Thoughts on Interdisciplinarity

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Since arriving at the University of Wisconsin—Green Bay as Chancellor late last summer I have said the University's commitment to the ideals of interdisciplinarity, a founding principle, is both one of our the most important assets and potentially one of the strongest inertial forces to our progress. Our claim of a unique approach to interdisciplinarity is part of our identity.[1] It is part of our select mission.[2] My informal conversations with employers of UWGB students suggests our approach is effective overall.

The original innovation was not the formation of interdisciplinarity as an intellectual approach, that having been accepted as part of liberal learning from ancient times.[3] Rather, it was the adoption of an organizational structure intended to more intentionally apply interdisciplinarity in teaching and learning. The goal was – and continues to be—providing students the tools necessary to confront and solve significant problems. Our original innovation is nearly fifty years old. The world and the environment of public higher education has changed dramatically over the past half-century. The environment in which we operate continues to change and, more importantly, the environment in which our students will live and work will be much different than the present and astronomically different than at the time of our founding.

It was our rather unique approach to interdisciplinarity I had in mind in my installation speech when I urged the university to reflect deeply on our past and our future:

> But, the Power of Innovation requires exercise and practice. To teach our students to be innovative, <u>we</u> must be innovative. To lead in a time of great change, we must examine ourselves fearlessly and with a willingness to reinvent and redeploy. This requires us to turn a critical eye to the very innovations that set this university on its journey 50 years ago.

We have initiated the *Invent the Future of UW-Green Bay* process to consider this and other important features of our university. Our conversations have been rich and our courage great and the outcome of that process will fuel the rediscovery of UWGB and shape our future. Thus far, I have not participated formally in the conversations of the *Invent the Future* workgroups or expressed any organized thoughts about the workgroup topics although I have provided sketches of my views at meetings I have been invited to attend. I have been very clear about our need to reexamine our particular version of interdisciplinarity but I have given few specifics both because I prefer to allow thinking about this to emerge organically from the *Invent the Future of UWGB* process and, frankly, because, until recently, I was not satisfied with my own analysis of the situation. The holiday season afforded me some time to read and reflect on this important challenge and to prepare these more formal thoughts about interdisciplinarity in general and as applied at UWGB.

Over the recent Thanksgiving holiday I read three books and that stimulated my thinking about the future and reshaped my thoughts about interdisciplinarity.[4] Very different circumstances

brought me to each of these books. I stumbled across John Brockman's *This Will Make You Smarter* on Brockman's Edge.Org web page while looking for new ideas about the future of higher education. Jim Clifton's book *The Coming Job Wars* was recommended to me by an entrepreneur friend for whom I have enormous respect. And, Melanie Mitchell's book *Complexity: A Guided Tour* about the nature of complexity was recommended to me by our youngest son William. A long conversation with William provided additional input for this essay.

My Thanksgiving reading was, originally intended to stimulate my thinking about the three Powers vision of the Phoenix – the *Power of innovation* the *Power of Transformation* and the *Power of Place* – as we move into the next phase of our *Invent the Future of Green Bay* process. What will be the narrative of this great university? How will we leverage our unique history to build models for the American Academy? What will UWGB say to this region about how we will navigate the coming decades? These were the questions I pondered as I brined the turkey for the Thanksgiving feast. More thinking on all of these questions is required and that is our task for the spring semester.

What emerged from this reading was a series of questions about our current interdisciplinary practice. Among them are: What is the role of the foundational disciplines in creating a unique and highly effective undergraduate experience? Related to this is whether the "problem solving" focus – the original motivation for the model – is appropriate for a highly complex and changing world where understanding a "problem" may be *a priori* virtually impossible? Does our approach give our students a better chance to recognize and accommodate the emergent properties – many of them exciting disruptive properties – that drive the dynamics of the global information economy? Does our approach align us with the new imperatives of state comprehensive universities to be a value-added partner in economic development and job creation? Does our approach enhance or diminish our ability to produce important faculty research and graduate education both of which are important to the future of the university? I will return to these questions at the end of the essay. First, here are some thoughts about academic disciplines, the nature of complexity and the new imperative for comprehensive universities, all topics that help us understand the importance of our approach.

<u>The importance of disciplines</u>

Any discussion of interdisciplinarity must include consideration of the importance of the academic disciplines themselves. Our catalog copy implies disciplines are narrow and overly constraining and, so, we offer interdisciplinary majors in broad "practical areas of interest."[5] We do recognize the importance of disciplines through traditional disciplinary majors and minors and with a departmental structure of sorts embedded in the overall organization. Our administrative structure is very rare in the Academy as the 2011 Task Force on Interdisciplinarity noted which suggests that organizing for interdisciplinarity is very hard to achieve or there are more parsimonious ways to achieve it. The latter would seem to be more likely given how stable the fundamental disciplines are in American universities. My informal review of fifty comprehensive universities revealed a very high level of overlap in basic department names and number.

