ITIC "INTEGRATED TECHNOLOGY INSTRUCTION CENTER"
MEDIA UNION
DUDERSTADT CENTER

The University of Michigan provides an interesting example of how academic programs characterized by technology-driven creative activities can evolve. On the University's North Campus, the University is fortunate to have several schools–music, dance, and the performing arts; art and design; architecture; engineering, and information–that focus on the creative activities that increasingly require new tools. In fact, the deans of these schools frequently referred to the North Campus as the "Renaissance Campus". (The North Campus coffee shop in the Pierpont Commons was named "Leonardo's".)

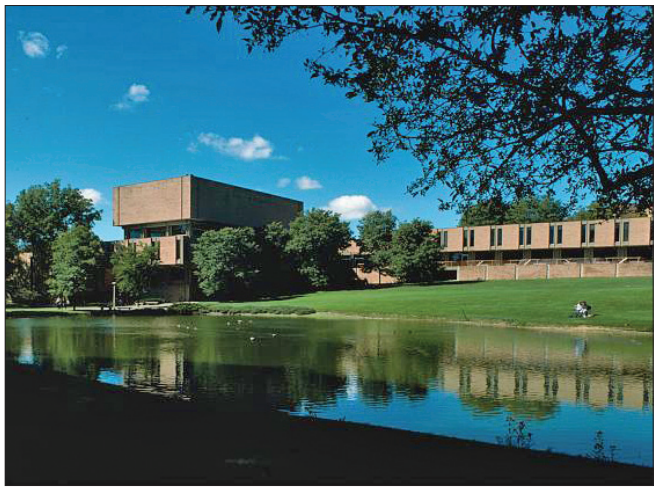
Key in responding to the unusual creative nature of these schools was a new facility proposed by the deans to serve as a "creative commons" supporting interdisciplinary activities in "making things"–3-D objects, virtual reality simulations, new art forms, CGI-based performances, responding to a growing need for both student learning and faculty participation in such activities. Initially named the "Media Union", the new facility was envisioned as an innovation commons or creation space where students, faculty, and staff from multiple disciplines could gather to create, invent, design, and even make things (whether objects of art, performances, buildings, or new technologies).

The fundamental purpose of the Media Union was to provide the North Campus schools with access to the rapidly evolving technologies that would change both their disciplines and their educational paradigms. Although all of the schools were exploring the impact of computer technology, the Internet was still relatively new, and the transition of documents from physical books to digital libraries (and into the "cloud") was just beginning. It was also intended as an innovation commons, where students from the various North Campus disciplines (along with those from Central Campus venturing into the "north country") could join together to learn and create.

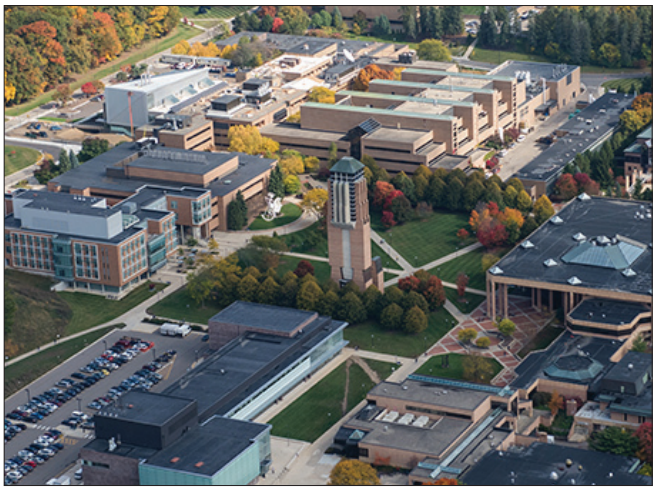
The University of Michigan Media Union

The team of deans, faculty, and staff responsible for the design of the new project envisioned it as more akin to the MIT Media Lab, although extending its mission beyond research to include instruction and performance. It was designed as a high-tech collection of studios, laboratories, workshops, performance venues and gathering and study spaces for students. The Media Union was viewed from the beginning as a place intended primarily for collaboration and innovative learning, research, and performance, a place where students, faculty, and staff could access a technology-rich environment to create their dreams, a place open to all "who dared to invent the future".

