Reimagining Higher Education:
Preparing the Next Generation for the Global, Digital Economy

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Executive Summary

Background

Higher education is failing to serve the needs of students and employers, and costs are skyrocketing. There exists an urgent need for accessible, high-quality, affordable post-secondary education that prepares graduates to succeed in a highly complex, competitive, and increasingly global, digital world.

Objectives

Phase 1: Identify key weaknesses of traditional models of higher education and strengths of new and innovative models.
Phase 2: Explore institutions that are engaging in best practices as models for future success and redesign.
Phase 3: Recommend best practices for reimagining higher education.

Results

The skills and tools needed for effective citizenship—problem-solving, critical and creative thinking, cooperation, tolerance, and collaboration—align with those needed for sustained success in the workplace. We identified nine fundamental barriers to and within higher education, and evaluated 12 universities that are applying best practices.

Key Messages

We identified and evaluated barriers to widely accessible, high quality, affordable post-secondary education and we recommend corresponding best practices.

1. **Unequal access -** Higher education remains inaccessible due to geography, cost, and opaque admissions processes. Administrators should work with funders to reduce costs and/or offer paid work opportunities. Accessibility can be improved through in-person, online, and hybrid programs with flexible scheduling. Admissions processes should be standardized, transparent, and equitable.
2. **Attrition and inequities in retention.** Only 73% of students who enroll in undergraduate programs in Canada complete their degree within 6 years. Higher education must provide value and improve job outcomes, without throwing students deeply into debt. Combined with reimagined student health, counseling, and work-study opportunities, students will be more likely to stay in school.
3. **Student health and well-being.** Most campus health and well-being programs and policies focus on responding to mental health crises, rather than preventing them. Schools should proactively reduce environmental stressors and promote protective factors.
4. **Difficulties transforming higher education in colonial contexts.** Efforts to hire and recruit more Indigenous faculty and students, to incorporate Indigenous content into the curriculum, and strengthen relationships with local Indigenous communities remain tokenistic, superficial, and respond selectively to Indigenous concerns. Any reimagining of Canadian Higher Ed must be considered within the frame of reconciliation, in consultation with Indigenous leaders, and with the aim to cause no further harm.
5. **Weak utilization of technology.** Institutions taking advantage of technological innovations are best positioned to prepare students for the 21st century. Technology can play a role in analytics and providing formative feedback, by tracking engagement and learning in real time as well as providing access to high-quality and affordable learning opportunities, course content, and materials. New technologies alone won't transform how we learn, and must play a secondary role to pedagogical innovations in the future of the classroom.
6. **Outmoded teaching methods and content.** Lectures are far less effective than active learning techniques in which instructors guide students to discover the knowledge themselves. The science of learning offers practices for educational institutions to put in place to foster a deep engagement with varying forms of knowledge.
7. **Changing nature of knowledge.** Rapid advances in scholarship require instructors to stay up-to-date on the newest research, and pedagogical innovations while resisting the temptation to let their content stagnate.
8. **Graduates lack preparedness.** Employers report that graduates lack critical thinking, written and oral communication skills, and an ability to self-teach skills for success. Graduates who've encountered supportive relationships with professors and mentors, and deep learning and experiential opportunities, are three times more likely to be engaged in their work, are more productive, are less likely to be absent, have lower turnover, fewer safety incidents and are more profitable.

Methodology

In Phase 1, we performed a literature search yielding 3,000+ documents. After screening, we retained 172 works which we analyzed to extract current and best practices for curriculum development; pedagogical frameworks; implementing the science of learning; and new methodologies and innovations. We then identified reimagined colleges and universities, yielding a set of 33 institutions for further study.

In Phase 2, we searched news reports, articles, and interviews with stakeholders to obtain more detailed information about the 33 institutions identified in Phase 1. We sorted that information according to key concepts identified in Phase 1, and created a rubric for evaluating the institutions. After applying the rubric, 12 institutions were found to be both qualitatively and quantitatively distinctive from the others.

In Phase 3, we synthesized results from Phases 1 and 2 to recommend best practices for the future of higher education.

Education is not the filling of a pail, but the lighting of a fire.
—Plutarch

Education…is being able to differentiate between what you do know and what you don't.
—Anatole France

Background

Our current system of higher education is challenged by a range of fundamental problems related to access, quality, and cost (Kosslyn & Nelson, 2017). Many qualified students around the world do not have access to a first-rate post-secondary education (Craig, 2017; Watkins, 2013). Students who do attend are often intellectually disengaged (Kosslyn & Nelson, 2017) and many find they are neither prepared to enter the job market, nor to succeed once they do. Knowledge, particularly scientific and technical, changes so rapidly that it becomes quickly outdated. In nearly every economic sector, job descriptions change rapidly and require an ability to stay mentally nimble and able to learn new skills and concepts on the job. Increased globalization in the digital economy requires us to interact with co-workers from different backgrounds and customs more than we have before.

In the summer of 2021, a Google search of *what's wrong with higher education* yielded 11 billion results. Articles bemoaning a broken system have appeared in *The Harvard Business Review, The Atlantic, The Chronicle of Higher Education, Forbes, The Wall Street Journal, Inside Higher Ed,* and *MacLeans.* Chief among a long litany of complaints are costs (they've risen 145% faster than inflation; Chamorro-Premuzic & Frankiewicz, 2019), and the changing nature of the employment landscape as the economy becomes increasingly global, industries become increasingly automated, and both employers and college graduates find that there is a gross mismatch between what is taught in school and what is needed in the workplace. The last five years have brought to the fore a long overdue grappling with a range of inequities in higher education that perpetuate existing disparities between privileged and underprivileged students, and make it difficult for many to reap the benefits of education. Widespread digitization and the rise of social media have changed the way we obtain information; but, have in many respects done us all a disservice, as it becomes increasingly difficult to know what is true and what is not. The COVID-19 pandemic that persists as of this writing further exposed a number of flaws in higher education, and exacerbated the lack of critical thinking skills in the general population, resulting in the current anti-vaccine movement.

As educators and students ourselves, we are particularly drawn to the gap between what has been well known in the peer-reviewed literature on the science of learning, and the way that colleges and universities teach. Learning and teaching practices within mainstream higher education have changed surprisingly little over hundreds of years. If we could reinvent higher education for the twenty-first century, what would it look like? We argue it should be lighting fires and teaching humility (stimulating students to become lifelong learners by acknowledging that they don't know everything), and it should transform entrenched systems towards inclusivity and equitability.

Pockets of innovation are found in almost every institution. For example, the National Center for Academic Transformation (NCAT) Pew Grant Program in Course Redesign supported colleges and universities in redesigning instruction using technology to achieve quality enhancements and cost savings starting in 1999 (Twigg, 2015). Initially, 30 institutions redesigned one large-enrollment introductory course. By 2015, NCAT and its partner colleges and universities had completed 156 redesign projects. Seventy-two percent improved student learning outcomes, while 28% showed learning equivalent to traditional formats; 98% reduced their costs by 1/3 on average (ranging from 4 to 81%). Other positive outcomes include increased course completion rates, better student attitudes toward the subject matter, and increased student and faculty satisfaction with the new mode of instruction. Yet few institutions have fundamentally changed how they teach. Inertia and complacency are powerful.

Those who address these issues tend to focus on modifying existing systems rather than specifying the goals of higher education and developing educational processes from the ground up to achieve those goals (Carey, 2015; Craig, 2015; Selingo, 2013). Our ambition is to outline best practices in providing wide access to high-quality post-secondary education at a low cost.

THE TRIANGLE OF
REIMAGINED HIGHER EDUCATION

Accessible,
High Quality,
& Affordable
Higher Education
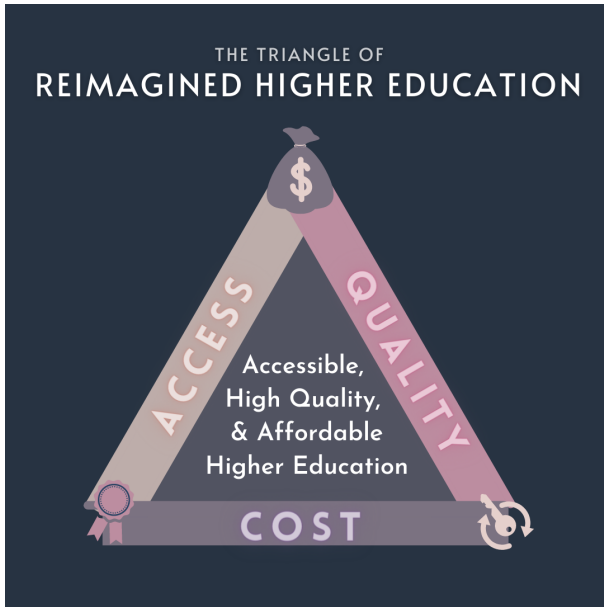
We can think of these three vectors—access, quality, and cost—as forming a triangle to represent new and reimagined models of higher education. Access, quality, and cost are each important, but often seem to be in tension with one another; making changes to one side of the triangle distorts one or both of the other sides.