In practice, interdisciplinarity manifests most obviously in the interaction of leading thinkers with other intellectual leaders as the very edge of their respective fields in discussions about the most pressing questions of the time. Literary agent and writer John Brockman has attempted to create such a space. The epigraph to his website Edge.Org describes his purpose more specifically: "To

arrive at the edge of the world's knowledge, seek out the most complex and sophisticated minds, put them in a room together, and have them ask each other the questions they are asking themselves."[6]

Brockman's book, *This Will Make You Smarter,* is a series of brief (few chapters in the book are more than two or three pages in length) answers to the provocative question: "What scientific concept would improve everybody's cognitive toolkit?" Brockman posed this question to one-hundred and fifty of the world's most visionary thinkers, Steven Pinker, Richard Dawkins, Brian Eno, J. Craig Venter and Matt Ridley among them. Each response is a short passionate case for deploying that scholar's leading idea as a key element in the human toolkit for addressing the mega-questions of our time. The reader is treated to over a hundred and fifty hard-hitting value propositions for broadening the mind by embracing a particular idea in the way in which we see the world.

Brockman's collection of disciplinary essays is quintessentially interdisciplinary. But, if the book were a university, the faculty (the authors) would be organized very traditionally. A review of the titles and professional positions of the one-hundred or so authors show the vast majority of them hold positions in traditional academic departments (e.g., physics, computer science, economics, journalism, sociology, etc.). The rest are primarily innovative thinkers in leading edge businesses. The essays are not produced by interdisciplinary scholars (are there such scholars?). These are passionate practitioners of the most important foundational disciplines. What is interdisciplinary is the uncommon awareness of these thinkers about the broader realm of human concern and their ability to understand and articulate their own scholarly passion in ways that make that passion relevant in other spheres. These thinkers and writers are scholarly examples of the "T-shaped" individuals so coveted in today's workforce: Individuals with deep intellectual roots (and skills) in a specific discipline *and* a high ability to think and collaborate with individuals having similarly deep roots in other disciplines.[7]

The structure of the book tells us something more about the nature of interdisciplinarity and its relationship to the disciplines. The essays rest within no obvious structure or outline. There are no subsections, just one essay after another following a forward by David Brooks and a brief introduction by Brockman. The arguments of each scholar are free to collide with any other essay in any way the reader wishes. The entire experience is driven by the reader. I began my exploration of the essays in this book more or less at random and, as I read, I found myself searching for connections among them. I developed my own structure, dismantled it, and then, structured my thinking once again. A scholar – or, a student—interested in the growth of the global middle class would select a much different suite of essays than a scholar interested in global climate change. The essence of the experience is the ability to construct it in a way that is meaningful to the question at hand. A true interdisciplinary thinker formulates and reformulates connections on the fly as the challenge and opportunities change.

If the authors of this book were a university faculty, could they organize themselves –create unique budgetary units—is such a way that would optimize the interdisciplinary power of the limitless possible interactions among them? I believe this would be impossible. For example, if there are between 10 and 20 basic disciplines represented in Brockman's virtual university, there are between 120 and 1,140 "budgetary units" of size three. Which combination of these would be the best representation of the world's most significant problems? Which combinations would best prepare undergraduate students for the new world of work and global citizenship? Which combination would have the best chance of capturing the emergent properties arising from new

disciplinary knowledge and connecting it with new discoveries from other disciplines? This last question may be the most important given the pace of change in our world. Consider for example some of the ideas from contributing authors to Brockman's collection.

In his essay "E Pluribus Unum", Computer scientist Jon Kleinberg cautions us against the illusion of experience as a singled unified behavior. Banking at the local ATM machine, working away at our laptop, or the sensory experience of tasting and smelling fresh baked bread are the results of complex distributed –sometimes globally distributed – systems of less complex functional nodes (e.g., neurons or globally distributed computers). The enterprise of keeping an experience whole is to Kleinberg a challenge in managing broadly distributed systems. "The principle of distributed systems," argues Kleinberg, "gives us a way to reason about the difficulties inherent in complex systems built from many interesting parts."

