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THE COMING PARADIGM SHIFT IN HIGHER EDUCATION[1]

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They will cease to exercise memory because they rely on that which is written, calling things to remembrance no longer from within themselves, but by means of external marks.

- Plato in Phaedrus

Show me a messy problem and I can show you how education will be a big part of the solution.

- Unknown but attributed to John Bravman, Bucknell's 17th President

INTRODUCTION

Thank you for this opportunity to speak to you today. The ideas I will share have been in my mind for a long time. This is my first attempt at putting them on paper or presenting them to others. Please be patient with my musings. I hope to have a much more refined version to share with you in the future.

In this talk I will highlight tensions that exist within higher education, making the case that we are ripe for a paradigm shift, and speculate what higher education might look like on the other side. As the opening quote highlights, education has been disrupted many times in the past. Like most paradigm shifts, it will only appear sudden in retrospect, perhaps over the span of a career or two. The shift is already happening. The evidence is all around us. And it will challenge us to reexamine our purpose and value to society.

[1] This text was the result of the lecture entitled *The Coming Paradigm shift in Higher Education*, organized by the Coordination of the Philosophy Course at the State University of Paraíba and which took place on March 21, 2023. The fruit of this work was given with the authorization and the elaboration of the text made by PhD. Joseph Tranquillo through the organization created by PhD. Otacílio Gomes da Silva Neto, course coordinator at the time.

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A few disclaimers before we dive in. First, this talk explores the disruption of our educational mission. A similar analysis on scholarship might be interesting, but it is not my focus tonight. Second, my views are necessarily biased - I am an academic (currently serving as an administrator) at a small, private institution that focuses on WEIRD (Western, Education, Industrialized, Rich, Democratic) populations between 18-22 years. I am very aware that some of what I will share is based upon western European colonial ideas – I very much hope that this will change on the other side of the paradigm shift. Third, I will be building upon complex adaptive systems theory – again, a bias of my scholarly background. Lastly, this is more of a theoretical talk, but I will try to hint at practical implications along the way.

A. THEORETICAL GROUNDING

We will begin with some grounding ideas: 1) the function of higher education, 2) the forces that build up tensions and 3) how systemic tensions are released.

A.1. The Educational Function of Higher Education

Higher Education has historically balanced two purposes: 1) The creation of new knowledge in the form of scholarship and 2) the education of the next generation of citizens. Over time universities have assumed other functions (e.g., stimulating the creation of new jobs, generating intellectual property). As my focus is on education, I will say a few words about the foundations of learning and education.

Learning is when an entity changes something internal to itself. It is different before and after, and as a result can generally do something new or different than before. Learning is a property of *adaptive* systems. Generally learning requires an expenditure of energy to make the change - in systems language it is the reversal of a thermodynamic process. We could go in many epistemological detours on the processes by which information and knowledge is constructed, stored, organized, and called upon when needed. By this broad definition learning can, and often does, take place without a teacher, as an entity learns from its environment.

Education makes this process intentional - the transfer of information from an entity that possesses that information to another that does not. This process is not passive and is present in animals, is beginning to occur between semi-intelligent machines and almost

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certainly aliens (if they exist). For this talk, our interest is in people and Ken Bain has my favorite simple definition - "learning has taken place when someone thinks, acts or feels differently".

The current model of higher education is not monolithic - it is built upon the history of young adult education – systems literature calls this *path dependency*. We have moved from small collectives of elite thinkers and private tutors to the origin of institutions of higher learning (University of Pisa) that primarily educated clergy and some specialized professions to the modern university that arose in the mid-1900's in response to the industrial revolution - This was the origin of degrees, majors, grades, and other aspects of our current system. Each of these were paradigm shifts, yet some vestiges of the old model remained.

A.2. Complex Adaptive Systems

Higher education is an excellent example of a complex adaptive system. Rules, practices, structures and policies emerge bottom up from the action of many actors. There is no centralized or top down control, but power and influence is unevenly distributed. Complex systems are inhomogeneous yet patterns arise - they exist somewhere between order and disorder. Most are open to, and require input from, their surrounding environment. Yet they maintain a degree of independence - they are separated from the environment by a semipermeable membrane. As a result they can maintain a homeostasis – internal integrity despite perturbations from the outside. The inability to maintain this integrity is the death of the system. These types of systems are known as *autopoetic* - they contain within them all the complex and interacting functions they need to maintain their own existence, only needing an external environment for energy and raw materials to locally reverse the laws of thermodynamics and turn disorder into order. For example, they can adapt - creating new functions that will solve challenges presented by the environment.

This may sound like I'm arguing that higher education is alive. The Chilean theoretical biologists, Maturana and Varela, who laid out the theoretical grounding for autopoietic systems, were using living cells as their model. But I suspect they would argue that higher education displays most, if not all, of the hallmarks of a living organism.