Online, blended, and hybrid learning have become an important part of Canadian post-secondary education and are likely to become more prevalent (Donovan et al., 2019; Taylor, Atas & Ghani, 2017), with most institutions recognizing that online learning is critical for their future. Online learning can help solve the problem of cost and access (provided that students have access to a high speed internet connection, which is not a given), and it can increase engagement, if properly implemented.

Our modern notion of the university is based on a model begun in western Europe around the year 1050, and not much has changed, despite advances in the science of learning. As one recent paper noted, learning is not a spectator sport—doing is better than watching or listening (Koedinger, et al,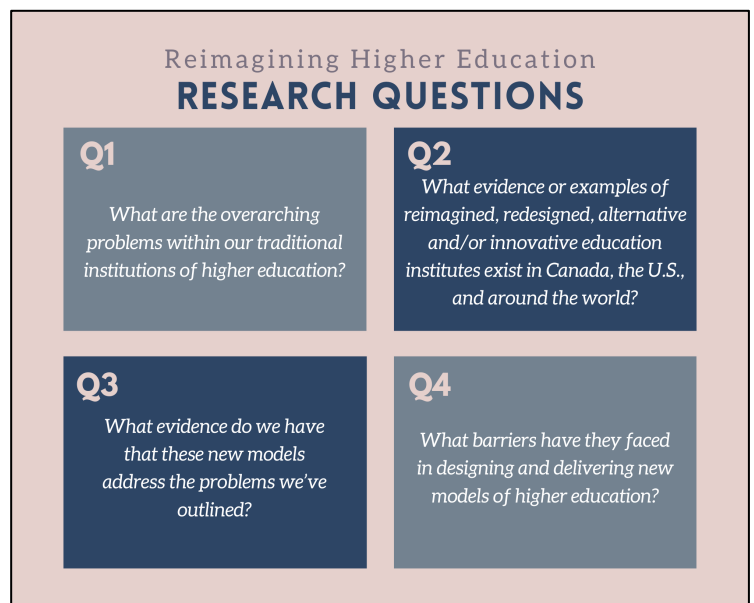 2015). It has long been known that lectures, during which students sit passively and listen, are among the *worst* ways to learn, and yet even in our best universities, students are lectured to rather than engaged with (Fagen, Crouch & Mazur, 2002; Schmidt et al, 2015). Students in traditional stand-and-deliver "sage on a stage" classrooms are 1.5 times more likely to fail as students in active learning classrooms (Freeman et al, 2014). Evaluation of students is often relegated to multiple choice tests rather than engaging in debate, discussion, or writing of scholarly papers. This not only denies students the opportunity for formative feedback, but practices them in something that is of little value in the workplace. And, to Anatole France's point, it makes them overconfident, believing that they know more than they do.

The concepts and skills that students ostensibly learn leave many unprepared for life after graduation, to succeed personally and professionally in a highly complex and competitive world (Bok, 2013; Bowen & McPherson, 2016). Preparing students for effective civic engagement is also a fundamental responsibility of post-secondary education. The skills and tools needed for effective citizenship—problem-solving, critical and creative thinking, cooperation, tolerance, and collaboration—align with those needed for success in the workforce.

Objectives

Our objective is to contribute to SSHRC's mandate to foster a deeper understanding of the state of knowledge on the implications of digital technologies for students and workers in a global landscape. In recognition of diversity, equity and inclusion in Canadian society, we cast a wide net to discover existing reimagined, alternative, and Indigenous models of higher education (indeed, the membership of our research team represented diverse backgrounds, opinions, and eight different national origins). The intended outcome is to add to Canadians' understanding and knowledge of various models of higher education and how they are preparing individuals for employment in the digital economy.

The main purpose of this knowledge synthesis project was to identify best practices in designing flexible learning experiences to meet key learning objectives, engage students, prepare graduates for success in the global digital economy, and deliver high quality, equitable education at

Reimagining Higher Education
RESEARCH QUESTIONS

Q1
What are the overarching problems within our traditional institutions of higher education?

Q2
What evidence or examples of reimagined, redesigned, alternative and/or innovative education institutes exist in Canada, the U.S., and around the world?

Q3
What evidence do we have that these new models address the problems we've outlined?

Q4
What barriers have they faced in designing and delivering new models of higher education?

reduced costs. We expect this report will be of value to institutions of higher education as they recover from the COVID-19 crisis and increasingly maneuver into digital learning environments. Our investigation was guided by four research questions (inset).

The significance of this project is to prepare Canada for the possibility of a prolonged and/or future pandemic lockdown period, and to use the current crisis as an opportunity to reimagine and reinvent higher education so that it better serves the needs of students and the future employers, rather than maintaining a status quo that benefits professors and administrators, but by many measures, provides true education to only a select few. Addressing inequities in educational styles and opportunities, this new approach promises to positively transform Canadian higher education, and ultimately Canadian society.

Methodology

In Phase 1, we performed a structured literature search using seven databases: Academic Search Complete, APA PsycInfo®, ERIC, Google Scholar, PubMed®, Scopus®, and broad web searches of "grey literature," stakeholder interviews, conference presentations, and public talks using Google and DuckDuckGo. Search terms were determined in consultation with research librarians at McGill University, University of California Berkeley, and Claremont Colleges. Search terms used were: "redesigned" "reimagined" "innovative" "new model" "alternative model" "indigenous model" "science of learning" "barriers" "best practices" "higher education" "post-secondary education" "university" and "college" (and combinations thereof).
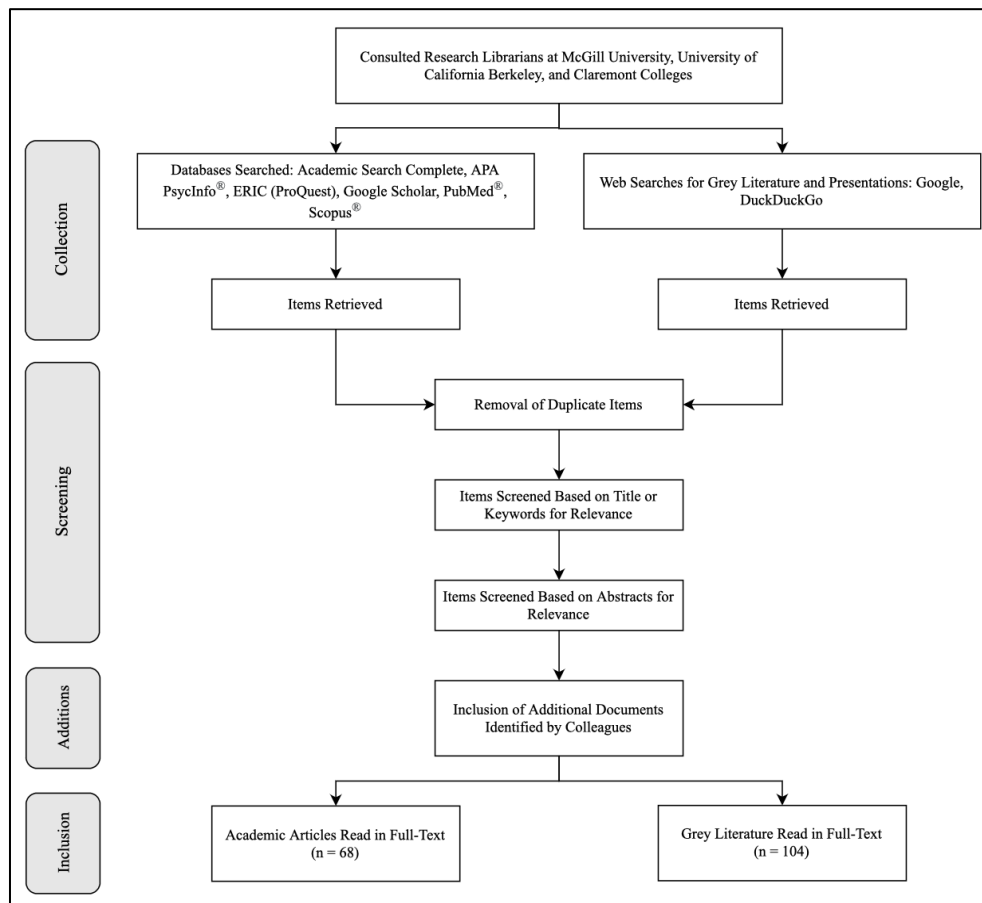
Figure 1. Flowchart of structured literature search

Our literature search returned over 3,000 documents. In a two-stage screening process (Figure 1), the titles and keywords of each document were used to assess relevance, and then the abstract or summary of each document was read by at least two researchers to confirm relevance to the study. Our search also returned 33 universities that we retained for further study in Phase 2.

