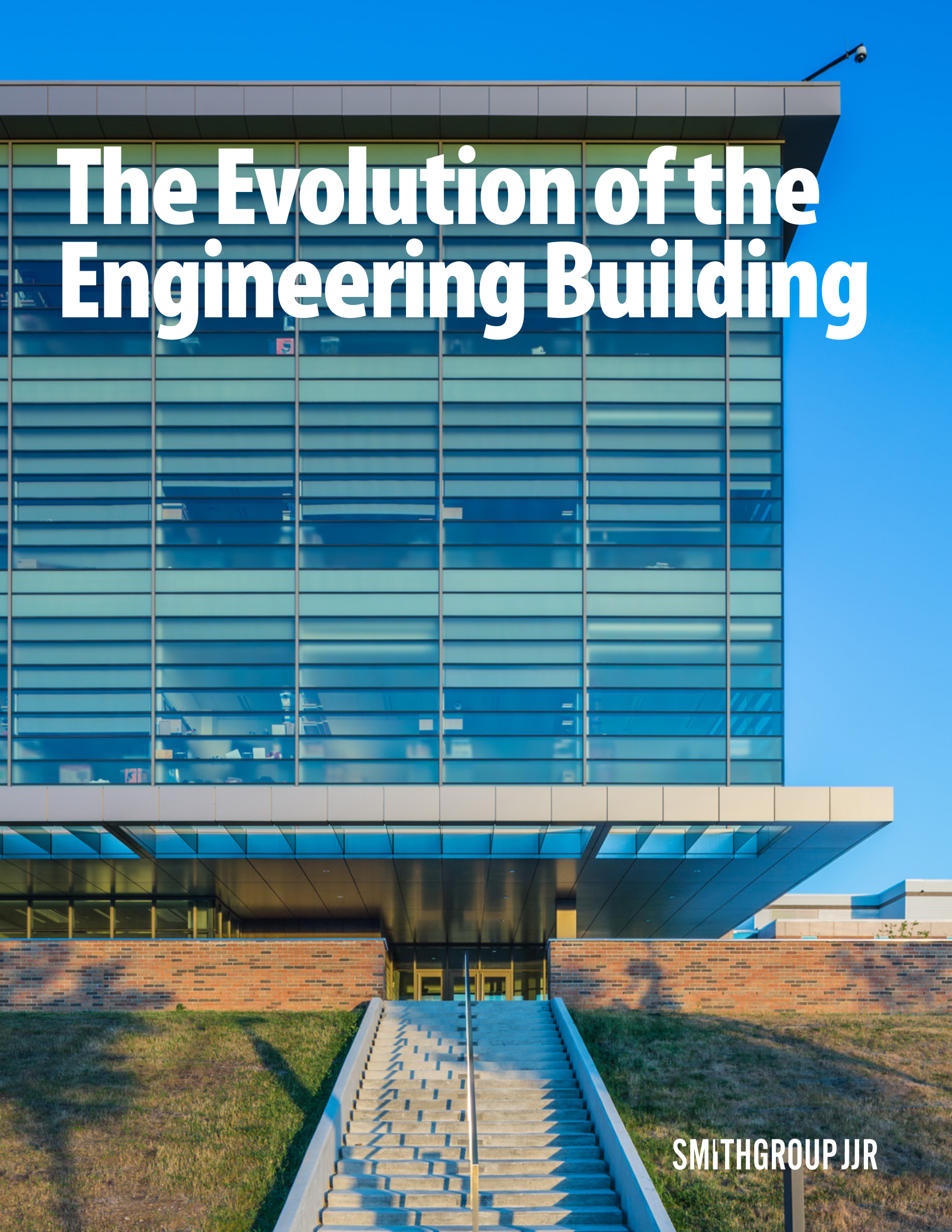
The Evolution of the Engineering Building



SMITHGROUP JJR

UNIVERSITY OF CALIFORNIA, MERCED

The evolution of the engineering building

As architects, engineers and planners, we continually strive to understand each client's perspective and what is driving their business model. To do this, SmithGroupJJR regularly conducts client forums and immersive research programs to investigate current issues and trends affecting higher education facilities. These projects—Advisory Boards—help us to understand the instructional and research needs of our higher education clients well into the future and enable our planners and designers to accommodate new ways of achieving a client's goals.