Midway through the book, the neuroscientist David Eagleman reminds us of the limits of our perception of our own environment. Placing himself in the position of a bloodhound, he marvels at how the pitiful olfactory perception of humans so limits what the two-legged hairless creature knows about the world around him. Imagine if our public lexicon included consideration of the "…idea of limited knowledge, of unobtainable information, of unimaginable possibilities." "Consider," says Eagleman, "the criticisms of policy, the assertions of dogma, the declarations of fact that you hear every day, and just imagine that all of these could be infused with the proper intellectual humility that comes from appreciating the amount unseen."

And think for a moment about the power of a view about how things seeming very different can be part and parcel of the same thing. Editor Amanda Gefter suggests the counterintuitive notion of dualities as an antidote to the Boolian structure of today's world: male-female, black-white, Republican-Democrat, a world where in Gefter's words, "statements are either true of false, answers are yes or no, and if I'm right, then you're wrong." The greatest advancements in modern physics have been dualities that make it possible, for example, to understand the universe as *both* particles and strings, two very different theories with "two very different manifestations of the same underlying reality." If we accept dualities, "Perhaps my argument is right and yours is wrong; perhaps you argument is right and mine is wrong, or, just maybe, our opposing arguments are duel to one another."[8]

What interdisciplinary organization would give our students a chance to understand the intelligence of distributed systems, ways to appreciate the sphere of the unknown and how it influences perception and action or power of dualities? More importantly, does our current structure encourage the kind of nimble mind required to continually form and reform connections in the manner of true interdisciplinarity?

The nature of complexity

One of our beliefs is the interdisciplinary approach is the best way to teach students about the complex challenges facing humans and, thus, an avenue for student formation focused on complex problem solving. One of the most common sentiments in the discussions of interdisciplinarity I have heard in the *Invent the Future of UWGB* process is the desire to return to the problem solving focus of the university founders. There are two aspects of this I wish to consider: the implications of a curriculum designed around "problems" and the nature of complexity itself.

Melanie Mitchell's *Complexity: a guided tour* along with a recent conversation with my son stimulated my thinking on both of these questions.

Mitchell's book was recommended to me by our youngest son William who is a video game designer. His job is to make computers interact with humans in a way that seems to anticipate reality. He does this by using artificial intelligence and other high level computer system innovations (e.g., genetic algorithms etc.). His most recent game, an interesting exercise in the application of knowledge and perception, is the latest version of the extremely popular game *Civilization*.

In the new version, *Civilization: Beyond Earth*,[9] his group imagined the exploration and colonization of worlds beyond our solar system after humans flee the Earth in the wake of the "Great Mistake." Upon discovering a new world the explorer (player) must adopt a suite of attitudes and approaches in the hope of prevailing against a natural environment of unknown character and, possibly, other explorers from Earth who stumble upon the same planet and wish with as much passion to prevail (because the game can be played on the internet, all the competition with other explorers can take place in real time). The explorer can choose peaceful or warlike approaches, may decide to take risks or not, can embrace the native culture and practice or reject it, and through the complex interactions of adopted principles and many individual decisions, live or perish in the new environment. The draconian outcome aside – or, given the state of the real world, perhaps not – this set of challenges is not much different than the explorations we are asking our graduates to consider when we launch them from the university at commencement.

I am fascinated by my son's work. In a way he is standing on the other side of our reality, creating the histories, situations and environments we are reacting to and teaching our students to react to. His job is to create a complex world and manage a human experience within it. His interdisciplinary team of artists, programmers, mathematicians and business professionals build an artificial world that receives the explorer's world view, educational experience, perceptions, even the explorer's political inclinations and gives a machine the power to manipulate those in unexpected ways with unexpected outcomes. His own approach to this is fully interdisciplinary. To succeed, the imaginary world he creates has to be grounded in history, have a specific ecosystem function, and react to collisions of political views and the decisions of individual explorers.

What strikes me as most important about the players experience in this game is not the ability to solve problems. Rather, it is the ability to recognize and adapt to emergent properties in a complex system, the recognition of the impact of possible choices, the ability to reflect and learn from mistakes and an appreciation for the imperative of survival in a complex and changing world. A winning strategy is not a problem solving strategy. The winning strategy is one of learning, exploration and adaptation. In her new world, the explorer cannot diagnose the problem. She can only observe the world and attempt to make sense of it by probing it. To assume a problem, it seems to me, would be the biggest mistake one could make particularly since the risk – failing to survive – is harsh indeed. As William put this to me: "It isn't until the game's final act when the path to victory (the problem) becomes clear." What a testament to the power and necessity of life-long learning.