Some curious phenomena arise in autopoietic systems. First, although they can maintain homeostasis in the short term, over time they will begin to mirror aspects of their environment.

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This is known as *Conway's Law*. In other words, higher education will adapt over time by solving the challenges presented by society. Second, autopoietic systems can be *meta-stable* - possessing more than one homeostatic state and the ability to switch back and forth between them. In humans, walking and running require a very different coordination of muscle firings. The result is that it is comfortable to walk at one pace and run at another pace, but uncomfortable to try to move at a pace in between. Faculty switching back and forth between a scholar and a teacher. Third, autopoietic systems use *exaptation* - the ability to use a function that emerged for one purpose to perform a different function. Spaces at a university may have been designed for one purpose but are often used in many different contexts.

A.3. Tensions, Avalanches and Paradigm Shifts

Systems that can maintain a homeostasis must be able to absorb perturbations from the outside environment. Overtime, however, tension builds up that must be released. The physicist Per Bak studied this phenomena in a simple mathematical model of an open adaptive system. More specifically the model simulates a pile of sand, where more sand is dropped, a few grains at a time, from the outside. The sand pile can absorb tension (through friction between grains of sand), but eventually that tension is released through *avalanches*. After an avalanche, the pile contains less tension than it did before.

Bak's studies came to several interesting conclusions, which we cannot detail here. One is of most relevance to our study of higher education. The level of tension (even if it is high) is not a predictor of when or how large the next avalanche will be - the same tension could be released through many small avalanches or one large avalanche. Bak went on to provide evidence that this avalanche behavior was evident in systems such as biological and technological evolution (known as punctuated equilibrium), the economy, and the metabolism of nearly all living organisms.

Bak studied primarily physical (natural or human made) systems, but he hinted that avalanches might also be present in conceptual systems. It has been noted by myself and others that Bak's idea of avalanches bears a resemblance to Thomas Kuhn's concept of a paradigm shift. In Kuhn's theory, tension is built up through observations and experiments that do not align with the currently accepted theory of a phenomena. Attempts will be made to release tension with small "avalanches" - slight modifications or adjustments to the current theory.

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However, if tension continues to build through more anomalous data, the system may undergo a paradigm shift. Kuhn's canonical example was the move from Newton's to Einstein's description of gravity. Over time Newton's description built up paradoxes and unexplained phenomena that were described by Einstein's more comprehensive description. Kuhn chose a massive shift to illustrate his point, but we see evidence in science and other fields that, like the avalanche model, there are paradigm shifts of all sizes.

There is not a perfect isomorphism between Bak and Kuhn's work. The simplistic model that Bak was studying was not adaptive - the rules governing the sandpile could not change and the pile would be erasing its own history over time. This is unlike Kuhn's paradigm shifts where path dependencies from the previous paradigm are preserved.

I am proposing that high education has undergone paradigm shifts in the past and that another paradigm shift (although not predictable in timing or size) is inevitable. Events such as pandemics, wars, political unrest, new technologies or natural disasters may speed up (or slow down) the shift. But tension will continue to build. If, and when, higher education undergoes a paradigm shift, it should become a system with less tension.

A.4. External Forces

All autopoietic systems have a bidirectional relationship with their environment. Higher education is no different. To organize our analysis of the environment surrounding higher education I will use the STEEPLED framework, which is an acronym for:

Social
Technological
Economic
Environmental
Political
Legal
Ethical
Demographic

Each of these areas is its own complex adaptive system that is open to all the others. Some may be considered autopoietic. Together they form a super-complex intertwined system. At times one area will lead while the others lag. Each is dropping grains of sand into the others, building up tensions. A change in one area of STEEPLED (perhaps through an avalanche) will ripple through the other areas. It is not uncommon for this ripple effect to feedback on the area

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that began the perturbation in the first place, forming what Douglas Hofstader calls tangled hierarchies. We use terms like agricultural revolution, industrial revolution or digital revolution, because a new technology set off a domino effect that impacted all of the areas of STEEPLED. Problems that arise in one area might be solved by another, or made worse. No one person or group could possibly understand this tangled super-system in its totality. In other words, my attempt at dissecting these systems, and the tensions they create, is doomed to be hopelessly simplistic.

A.5 (Super) Wicked Problems

The last theoretical idea I will introduce is the nature of wicked problems. Rittel and Webber described ten characteristics of a wicked problem. I won't go through them all here but they include, not having a definite formulation - it's hard to even state the problem separate from its symptoms, every wicked problem is wicked in its own way, there are an infinite number of possible solutions, progress is hard or impossible to measure. STEEPLED is a helpful framework, but it's not going to solve a wicked problem. Levin et al., went further to explain that some problems are super wicked because time is running out, there is no central authority, and those seeking to solve the problem are also causing it. The 17 UN Sustainable Development Goals - for example no more poverty, gender equity, and climate change - are great examples of super wicked problems. And in fact one of the super wicked UN goals is quality education.