In March 2016, SmithGroupJJR convened in San Francisco, California to host an Advisory Board discussion in conjunction with the Engineering Deans Institute Annual Conference. During this session, 13 deans, designers, architects and laboratory specialists joined together for a highly interactive dinner discussion focused on how facilities can build bridges between education and industry, support entrepreneurship and exploration, and encourage interdisciplinary and team-based collaboration. Key highlights from the discussion are included on the following pages.

"On campuses we expect to do 50 year buildings, but many companies aren't even around for 50 years."

- Advisory Board Participant

Industry Interaction

The connection between higher education and industry is a driving force on today's campuses, particularly for engineering-related disciplines. During the first discussion topic, which focused on how institutions interact with industrial enterprises, the deans shared some challenges and best practices in creating fruitful collaborations. One dean illustrated the importance of these partnerships by sharing that "training engineers without industry is like training doctors without patients."

Industry goals center on short-term objectives. Higher education goals focus on the long-term.

One of the most fundamental challenges to creating successful, collaborative partnerships between these groups is that business entities often focus on short-term goals, while higher education institutions are focused on long-term objectives. Many universities have been around for 100 or 200 years, yet the companies that work with them are not thinking about the next 200 years. They are focused on the next quarter. Universities must demonstrate that building space and programs for the long-term can ultimately benefit companies as well. This represents a fundamental difference between education and training.

Traditionally, much of the shared space provided for industry partners in an academic environment has been developed as research space. However, we are seeing a new trend emerge, where industrial partners are requesting access to instructional spaces, too. Designing instructional and research spaces which can flex and evolve over time will help to achieve the long-term goals of the institution, yet still support the immediate goals of an industry partner.

UNIVERSITY OF TEXAS, DALLAS

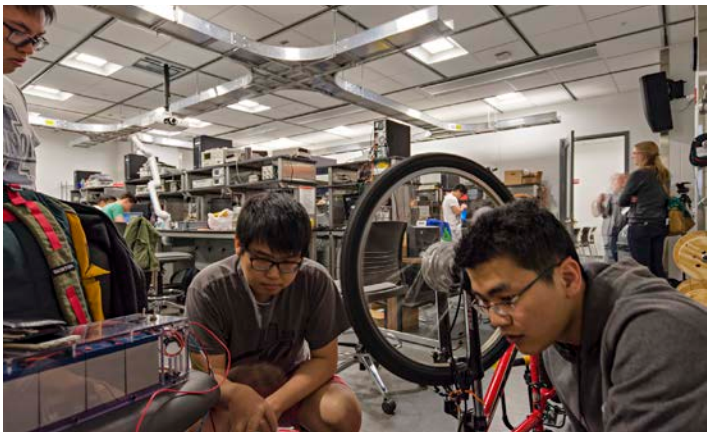
Invest in engineers.

With a shortage of engineers across the nation, it's no secret that industry partners value higher education as a recruiting tool and proving ground for the next generation of employees. Engineering schools are the purveyors of talent at all levels -- the undergraduate level, the trainee level, the re-trainee level – and that's a unique advantage.

With a move to focus on quarterly outcomes, the research and development programs at corporate levels have shrunk and are increasingly counting on academic institutions to satisfy their R&D objectives in a covert way. In order to have access to students, companies are investing in university infrastructure to support the development of students and collaborative projects. Industrial partners has also taken steps to be part of the curricular design at certain institutions in an effort to bolster student learning. However, some universities feel that the industry should only make contributions on technical electives, and not core curriculum.

"My philosophy, as a public institution, is that our mission should be to transfer technology to industry to create jobs."