I believe it is important to ask whether the view of our founders that we should prepare our students to solve the world's biggest problems is ultimately constraining and unrealistic. In particular, are interdisciplinary foci of "practical areas of interest" (from university catalog) more than mere presumptions? The goal of our interdisciplinary approach should be about taking on the

world as it comes with great intelligence, curiosity and a survivor's mentality. Leaving our students with the impression they should and can solve the "problem" of global climate change for example is both unrealistic and constraining.

Related to the difficulty of selecting the most important problems (or "practical areas of interest") is the nature of complexity. While much has changed since UWGB was founded in 1965, perhaps the most important change is our understanding of the nature of complex systems, how those systems work, how the interaction of technology and organic realm changes the natural world and, most provocatively, whether technology itself contains an independent reproducible intelligence. Mitchell's book is a good place to start with such considerations.

The complex systems of ultimate importance are not sets of ordinary complications and intricacies. Mitchell's focus is on complexity as a measureable attribute of a phenomenon. She defines a complex system as:

> A system in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution.

The precision of this definition is particularly important in understanding the relationship between what we are learning about machines and their analogs in the natural world. The brain, insect colonies, the immune system, economies (including the stock market), and the world-wide web are among the most important adaptive complex systems. The fascinating attribute of these systems is the presence of "nontrivial emergent and self-organizing behaviors," yielding from a non-centralized system operating under simple rules. For example, consider the difficulty of predicting the behavior of markets driven by collections of individuals and companies buying and selling products more or less independently of each other. That markets would obtain an equilibrium (market efficiency) through this collective action suggests a kind of complex adaptability and self-organization of a system of relatively simple components (the "invisible hand" of Adam Smith). Recent work by economists apply the field of complex systems to understand bubbles and crashes as emergent properties.

Changing views about the nature of complexity and, specifically, the intelligence and reproductive power of complex systems, even non-organic ones, track changes in our understanding of important phenomenon. Take, for example, the theory of evolution by natural selection[10].

Over the decades, Darwin's original idea was modified substantially by discoveries in genetics and, later, molecular biology. By the mid-1960s the Modern Synthesis which incorporated emerging knowledge of genetics appeared to explain the important mechanisms of evolution only to be challenged by Stephen Jay Gould and Niles Eldredge in the 1980s. The ideas of Gould and Eldredge were initially rejected by evolutionists because there seemed to be no genetic mechanism to explain them. The ideas are now routinely taught in evolution classes.

What is happening in evolutionary biology today is an exciting collision of disciplines. It is not the emergence of a great problem or a practical area of interest. The technology-fueled molecular revolution of recent decades is giving rise to a much different view of the nature and function of DNA and, consequently, the way evolution works. The great complexity of molecular systems when viewed from within the field of complex systems (*sensu* the definition from Mitchell's

book) may appear to be astonishing and unpredictable result of a gradual accumulation of favorable mutations, the essence of Darwinian evolution. "The question of how, why, and even if evolution creates complexity, and how complexity in biology might be characterized and measured, are still very much open." contends Mitchell. "…the idea that gradual change via natural selection is the major, if not the only force in shaping life is coming under increasing skepticism as new technologies have allowed the field of genetics to explode with unexpected discoveries, profoundly changing how people think about evolution." The molecular genetic revolution with its new findings about what, exactly, represents a gene, the phenomenon of non-coding RNA and the rich interacting functions of genes give rise to important new clues about why humans are so complex with only about 25,000 genes ninety percent of which are identical to those of mice and ninety-five percent with apes.

These contemporary questions about evolutionary processes do not fundamentally alter the central role of evolution in life as we know it. Nevertheless, we might expect their impact on our understanding of the process to be as important as the initially disregarded thinking of Gould and Eldridge. That is the nature of science. Is our approach to interdisciplinarity with relatively less emphasis on disciplinary rigors (e.g., genetics; molecular biology) capable both of capturing rapid intellectual change and translating it through curriculum and pedagogy into educated students better than a more traditional approach? The argument I want to make here is that without strong disciplinary foundation, we may miss the emergent properties of complex systems because we do not retain the methodological rigor we would need to make all the thousands of connections necessary to see the property. When we set up interdisciplinary units we presume to know what the major connections are. We could be wrong from the beginning or things could change around us so fast we become wrong before we know it.

Let me move to another aspect of the future for which we must prepare our students: the ability to understand their role in national survival in a globally dependent world.