In Phase 2, we conducted internet searches of news reports, articles, and interviews with stakeholders to obtain more detailed information about the 33 institutions identified in Phase 1, including basic demographics, cost and financial aid information, curriculum and pedagogical approach, student support systems, retention rates, completion rates, and goals of the institution.

We devised a rubric, based on Phase 1, to evaluate the performance of each on the problems of access, cost, and quality. Each school was independently evaluated by two researchers and disagreements were resolved through discussion. Following a procedure similar to doctoral student admissions, a committee, formed of the authors and other lab members, discussed each of the colleges while consulting the rubric scores, and assigned it a grade of A (include in report), B (possibly include), or C (exclude). Schools receiving a grade of A or B that had been in operation for at least 5 years qualified for more focus and research after which they were retained or eliminated. Those for which additional, detailed information was unavailable through primary sources were eliminated. The evaluative process yielded 12 innovative and unique institutions, in Canada, the U.S., and Australia. Finally, we synthesized our findings to outline what the higher education community is doing to improve all students' access and success, and how promising practices can be applied more broadly. We described the goals, attributes, and benefits of new teaching models. Then we identified best practices to help institutions design flexible learning experiences that meet key learning objectives, engage students, and allow instructors to add value in new ways, while embracing diversity, and lowering costs.

Results

Research Question 1: What are the overarching problems within our traditional institutions of higher education?

Through our literature search we identified nine barriers to widely accessible, high quality, affordable post-secondary education. These fell into two broad categories: (1) reasons students do not receive university degrees (unequal financial access, unequal geographic accessibility, lack of admissions transparency, attrition and inequities in retention, student health and well-being, and difficulties transforming higher education in colonial contexts) and (2) reasons students are unprepared for the real world after graduation (weak utilization of technology for pedagogical improvements, outmoded teaching methods and content, and lack of career relevant skills).

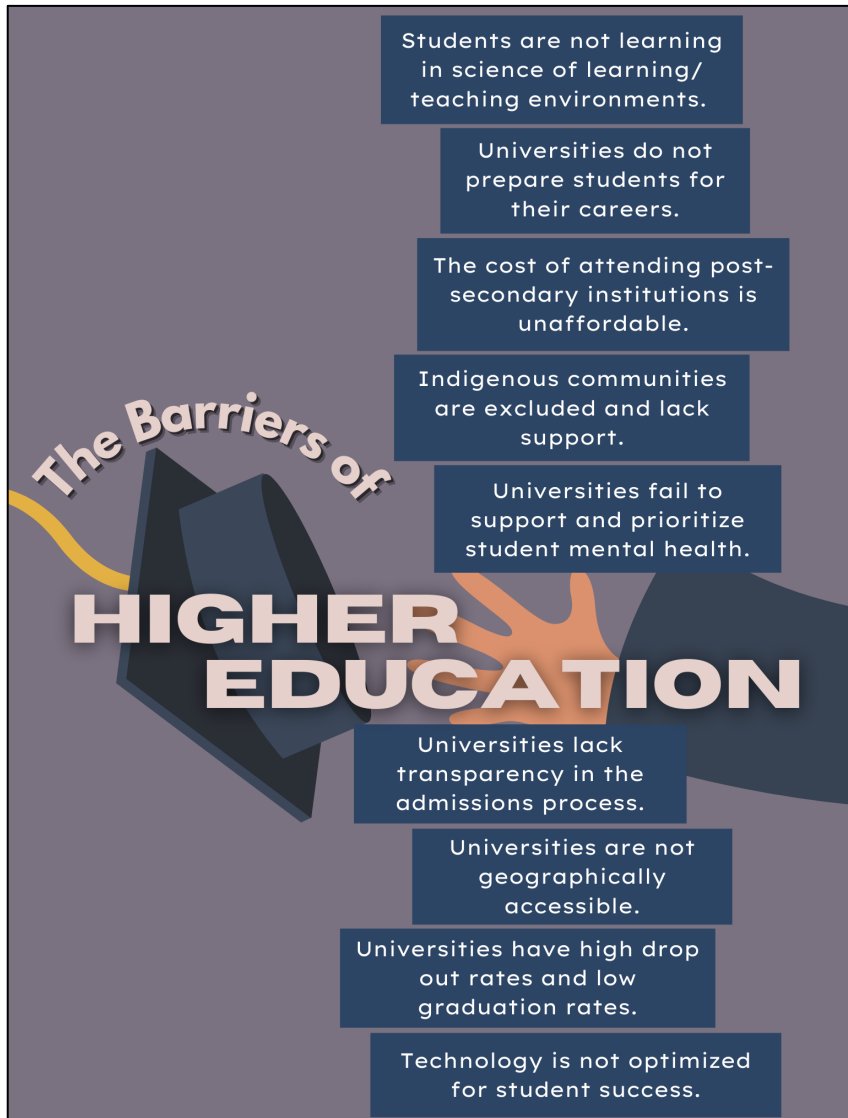*Unequal Access* (*Financial Accessibility, Admissions Transparency,* and *Geographic Accessibility*)

Universities are too expensive for much of the population, and more than half of Canadians who do attend incur governmental debt at an average of $28,000 per student (Statistics Canada, 2018). Students who supplement student loans with credit cards, bank loans or lines of credit, incur an average debt balance upon graduation of $44,200 (Statistics Canada, 2014). This poses obvious challenges for graduates' financial independence, and extensive costs are assumed by government, taxpayers, and private entities in the form of subsidies, grants, processing and collection fees (Kelly & Carey, 2013).

Fewer than six percent of youths claim that finances constitute a barrier to post-secondary education, and institutions continue to experience increases in attendance, especially among lower-income families (Finnie, Wismer, & Mueller, 2015; Vaccaro, 2012). This might lead us to believe that finances do not limit students' access to higher education, but the issue of financial inaccessibility to higher education is more complex than that. The reality is that many students don't have enough money, and must choose between essentials like food, housing, and textbooks. Forty percent of students across Canada report some form of food insecurity, significantly affecting physical and mental health. Almost half of Canada's students report that they had to sacrifice buying healthy food to pay for expenses such as rent, tuition and textbooks (Silverthorn, 2016). More vulnerable students, including Indigenous students, students of colour and student parents, report even higher degrees of food insecurity. There are numerous systemic factors that hinder post-secondary access, especially in marginalized communities. Students from minority populations and low socioeconomic status are particularly vulnerable to these barriers, especially those whose parents did not pursue higher education (Galarneau & Gibson, 2020).

Even applying to colleges and universities can impose a financial hardship. Colleges Ontario, e.g., requires a $95 non-refundable application fee. Canadian University application fees range from $40 to over $200. Many students and families complain that higher education "costs too much," which could reflect a low perceived value of attending college or university (Finnie, Wismer, & Mueller, 2015). Many factors influence perceived value including low perceptions of one's own academic abilities or job prospects, family socioeconomic status, and income. There is a positive correlation between university access and parental education (Finnie, Wismer, & Mueller, 2015) and post-secondary education aspirations are negatively correlated

with parental education and family income. Perceptions of expenses and post-graduation debt can interfere with one's chance completing a degree, thus many prospective students do not even attend to avoid borrowing money (Burdman, 2005).

Students from low SES families tend to have lower educational aspirations. In many Canadian high schools, these students are identified and streamlined into non-academic programs making them less likely to attend a post-secondary institution (Finnie, Wismer, & Mueller, 2015; Robson, Anisef, & Brown, 2016). These findings point to the need for a more developed "college-going culture," or environments where post-secondary education is more highly valued, especially among youth who may not receive this support at home, to mitigate the perception that college or university is not worth the cost.

The Barriers of HIGHER EDUCATION

- Students are not learning in science of learning/ teaching environments.
- Universities do not prepare students for their careers.
- The cost of attending post-secondary institutions is unaffordable.
- Indigenous communities are excluded and lack support.
- Universities fail to support and prioritize student mental health.
- Universities lack transparency in the admissions process.
- Universities are not geographically accessible.
- Universities have high drop out rates and low graduation rates.
- Technology is not optimized for student success.

Overall costs and perceived value are not the only obstacles. Many top American universities maintain quotas on how many non-American students they admit (Bi, 2018; Hartocollis, 2020). While Canadian universities do not impose these quotas, our admissions process presents other barriers. It is unclear to applicants what criteria institutions prioritize when admitting new students. This lack of transparency makes it difficult for students to choose a program that is a good fit with their goals and skills, to understand their chances of admission, and to know what in the application itself to focus on. The "holistic review process" can improve equity when student applications are reviewed in a wider context than just grades and test scores. A holistic review takes into consideration factors that affect school performance such as family background, participation in extracurricular activities, and the need to work while in high school or provide sibling care. In this way, unique challenges faced and overcome by particular applicants are considered. Even so, biases can infiltrate this process, as when admissions officers succumb to the halo effect, reverse halo effect, or confirmation bias (Sukumar & Metoyer, 2018).

