On Empowering Medical Student to Become Innovators

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Doctors have long served critical roles as medical innovators shaping the way we practice medicine or perform surgery. Homer Stryker, for example, was an orthopedic surgeon who developed the oscillating electric saw still used today for the removal of casts. Patricia Bath, an ophthalmologist, developed the laserphaco probe for cataracts removal. We too, as medical students, have unique opportunities and perspectives that we can draw from to inspire and develop new medical technologies. But without a technical background, it can be intimidating to design, prototype, and develop novel solutions to the medical problems we observe daily. However, we strongly believe that medical students and healthcare workers have a critical role as innovators. In fact, we believe that medical school provides the ideal environment to encourage ideation, design thinking, and prototype development. Innovation begins with customer discovery, the process of understanding processes and identifying unmet needs. This customer discovery process thrives with fresh perspective and immersion in all aspects of patient care, both of which are in abundance during this phase in our training. As medical students during our rotations, we have the great privilege to work with diverse medical specialties and to engage in operations and workflows at several different clinical sites. We are constantly learning from the many end-users coordinating patient care including doctors, nurses, pharmacists, technologists, and medical assistants. Every new rotation is a new opportunity to perform a clinical needs assessment and customer discovery.
After finding a clinical need that we are passionate about, the innovation process can progress to the brainstorming phase. Brainstorming involves creative thinking and rapid imagining of large diverse range of potential solutions (usually huddled around a whiteboard with some coffee or chai). Narrowing this list down to begin prototyping is usually a daunting exercise of judgement— balancing critical evaluation with optimism. If we pursue too many solutions, we run the risk of running out of time and other resources, but too few and we have no backup plan. Our organization, Advancing Innovations in Medicine (AIM-SIG) with the help of the Ruth Lilly Medical Library, uses *pretotyping* as a way to fail fast and early, allowing resources to be allocated to the most promising ideas. This hands-on, creative process allows us to test and present imaginative ideas quickly using simple materials: Play-Doh, Legos, cardboard, and pipe cleaners. This process provides a tangible, visual idea that we can refine before developing a more advanced prototype— and it requires very little time and no technical skills.

Once the ideation list is filtered through pretotyping, we advance to the *prototyping* phase. This is where a little technical skill goes a long way. AIM-SIG was founded with the mission to empower medical students to feel confident prototyping. There are now several easy to use, freely-available tools that facilitate this. For example, computer-assisted design (CAD) traditionally carried a steep learning curve to designing models that can be 3D printed. However, new tools like TinkerCAD, enable the CAD process to feel akin to building Legos. Historically, we have hosted workshops with medical students who despite having minimal technical background can quickly pick up the fundamentals required to build basic 3D models. Beyond CAD, the Arduino platform and community have created an amazing platform to learn about circuitry and developer programming skills— enabling learning at a broad range of ages. With some guided knowledge of these tools and resources, one can easily take an idea and create a basic prototype with limited prior technical knowledge.

Medical school remains an opportune time to become involved in medical innovation and requires only a willingness to learn, explore, and be creative. As medical students, we have access to and learn about a wide array of medical specialties, facilities, and professions. This provides us the opportunity to assess clinical needs and identify opportunities for innovation. Once identifying a clinical need, one can enter the pretotyping phase to identify potential solutions and to fail early. While entering the prototyping phase may seem challenging, there are many open-source resources that have significantly reduced the barrier to entry. Further, at IU School of Medicine, AIM-SIG was designed to help medical students navigate the innovation process from ideation to prototype. We host workshops in collaboration with the Ruth Lilly Medical Library to guide students through these phases. Our goal as AIM-SIG is to empower any and all medical students to become great medical innovators.