Innovation, entrepreneurship and the future of work

Substantial evidence suggests that the future will belong to people – and countries – who have the ability to move innovation to application. American universities that adopt this insight in their undergraduate programs are at a premium. Few American business schools are without structured program in entrepreneurship. Throughout the country, universities are intentionally incorporating application and career focus in the liberal arts curriculum often as part of general studies programs.[11] There is now little doubt the future world of work will favor people who are flexible, highly adaptable, entrepreneurial and effective communicators. That is to say, T-shaped people.

One of the most dramatic transformations of the last two decades in the American Academy has been the new imperative of regional comprehensive universities like UWGB to become actively engaged as a value-adding partner in economic development, job creation and moving innovation to product. I have written about the challenges and opportunities of this new role for comprehensive universities.[12]

I consider this new imperative a survival strategy in an environment of increasing skepticism about the value of the university experience as a path to the American Dream and, consequently, decreasing public support. As a business friend of mind suggested: Public higher education is a

burning platform. But the more utilitarian university mission is a hard sell to many whose core inspiration is simple, precious learning and for whom the highest intellectual achievement is simple understanding, the successful life of involved citizenship and a productive career the inevitable result of that life of the mind. The ascendency of America after World War II rested on the back of a public higher education system having a rather traditional and much more rigorous regime of classical studies than the open curricula of the 1960s when most of the American professorate came of age. The social revolutions of the 1960s left many in the Academy wary of the corporate and government establishment and, in my view, reinforced the feeling of purity of the liberal arts. It is within these roots, the University of Wisconsin—Green Bay emerged in 1965. To repeat the theme of this essay, the question before us today is whether our brand of interdisciplinarity born of the turmoil of the 1960s is relevant to the world of work and life we expect for our students.

The third book of my Thanksgiving holiday reading, *The Coming Job Wars* by Jim Clifton offers a stark economic assessment of the challenge before us. Clifton is the Chairman and CEO of Gallup. Under his leadership, Gallup began the Gallup World Poll, a long-term polling exercise to ask the world's seven billion people what they think about the most important issues of the day. Clifton's perspective is clear from the beginning:

> If you were to ask me, from all the world polling Gallup has done for more than 75 years, what would fix the world – what would suddenly create world peace, global wellbeing, and the next extraordinary advancement in human development, I would say the immediate appearance of 1.8 billion jobs – formal jobs. Nothing would change the current state of humankind more.

Polemic statements such as Clifton's, when taken in isolation, seem little different than the sound-byte hype we get during political campaigns. But Clifton's assertion is deftly supported from arguably a most unique set of information of decades of Gallup polling. His argument is complex but can be distilled down to this: The growth and quality of the American Gross National Product (GDP) drives world influence more than political or military power. Within the next 30 years, absent some herculean effort on the part of the United States, our country's 25% share of global GDP (currently about $15 Trillion) will be surpassed by China (currently about $6 Trillion in 2010) because the Chinese GDP growth rate is nearly 10% compared to the U.S. GDP growth rate of about 2% annually. At the point the Chinese and American GDP cross, "America will no longer have a disproportionate financial advantage that gives it the moral, economic and leadership authority it has now." The only possible approach to preventing this from happening, according to Clifton, is an organized and massive American jobs creation phenomenon.[13]

Clifton's argument is much sharper than the job creation rhetoric we hear from our policy makers today. It is a full throated assertion that the only way to create the number of jobs required to sustain America's global economic prominence is through new jobs created by startup companies through the process of entrepreneurship. This is not a new idea. Although large companies employ large numbers of peoples, they produce virtually no new jobs. Recent studies show over the past five years nearly *all* new jobs in America were created by companies under five years old.[14] What American needs now are *new* jobs.

If we are to accept the new imperative of public comprehensive universities as I do, and embrace the role of entrepreneurship in solving the jobs challenge in this country, then how must we change? What does this new challenge say about our approach to interdisciplinarity? I believe

we must adopt a more expansive view of our role as educators, a new role that accepts the obligation not only to teach students to learn but, also, to teach them how to make their way in the modern world of work.

Clifton's book speaks to the need for strong intentionality in the way in which we teach our students about innovation and entrepreneurship and in the way the university engages its community. The practical dimension of this calls for us to rethink the relationship between liberal arts and sciences and the professions. It also requires us to think carefully about what parts of our interdisciplinary culture can be aligned with this more practical imperative. If it is innovation and entrepreneurship that creates new jobs and if the creation of new jobs will be one of the major opportunities for the future of America – a future that belongs mainly to our students not to us – then shouldn't we include an understanding of innovation and entrepreneurship into what we hope for our graduates?