B. THE TENSIONS WITHIN HIGHER EDUCATION

I will first explore tensions within higher education and then turn to tensions that we are feeling as a result of our external environment. To begin, consider this quote from Larry Spence:

> *A 12th century farmer would only recognize the cows in a modern dairy*
> *A 13th century physician would run screaming from a modern operating room*
> *Galileo could only gape in wonder touring NASA's Johnson Space Center*
> *Columbus would be terrified of a nuclear sub*
> *A 15th century professor would feel right at home in most classrooms.*

Spence's point is that other professions have adapted to changes in the world but many in higher education have resisted. This is one way in which tension has been built up over time.

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B.1. Framework for Dissecting Tensions in Higher Education

Before diving into specific tensions I will introduce an overly simplistic three-part framework. First is **How We Teach** - what we do as educators. It depends upon who we teach, where learning takes place, and what we assume about the learning process. Second is **What We Teach**. This is dependent upon our goals, the areas of expertise we possess in the academy, and what we assume our students need. Third is **Why We Teach**. This is rooted in what we assume is our purpose and role in society. Let us explore this framework in a bit more detail.

B.1.1. How we teach

How we teach is based in large part on what we know about the learning process. I can only scratch the surface of what we have learned about learning. We know that students only retain between 2-5% of what they hear in a lecture. The more they participate, the more this percentage goes up. It can go all the way up to 90% if the learner is asked to teach someone else - in other words, teaching is the best way to learn material. The irony has not escaped me that I'm giving this talk as a lecture online.

Humans naturally build from concrete experience to theory, rather than the other way around. We get better with practice and learn even faster when we receive feedback. Reflection is a critical part of the learning process, as too is a balance between intrinsic and extrinsic motivation. Emotions play an important role, and therefore mental, physical and emotional safety are important in learning. Neuroscientists have verified that Wittgenstein was right - we store knowledge in tangled webs of concepts - constructing new knowledge by layering on top of what we already know. Learning can be a social process, as we learn from peers and near-peers - the teacher is only one player in the overall learning process. My own small contribution has been to explore the possibility that learners are undergoing various internal avalanches as they reorganize their mental models.

Based upon these and other findings, many in education are recentering the student – teachers become a guide on the side rather than a sage on the stage. The learning environment we create is more social, active and creative. And this changes the kinds of challenges and assignments we offer to students as well as how we assess their learning.

B.1.2. What we teach

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What we teach is influenced by many factors. We have opinions about what must be taught, what is good for our students to know and what is merely interesting. Is our intent to help students understand a model of the world as it was understood, as we understand it now, or how we might imagine it could be? It is also influenced by the textbooks that we adopt, other courses in our curricula, the norms and policies of our institution, and how similar content is covered at other institutions. How do we balance exploration of the world with exploration of the self? We cannot cover everything, yet some topics require prior knowledge - scaffolding and coordination is essential. Building upon the ideas of Benjamin Bloom we can ask if the goal is simply awareness of a topic or if it is to become an expert creator or evaluator. Is there more to teach than knowledge and skills? For example, some institutions add in the cultivation of personal habits, and mindsets as well as a sense of agency, identity or purpose.

B.1.3. Why we teach

Why we teach is grounded in what we believe to be the purpose of higher education. There are two interwoven threads, one personal and one societal. On a personal level, individual faculty consider whether being a professor is a calling, a profession or a job. As a calling, being a professor is similar to being a spiritual leader, emergency worker or nurse - a noble profession one would never go into for the pay, stress or upward mobility. We are attracted to the life of the mind and feel that we are playing a critical role in passing down sacred knowledge. It is not uncommon, however, for drift to occur - a calling becomes a profession and eventually just a job. There is a trend in the States of faculty leaving the university for other professions. This is not a criticism, but rather an observation. The societal reason to teach is typically embedded in the values, mission and vision of our universities and often mandated by a government, board or administrative leadership. We will discuss higher education's purpose further.

Past models of higher education viewed how we teach, what we teach, and why we teach, in a particular way that changed on the other side of a paradigm shift. I will present five tensions that have built up in higher education. Although I will present them as opposing poles, in reality most faculty, departments and entire schools will have strong advocates on both sides.

B.2. Credentialing versus Growth and Development

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We have a duty to help our students grow and it is fulfilling to see their progress. We also have a duty to society to graduate people who will make the world a better place. The impact of our students, however, is nebulous and occurs on a longer time scale. As a proxy, credentials (majors, minors, certificates) promise that our graduates have attained some level of proficiency.