As explained by John Merlin Williams, the Director during much of its history, its mission was also to provide students and faculty with access to advanced tools and the experience of collaborative, interdisciplinary practice to prepare them for their future careers. Students need to use the "real stuff" of their professions and be guided by real-life practitioners to be a success in their fields. Hence the Center was designed to offer a distinctive combination of advanced network and computational technologies, specialized software, technically rich spaces, professional practioners, and collaborate work environments free of intellectual and physical barriers to interdisciplinary discovery. It was not a space filled simply with learning technologies but rather the advanced tools students needed to master for professional success. It provides the scaffolding for technology intensive work–the facilities, infrastructure, and the staff–so that students and faculty can move

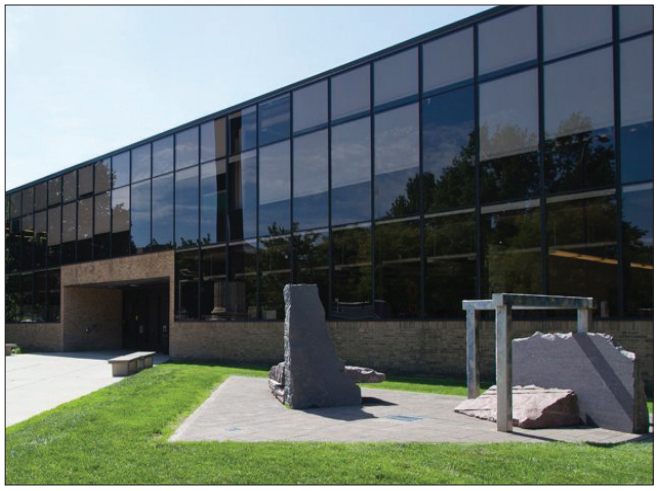


School of Music, Theatre, and Dance



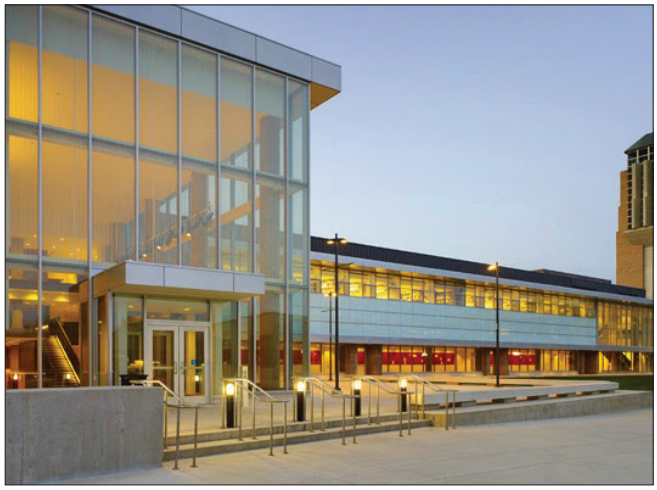
College of Engineering

School of Architecture and Urban Planning



School of Art and Design

School of Information (before move to NC)



Walgreen Center


Paul Boylan


Allen Samuels


Robert Beckley


Peter Banks


Randy Frank


Dan Atkins


Lynn Conway


Maurita Holland


Judy Olsen

The "Dream Team" of North Campus deans and faculty who created the concept for the Media Union

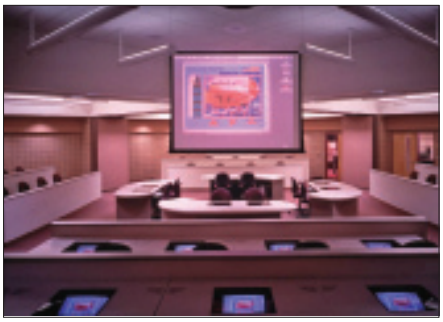
rapidly to the creative level of their projects with a small faction of the effort usually required.

These discussions began to converge on the concept of a major facility, a "commons" for the students and faculty of the North Campus programs, that would provide the new technologies not simply for their traditional instructional and research programs, but that would kindle new innovative and creative projects. Since this would require major new facilities, as President, Jim Duderstadt was drawn into the discussions since one of his roles was "begging for dollars" to support both the ongoing needs and the exciting new ventures proposed by academic programs. The concept of an "innovation-creativity center" based on state-of-the-art communications and information technology supported by leading professional staff soon was translated into a goal for $45 million of state support. In lobbying for state support, the name "Integrated Technology Instruction Center", was used in the hopes that this would create support from the Governor and Legislature. Although the name was successful in stimulating funding, it meant nothing and was later changed by the deans to "Media Union".