Affirmative action remains a contentious issue; underprivileged students admitted on a contextual basis often lack the proper resources to succeed once enrolled. The lack of transparency in admissions processes makes it difficult to understand how applicants are selected, and the existing data remain unclear about the extent to which affirmative-action programs are fulfilling their goals (Arcidiacono, Kinsler, & Ransom, 2020).

Increased transnational education is driven by rising income levels in developing countries, technological improvements, and increased value of intercultural skills but many economies—and promising young students throughout the world—are being left behind. On the plus side, global education has increased in size (both enrollment and available programs) and has increased in diversity of delivery. Some of the methods of delivery of transnational education include international branch campuses, partnerships with international institutions, study abroad, joint degree programs at multiple institutions, and short-term or partial credit programs. Data also suggest that increasing transnational education is positively correlated with higher levels of societal development (British Council, 2013).

While the Gross Enrollment Ratio (GER), measuring the percentage of the population enrolled in post-secondary education within 5 years of graduating secondary school, increased approximately 20% between 2000 and 2018, nearly two thirds of recent high school graduates worldwide still do not have access to higher education (Nascimento et al., 2020; World Bank, 2020). Additionally, the GER does not take into account regional disparities and inequalities in access. While the internet and globalisation offer the opportunity for institutions to share tools and content internationally, the digital divide—lack of access to high speed internet and to tablets or laptops—is an obstacle to true universal access to education (Huijser, Bedford, & Bull, 2008).

A growing body of research suggests that close proximity to post-secondary education institutions has a positive impact on participation rates, particularly for lower- and middle-income families, in part because it allows students to live at home where they can save rent money, and help to supervise younger siblings while parents work, often in multiple jobs (Frenette, 2006; Gibbons & Vignoles, 2012; Looker, 2009; Turley, 2009; Turley, Desmond, & Bruch, 2010). Approximately 20% of Canadian high school students live more than 80 km from a university and are 42% less likely to attend, even after accounting for family income, parental educational attainment, gender, and province (Frenette, 2006).

Attrition and Inequities in Retention

More than half of students who attend post-secondary institutions don't graduate (Bowen & McPherson, 2016). In Canada, only 73% of students who enroll in undergraduate programs complete their degree within 6 years, while only 69% of students pursuing certificate or associate degrees earn these credentials within 3 years (Statistics Canada, 2021). Completion rates are disturbingly unequal, when further analyzed by student demographic characteristics (see Figure 2; Statistics Canada, 2010).
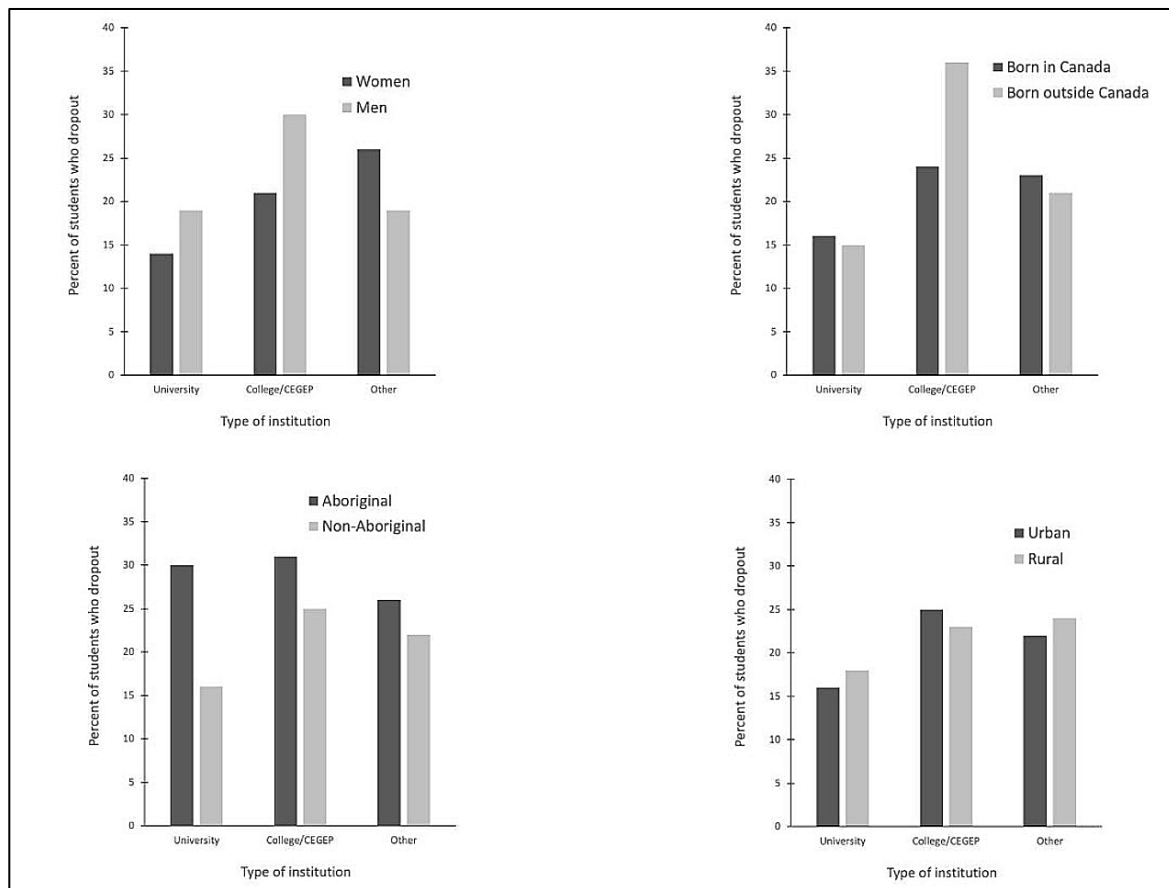
Figure 2. Disparities in dropout rates in Canadian higher education.

Women complete their studies at higher rates than men, but little information is available on graduation rates for transgender and non-binary students. Students from rural areas complete their studies at significantly lower rates than their

urban peers. Low-income students complete at lower rates than their high-income counterparts. Students who attend part-time (often working adults and young parents) also complete at much lower rates than those who attend full-time. Indigenous youth successfully complete their studies at significantly lower rates than their non-Indigenous peers (First Nations Post-Secondary Education, 2018; Statistics Canada, 2010), further exacerbating historic inequities in opportunity. Few do well in school or go into higher education because of poverty, parents and relatives with substance abuse challenges, life in rural areas (far from good educational resources), the need to work at a young age, lack of mentoring—and, in a vicious cycle—lack of role models. These disparities reflect and reinforce societal inequities, obstructing social progress.

An additional problem is that few schools provide the support systems necessary for individuals with various disabilities, such as visual or hearing impairment, mobility problems, or learning disabilities to truly have equivalent learning experiences to the majority. Hearing impaired individuals have been all but ignored in discussions about EDI (Equity, Diversity and Inclusion) and technological solutions need to be given greater urgency. For example, visually impaired students (and indeed almost everyone else) can use voice assistants such as Alexa and Siri to give voice commands for internet searches or for voice-to-text transcription. The equivalent for hearing impaired individuals could use computer vision (Wadhawan & Kumar, 2020) or sensor gloves to track visual sign language (Bazarevsky & Zhang, 2019; Das, et al, 2016), which are currently in development as prototypes.

Student Health and Well-being (Poor Mental Health Resources)

The mental health of university students is a public health concern with an increasing body of empirical research suggesting that university students are at very high risk for psychological distress and mental disorders (e.g., Eisenberg, Hunt, & Speer, 2013; Larcombe et al., 2016; Orgyen, 2017; Royal College of Psychiatrists, 2011; Stallman, 2010). Twenty-six percent of Canadian post-secondary students report having been diagnosed or treated by a professional for one or more mental health conditions (with anxiety and depression being the most frequent). More than 60% of students report feeling more than average levels of stress, feelings that life is hopeless, and overwhelming anxiety. Almost half report feeling so depressed it was difficult to function at some point, and 13% reported having seriously considered suicide (ACHA, 2016). While many factors can affect students' mental health, academic and financial stressors have a particularly negative impact (EPI, 2018; Beiter et al., 2015). Few institutions of higher education are designed to promote student health and well-being, often emphasizing competition over cooperation, evaluation over education, and promoting memorization over true understanding.

Many academic institutions have introduced mental health strategies and wellness programs, but there exists a lack of comprehensive, structured, and integrated approaches to health and wellness (Hill-Mey et al., 2015). Programs and policies focus on responding to mental health crises, rather than preventing such emergencies in the first place. There has been little research on the measures that universities could take to reduce environmental stressors and promote protective factors in the university environment. It is time that universities adopted a proactive approach to address the many challenges we know students face.