Let us explore the case for credentialing. How we teach is impacted by scoring students using grades (summative assessment) that society can understand. A course is structured to build toward some level of mastery of necessary skills and knowledge. We design curricula using prerequisites so we can stack courses - advanced courses building upon competencies from previous courses. Not everyone will pass to the advanced courses - a phrase I've heard from colleagues is "not everyone is cut out to be a {fill in discipline}". As faculty we are concerned with grade inflation as it harms our credibility with the wider society.

What we teach is based upon what it is possible to measure. We design assignments, based upon learning objectives, that can be assessed and demonstrate that students have achieved a desired level of competence. Elective courses may allow for free exploration, but they typically conform to the paradigm of assessable assignments.

The purpose of teaching becomes academic rigor that will be trusted by our colleagues and others outside of the university. Internally we also review our programs and external accrediting bodies rely on this assessment of student work to provide their approval of a program or university. The goal is to give the public faith in our programs and graduates. Some departments feel an ethical obligation to maintain high standards. In my own discipline of biomedical engineering, we feel a duty to graduate students who can be trusted to create devices such as pacemakers and artificial hips that might someday be implanted in you.

The case for growth and development is based on the premise that if we teach students how to learn, regardless of their immediate mastery in college, they will lead a happy and productive life. Holistic growth is an end in itself, but it will seed great work later in life. Furthermore, John Dewey, the educational philosopher, argued that educated citizens are the key to sustaining democracy.

Our teaching focuses more on formative feedback. We meet students where they are - indicating where they have grown but also where they need more effort and attention. Faculty might move to "ungrading" or competency-based grading. Some universities such as Hampshire and Reed College have abandoned grades altogether. Courses and curricula are not

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the end goal but rather to instill habits of mind and action (such as meta-cognition, reflection, critical thinking, creativity and organization) that will encourage students to continue their growth throughout their lives. General education requirements and electives dominate the experience.

The purpose of higher education is to retreat from the world to concentrate on cultivating identity, character, ethics, decision making, and leadership and other more abstract aspects of the self. Self-contained communities that look like sanctuaries - sometimes with physical walls to keep the distractions of the outside world away - is the dominant architecture of a campus.

B.3. Academics or Whole Person

The case for academics is based upon the history of higher education. Academic growth is written into the mission of most universities – other opportunities (e.g., student clubs, residential living) are in the service of academics. Faculty are the keepers of the knowledge - the expert in the classroom - and we determine the best way to convey content to students. We tend to teach the way we were taught, and therefore lecture and discussion dominates. Learning is expected to be an individual endeavor.

Courses and curricula are determined by the expertise of the faculty. We stick to what we know and assume that non-academic growth is up to the student and is the domain of family and others in society.

We teach to preserve sacred academic knowledge and skills to ensure that it is passed down to future generations. Students must progress from novice to competent at the undergraduate level and to expert at the graduate level. We struggle with the balance between depth of study in a particular academic domain versus having a breadth across several domains. Some argue that academic habits of mind can only be sharpened by going deep - the major is the core of the experience. Others point out that we are in a post-disciplinary world - a generalized curriculum should dominate learning. This tension is very much related to the Aesop fable (with a modern interpretation by Isaiah Berlin) of the Hedgehog (who knows one thing very well) and the Fox (who knows many things). We often split the difference - students major in a discipline but also earn minors and take electives that round out their education.

The case for whole person education is an acknowledgment that students are embodied, emotional, socially embedded, moral beings with their own identity, agency and sense of

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purpose - universities are a place for them to grow along these dimensions. The entire campus is engaged in the education of students, not only professors. Students who are academically gifted and even land a great first job, but are deficient in other areas, have little chance of thriving throughout a lifetime. Faculty acknowledge that there is more going on in a classroom than the academic content. Learning is emergent and the faculty member is not always the expert in the room.

Courses are less driven by rigid learning objectives and more by opportunities for students to develop their strengths and grow into areas of weakness. Faculty are still the academic experts in the room but there is more freedom to explore. Classrooms may be more democratic - the students co-create the syllabus and vote on the direction of the course. Faculty become more the guides on the side rather than the sage on the stage. This is uncomfortable for many faculty. So some universities are hiring non-faculty professionals who help students with their non-academic development.