- Advisory Board Participant



UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN

In the past, it was common for companies to sponsor corporate affiliates programs, whereby an organization would contribute substantial sums of money to universities to obtain access to talent. Today, the world is so competitive that these companies don't have the resources to continue this practice. So now, new recruitment and talent development models have come into play. For example, at University of Texas at Dallas, engineering leadership created UT Design, a corporate-sponsored capstone senior design program. The program solicits money from industry. In return, the companies define capstone project concepts and parameters, and UT Design students essentially work for a given company for the duration of their senior design course. The course is housed in a design studio, which is a large open space with adjacent rooms that are flexible and can provide security and privacy as teams of students work on proprietary projects.

Design space to meet diverse goals.

Industry wants to come into academia and see that students are working in a way that mirrors their own workplaces. They want to see team-based learning and collaboration along with diverse, open and transparent spaces that support evolving pedagogies. Companies want to be assured that students are being molded into future employees that can think, create and innovate.

One of the challenges noted by this group of Advisory Board participants is that it is difficult to obtain financial support to create these new space types, as they are more costly to build than traditional learning environments. Spaces devoted to supporting engineering curricula are also expensive to operate. Therefore, the challenge is to entice industry partners to help invest in the development of space that benefits them while also enhancing the student experience.

Innovation center models are a prevailing trend at universities today, and aim to create these desired new collaborative space types. Innovation centers put student-focused activities front and center, create visibility for new learning collaboration models, provide spaces for students to showcase the results of their work together, and catalyze the inventiveness of students, faculty, and staff. These facilities demonstrate that innovative learning environments should be designed to facilitate partnerships with stakeholders inside and outside of academia.

"The challenge is to get industry to help invest in the development of space that benefits them and also enhances the student experience."

- Advisory Board Participant

UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN

Another interesting perspective that arose during this Advisory Board meeting is the premise that the wants and needs of faculty members typically vary from industry partners. As a result, creating a space that suits the needs of both institutions can be challenging. For example, one of the sticking points for tenured faculty has been the desire to maintain private offices, yet trends in industry point toward an open office concept that encourages greater collaboration and connectivity.

Create open and secure environments.

At times, industry collaborations have been so embedded with engineering schools that secure laboratory spaces have been constructed immediately adjacent to faculty labs. Yet, in today's age, as we think about space, we must think about embedding flexibility for the future. Some faculty research programs may shrink, while other industry collaborations may expand. So, how do we design space so that is open and collaborative, yet has the ability to be secured and segregated when needed? In shared space environments, industry partners should have the ability to remain connected to the talent of the student and faculty populations, but at the end of day be able to close the door and be confident that their research and property is secure.

Rethink Intellectual Property Rights.

While industry is looking for academia to partner in research, there are differing viewpoints regarding how intellectual property (IP) rights should be handled. When it comes to IP, some universities have agreed to partnership arrangements which allow the companies to retain full ownership and rights to the bodies of their work. These universities have chosen to embrace this approach under the assumption that if they do not relinquish IP rights, companies may choose to take their valuable research initiatives to competing institutions. In situations where a university forfeits IP rights, students who choose to work on such research projects must sign non-disclosure agreements (NDA). If a student is not willing to sign a NDA, the individual is reassigned to work on an alternative project for a non-profit or other entity whose initiative does not require absolute privacy.