The North Campus Deans breaking ground for the new ITIC complex


Project Manager Randy Frank leading a tour of the construction site.


Jim and Anne Duderstadt and Doug Van Houweling join Governor John Engler in dedicating the ITIC complex.






The original design by Architect Albert Kahn and Associates

The Duderstadt Center

Anne and James Duderstadt

The Evolution of the Media Union

Over the first two decades this facility "full of unknowns" became the home for a large and evolving collection of new information and communications technologies far beyond the resources that any one school or college could acquire and maintain. The Media Union's collection of digital assets and resources required constant renewal with the latest versions of software and hardware, and an expert team of professionals who enable U-M users to get up-to-speed and use them productively for innovative research and teaching.

The Media Union rapidly became one of the most active learning spaces in the University, providing thousands of students with 7x24 hour access to rich resources including libraries, advanced technology, workshops, performance venues, and high quality study and community gathering spaces. It evolved into an innovative center for discovery, learning, invention, innovation, demonstration, and deployment utilizing state-of-the-art technologies and facilities and assisted by expert staff. Today it serves as a new form of public good, an innovation commons, where students and faculty would come to work together with expert staff mentors to develop the skills and tacit learning acquired through studios, workshops, performance venues, and advanced facilities such as simulation and immersive environments. The Media Union encourages experimentation, tinkering, invention, and even play as critical elements of innovation and creative design.

Rationalizing significant investments in cutting-edge resources by enabling free access to a shared, expertly supported collection of assets has enabled a widespread culture of innovation in digital technologies at the U-M. Students and faculty are free both to envision and to lead, hands-on, change in disciplines being transformed by the digital revolution – from engineering, the performing and design arts, and medicine, to economics and government.

The Duderstadt Center

In 2004, in keeping with a long-standing tradition of naming an appropriate building after each former president, the Media Union was renamed the James and Anne Duderstadt Center, or more commonly known to students simply as "the Dude". This also recognized the effort that President Duderstadt and his team put into convincing the State of Michigan that they should provide $45 million to create this new technology-based center of learning, discovery, and creativity.

Perhaps one student best captured the role of the center when asked to explain its purpose as: "The Dude is the place you go to make your dreams come true!"

Today, the Duderstadt Center has become one of the most active learning spaces in the University, providing thousands of students with 7x24 hour access to rich resources including advanced technology, workshops, performance venues, and high quality study and

community gathering spaces. More specifically, beyond its current role as a gathering space for learning and research, the Duderstadt Center has become an innovative center for discovery, learning, invention, innovation, demonstration, and deployment utilizing state-of-the-art technologies and facilities and assisted by expert staff. It provides the resources to support a community engaged in the creative transition from concept to technical realization. In fact, today the Duderstadt Center has evolved still further into a generalization of the university itself, using technology to add to the traditional university activities of teaching, research, and service, deeper intellectual activities such as creativity, innovation, demonstration (e.g., performance), and impact on society.

The Center serves as a new form of public good, an innovation-creativity commons, where students and faculty come to work together with expert staff mentors to develop the skills and tacit learning acquired through studios, workshops, performance venues, and advanced facilities such as simulation and immersive environments. The Center strongly encourages experimentation, tinkering, invention, and even play as critical elements of innovation and creative design. It invites and enables the creation of highly interdisciplinary teams of students and faculty from various academic and professional disciplines, providing a Greek agora, where people can come to network, exchange knowledge, and create new ideas with experienced staff.

Beyond providing a technology-intensive platform for learning, discovery, creation, and innovation, it has also become a place for studying new paradigms for these activities and propagating them to the rest of the University. In this sense it serves as a "skunkworks" for the future of learning and discovery, a "do tank" rather than a "thinktank", where new paradigms can be created, explored, and launched to serve society. As such, the DC is reaffirming its original vision, as first proposed by the North Campus deans, of serving as a change agent exploring new visions for the future of the university as a public good that provides rich resources that enable students and faculty "to know" (inquiry, discovery, learning), "to do" (skills, experience, mentors, tacit knowledge), "to become" (team building, communities of practice), "to create " (workshops, studios, tinkering, intuition, invention, innovation), and "to spinoff" (intellectual property, entrepreneurship, economic impact).

