroom. Last spring, the group met inside Jefferson’s bustling Center-City Philadelphia emergency department at the corner of 10th and Sansom streets for a workshop. “The ER is the front line of our healthcare system,” notes Design Track co-director Dimitrios Papanagnou, MD, vice chair



Genevieve Dion, director of the Shima Seiki Haute Laboratory at the ExCite Center of Drexel University, demonstrates to SKMC Dean Mark Tykocinski a lightweight prototype glove called “Exoskin” — a software-controlled, rapidly prototyped wearable technology that allows therapists and patients alike to control hand movement in a comfortable manner for rehabilitation purposes, including for issues arising from neurological damage. This type of project, which will be clinically tested in part as a collaboration between MEDstudio and Drexel’s student co-op program, is possible through the fusion of multiple fields including industrial and fashion design.

Think Like a Designer

Design thinking solves problems by focusing on people — their needs and their responses to potential solutions. Here's how the process works:

Step 1: Empathize. The centerpiece of design thinking, empathy in this context means deeply understanding the problem at hand from the perspective of the people experiencing it. It's also about understanding them in a broader, deeper way — their physical and emotional needs, values and habits. "In healthcare, design thinking isn't patient-centered, it's human-centered," says Design Track co-director Dimitrios Papanagnou, MD. "We want to look at the whole person in order to find better solutions."

Step 2: Define. Outline the problem, based on knowledge from step 1.

Step 3: Ideate. Generate ideas, thinking broadly about potential solutions. The goal: Move beyond obvious answers to find unexpected and creative possibilities.

Step 4: Prototype. Build a quick mock-up of one or more promising solutions. It may just be a picture or a rough approximation of a device. The objective: Make something quickly that users can try out.

Step 5: Test. Have users try out one or more prototypes. Use their feedback to generate more ideas and prototypes to test. The process may repeat several times until a viable solution emerges.



for education, emergency medicine, and assistant dean for faculty development. "We asked the class to talk with patients and staff, identify a challenge and propose a creative solution."

A light bulb switched on for Koenke-Hernandez.

"The pattern I saw in the ER is that patients can wait for hours, without knowing when they'll be seen," he says. "Frustration, fear and worry build. Almost nobody in the waiting room understands how triage decisions are

made. For ER staff, the tension can be a real source of concern. I thought, what if there were a free smartphone app that would show ER patients their estimated wait time and explain the process?" He's now working with the university's Innovation Pillar team to develop the app for possible release.

That, Ku says, is exactly how design thinking works.

"People hear the word 'design' and think it's about fashion or furniture or housewares. It's really a way of

seeing the world based on empathy, creativity and practicality," he says. "Ludwig's app is a great example of how even first-year medical students are creative problem solvers, when given the opportunity. There's not much room for that in the conventional medical school curriculum."

Design thinking is a specific process, a multi-step methodology that begins with deeply understanding a problem from the user's perspective, Ku says. "In the second step, you use that information



Friends of the Railpark (FOTR) directors Michael Garden and Liz Maillie take MEDstudio@JEFF participants and collaborators on a tour of the abandoned Reading Railroad in North Philadelphia. If fully realized, this preliminary alliance between FOTR and MEDstudio will lead to Jefferson playing a vital role in the design of a unique three-mile elevated and subterranean park that will eventually weave its way through Philadelphia.

to brainstorm solutions. Finally, you implement the solution. There's plenty of tweaking, collaborating, gathering new information from the people affected by the issue, striking out in new directions if one idea fails. You're constantly testing, changing, collaborating and improving to find a solution that truly works for people."

Hence the design world's ubiquitous catch-phrase, "Fail Faster."

"It's about being creative and not attached to preconceptions,"

Papanagnou says. "This can be uncomfortable for medical students, who've been high-achievers taught not to fail since high school. We want to foster a new kind of healthcare provider — someone who's ready and able to work with patients and colleagues to find real solutions."

Extreme Collaboration

Across the nation, medical institutions and innovative businesses are leaping into design thinking. The University of

Texas at Austin will open its Design Institute for Health in 2016. Design workshops have cropped up at the University of Utah, the University of Michigan and the University of California San Francisco (among others); a North Carolina healthcare start-up called Smashing Boxes recently held design workshops for students from Duke University and the University of North Carolina at Chapel Hill. Innovation teams at Tufts University, the Massachusetts Institute of Technology, UCSF and other schools are melding expertise in engineering, research, clinical medicine and other fields to redesign clinical trials, develop devices to combat global diseases and more.

It's all about breaking down walls, sharing ideas and creating new languages. MEDstudio founder Jones has firsthand experience in this world. Extreme collaborations furthered the work of architects and biomedical researchers at the University of Pennsylvania, where beginning in 2006, he co-directed a multi-disciplinary research unit called LabStudio with experimental architect Jenny Sabin (LabStudio was launched under the

auspices of Dean Tykocinski, then chairman of Penn's Department of Pathology, of which Jones was a member). One of the many exciting outcomes that emerged from unlikely LabStudio pair-ups: Measurement systems used by digital architects helped researchers like Jones, then an associate tenured professor of pathology, track the three-dimensional movement of breast-cancer cell walls in exquisite detail. "Suddenly, we could document changes that were difficult to track and record before," he says. "We found that identical-looking breast cancer cells moved in unique ways. It was very exciting."