UNIVERSITY OF MICHIGAN

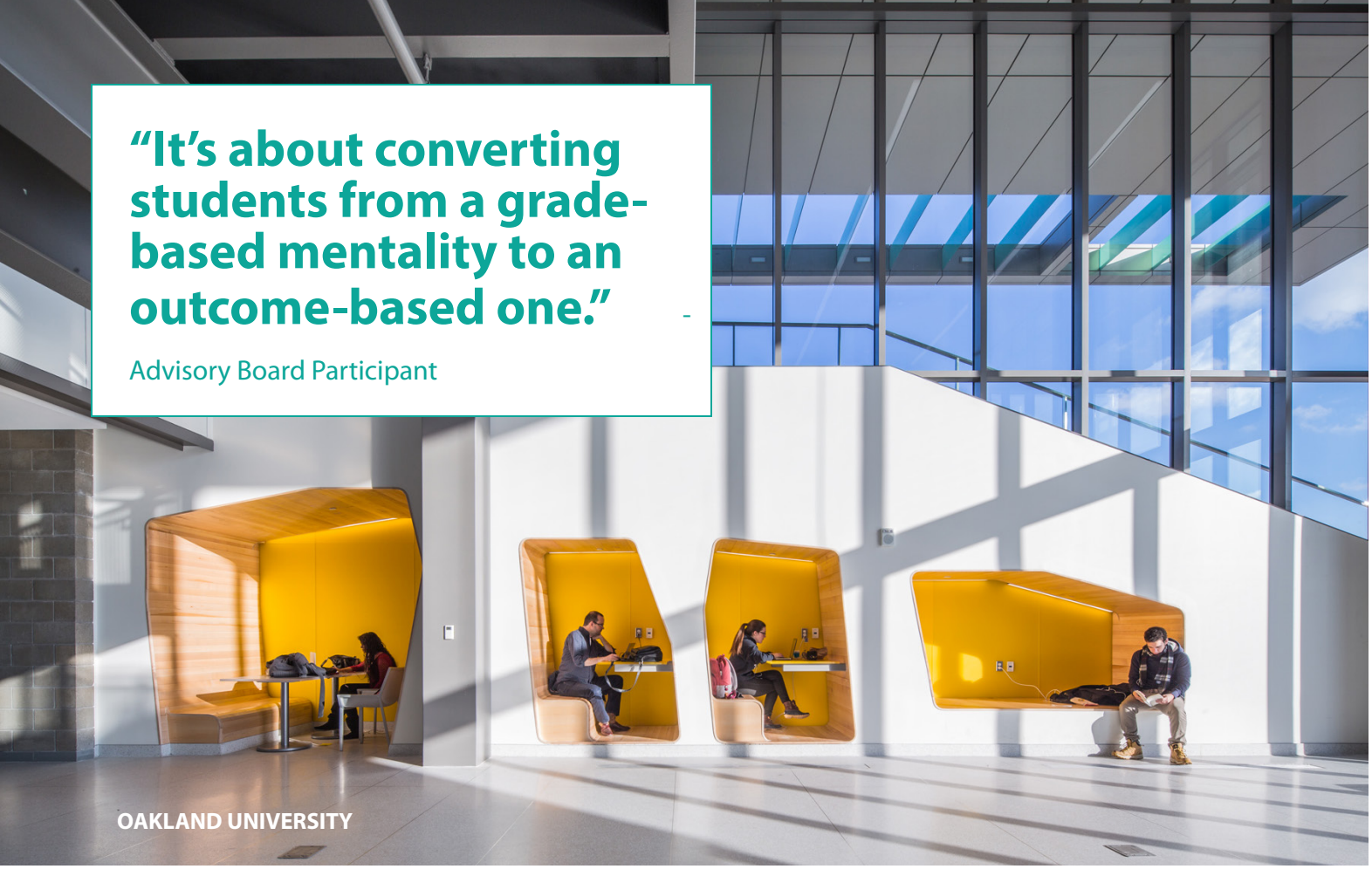
Conversely, several Advisory Board members shared that their institutions had, in fact, enjoyed benefits of having companies come in and maintain ownership of IP rights. In these cases, students have been able to include their names on patents developed during a research partnership, and their institutions have not been required to cover costs related to filing those patents. Not only is this experience beneficial to students, but the arrangement also eases financial burdens that would otherwise have been placed upon the university.

"It was critical to make intellectual property rules much more flexible than they were originally, and this required support from university leadership."

- Advisory Board Participant

OAKLAND UNIVERSITY

UNIVERSITY OF MARYLAND



> **"It's about converting students from a grade-based mentality to an outcome-based one."**
>
> Advisory Board Participant

Another member of the Advisory Board shared that, at their institution, it was critical to make IP rules more flexible than they had been in the past. Historically, this school had contributed to the development of tens of thousands of patents. As a result, it was a challenge to shift faculty and administration's mindsets to support a new philosophy and outlook on this subject – particularly regarding their viewpoints surrounding how promotions, tenure and reappointments (PTR) would be addressed moving forward. Ultimately, it was deemed essential that any change in how IP rights were handled must be supported by university leadership, including the Provost.