The curricular approach may be less important than a simple feature of innovation and entrepreneurship that Clifton emphasizes: the two are not necessarily linked. And therein lies the problem and the challenge. "Innovation is not rare in America. Neither is creativity." Claims Clifton. "In fact, there's an oversupply of innovation in America and other places in the world.....What's wrong is that America—and most all countries—have a mass shortage, a significant undersupply, of *successful business models.* [emphasis author's]….The scarcest, rarest, hardest energy and talent in the world to find is entrepreneurship. Call it rare salesmanship, call it genius business-model design, call it rainmaking, but whatever the case, America doesn't have enough to fight the coming global jobs war."

How do we teach entrepreneurship in our undergraduate curriculum? There are hundreds of organizations and universities that offer specialized training or curricula in entrepreneurship for high school and college students. The principles of such training and instruction are more or less straightforward. What is most often missing are mechanisms and space for colliding new ideas with potential investment capital and subsequently a fast and proven process for vetting the efficacy of new ideas as viable and sustainable business models. These incubator and accelerator spaces and support systems are most often found in cities near universities and represent those geographic locations in America where new job creation is greatest, average wages are highest and economic growth more vital and sustained.[15]

One of the most interesting and potentially important assertions Clifton makes regarding the challenge of entrepreneurship in American has to do with the role of cities. "The next breakthrough, such as internet-based everything," says Clifton, will come "from the combination of the forces within big cities, great universities, and powerful local leaders." He continues, "Great universities are the origin of most highly successful startups. Universities have, by design, the best ecosystem for entrepreneurship and innovation." Other work suggests even more strongly that the synergy between good universities and forward thinking cities and municipalities creates a geographic distribution of good jobs around the country, with the most desirable jobs increasingly being located in cites with high levels of entrepreneurship.[16]

To be sure, the focus of Clifton and others is on the top 100 U. S. cities and, in particular, those municipalities having prestigious research universities. After all, there are relatively few Silicon Valleys in the country. But Clifton urges a strategy that will work for cities of any size. A successful plan for creating jobs will be one that recognizes the most important solutions are local, the entire

city must wage the war for jobs, citywide efforts must be aligned, and appreciates salvation rarely comes from Washington, DC. Most importantly, urban universities must lead in organizing the local efforts necessary to grow jobs in a region and in supplying research energy to the enterprise. The *Power of Place* I talked about in my installation remarks is about how UWGB will play a leadership role in creating the entrepreneurial based jobs of the future in the New North.[17] We are an urban university and our transformation into the full features of that role will be important to our survival.

How does our interdisciplinary strategy inform (support or detract from) this new engagement imperative? To put this question in terms of Clifton: Does our interdisciplinary organization and approach enhance or diminish the entrepreneurship and innovation ecosystem we have come to expect from great universities? I do not have an answer for this question but, as I mentioned earlier in the paper, if our interdisciplinarity somehow diminishes the rigor of disciplines it will also likely diminish the potential of basic research which is the foundation of innovation and, thus, the fuel for entrepreneurship. As we examine our interdisciplinary approach we must keep this in mind if we are to succeed in taking a leadership role in the economic vitality of our region.

Interdisciplinarity and the liberal arts and sciences

I am a product of the disciplinary model. I received my undergraduate education at The College of William and Mary in Virginia. At the time I was a student there – I believe this is still the case – William and Mary was a very traditionally organized university. Nearly all of the contemporary arts and sciences disciplines were represented and, of course, the university hosted various professional schools.[18] The curriculum was fairly straightforward: everyone took a major (mine was Biology) in one of the disciplines and completed a minor (I chose anthropology with emphasis in cultural anthropology) also in one of the disciplines. Through the general studies program we were all required to sample widely from among the disciplines and explore several in some depth. The pedagogy was also pretty straightforward: we were to read and write our way to understanding (I still remember my shock upon learning I was required to buy [and read!] six books for my introductory biology class!) Lengthy research papers were assigned in nearly every class. Tests and quizzes were most often grueling in-class writing exercises using those famous blue books they sold at the book store for pennies a piece. The entire experience was designed primarily to focus our attention within a discipline. It worked for me. I graduated with a single-minded interest in biology and, in the tradition of disciplinary scholarship, pursued that interest with the passion and energy through graduate school and into a career as an academic biologist.

But, something else happened to me at William and Mary. I was introduced to entirely new ways of analyzing the world, different music and art and a nearly unlimited universe of people and ideas. I found I loved art history and, so, I took a lot of it. I learned to write in my first history courses. The country boy from Western Virginia who went to William and Mary in the early 1970s was never the same. I was transformed.[19] It is this *Power of Transformation*, the power of the university to open minds and imbue a broad awareness and curiosity that is one of the most unique assets of the American Academy. This is the interdisciplinary perspective we seek for our students.