At Bucknell we are taking this very seriously. We are asking the question that has driven the long tradition of the liberal arts - "What does it mean to be a truly free citizen of the world?" Clearly today this is more than only academic knowledge. So we have created a Thrive Framework, composed of four simple objectives that students should achieve by the time they graduate. Every student should be able to say "I can:

1) Meet my own basic needs
2) Seek out spaces and people that help me feel a sense of belonging
3) Find and use the resources available to me
4) Continue to grow holistically in ways that will advance my identity, agency and purpose"

If a citizen can do each of these throughout their lives, they are almost certainly thriving. Each of these has sub-objectives. For example, safety is a basic need and there is an objective: "I can enter an environment or situation, assess the risks to myself, and take an appropriate action". Most students have already made steps toward this objective but it becomes our job to help them advance. When written as objectives we also use backward design to create assignments, challenges and assessments that might take place in or out of the classroom.

B.4. Selectivity/Filtering versus Open Access

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The case for selectivity is based upon only some students being college-ready. We expect them to already possess a solid grounding and desire to guide their own learning - there is little need for supplemental support systems.. Historically, higher education was only for the elite and most schools still reject students who do not meet some academic criteria - we are proud of our selectivity and university ranking systems reward schools with low acceptance rates. As faculty, we take pride in the rigor of our courses, worry about grade inflation, and design "weed-out" courses to prevent students who are not up to the challenge from moving on. In other words, college is not for everyone.

The case for more open access is to break through the status quo and provide social mobility to students and families who are not from privileged backgrounds. It is based on both an ethical (it is the right thing to do) and practical (nurturing anyone with talent) theme of social justice. However, open access means we need to become more student-ready. An example in the States is that many schools are making entrance tests optional. Higher education is afterall meant to be freeing.

Teaching methods meet every student where they are, and try to avoid biases through techniques such as universal learning design. Struggling students have access to supplemental help such as office hours, teaching assistants, bootcamps, workshops and support centers staffed with non-teaching professionals. We consider the entire journey of students from recruitment to enrollment, orientation, retention and eventually graduation. Financial aid is provided to soften loan debt. Some schools create unique cohorts of students to create peer-support groups. More emphasis is placed on evaluative feedback than on grades - some faculty are moving to contract-based or ungrading.

We slow down and do not try to cover "everything", focusing only on critical learning objectives. The start of a course may cover background material to catch up students who may have missed content due to their background.

Why we teach is not only about social mobility. It also is related to Dewey's ideas about education as the foundation of a strong and sustainable democracy. Poorly educated citizens will no longer make good collective decisions.

B.5. Preparation for a Career versus Life of the Mind

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The case for career preparation is to help students get their first job, on their way to a 40+ year career. Students (and their families) see college as a pathway to financial stability and a fulfilling life. Historically, universities are trending in this direction and it is what is attracting more students to college.

How we teach is then about modeling aspects of the real world into our classrooms by introducing current methods, trends, events and case studies. Non-academic guest speakers, showing where course material shows up in their profession, and field trips motivate students to think about their career. Professional skills, such as working in teams, writing memos, or negotiation skills, are part of the classroom experience. My own department scores students in more advanced courses using a performance evaluation that is used in industry, and our lower level courses have a percentage of the final grade based upon professionalism.

The content also changes, as the deep history and context of the discipline become less important, replaced with career-focused competencies. Courses and curricula become more flexible to mirror trends in the world. I often end class with a Professional Moment – a story or reflection that will help students think about their career. I also spend a few weeks on practical applications of the course content. Some institutions give credit for internships, known as co-ops, and a few even require students to work in a professional setting while in school.

Why we teach becomes about adding highly skilled laborers to the workforce.

The case for the life of the mind is where faculty and universities have expertise. We thrive in this environment and challenge students to follow us to the depths of our discipline – to experience what it is like to be in the intellectual trenches. How we teach is about modeling how a scholar thinks. We expect students to be intrinsically motivated, like us. Assignments are meant to mimic the kinds of products that are valued in academia, and we can grade them in the same harsh way that our colleagues would evaluate us. We may engage students in our own scholarship and give them practice with interdisciplinary thinking because that is where the academic action is. Anything that seems practical in the outside world is suspect - the goal is to remove as many distractions as possible so they can focus narrowly on our learning goals.

We believe that students study at the university because they wish to engage in the life of the mind - they will learn what they need on the job later in life. We also want to find those students (of course the very best) who will become professors like us. A more cynical view is that we create copies of ourselves. This is in fact the very nature of an autopoietic system – one that can create and maintain itself over long periods of time.

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I want to share my own way of thinking about how to balance the life of the mind and career preparation. Two years ago I spent a day reading over the mission, values and vision of my university, the learning goals of each of our colleges, and our strategic plans and campaign documents. It was hundreds of pages. The challenge I gave myself was to distill this down to three or four core ideas and use no buzz words. I came up with a three-part framework for how students should grow.

First is Genuine Care for Others. This is about how to relate to another person through relational, not transactional, connections. It is related to Kant's categorical imperative to treat others as ends in themselves and not means to your own ends. To assume good intent, to meet others where they are and to see every individual as a work in progress. I avoided buzz words like empathy, intercultural humility, emotional intelligence and others, but they are implied.