The structure, strategic goals, policies, and practices of a postsecondary institution all influence student and employee mental health, which in turn, affects learning. Prolonged psychological distress impairs information processing, attention, memory, decision-making, motivation, immune system function, and impulse control, reducing students' capacity to learn and participate (Maslach, Schaufeli, & Leiter, 2001; Marin et al., 2011). Further, psychological distress does not affect individual students in a vacuum; rather, it can manifest in disturbing, disruptive, or aggressive behaviors that affect both peers and university staff (Brooker, Baik, & Larcombe, 2017; Kitrow, 2003). Innovative and evidence-based practices are needed for students, faculty, and staff to improve population health outcomes and enhance overall well-being. Learning experiences and environment—classroom culture, course design, curriculum, teaching practices, assessment, assignments, physical spaces, and instructors—can have either a positive or a negative effect on student health and well-being, which in turn impacts deep learning (Adler, 2016; Di Placito-De Rango, 2018; Farr, 2018; Fernandez et al, 2016; Harward, 2016; Stanton, Zandvliet, Black & Dhaliwal, 2016; Zandvliet, Stanton & Dhaliwal, 2019).

Difficulties Transforming Higher Education in Colonial Contexts (Indigenous Inclusion)

Though there is cultural variability across tribes and groups, the pedagogical practices of Indigenous peoples in Canada share a number of common features, many of which overlap with the "new" principles of the science of learning, including connections to culture (the sacred), nature, hands-on activities, differentiated instruction and assessment, connections to real life experiences, multileveled questions, storytelling, group discussions, and experiential land-based activities (Matilpi, 2012;

Wyatt, 2009). Beyond transforming teaching, the 21ˢᵗ Century classroom needs to ensure that content engages with foundations in human rights education. Ensuring that Indigenous students have a voice within the classroom is crucial to helping members of this community gain a sense of ownership within the institution, and of being able to guide their own futures within a Canadian governmental organization. In recognizing the value of individual voices, Indigenous students find a sense of belonging in academic contexts leading to further engagement in classrooms and better academic outcomes (Matipli, 2012).

The classroom must be welcoming and foster consistency in expectations regarding respectful behavior, acceptance of differences and risk taking in learning (Wallace, 2011).

The Truth and Reconciliation Commission (TRC) of Canada report and corresponding calls to action prompted many institutions to move toward reconciliation by extending earlier efforts that make space for Indigenous peoples and knowledge in higher education. Efforts manifested through commitments to hire more Indigenous faculty, recruit more Indigenous students, incorporate Indigenous content into existing courses or create entirely new ones, and strengthen relationships with local Indigenous communities. However, many of these efforts remain tokenistic, superficial, and respond only selectively to Indigenous concerns (Stein, 2020). Any reimagining of what the Canadian University could and should be, must be considered within the frame of reconciliation, in consultation with Indigenous peoples, and with the aim to cause no further harm.

The 11ᵗʰ Call to Action calls for "adequate funding to end the backlog of First Nations students seeking post-secondary education" (TRC, 2012). The Post-Secondary Student Support Program (PSSSP) federal program attempts to address this issue to provide First Nations students with funding for post-secondary education in Canada (Government of Canada, n.d.). The amount of funding received depends on the overall amount of funding in the program, the number of recipients selected, and the total costs for tuition, books, travel support, and living allowances (Government of Canada, n.d.). Any First Nations post-secondary student who maintains satisfactory academic standing within an eligible post-secondary institution may apply for assistance through PSSSP. Since 1996, the number of students funded through PSSSP has never exceeded 25,000 students, despite growing First Nations populations and increased high school graduation rates, and the program has consistently assisted only approximately 14% of students enrolled in the program (First Nations Post-Secondary Education, 2018). The growth of Indigenous populations in Canada in comparison to non-Indigenous youth reflects the increasing need for financial aid for Indigenous students (Indian and Northern Affairs Canada, 2010). This effort to address the 11th TRC call to action is failing to fulfill its goal to the fullest extent, and many Indigenous students are still left without financial assistance when seeking post-secondary education. While the majority of First Nations people manage to obtain trade or college level certification, an education gap persists between Indigenous and non-Indigenous populations such that non-Indigenous students attain more university certificates, diplomas or degrees than Indigenous students (First Nations Post-Secondary Education, 2018).

The 16ᵗʰ Call to Action of the TRC states that universities and college degree and diploma programs be created in Aboriginal (Indigenous) languages (TRC, 2012). More than 30 Indigenous languages are currently taught at Canadian universities and 3/4ths of these universities offer programs specifically designed for Indigenous students or have an Indigenous focus (MacDonald, 2016). The University of British Columbia Okanagan has launched Canada's first Indigenous language degree program, the Bachelor of Nsyilxcn Language Fluency, to revitalize an endangered language (Universities Canada, 2019). These efforts are particularly important in reimagining higher education due to the oppressive history of Canada's residential schools in which Indigenous students were forced to live and study away from their families and culture with the goal of assimilating them into dominant Canadian culture (Logan, 2015; Sterzuk & Fayant, 2016). Creating meaningful inclusion of Indigenous languages and their speakers is a vital action to move effectively toward reconciliation (Sterzuk & Fayant, 2016) and a full experience of co-ownership in the higher education system.

The 24ᵗʰ and 28ᵗʰ Calls to Action call for medical, nursing schools and law schools in Canada to require all students to take a course on Indigenous people in relation to health and justice, covering the history and legacy of residential schools, Indigenous knowledge and practices, and general skills-based training in, "intercultural competency, conflict resolution, human rights, and anti-racism" (TRC, 2012). These items relate to the systemic racism that many Indigenous people encounter in the healthcare and justice systems and to date, no significant progress has been made towards eliminating it (Jewell & Mosby, 2020). The University of Ottawa, McGill University, and University of British Columbia offer Indigenous health programs through their medical schools that aim to increase the number of Indigenous health professionals across Canada as well as teaching all future health professionals about the health needs of Indigenous peoples. The University of Victoria introduced a four-year JD/JID program offering both Indigenous and non-Indigenous law studies, the first joint degree program of its kind anywhere in the

world: students graduate with two professional degrees in Canadian Common Law and Indigenous Legal Orders (Universities Canada, 2019). Many other Canadian universities such as University of Saskatchewan, University of Toronto, and University of Alberta also offer Indigenous law degree programs or Indigenous specializations within their existing law programs.

Finally, Call to Action 62 directs all levels of government to fund education of teachers on how to integrate Indigenous knowledge and teaching methods into post-secondary classrooms (TRC, 2012). Teachers are being educated on Indigenous reconciliation, for example through Indigenous Requirement Courses at the Ontario Institute for Studies in Education at University of Toronto, but student reactions and enthusiasm have been mixed (Jewell & Mosby, 2012; 2020). In British Columbia, all teachers graduating from teacher education programs must complete one course related to the historical context of Indigenous learners and students, but it is unclear what has been done on a Federal level to address the issue of funding teacher education on Indigenous reconciliation (British Columbia Ministry of Education, n.d.). A main goal of higher education institutions of the future must be to create space for meaningful inclusion of Indigenous cultures, languages, practices, perspectives, and knowledge in institutionalized spaces in order close this education gap and to be a truly inclusive society.

Weak Utilization of Technology for Pedagogical Improvements

Other sectors of the Canadian economy, such as banking, music, and publishing, have been revolutionized by digital technology, but higher education has not fully exploited the potential of new technologies. Those Institutions that do take advantage of technological (and pedagogical) innovations are best positioned to prepare students for skills and work in the digital economy. But change in higher education is slow. It happens through punctuated equilibrium—long periods of relatively slow change tend to be interspersed with occasional periods of rapid adaptation. In early 2020, higher education experienced a punctuated moment as they scrambled to move their teaching activities online in response to the COVID-19 outbreak. This unexpected and abrupt shift to remote instruction further highlighted the need to rethink our outdated and inflexible systems. In attempting to replicate in-person assessments in online settings, many institutions recognized that a change of medium required a change of design—focusing less on testing and thinking more about learning—a change long overdue.
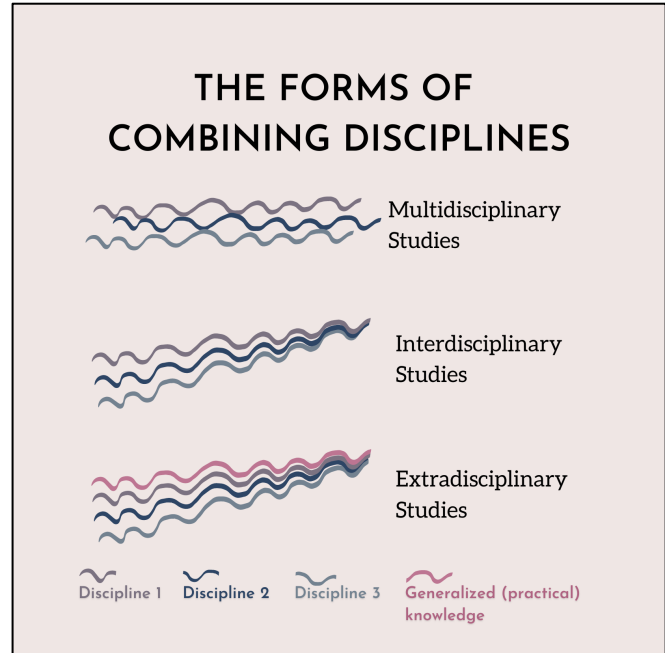
The pandemic has exposed inadequacies in our current model. To paraphrase Marshall McLuhan, in education the medium is the message. The book and the lecture are not the only technologies upon which universities can base instruction. They make good supplements but are an inadequate substitute for active student engagement. As the emergency subsides, we should not return to a "normal" that was not working. What started as a short-term response to a crisis could—and should—become a catalyst for transforming higher education. How might we make this an opportunity to rebuild an educational system that is equitable for all, rather than undertaking repairs to one that is designed for a particular kind of student to succeed?