Elements of Today's Duderstadt Center

Design Labs: The DMC's Design Labs are creative learning environments that support initiatives to bridge disciplines, build networks and discover new contexts for scholarship. The most important resource you'll find here are the student content experts: the consultants who lead learning and research activities. Looking for hard-to-find expertise, or a collaborator?

Conference Rooms: The Duderstadt Center has four conference rooms available for meetings, workshops, etc. These rooms are available to U-M groups for academic and student service purposes (for social events, we recommend the Pierpont Commons). To maximize access, these rooms may not be scheduled for regular classes or weekly meetings. A class requiring video conferencing may schedule a conference room for those particular class sessions.

Gallery: The major function of the Gallery is to exhibit the widest range of creative talents from within the University. The exhibits can be either two- or three-dimensional, from art to engineering products, or computer-based interactive displays. Artifacts can be free standing, placed on pedestals (which we provide), or hung on the walls and from the unistrut ceiling structure. The space consists of a 2600-square-foot octagonal room fronted by a long glass wall. The wall can be opened for receptions. The glass doors from the Connector Hall to the outside also open, providing outside access for large structures and allowing for open-air receptions — weather permitting.

GroundWorks: A walk-in, self-serve media lab with hardware and software for creating, editing and converting audio and video recordings. It is open any time the Duderstadt Building is open. The lab features:

- Mac and PC workstations
- DVD recorders

- CD/DVD duplicators
- Document scanners
- Video dubbing equipment
- Software for audio, video, 3D, graphic design, programming, and more...
- Lynda.com video tutorial access
- Recording booth
- Multimedia workrooms
- Large format poster printing

Multimedia Rooms: There are three high-powered, reservable Multimedia Editing Rooms.. Beyond providing a quiet environment for working, the rooms have a number of extra features, including Mac Pros with substantial RAM and processing power, high fidelity audio monitors, two HD displays, a 4K reference monitor, Blu-Ray burners, music keyboards and computer keyboards labeled with Final Cut Pro shortcuts for easier editing. The Multimedia Editing Rooms are ideal for a big project that requires quiet concentration, or for small groups that want to work together without disturbing others.

Personal Studios: The Personal Studios are designed for users to create dynamic video ready for publication at the push of a button. This all in one, easy to use video production resource provides preconfigured professional lighting, teleprompter, backdrops, cameras and microphones. Users operate the versatile Wirecast software to switch shots, add titles, picture in picture, realtime greenscreen keying, multiple cameras, annotation capability and a laptop connection with modes for capturing or streaming an activity. Orientations daily, class orientations by request.

Audio Studio: The Audio Studio is an audio laboratory set up in the style of a recording studio. The resources are intended to encourage experimentation and research, and develop skills and techniques in audio production. The studio consists of five rooms: the control room, main tracking room, two isolation booths, and an amp room. It has been set up with the resources to explore stereo recording, surround recording and surround recording with height.

Study Rooms: Eighteen study rooms are located on the second floor and one group study room is located on the lower level of the Duderstadt Center for individual or small group study. Sixteen of the 19 rooms can accommodate one or two people, and three are intended for groups of 3 or more. Seventeen of these individual study rooms may be reserved in advance and two additional individual study rooms are available on a walk-in basis.

Training Rooms: The DMC has two computer training labs that are open to all U-M students, faculty and staff — though reservations are required.

Video Studio: The DMC Video Studio is an experimental media lab and high quality documentation space that is available to the entire University of Michigan's community. Well equipped and staffed, it enables original concepts and ideas to be turned into rich media that can be shared with the world. The Video Studio is also a collaborative sandbox, where faculty, students, visiting educators, scientists and artists come to collaborate and to produce or display high quality video and audio and to experiment with media technology. Whether it be capturing green screen sequences, recording motion capture data, experimenting with projection mapping, or documenting an original performance using multiple cameras and microphones - to name just a fraction of the possibilities - Video Studio projects are typically experimental or academic and represent learning, teaching and research across the disciplines.