Second is Being a Good Steward of ALL the Environments you inhabit. These environments may be your friends, the university, your local community, church, clubs, to your country or the entire world. The challenge is to be a good steward of all of them simultaneously. It hints at what Gregory Bateson calls a double bind - what might be good for one community might be harmful to another. Students need practice making decisions in these situations. I avoided buzz words like social justice, sustainability and the triple bottom line, the anthropocene, entrepreneurship and economic development. But they are all implied in how to balance being a good steward of all the environments you inhabit.

Third is Continuous Investment in Yourself. This isn't selfish or only academic - but to challenge yourself to always be growing socially, emotionally, physically, mentally, financially, spiritually, and in your sense of identity, agency and purpose. Career is a consideration but it is not the end goal. It is to always see yourself as a work in progress. Again I have avoided buzz words but contained within are ideas of lifelong learning, mentorship, leadership and identity development.

This framework could be the subject of another talk. But as a hint, consider equity and inclusion - it touches upon all three pillars - how to treat others, how to disrupt the status quo of society and how to think of oneself as an intersectional individual.

B.6. The individual versus efficiency and scaling

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The tension between a focus on the individual and efficiency of the organization is inevitable but has been building over time.

The case for the individual is the case to meet every student where they are in the learning process - growth and development are inherently messy and inefficient. But learning is more robust when the teacher knows their students as individuals, not only their names but their interests, motivations and goals. Some institutions assign every student a faculty advisor who can help them chart their own pathway. Others allow for asynchronous instruction or a competency certificate (as opposed to grades in a course) to accommodate individual needs.

Courses allow for flexibility and self-guided work, while curricula may have many electives outside the major. Some schools allow the whole curriculum to be guided by the student to encourage the following of passions.

The university exists to serve as an amplifier of the individual student, in keeping with the humanistic position of putting the person at the center of all that we do. This becomes the reason we teach – to help each of our students grow into the person they wish to become.

On the other hand, individual self-guided education is nearly impossible in practice and is the core of the case for efficiency. Universities do not have the resources to serve the needs of every student so we follow the corporate product model and offer a few variations that we hope will mostly serve the needs of most students. We teach in classrooms with many students, often with one kind of delivery method (lecture) because it is efficient and scales well. We enlist the help of other students as teaching assistants or allow students to teach (or even grade) each other.

What we teach is also impacted. An efficient system strives to become more efficient. We choose topics and create assignments and assessments that can scale to many students. For example, we build rubrics to operationalize our grading and explain our judgements to students and colleagues.

Why we teach in this corporate model is about our need to satisfy students who we view as paying customers. Course evaluations, numbers of incoming students, majors and graduates are used to make decisions and compare ourselves to other institutions who we view as competitors. If something cannot be reduced to a number, then it must not matter. At some institutions, like my own, we have hired administrators who do little else than watch over the numbers.

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C. TENSIONS FROM OUTSIDE OF EDUCATION: STEEPLED

I will now touch upon some of the external tensions coming from the areas of STEEPLED.

Social

Strong and sustainable societies have historically invested in educational systems. Currently we are being pushed to open up access in the name of equity, inclusion and social justice. Simultaneously, there are social forces pushing colleges toward career preparation, which influences the disciplines students choose. Some disciplines seem to be dying as a result. Our campuses are becoming more open systems, and due to Conway's Law this means we are more influenced by the other areas of STEEPLED. But we tend to resist this. In a recent poll in the States, over 50% of the adult population believes higher education is going in the wrong direction.

Technology

We have experienced some technological disruptions in the form of youtube instruction, Khan Academy, and companies that specialize in massively open online courses (MOOCs). Some universities (University of Phoenix) are entirely online, requiring very little infrastructure. As a result they operate with greatly reduced costs which they pass on to their students in the form of lower tuition. Digital courses and universities can also scale more easily and pivot more quickly to meet changes in demand. I will share more about technology later in this talk.

Economic

We give back to the economy by providing highly skilled labor, new ideas and technologies as well as employing local staff and faculty. This has accelerated due in large part to the societal need for more highly educated citizens. However, campuses often occupy prime real estate, and we rely upon governmental support in the form of grants, financial aid and in some cases loans. As higher education has become more tightly regulated, more staff and administration has been added. We must remain financially sustainable and generally student

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tuition is used to offset deficits. The result has been rising tuition costs, countering the move for open access. This creates a tension between adding more students to gain tuition and the overhead to support these students - however, not all aspects of higher education scale the same.