Outmoded Teaching Methods and Content (Changing Nature of Knowledge and Interdisciplinary Studies)

While scientific and technical information are growing exponentially, data should not be confused with knowledge. Knowledge is more than the collection of information. Academic knowledge should be transparent, codifiable, reproducible, communicable, and training should employ abstraction, deduction, induction, and generalizations to arrive at logical conclusions, based upon evidence (Bates, 2015). To arrive at such evidence, knowledge necessitates tools of collection, such as are found in science, to test hypotheses and theorize ways of understanding the world (McIntyre, 2019). Not only do the techniques of arriving at knowledge develop over time (e.g., the invention of the telescope, the decoding of the human genome), the collective knowledge itself is dynamic and must be reactive to recent discoveries and explorations (e.g., the Copernican System replacing the Geocentric Model). Because of the bipartite nature of knowledge, including both epistemology and information, the rate of change of knowledge challenges education's adaptation speed and ability. Education is the language by which knowledge is communicated, revised, and created.

In extending the work of Menken et al (2016), we add a distinction between integrating multiple disciplines involved in *inter*disciplinary studies, and bringing in sources of real world experience and practical knowledge from outside traditional academic disciplines to achieve *extra*disciplinary learning (inset).

The creation and implementation of *inter*disciplinary studies blends academic disciplines to give rise to unique knowledge. *Extra*disciplinary programs may involve internships, volunteer work, and similar opportunities to prepare students for success in the workplace, addressing employer needs of highly skilled students who can digest knowledge across many disciplines and traditions. For career-relevant skills, employers seek students well-rounded in "the ability to communicate clearly, both in writing and orally, teamwork, ethical decision making, critical thinking, and the ability to apply knowledge in complex, multidimensional, and multidisciplinary settings" (Bear & Skorton, 2019). Transdisciplinary programs coupled with up-to-date forms of knowledge encourage students to learn to draw unforeseen connections and develop communicative skills for ultimate academic and career achievement.

THE FORMS OF COMBINING DISCIPLINES

Multidisciplinary Studies

Interdisciplinary Studies

Extradisciplinary Studies

Discipline 1   Discipline 2   Discipline 3   Generalized (practical) knowledge

*Outmoded Teaching Methods and Content (Failure to use the science of learning)*

Information is the content that forms the building blocks of knowledge. It is not itself knowledge, which requires understanding, context, and judgement. On the internet, information is cheap; true knowledge is difficult to acquire. The science of learning tells us that knowledge must be constructed; the student's brain is not an empty vessel waiting to be filled (King, 1993), but a dynamic complex system through which connections must continually be made and updated to achieve the sort of knowledge that can be applied in new situations. Higher education currently focuses primarily on how students consolidate, retain, and internalize information. Little attention is put on the acquisition of new information outside of what is taught in textbooks and lectures. That is, students are not typically taught the skills necessary to learn on their own, to incorporate new information as it becomes available—to become lifelong learners, something that most careers require.

Researchers in educational and cognitive psychology have learned a great deal about learning and memory over the last three decades, but little of it has made its way into the classroom (Kosslyn, 2017). The accumulated knowledge from the science of learning should be used intentionally to help students master the material they need to know. Presently, it is the responsibility of the *student* to stay engaged, but the science teaches us that successful classrooms are those in which the *instructor* takes responsibility for student engagement (Franklin & Harrington, 2019). Instructors often retain outdated syllabi and textbooks out of convenience. Most classes are taught using methods that were developed over a thousand years ago; lectures remain common because they are a convenient and efficient way to teach, serving the needs of everyone but the students. But we must distinguish teaching from learning. Numerous studies have documented lectures are a terrible way for students to acquire information (Freeman et al., 2014). The founder of the Department of Psychology at MIT, Hans-Lukas Teuber, once quipped that "lectures are the fastest way to get information from the mouths of professors to the notebooks of students, without going through the minds of either" (Teuber, 1976). Teaching focuses on *information transmission*, whereas learning should focus on *knowledge acquisition*. Successful course planning and teaching should be a goal-oriented process with the instructor defining the desired skills and outcomes to be acquired and adopting the best teaching practices to maximize student acquisition of these skills (Davidovitch, N., & Shiller, Z., 2016) through active learning.

If everyone learned the same way, teaching would be easy. Effective teaching requires a deep appreciation for the varied backgrounds, culture, opportunity, and experience different students bring to the classroom. All too often the classroom is a place where advantaged students show off what they already learned at home, while disadvantaged students try to avoid being caught not knowing the right answers to questions about material that hasn't been taught yet (Varenne & McDermott, 2018). Senior university administrators must create space for faculty to prioritize innovation and improvements in pedagogy and teaching. Faculty should be encouraged or incentivized to become excellent teachers, rather than rewarding only excellence in

research (Bradforth et al., 2015). Education should extend beyond the walls of the classroom to include internships, laboratories, research projects and real-world experiences. Institutions will need to rethink how they allocate resources and create an infrastructure to support outreach to accomplish these goals.

What is the alternative? Best practices use class time for the construction of meaning rather than information transmission. This is best realized in the *flipped classroom* in which students complete coursework prior to class and then participate in problem solving activities during class (Herreid & Schiller, 2013; Knight & Brame, 2018; Mazur, 1997). The benefits of the flipped classroom include increased student engagement and achievement, more effective use of instructor time, and flexibility in pacing. Students can watch or review lecture material if they miss class, promoting thinking both inside and outside of the classroom (Fulton, 2012; Brame, 2013). Flipped classrooms lead to improved learning outcomes when compared to traditional lecture-style classes (Brame, 2013; Shi, Ma, McLeod, & Yang, 2019; Shukla & Mcinnis, 2021) with students retaining knowledge up to ten times longer than with lectures (Kosslyn & Nelson, 2017).
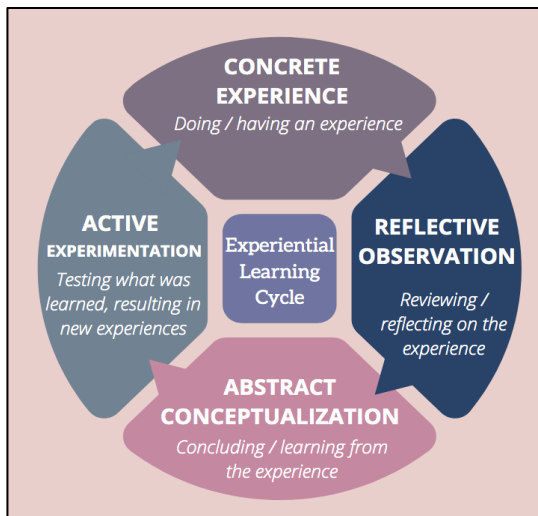
Experience is the foundation of learning; the way in which one learns becomes how they approach life in general (Kolb, 1984). Each new experience helps develop concepts that can be used in a wide variety of situations. Kolb's learning cycle (inset) describes the process by which new experiences mold new concepts into working memory and thus become part of our knowledge bank. Learners require concrete experience abilities, reflective observation abilities, abstract conceptualization abilities, and active experimentation abilities. Experiential (also referred to as "hands-on" or "active") learning has been shown to significantly increase attention, satisfaction, and relevance for those who engage in it properly (Kaneko et al., 2018). "Learning by doing" enhances neuroplasticity; for example, the motor experience of writing things by hand fires neurons that help children recognize letters better (James, 2017). However, the learning environment must be adaptable for each student and the instructor must adopt new instructional design and pedagogy to bring superior learning effectiveness (Kaneko et al., 2018).