Visualization Labs: 3D Lab, Visualization Hubs, MiDen, StereoWall

Computer and Video Game Archive: The Computer and Video Game Archive in the lower level (basement) of the Art, Architecture and Engineering Library collects materials relating to games for the purpose of academic inquiry, including but not limited to:

- Programming and technology
- Artistic and literary expression
- Social and cultural impact
- Instruction and education

Visitors to the archive can play a wide variety of games from the 1970s to the present. The archive does

not allow games to be loaned out; it is instead equipped with a complete collection of consoles and related equipment for visitors to use.

Further Evolution of the Duderstadt Center

How should the Duderstadt Center evolve in the years to come? There are many options:

- A technology-intensive community learning and gathering space for the University
- A primary University resource (technology, internet, clouds)…"to know"
- A place for learning "to do", developing skills, tinkering, invention tacit knowledge studios, labs, workshops, performance venues
- A place for learning "to be", becoming a professional team projects, practice and performance venues, communities of practice and performance, immersive simulation, games and play
- A creativity and innovation commons where students and faculty come to create, "to make their dreams come true"
- A center for translational applications, "to propagate" into society not just new ideas but actual creations
- A "media union", interdisciplinary, merging of the media
- A skunkworks, a "do tank" (in contrast to the Central Campus "thinktanks")
- A center for advanced technologies (artificial intelligence, virtual reality, big data analytics, …)

More broadly, how should the University of Michigan itself face the digital age? Over the past four decades, computation speeds have increased a billion-fold. In fact, most characteristics of this technology are continuing to evolve exponentially at rates of 100 to 1,000-fold per decade. This is one of the big reasons for the continued surprises we get from the emergence of new applications–the Internet, social networks, big data, machine learning–appearing in unexpected ways at an ever faster pace. We have learned time and time again that it makes little sense to simply extrapolate the present into the future to predict or even understand the next "tech turn". These are not only highly disruptive technologies, but they are highly unpredictable. Ten years ago nobody would have imagined Google, Facebook, Twitter, etc…and today, nobody really can predict what will be a dominant technology even five years ahead, much less ten!

Fortunately, the University of Michigan has been able to respond to such rapid technological change in the past–and, indeed, achieved leadership–because it has functioned as a loosely coupled adaptive system with many of our academic units given not only the freedom, but also the encouragement, to experiment and to try new things.

At an NSF sponsored conference at Michigan on the role of cyberinfrastructure in discovery and learning, many participants stressed the importance of "craft", of the contributions of truly talented staff who drive innovation in units where they are most competent. The list of such people at Michigan is very long, e.g., people like Eric Aupperle, Randy Frank, Joseph Hardin, Paul Killey, and many, many others. These people are attracted to Michigan to work in academic units with faculty and students where they are highly valued and have the freedom to do exciting work.

The current pervasive digital revolution and cyberinfrastructure has enabled radical transformation of technological, economic and social environments. The digital revolution has removed so many of the constraints that today hundreds of millions of individuals, with modest investment, can turn almost any content into a public artifact accessible by billions of people at any time, in any place, on a wide range of devices.

This suggests a new social contract: to be intentional about engaging all disciplines that affect and will be affected by the cyberinfrastructure revolution and to create alignments that can help anticipate and begin to create practices and policies that maximize legal, social and economic freedom. It transforms the learning experience into the constructionist models of John Dewey and Seymour Pappert.

Extending the design principle of the Duderstadt Center should lead us to avoid placing obstacles in the

path of the unexpected, what "could be," just as much as we plan resources to anticipate what is "likely to be." Planning for the likely, while removing the obstacles to that which could be, is a simple interpretation of what designers are calling modeless environments.

And most important of all, it enables the University to continue to attract, support, and value the outstanding technical staff that are not only key to building and maintaining the sophisticated technologies key to the mission of the Duderstadt Center, but also serve to teach students and faculty how to use these powerful resources.

A Future Shaped by Creativity

We are creating an environment where students and faculty can dream and then act on their dreams.

—Paul Boylan of the Dean, School of Music

A determining characteristic of the university of the 21st Century may be a shift in intellectual focus, from the preservation or transmission of knowledge, to the process of creation itself. Here, the University of Michigan is already very well positioned. On our campus, we already are fortunate to have several schools that focus on the act of creation, in music, dance, and the performing arts; art and design; architecture; and in engineering—which, of course, is the profession concerned with "creating what has not been." But, the tools of creation are expanding rapidly in both scope and power. Today, we have the capacity to literally create objects atom-by-atom. We are developing the capacity to create new life-forms through the tools of molecular biology and genetic engineering. And, we are now creating new intellectual "life forms" through artificial intelligence and virtual reality.