Environmental

All sectors are being called to consider their environmental impact, often managing their carbon footprint, by some combination of reaching zero emissions, purchasing offsets or using technology - to give this talk I did not need to take a plane ride. My university has a bank of solar panels that supplies about 15% of our power - there are plans to add more. Most of our buildings are LEED certified, meaning that they are much more energy efficient. Our carbon footprint is further offset with a bamboo field in Ghana. The solar panels, LEED buildings and bamboo field are all used for teaching and research purposes and have resulted in new courses, a requirement for graduation and two new majors in environmental engineering and environmental science. However, none of this is easy. For example, our LEED buildings cost more to build, are not as easy to maintain and honestly have some functional problems.

Political

As Dewey pointed out, there is feedback between the education of citizens and the priorities that a voting electorate supports. Politicians tend to follow the will of the public and put out the fires of the day rather than invest in the future. Education is a long-term investment and is therefore susceptible to budget cuts and short-term swings in political support. A tension is how much political leaders value higher education relative to other priorities. Both of our countries have politicians who have stated that our current model of higher education is broken and should be defunded. On the other hand, some countries (for example Sweden) believe that higher education is a basic right and provide full financial support to all who are accepted.

Legal

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Higher education has historically been an underregulated sector of society. However, several high profile scandals have resulted in more scrutiny and regulations. These new regulations provide guardrails but also create constraints. At my own institution we have tried to buffer ourselves from as many legal regulations as possible - having our own police force, waste removal, and energy production. The University of Cape Coast in Ghana had their own internal primary and secondary schools, a farm and fishery, and water bottling plant. They are essentially their own self-contained community.

Ethics

The ethics of higher education is complex. We have codes of conduct for students, faculty and staff, and internal review processes to ensure accountability. These aim to protect the rights of students, faculty, staff, administrators or third parties, and protect the learning environment. Paying a fair living wage to employees, keeping tuition low, maintaining confidentiality, opening access to those who are less privileged and respecting privacy all have ethical dimensions. Tenure is a way to protect the intellectual rights of faculty and shared governance is meant to include different stakeholders in decisions that may impact them. Questions we might ask are: Are we running a business or serving a vital societal need? Do we have a duty to help students grow not only in their skills and knowledge but also in other areas such as character?

Demographic

Many areas of the world are undergoing rapid demographic changes. More people are moving across national and internal boundaries, often sparked by opportunity, famine, natural (or human-created) disasters, poverty, or political unrest - in some cases leading to mass refugee crises. Developing countries need more highly educated citizens to continue their development. Worldwide, there is more mixing of ethnicities, races and social status. Many countries also have a greater awareness of differences in gender and sexuality. Who we are teaching in college classrooms is changing and as a result we need to adapt to a more diverse classroom environment.

D. WHERE ARE WE GOING?

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Which tensions will be released on the other side of the paradigm shift and which will remain? Any prediction of where we are going is bound to be wrong in the details. Perhaps universities will splinter, with some focusing entirely on research and scholarship and others on teaching. Could we go back to being the ivory tower that is disconnected from the world and focused on the life of the mind? Or will we become more and more integrated with society and become more corporate-like? What will happen to grades? Degrees? Credentialing? The simple answer is that I do not know. But I will give you a hypothetical vision to illustrate how different college could look. I invite you to imagine with me and think like a disruptor.

As a person trained in the creation of new technology, my personal bias is that technology often leads change, in society and in higher education. Plato viewed writing as a disruptive technology that would weaken the ability to memorize long passages. Just as the industrial revolution prompted a reimagining of higher education, the digital revolution, with the rise of laptops, the internet, social media and smartphones, is prompting a new learning revolution. We have learning management systems to organize our courses, we track student progress by entering grades into university-wide databases, and many of our assignments are completed and turned in digitally. My own institution is using algorithms to help in making admissions decisions. And we are rolling out a chatbot that can answer student questions, even in the middle of the night. It even has a name - Bucky the Bison - named after our school mascot.

I would like to present two provocative and complementary views of how technology might impact formal education. I am not predicting that these will happen. But all of the technology I will mention already exists, it simply has not yet been integrated.

The first case study is a virtual reality (VR) environment. Imagine a student puts on VR goggles and enters a virtual room. In that room are clues and challenges that they must figure out - like an “escape room”. The clues are all from a particular domain of knowledge. By completing the challenges they receive a key that opens virtual doors to neighboring rooms. These rooms have more clues that are a bit harder and build off of what was learned in the previous room. The farther this student ventures into this virtual world the more knowledge and skills they gain. They might even return to the original room, but see the same simple material, but now with more complex clues that take on a deeper meaning. Virtual worlds also allow for interaction with others, so some challenges might be impossible to overcome without banding together with others - groups could go on “quests” together. Students can explore at their own

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pace, on their own schedule, and are scored based on how much of the world they have explored.