Peer instruction is one form of cooperative learning used to improve students' conceptual understanding and problem-solving skills (Knight & Brame 2018; Johnson and Johnson 2009). It functions with a "think-pair-share" technique that includes an instructor asking a question, students answering individually (often with voting), students discussing their answers with their peers, a second round of voting, and finally the instructor discusses the correct answer with the class. The questions used for peer instruction should be challenging enough to require students to think about the answer and should be conceptually-focused in order to promote discussion (Crouch, Watkins, Fagen, & Mazur, 2007; Knight & Brame, 2018). Working in teams encourages reflection, inclusion, and cooperation, although this may hinder the creativity of lower-level students if not carefully implemented (Knight & Brame, 2018; Wang & Murota, 2016). Note that cooperative learning parallels the cooperative nature of most workplace environments and thus positions students to value teamwork and learn to identify their own strengths and weaknesses. Group discussions that require students to explain their reasoning to others allow students to integrate new knowledge into existing mental schemata (Knight & Brame, 2018). Peer instruction also combats the exclusion of students who are not as eager or willing to answer questions in more formal settings and is effective in both large and small classes (Crouch & Mazur, 2001). Immediate feedback in a low-stakes setting encourages reevaluation of misconceptions and reflection on mistakes (McDonnell and Mullally, 2016).

Practically speaking, lectures will not go away anytime soon, and we don't expect that our one report can change the minds of institutions that are deeply entrenched in this pseudo-educational practice. Fortunately, the science of learning provides evidence for techniques that can improve the lecture experience. Chiefly, these include real-time student response technologies (Greer & Heaney, 2004) and assessment tools such as surveys, anonymous quizzes, using devices such as clickers, as well as asking structured questions that guide students to discover the correct answer on their own. Students retain information better when engaged in relevant cognitive processing during learning. This occurs through three distinct processes: selecting relevant material from the lesson, organizing the new material into a mental representation in working memory, and then integrating the representation with pre-existing knowledge retrieved from long-term memory (Mayer et al., 2009).

There are many benefits to real-time assessment, such as drawing connections between ideas, providing immediate

feedback to the students and by the teacher's explanations, providing feedback to the instructor as to how effective their lecture is thus far, and a myriad of other benefits (Wieman et al., 2017). Mazur's clicker method not only actively engages students, but it highlights the key concepts that the instructor is trying to put forth. (The corresponding author of this paper used clickers when they were first available at McGill and observed their effectiveness firsthand.)

Understanding spacing, interleaving, and retrieval practices is also essential for ensuring long-term retention of information and longevity of learning. Retrieval practice refers to directly recalling information to the mind rather than rereading or hearing it (Landauer & Bjork, 1978; Roediger & Butler, 2011). Research has shown that utilizing spaced schedules of retrieval optimizes retention (Roediger & Karpicke, 2006). Spaced schedules leave time between practice sessions. While this may lead to slightly greater forgetting across sessions, spacing schedules yield better retention on tested material when tested on a later date (Dunlosky et al., 2013). The neuroscientific underpinnings of this are that memory consolidation occurs during sleep, and without sleep in between study sessions, the information may not become properly encoded (Zadra & Stickgold, 2021).

Interleaved practice entails alternating which kinds of problems are studied (Dunlosky et al., 2013). Using blocked practice (repeating one skill) leads to better performance while practicing, but interleaving leads to greater accuracy over time (Rohrer & Taylor, 2007). Interleaving promotes greater comparison of problem types, helping learners choose the optimal method for finding a solution, and to retrieve the method they want to use from long-term memory.

There continues to be great resistance to these methods due to inertia, budget constraints, and a failure to understand their effectiveness. Students passively memorize information without truly understanding it and multiple choice exams only test what has been memorized. This leads the educator to mistakenly believe they have effectively taught their students. Much student and employer frustration ensues when memorized information cannot be applied to novel problems and domains.

University Graduates Lack Career-Relevant Skills (Career-Prepared Graduates)

Current and future students can expect to change occupations and careers several times and many will likely end up in jobs and industries that do not exist today. A large majority of employers find recent graduates are unprepared for the types of skills and knowledge they define as most important to workplace success, such as applying knowledge and skills in real-world settings, critical thinking skills, and written and oral communication skills (AACU, 2015; Brown, Gardner & Levitin, 2017). Students agree they are unprepared—only about one third think they will graduate with the skills and knowledge to succeed in the job marketplace and in the workplace (Strada-Gallup, 2017). Findings from more than 30,000 graduates also reveal substantial correlations between the experiences students have in university and level of engagement in their work after graduation (Gallup, 2014). Graduates who had supportive relationships with professors and mentors, and deep learning and experiential opportunities, such as internships and long-term projects that mimic real work environments, are three times more likely to be engaged in their work, to be more productive, are less likely to be absent, have lower turnover, fewer safety incidents and are more profitable (Busteed & Seymour, 2015).

> *"Many of the jobs our students will take at a later stage have not yet been invented, and the required skills for these have not been defined."* —Drew Faust, Former President of Harvard University

Research Question 1 – Conclusions

The problems that we feel need to be addressed cluster into four areas: inequities in educational opportunities that perpetuate long standing societal inequality; poor attention to student health and well-being; high costs; and the widespread feeling among graduates and employers that college does not provide adequate career-ready training. We feel that reform is urgent. Technology and pedagogical reform could be used more effectively to reduce these problems, but it must be done in a context of addressing systemic racism and other forms of bias that seek to limit or encumber human rights. We recommend that educators embrace cultural diversity by recruiting faculty and students from backgrounds that are underrepresented in higher education; that educators use the science of learning to redesign the classroom experience, using active learning methods, extradisciplinary approaches, and work internships to enable students to acquire real-world experience; that institutions strengthen and integrate mental health services on campuses into curriculum design; and that institutions allow students to learn from wherever they are geographically.

Research question 2: What evidence or examples of reimagined, redesigned, alternative and/or innovative education institutes exist in Canada, the U.S., and around the world?

We conducted an online search for institutions, programs, and courses offering a different approach to education to provide a picture of what higher education might resemble in the future. These real-world success stories can lead to radical change. Our search yielded 12 exemplar institutions that are demonstrating effective applications of current technological and pedagogical innovations to ensure accessibility, quality, and affordability. We provide a brief summary of each in order of their overall ranking by our research criteria (described below).

University of Technology Sydney (UTS) is a public research university in Sydney, Australia. Its mission is "to provide integrative and practice-oriented business education, to be internationally recognised for relevant and innovative research, and to engage actively with business and the community." Courses are closely aligned with industry needs to prepare students for future careers. Faculty are explicitly taught to integrate the best of online and face-to-face teaching methods, and students are encouraged to review material before coming to each class. UTS keeps up with both technological and pedagogical innovations to prepare students for the workforce through their Learning Futures Program.

Minerva University is a private university headquartered in San Francisco, California. Students complete a rotational program in six additional locations over eight semesters to promote firsthand cultural understanding (as of this writing, the cities are Seoul, Hyderabad, Berlin, Buenos Aires, London, and Taipei). The rotational program is highly encouraged, but optional; students may choose to complete some or all semesters online from anywhere in the world. Minerva's mission is to nurture "Critical Wisdom for the Sake of the World." In operation since 2014, Minerva has done something radically different by rethinking the system of higher education from the ground up—building an entirely new curriculum, pedagogy, and education delivery system—using student outcomes as the lodestar in designing the institution. To our knowledge, Minerva is the only institution of its kind and the only one to use the science of learning systematically in all aspects of the curriculum. Their model is designed to keep tuition costs low, with tuition and fees less than a third of what peer institutions charge, despite being the most highly selective undergraduate program in the United States. Minerva's curriculum is rooted in both non-traditional and traditional structures, where students have the opportunity to design their own courses and capstone projects, but are informed and guided by professors.

First Nations University, in Regina, Saskatchewan is a unique Canadian public university specializing in Indigenous knowledge, providing post-secondary education for both Indigenous and non-Indigenous students within a culturally supportive environment. It is First Nations owned and operated, with a mission to "enhance the quality of life and to preserve, protect and interpret the history, language, culture and artistic heritage of First Nations." FNU encourages the use of traditional Indigenous methodologies and pedagogical practices (that often overlap with the science of learning) for academic programs and delivery options. FNU also partners with communities to develop and deliver programs to build student leadership and capacity. Students can attend classes on one of three campuses or remain in their own communities, while taking classes online.

Paul Quinn College is a private, historically Black liberal-arts college in Texas. Their work-college model integrates work into students' college experience to reduce tuition costs while developing career-relevant skills. Their mission is to "provide a quality, faith-based education that addresses the academic, social, and Christian development of students and prepares them to be servant leaders and agents of change in the global marketplace." In addition to tuition being below the national average, 92% of students receive financial aid. Students can choose from two low-cost ways to learn in the Urban Scholars Program: a hybrid campus-based experience, and a fully remote option with even lower tuition and fees. Both options include engaging classes using Minerva University's proprietary active learning Forum™ (discussed below).

College of the Atlantic is a private liberal arts college in Bar Harbor, Maine, dedicated to the study of human ecology. The mission of COA is to "encourage, prepare, and expect students to gain expertise, breadth, values, and practical experience necessary to achieve individual fulfillment and to help solve problems that challenge communities everywhere." At COA, students design their own major within the vast boundaries of human ecology. With transparent admissions requirements and a stable mission, COA focuses on including the student body in administrative processes as well as foundational committees. COA's relatively small size of around 350 allows students and faculty alike to engage in an intimate learning experience to help propel environmental studies.