William and Mary is an elite institution but it is not unique in its organization or approach. Indeed, an inescapable observation we must make is that hundreds of American colleges and universities strive for and achieve an interdisciplinary outcome within rather traditional disciplinary structures. How do they do this?

It is my view that liberal arts and sciences, applied with vigor and passion and complemented with enough technical training to give every one table stakes for a first good job, is a time tested and fully validated approach to developing the interdisciplinary mind. The approach at William and Mary was simple: Faculty talked to one another all the time – as students we could see this—from the base of their disciplines in much the same way Brockman's authors talk to one another in his collection of essays. Innovation, ideas, edge of discipline thinking was everywhere because that is what the arts and sciences is all about. My own interest in ecology – indeed, my first realization there was something called "ecology"—came from a young anthropology professor who suggested I apply energy dynamics to my study of the cultures of the people of the high Andes. Interdisciplinarity is a state of mind, a determination to discover, an insatiable appetite to explore. It may be, in my view, too large and dynamic to be bottled into an organizational structure.

Final thoughts

Let me return to the questions I posed at the beginning of this essay. There is no question that interdisciplinary perspectives are critical for our graduates – it is those perspectives that represent the horizontal component of the T-shaped individual sought in today's work world. But I believe we must also ensure deep roots in the foundational disciplines in order to give our students the skills to recognize and take on the opportunities and challenges presented by the dynamic emergent properties of today's technology-driven economy. I believe we must examine whether our approach is too self-reflective to meet the new mandates of the modern comprehensive university particularly an urban university like UWGB. Related to this we must understand whether more emphasis in the disciplines will provide us a better opportunity to support the faculty research and graduate programs that represent the currency of our activities in economic development and community engagement.

While I doubt those reading this will misunderstand my perspective, it is important to know that this is not a manifesto for any particular set of reforms – though reform is certainly needed. There are very important strategic and resource implications related to these (and other) questions which must be considered within the university planning process. We have deployed structures within our shared governance paradigm to address the critical questions of our time. I invite everyone to participate.

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[1] This claim was examined by a university task force in 2011. Based on internal surveys and the examination of selected interdisciplinary programs around the country (generally, highly specialized programs at prestigious universities), the task force make a series of recommendations aimed at reinforcing the existent interdisciplinary approach. The work of the task force did not address the efficacy of the existing interdisciplinary approach.

[2] While the university select mission does mention interdisciplinarity it does not prescribe a unique operational structure to it.

[3] The contemporary liberal arts derive from the seven liberal arts of the medieval university. The Trivium (grammar, logic, and rhetoric) and the Quadrivium (Arithmetic, geometry, music and astronomy) embody the foundations of critical thinking and philosophical consideration and remain fundamental in the modern disciplines. Medieval learning necessarily included all seven of the liberal arts and, thus, was interdisciplinary as a course of study.

[4]Mitchell, Melanie. Complexity: a guided tour. Oxford University Press. 2009.
Clifton, Jim. The Coming Job Wars. Gallup Press, New York. 2011.

Brockman, John. This Will Make You Smarter. HarperCollins Publishers, New York. 2012.

[5] If there is a recommendation in this essay it would be to carefully reconsider the undergraduate catalog copy regarding the interdisciplinary major which is (emphasis mine):

> While students elsewhere may devote themselves to a single, narrow field, there is an expectation that every student at UW-Green Bay will enjoy learning experiences that challenge him or her to integrate ideas from different fields.
>
> The UW-Green Bay approach is notable for its extensive array of "interdisciplinary" majors. "Interdisciplinary" is a term used by educators to describe programs that are grouped not by narrow departments or a single discipline (field of study) but by practical areas of interest.
>
> These majors apply knowledge from several disciplines to a broad topic. An Environmental Science student, for example, will apply biology, chemistry, mathematics, botany and other disciplines to the larger study of environmental issues. Other examples include the majors in Human Development, Business Administration, and Democracy and Justice Studies.
>
> Students can pursue more intensive coursework in a particular topic of interest (their "area of emphasis" within the major), but this specialization is balanced by the fact every student completes either an interdisciplinary major, or a disciplinary major coupled with an interdisciplinary minor.
>
> The value of this approach is evident when one considers that today's students prepare for a first job but also for 21st century careers that do not yet exist, and for societal challenges not yet known. Identity theft, viral epidemics and global sustainability are examples of issues not easily addressed by relying solely on yesterday's answers.