As companies move away from corporate research enterprises and shift research activities into university environments, there becomes a unique opportunity to design space that supports additional research capacity. Looking at design drivers such as flexibility, security, privacy, transparency and collaboration can create a new facility planning model that encourages greater industry partnerships in the future.

Entrepreneurship and Innovation

Within and across disciplines, engineering is a social enterprise. Collaborating to solve complex problems is foundational to STEM education. Fostering entrepreneurship and innovation in engineering facilities is supported by both the institution's curricula and space. During the second portion of the Advisory Board discussion, the participants shared some thoughts on how to best encourage innovation on campus.

It's about what you DO.

The first challenge when it comes to fostering entrepreneurship is converting students from the traditional high school mentality (getting an 'A' is what matters) to understanding what they need to do to secure a job as an engineer. Good grades are one measure of intelligence, but during a job interview, an employer is going to ask "what did you DO," not "What did you get?" Students must be converted students from a grade-based mentality to one that is outcome-based. This is what drives entrepreneurship and innovation.

UNIVERSITY OF GEORGIA

Think of space in terms of collisions and intersections.

Innovation and entrepreneurship is fueled by interaction. The number of interactions students experience in their residence halls far exceeds what they will have in the academic buildings. Our challenge in designing academic facilities is to provide space for students to consistently collide and collaborate. This must extend beyond laboratories and classrooms and out into the informal areas of a building.

Engineering space must provide a balance between theory, hands-on learning and the lab. It's very important that students have an opportunity to "make" as part of their educational experiences. Space should be large enough to accommodate diverse teams, yet flexible enough to provide individuals with their own workspaces. Beyond space in the engineering building, the Advisors felt strongly that if there's an incubator space on campus, engineering students should have access to it.

UNIVERSITY OF ARIZONA

Design space that creates memories.

When the deans were asked about the spaces they remembered fondly in college, the engineering building was never mentioned, with the exception of the machine shop. The library, the residence halls, and random classrooms or spaces that they modified for ad hoc uses were all thought of as "memorable." Participants indicated that spaces in the older buildings were never really designed for informal interaction or collaboration, yet the shift in today's learning styles demands it.

Now, as the deans move to create and fund new space for their students, they are looking to incorporate informal and team-based learning environments. They are looking to design spaces that foster peer-to-peer learning and camaraderie; that are technology-rich and connective; and that create memories for today's students.

Conclusions

It's all about creating connections -- with industry; tools and technology; peers and faculty; and, of course, with space. Making these connections for students is what drives innovation and prepares these individuals for today's workforce.

Higher education institutions are fertile recruiting grounds for up-and-coming engineers at leading companies around the globe. Yet, engineering schools are challenged to produce students that are fluent in collaboration, problem-solving and entrepreneurship. To shift this paradigm, colleges and universities need flexible, open and transparent spaces that support evolving pedagogies and team-based research and learning.

Today's engineering schools also need space that facilitates industry partnerships, and the evolution of these partnerships over time. Designing for flexibility, collaboration, privacy and security are all key design drivers when planning for industry space in academia. Rethinking how intellectual property rights are organized on campus can also help to enhance collaborations with industry.

Finally, today's students must understand that their educational experiences are not merely about grades – this experience must also incorporate what they DO and what they make. This requires a new ecosystem of learning spaces, including the creation of extra-curricular spaces where students can conceptualize, visualize and prototype the manufacturing of their ideas. In these spaces, students can not only "make," but they can also interact and collaborate with industry representatives. Additionally, they can make memories that will stay with them for years to come.

A Special Thanks to our Engineering Advisory Board Roundtable Participants

On behalf of SmithGroupJJR, we would like to thank the dedicat-edengineering professionals for their participation and insights in this discussion on the future of the engineering building.

Louay M. Chamra
Oakland University

Jeffrey Duerk,
Case Western Reserve University

H. El-Rewini
University of North Dakota

Eric Johnson
Valparaiso University

Kazem Kazerounian
University of Connecticut

Donald J. Leo
University of Georgia

Mark W. Spong
University of Texas Dallas

Thomas N. Farris
Rutgers University

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