We could even imagine that there are many of these virtual worlds, each for different areas of knowledge. But there could be portals between them. A virtual world of technology might have a portal to ethics or politics or sociology.

These virtual worlds could also be created in the VR platform too - creating a learning environment would be like what happens in lego minecraft - moving around building blocks that others have already created. More advanced designers can create their own blocks. A teacher becomes less of the content knowledge expert and more of a learning environment designer. If an old professor can do this, so can students. Imagine a student adding their own rooms, with more advanced clues on the outskirts of the virtual world. They become learning environment designers too, blurring the lines between who is the student and who is the instructor.

This is the gamification of learning. It uses all of the principles of what makes games fun and intrinsically motivating. But because it is virtual, it can scale up to any number of students and be disseminated anywhere in the world - maybe even with live language translation so students who don't speak the same language can seamlessly work together.

Video game companies can already do all of this, but because it is not as profitable they aren't doing it. Yet. As a small side project, I have been talking with colleagues at Stanford. If I had more time, I would be working on this with them, perhaps even leaving academia to pursue this idea as a start up company.

Our second case study builds off of artificial intelligence. ChatGPT has recently made a big splash but the basis for this has been around for a long time. ChatGPT is linguistically gifted, but there are other artificial intelligences that have similar abilities in organization, optimization, knowledge acquisition and integration. For example, artificial intelligence can "listen" to all of the data streaming back and forth and create models of how a system works. Some industries are already using this to create models of how their internal systems actually work - as opposed to what is written down. With these models they can create a Digital Twin of their company. And with this twin they can simulate what might happen if they make certain changes.

On most of your smartphones is a Health App. Imagine that right next to it is an Education App. Like the Health App, it is listening all the time. Seeing your calendar, your

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email and hearing your conversations. It can detect when you are stressed or engaged, all based on the tone of your voice and breathing patterns. If it is synced with your smartwatch it also can track your heart rate and other biological markers. Over time a model of you can be created - of how you learn - what excites and engages you, but also when you are stressed. It can predict when you are most likely to try something new, and when you would rather stick to something you know. It will use this model to suggest events, books, movies and time them to when you would be most receptive. Over time it becomes your own personal education coach. Amazon, Netflix and other companies are already doing some version of this.

Now imagine that this education app has been with you your entire life - my own children got their first school-issued iPad when they were five years old. Imagine how good this digital coach could become. Now imagine that my kids are applying to college - in fact my daughter is next year. Rather than write an essay or submit grades, she would give access to the settings on her education app. The college that she's applying to might have a digital twin of their own campus and perform massive simulations, with all the permutations of the thousands of applicants, and then use the results to determine who is accepted or who is denied.

Now imagine combining the ideas in the two cases I presented. What if an artificial intelligence could design these virtual reality worlds? It could easily use the incredible amount of information on the web to create clues. And it could probably even create custom environments for individuals based upon the settings in their learning app.

Does this sound terrifying? It does. But we don't seem all that bothered by the fact that Google, Amazon, and even our grocery stores are already doing a version of this. Is this where higher education is headed? I don't know. My scenarios were meant to give an idea of the kind of paradigm shift we could be headed toward. And this was only taking into account the technological disruption - imagine exploring the ripple effect throughout all of the STEEPLED areas.

CONCLUSION

The premise of this talk is that education, like all complex adaptive systems, will naturally build up tension due to internal and external forces, resulting in avalanches of all sizes, some of which might be considered a paradigm shift. Higher education has undergone shifts before and will do so again. Given the current state of tension in the system, along multiple

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dimensions, both internal and external, we seem ripe for disruption - maybe even during our careers as faculty. What education looks like on the other side of this shift is anyone's guess, but it could look very different than it does today, perhaps even calling into question the role we play. Are we simply existing for the sake of existing? Afterall, this is the essence of being an autopoietic system. Like all super wicked problems, they are hard to pin down and I doubt I have done much to clarify the problem. And I know I haven't outlined a solution.

But I want to leave you on a hopeful note. No matter the tensions, there will always be a reason for higher education to exist. The world is facing so many super wicked challenges that the next generation, and generations after them, will need to address - the UN sustainable development goals will not be solved in one generation.

And as the pandemic taught us, technology is amazing - it has always acted to catalyze changes that were already happening. But it also showed us that there is no substitute for face-to-face learning. This is how our species evolved and I suspect that no matter how good technology becomes, there will always be a need for human interaction in the learning process. Higher education has faced similar challenges - writing, the printing press, correspondence courses through the mail, and more recently the rise of online learning. Each of these was trumpeted as the end for institutions like ours. But we have persisted. I'm hopeful.

As the President of Bucknell has said many times - "*Show me a messy problem and I can show you how education will be a big part of the solution"*. I think that whatever paradigm shift comes our way, there will still be a need for higher education.

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