We might want to consider the value of a number of value judgments and assertions in this narrative. The first sentence suggests our programs are better than those "elsewhere" because those other universities are based on a more traditional disciplinary approach. Yet, most of us are trained in rather traditional environments and it is difficult to claim the results of our approach is better than, say, my alma mater William and Mary, which is organized by traditional disciplines, or most of the other 300 or so excellent liberal arts colleges around the country. The selection of "practical areas of interest" as interdisciplinary foci represents a choice about how to arrange our understanding of the world. Are such choices justified or even possible in today's complex world? The assertion that "specialization is balanced" by cross disciplinary study is well established and not an innovation. The fact that complex problems are "not easily addressed by relying solely on yesterday's answers," seems to suggest that discipline-based education is entirely or substantially retrospective in nature. As I mention in the essay, I do not believe this is the case though I will allow that any subject may be *taught* from a purely historical foundation.

[6] http://edge.org/

[7] Tim Brown, CEO of IDEO, a world-leading design firm is generally given credit for popularizing the idea of the T-Shaped Individual. See also: David Guest. 1991. The Hunt is on for the Renaissance Man in Computing. The Independent. September.

[8] As Getter points out, one of the dangers of dualism is relativism, which is a perspective we see all too often in undergraduate students. The idea there are no real answers is particularly dangerous in understanding science where the word "theory" is often misinterpreted (particularly true with regard to public views about evolution and climate change).

[9] Sid Meier's Civilization: Beyond Earth. Firxsis Games, 2K, 10 Hamilton Landing, Novato, California.

[10] "No idea in science has been more threatening to humans' conceptions about themselves than Darwin's theory of evolution; it arguably has been *the* most controversial idea in the history of science." Mitchell.

[11] The accreditation process of the Southern Association of Colleges and Schools (SACS) requires every accredited university to engage in an institution-wide learning advancement of some kind. At my previous institution, the entire university supported a program in applied learning which sought to give every student a significant career-focused experience before graduation.

[12] Gary L. Miller and Robert R. Hoon. 2014. The Role of Public Comprehensive Universities in Closing the Innovation Deficit. Computer 47(8): 22-27.

[13] Clifton is clear in his view that the kind of job creation required in the next 30 years is not within the ability of government to fix since its resources are inextricably linked to GDB and, thus, to the dynamics of employment. He is also clear in his view that any resurgent job creation phenomenon would have to be accompanied with massive cuts (he argues up to one-third) in government spending particularly on entitlements if the job program were to have the desired effect.

[14] Jason Wiens and Chris Jackson. 2014. The Importance of Young Firms for Economic Growth. Erwin Marion Kauffman Foundation. Entrepreneurship Policy Digest. http://www.kauffman.org/what-we-do/resources/entrepreneurship-policy-digest/the-importance-of-young-firms-for-economic-growth.

[15] A nice companion book to Clifton's *The Coming Job Wars* is Enrico Moretti's book *The New Geography of Jobs.* 2012. Mariner Books, Houghton Mifflin, Boston and New York.

[16] Enrico Moretti, 2012. The new geography of jobs. First Mariner Books.

[17] The University of Wisconsin – Green Bay is a member of the Coalition of Urban and Metropolitan Universities (I am a member of the Executive Committee). An important new focus of that group is enabling universities – mostly comprehensive universities – in working as a full partner for economic development in their regions.

[18] Some may not know or have forgotten that William and Mary is a public university.

[19] I talked about this personal transformation in my remarks at the Chancellor's Scholarship Dinner in October 2014, one of my first major speeches as Chancellor. This is what I said:

> It is difficult to imagine a more naïve or less worldly individual than me on the hot day in late August 1972 when my parents drove me the 150 miles to Williamsburg to enroll in my freshman year at William and Mary.
>
> Rockingham County, Virginia where I grew up was an idyllic place of old-order Mennonite farms, Ruritan Clubs, Friday night high school football and covered dish suppers in the church basement.
>
> The turmoil of Vietnam and the long-hair, rock fueled youth movement were kept as far away as possible by our baby boom parents who insisted we keep busy with part time jobs, athletics, our studies and approved girl friends from like-minded families.
>
> The high school curriculum stuck to the facts with rarely a foray into philosophy or eastern religion or the emerging new age music and alternative literature.
>
> In a very real way, when I arrived on campus that August, I was powerless in the face of the great dynamics of 1970's America. I had only rudimentary social and intellectual tools to make sense of anything of the world except my patch of rural western Virginia.
>
> I was transformed!