Even libraries will increasingly become places where the difference between "researching" and "doing" blurs. As Dan Atkins points out, the new information technology not only supports information retrieval, but also helps scholars actually manipulate that information. He notes that today a student can not only read about architecture, but use a computer tool at the same time to try out a design. The University will need to structure itself in a more strategic fashion to nurture and teach the art and skill of creation. Alliances with other groups, organizations, or institutions in our society whose activities are characterized by great creativity would dramatically enhance our capacity to move in this direction.

Yet here the contributions of an innovation and creativity commons merging the creative arts and disciplines on a university campus may play even a more significant role. Our world is changing rapidly, driven by the role played by educated people, new knowledge, innovation, and entrepreneurial skill. While these forces challenge us and our social institutions, they also contain the elements of what could become a *renaissance* of creativity and innovation in the 21st century. Since universities will play a critical role as the source of these assets of the age of knowledge, our vision for the early 21st century involves stressing similar characteristics among our people and our programs, e.g., creativity, innovation, ingenuity, invention, and entrepreneurial zeal. Put another way, the future university must add to its traditional motto of *lux et veritas*, the scholarship to discover *truth* and the learning to *enlighten* society, the mission of *genius* itself, of the creativity demanded by an ever changing world.

Of course while learning and scholarship have long been viewed as missions of the university, so too has been the creation of new knowledge across all intellectual and professional disciplines. Developing new approaches to scholarship, great works in literature and the arts, ingenious approaches to investigating physical and social phenomenon, these have long been the goal of most scholars. Not just to preserve and transmit knowledge, but to actually create it.

The professions that have dominated the late 20th Century—and to some degree, the late 20th Century university—have been those that manipulate and rearrange knowledge and wealth rather than create it, professions such as law, business, accounting, and politics. Yet it is becoming increasingly clear that the driving intellectual activity of the 21st Century will be the act of creation itself, as suggested by Jacques Attali in his provocative forecasts for the 21st century at the turn of the Millennium:

"The winners of this new era will be creators, and it is to them that power and wealth will flow. The need to shape, to invent, and to create will blur the border between production

and consumption. Creation will not be a form of consumption anymore, but will become work itself, work that will be rewarded handsomely. The creator who turns dreams into reality will be considered as workers who deserve prestige and society's gratitude and remuneration."

(Jacques Attali, 2000)

But today new tools of creativity are appearing that are characterized by extraordinary power. We have the capacity to create new objects literally atom by atom. With new methods in molecular biology such as CRISPR/Cas9 and gene drive, we can not only precisely modify the DNA code for a living organism, but actually cause it to propagate through a species to change future generations (a frightening thought when human gene editing is considered). The dramatic pace of the evolution of information technology shows no sign of slowing, continuing to advance in power from 100 to 1000-fold a decade, enabling not only new forms of analysis such as augmenting the traditional tools of experiment and theory with the sophisticated tools of data analysis (big data). Indeed, the tools of artificial intelligence not only are rapidly progressing but have stimulated fears of eventual sentient behavior of machines. These tools also have changed the opportunities available in literature, performance, and art, with powerful tools of investigation and display (e.g., the CGI techniques increasingly dominating the film industry.)

Already we are seeing the spontaneous emergence of new forms of creative activities, e.g., the "maker" fairs providing opportunities to showcase forms of artistic, recreational, and commercial activity; the use of "additive manufacturing" to build new products and processes atomic layer by atomic layer; and the growing use of the "app" culture to empower an immense marketplace of small software development companies. In fact, some suggest that our civilization may experience a renaissance-like awakening of creative activities in the 21st century similar to that occurring in 16th century Europe.

Of course, the creative process of design has long been the culmination of the engineering process, the ultimate application of science and technology to meet the needs of society. As such, engineering design is an intellectual endeavor very similar to that encountered in the creative arts, but distinguished by its rigor and use of scientific and technological tools. Unlike research, which attempts to induce general conclusions from specific experiences, engineering design is a rigorous deductive process that develops a specific solution to meet a specific need from a general set of principles. Engineering design is a far more general, powerful, and disciplined approach than mere invention. In addition to innovation, ingenuity, and creativity, design requires great skill and training. It is not an activity left to happenstance, to accidental discovery. Rather, engineering design is approached with the disciplined methodology of engineering problem solving.