In the spirit of extreme collaboration, MEDstudio@JEFF has hosted lectures by healthcare visionaries including Jay Parkinson, MD, founder of the virtual medical practice Sherpaa.com, and by textile designer Genevieve Dion, director of the Shima Seiki Haute Technology Laboratory at Drexel University — a high-tech knitting center. In collaboration with Drexel ob/gyn researchers, Dion has created a belly band for pregnant women that tracks uterine contractions and fetal heart rate

in real time — knitted with electrically conductive thread.

"What I know from LabStudio is that developing a design mindset can take time. People know it's powerful stuff that can change the world. Seeing the possibilities in collaboration, learning the process are exciting. That's why it's great we have the four-year CwiC-Design Track and why it's great that we can draw on amazing talent from universities and firms throughout Philadelphia," Jones says.

In summer 2015, Verena Paepcke-Hjeltness, assistant professor in Drexel's Antoinette Westphal College of Media Arts & Design, presented a MEDstudio workshop for emergency medicine residents focused on solving real-world healthcare challenges, including how architectural context may be re-designed in a way that is beneficial for staff and patients alike. Paepcke-Hjeltness, an industrial designer who will become MEDstudio's first Designer in Residence, says she planned to introduce the use of not just deductive and inductive reasoning but also "adductive logic." "This is geared toward finding newness through asking 'what if...?' questions," she explains.



SKMC students attend design workshops at Philadelphia University, just one of Jefferson's many partners. During a workshop in April, participants assessed the pros and cons of standard emergency-room equipment and presented ideas on improving the equipment's design. Here, Menachem Yondorf and Salam Peter Beah examine an asthma meter, and Kristen Adorno and Alison Grady evaluate a neck brace. Photos by Bill Cain.

Medical Students as Designers

On a warm April evening, Design Track students convened in an industrial design lab at Philadelphia University for a workshop on designing medical devices. In other parts of the building, machinery hummed in wood-working, model-making and weaving studios. Meanwhile Michael Leonard, dean of Philadelphia University's School of Engineering and Design, discussed his experiences designing a home cholesterol test for a client that went through dozens, if not hundreds, of design changes. "A device needs to be intuitive," he noted. "It's got to be easy to use." The following week, students tried their hand at redesigning familiar medical devices. "I want to be able to use my hands-on experience with patients to generate ideas for better devices and systems, for better health," says student Lorenzo Albala, who already has degrees in biomedical engineering. "I've always looked up to people who come up with great ideas."

Student Pavitra Krishnamani says the CwiC-Design Track has given her skills and confidence that will help her learn more from her patients. "Design is human-centered. You have to ask questions. In our very first workshop, we were on the street asking Philadelphia residents about their experiences with Jefferson's health system. I felt some anxiety, but got over it. I'm not afraid to connect now," she says. Krishnamani isn't afraid of collaboration now, either: She attended an MIT healthcare "hackathon" in April 2015 where engineers, medical students and others from several institutions joined forces to quickly solve a healthcare problem. She's now part of a team of SKMC students planning a similar event in Philadelphia.

As one of SKMC's College within a College offerings, Design Track students attend seminars and workshops outside normal class hours for their first two years. Workshops cover everything from fixing hospital discharge problems to finding health applications for wearable technology to hacking medical devices. They will also complete two "capstone projects" that apply their new design thinking chops in the real world. At press time, class members were considering their first big project.

Krishnamani was thinking about applying design thinking to providing mental-health services for South Philadelphia's Bhutanese refugee community, a group she works with as a volunteer. Student Salam Peter Beah was thinking about ways to apply design thinking to urban health outreach programs, especially for blood pressure control and smoking cessation. "Design can teach us to be leaders in the healthcare field, to work with multidisciplinary teams and to think freely," Beah says. "Most importantly, it's teaching me to really look at what's going on around me." ■

Jefferson is seeking scholarship support for Design Track students. A matching opportunity made possible by the Sidney Kimmel Foundation will double the value of new endowed scholarships through June 2016; learn more on page 24.



Students Steve Selverian and Graham Hale used Lego bricks and other tools to build prototypes of "waiting room pods." Their designs included privacy, reclining chairs, retractable ceilings and charging stations for mobile devices — features they introduced with the patient experience in mind.

What a Great IDeA!

Last spring, four Princeton University sophomores found out they'll start med school at SKMC in 2017 — without having to take all the usual pre-med requirements or studying for the grueling MCAT (Medical College Admission Test) exam. They're the first in the new Innovation & Design Application (IDeA)@ Sidney Kimmel Medical College program. While they'll take basic science classes as Princeton undergrads, the program frees promising students' schedules so they can pursue interests in everything from architecture and engineering to philosophy, sociology and English, says IDeA director Bon Ku, MD. Once at SKMC, IDeA students will also join the College within a College Design Track.

"We don't think taking an enormous science load or studying for the MCAT will make them better doctors," Ku says. "Their time is better invested following right-brained interests that will prepare them to be more compassionate, creative physicians and more flexible problem-solvers. We're already hearing that the program is giving them flexibility. One IDeA student, for example, will spend his junior year at Princeton exploring links between physics and classical philosophy."