Ironically, the immense importance of design in addressing the myriad needs of a rapidly changing world has not received the visibility and priority of other activities such as "creativity", "innovation, and "entrepreneurship" that are clearly dependent upon it. So, what to do to provide this rigorous intellectual skill, so critical to innovation, entrepreneurship, and economic growth, with the priority and support that it requires?

Since universities will play such a critical role as the source of these assets of the age of knowledge, perhaps the university of the 21st century will also shift its intellectual focus and priority from the preservation or transmission of knowledge to the process of creation itself. But here lies a great challenge. As noted earlier, creativity and innovation are key not only to problem solving but more generally to achieving economic prosperity, social well being, and national security in a global, knowledge-driven economy. Yet, while universities are experienced in teaching the skills of analysis, we have far less understanding of the intellectual activities associated with creativity. In fact, the current disciplinary culture of our campuses sometimes discriminates against those who are truly creative, those who do not fit well into our stereotypes of students and faculty.

The university may need to reorganize itself quite differently, stressing forms of pedagogy and extracurricular experiences to nurture and teach the art and skill of creation and innovation. This would probably imply a shift away from highly specialized disciplines and degree programs to programs placing more emphasis on integrating knowledge. There is clearly a need to better integrate the educational

mission of the university with the research and service activities of the faculty by ripping instruction out of the classroom–or at least the lecture hall–and placing it instead in the discovery and tinkering environment of studios or workshops or "hacker havens".

Drawing together aspects of hardware and software, inquiry and discovery, tinkering and invention, and creativity and innovation, experimentation and performance, the Duderstadt Center and Walgreen Center provide a tremendous interactive playground for imaginative scholars and students. The tools in these facilities are so easy to use that ideally they become natural extensions to everyday activity. For example, an artist, an engineer, and a choreographer should be able to think up a new staging for a performance together, sketch it out in three dimensions on a computer, then show it off and discuss it in real time with colleagues both here and across the world, all without noticing the complex technology that allows them to collaborate.

This model of "creativity and innovation" commons facilities that enable faculty members and students from diverse schools to work together is now being propagated to other parts of the University, including the arts and humanities and social sciences of the Central Campus and the natural sciences and biomedical programs.

This vision of "renaissance education" aligns well with several other aspects of the University's institutional saga such as its commitment to excellence and leadership and its belief that this rests upon building diverse learning communities. But achieving such a vision will also likely require a culture change that encourages risk taking and tolerates occasional failure as the price one must frequently pay for setting and accomplishing challenging goals.

Particularly key in this effort is the earlier goal of diversity. As Tom Friedman noted in a New York Times column,

"The sheer creative energy that comes when you mix all our diverse people and cultures together. We live in an age when the most valuable asset any economy can have is the ability to be creative–to spark and imagine new ideas, be they Broadway tunes, great books, iPads, or new cancer drugs. And where does creativity come from? To be creative requires divergent thinking (generating many unique ideas) and then convergent thinking (combining those ideas into the best result). And where does divergent thinking come from? It comes from being exposed to divergent ideas and cultures and people and intellectual disciplines." (Friedman, 2011)

Actually, as John Seely Brown points out, today's students are already using technology to function much like artists – disciplined, focused, pushing boundaries, challenging assumptions and creating meaning. (Brown, 2009) They are willing to engage with multiple viewpoints before synthesizing their own. But beyond that, they look for meaning not just in what they create or own but in addition through what they contribute back to society-at-large. They are engaged, first and foremost, in fostering what might be called the creative class. Not only do they want to create for themselves, but they also want others to build on their creations.

The platforms they use are mostly digital: instant messaging to keep in constant contact with one's own intimate community; blogging to let one experiment by exposing their ideas to others and getting rapid feedback; by participating in the rapidly expanding worlds of open source, open content (e.g., Wikipedia), and remixing the work of others; rich media capable

of expressing complex ideas; and a vast network characterizing cyberinfrastructure that lets one access communities, instruments, and databases all over the world (an infrastructure that the University of Michigan has played a key role in creating). These are the power tools of the Net Generation.

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