Hampshire College is a private liberal arts college in Amherst, Massachusetts founded in 1965 as an experiment in alternative education. Hampshire is known for its alternative curriculum, self-directed academic concentrations, progressive politics, and its focus on portfolios and narrative evaluations. Their mission is "to foster a lifelong passion for learning, inquiry,

and ethical citizenship that inspires students to contribute to knowledge, justice, and positive change in the world and, by doing so, to transform higher education." Hampshire College describes itself as "experimenting" rather than "experimental," to highlight the continually changing nature of its curriculum. From its inception, the curriculum has emphasized project work over courses with students taking an active role in designing their own concentrations and projects based on individual interests. The course of study is divided into three "divisions" rather than traditional grade-years. Students move from one division to the next based on a portfolio review (including narrative feedback from all courses, final papers or projects), community-engaged learning, other meaningful work, and a retrospective. In Division I students explore and work across multiple disciplines, while Division II consists of a self-designed concentration. In their final Division, students design and complete an advanced independent study project addressing a complex set of questions, concepts, and skills under the supervision of a faculty committee.

Antioch College is a private liberal arts college in Yellow Springs, Ohio. Antioch forms a collaborative community in which students and faculty work together on learning projects, and everyone contributes to community governance. Each student creates a self-designed major, choosing courses that fit their individual academic interests, then engages in real-world experiences off campus through their Cooperative Education Program. Evaluation is an integral part of both learning and teaching. Assessment is a continuous process requiring the active participation of the student and the instructor. In addition to receiving traditional number/letter grades, each student's performance is detailed in a narrative evaluation based on a set of standards and learning objectives. Antioch's mission is to provide "a rigorous liberal arts education on the belief that scholarship and life experience are strengthened when linked, that diversity in all its manifestations is a fundamental component of excellence in education, and that authentic social and community engagement is vital." Antioch is more affordable than the average private American university and online options improve both financial and geographic accessibility.

Arizona State University is a public university in Metropolitan Phoenix, Arizona. ASU runs three parallel programs: one traditional program, one synchronous online program, and one asynchronous online program (entitled "ASU Online"). ASU Online uses a technological infrastructure called EdPlus to deliver individualized feedback, customized learning paths, and educational simulations. With better-than-average financial and geographic accessibility, ASU aims to be a leader in filling in the achievement gap through initiatives such as their Starbucks College Achievement Plan. This plan covers the full cost of tuition and mandatory fees at ASU Online for Starbucks employees who work an average of 20 hours per week and have not yet obtained a bachelor's degree. Employees who are serving or have served in the U.S. military can also designate an additional family member to receive the benefits of the Starbucks College Achievement Plan.

New School at Dawson College is a public two-year college in Montréal, Québec, aiming to offer "a different way of doing Humanities and English" by considering the science of learning in their methods and promoting active learning. As a part of the CEGEP system, the New School is financially accessible; however, its one campus is geographically inaccessible to students outside the Greater Montreal area. Established in 1973, New School takes a Critical Humanistic approach to learning, based on the principles of Critical Pedagogy and Humanistic Education. In small learning groups, students play a greater role in shaping the content of their courses and designing how they will study their subjects. In student-led group discussions, learners are encouraged to relate their studies to their personal and social lives and constantly link the personal to the political.

Bryn Mawr College is a private, women's liberal arts college in Pennsylvania. Their mission is to "educate students to the highest standard of excellence to prepare them for lives of purpose". The cost of attending is high, however around 70% of students receive financial aid. Geographic accessibility is limited to one campus, however, there have partnerships with other institutions in Pennsylvania. Bryn Mawr uses an interdisciplinary active learning approach through their 360° (degree) program, providing opportunities to participate in a cluster of courses connecting students and faculty across disciplines to focus on common problems, themes, and experiences. The courses in a cluster aim to approach a common topic from different angles, methods or lenses (a full, 360° perspective).

Quest University in Squamish, British Columbia, is one of only 22 private universities in Canada. It sought to reinvent undergraduate liberal arts and science education, using an innovative philosophy and novel curriculum when enrolling its first class in 2007 with 73 students. They emphasize teaching skills that meet real world demands, while preparing students for any occupation or career they choose. Classes remain small and are all seminar-discussion format. In 2017, Quest had the highest National Survey of Student Engagement (NSSE) scores in Canada. Quest's mission is to "transform how our students think, question, and engage with the world through a revolutionary educational model that sparks personal growth and intellectual development." Although 85% of students receive financial aid, as a private university, the tuition is significantly higher than other universities in Canada. Students take one "Block" at a time—a single course that meets for three hours per day for 3½

weeks. The Block Plan is a major part of Quest's teaching philosophy, allowing full immersion in a single subject, close interaction between faculty and students, highly interactive classrooms, and seminar-style learning. The scheduling flexibility afforded by the block plan also allows elite athletes and performers to complete a university degree despite intense training and touring schedules. All students spend at least one block in an experiential learning course.

Alverno College is a private, catholic university in Milwaukee, Wisconsin. Alverno aims to "prepare women for lives of personal and professional distinction and meaningful engagement with the world." (Alverno admits both men and women in their graduate programs.) Founded in 1887, Alverno started innovating new education models in the 1970's to attract "more and better" students. All 60+ undergraduate majors offer an education grounded in the same "8 Abilities" — communication, analysis, problem solving, social interaction, effective citizenship, valuing, aesthetic engagement, and developing a global perspective — through meaningful feedback, small class sizes, dynamic learning, hands-on experience, and supportive, empowering community. They do not use a standard numerical or letter-based grading system, but instead a narrative grading system. Instead of a student receiving a GPA or a single letter grade, they get a written assessment regarding their ability and the quality of their work. Alverno offers a traditional campus setting, with distance learning opportunities. Alverno's approach is characterized by continuous improvement. Everything is assessed, and these evaluations are the basis for analysis, problem solving, implementation of new schemes for learning, and further assessment. In 1996, Alverno was one of six small, innovative liberal arts colleges awarded funds by The John D. and Catherine T. MacArthur Foundation (best known for its "genius" grants to creative individuals) for being "found to show a certain genius" in how they educate students.

Research question 3: What evidence do we have that these new models address the problems we've outlined?

The 12 institutions identified in Research question 2 were evaluated on 9 factors that grew out of our Phase 1 research: Science of Learning Methods, Career-Prepared Graduates, Financial Accessibility, Indigenous Inclusion, Mental Health Resources, Admissions Transparency, Geographic Accessibility, Attrition and Retention, and Technological Infrastructure. Here, by *Technological Infrastructure* we are not referring to the extent to which universities have fast internet service, 100% wifi coverage on campus, or whether every incoming student receives a laptop or tablet computer; we're referring to the use of technology to drive pedagogical improvement, through the use of synchronous, online courses, access to remote laboratories, databases and archives, and innovations that may help students who are disadvantaged, have learning disabilities, mobility challenges, and hearing or visual impairment.

We considered the possibility that some of the factors might be more important than others for reimagining higher education, and so should not be equally weighted in evaluating successes and failures of currently operating institutions. After discussion among the eleven project team members who had participated in the Phase 1 research (the seven authors plus four additional laboratory members), each team member proposed a weighting factor by secret ballot, and the final weights were determined by averaging those scores.

For each factor we created a three-point evaluation scale with rubrics; these were applied to each school and factor by two authors, and disagreements were worked out through discussion or appeal to a third author. A score of 1 on the rubric indicates that for the factor in question the school did not succeed in overcoming the barrier, 2 indicates moderate or mixed success, and 3 indicates excellent success. We translated those scores into proportion multiples of the total available score for that factor (shown in the top row), yielding final multiples of 0, .5 and 1 corresponding to rubric values of 1, 2, and 3 respectively. In cases of missing data, the proportion multiple was imputed by the mean across all factors for a given institution. The table below presents the evaluation factors in order from most relevant to least relevant by consensus of the authors, assigned weights corresponding with a total sum of 100. Each institutional total is ranked relative to all exemplar schools; yet also stands alone as a score out of 100. Below we describe examples of schools that fail to provide for these factors, as well as case studies of excellence, for each of the nine factors studied. Details of the weighting/ranking system are included in the Appendix.

	Science of Learning	Career Prepar- ation	Finan- cial Acces- sibility	Indige- nous Inclu- sion	Mental Health	Admis- sions Trans- parency	Geo- graphic Access- ibility	Attrition, Retention	Techno- logical Infra- structure	Total	Rank
Weighting	15	14	13	12	12	10	9	8	7	100	
UTS	1x	1x	**1x***	1x	1x	1x	1x	1x	1x	100	1
Minerva	1x	1x	1x	0.5x	1x	1x	1x	1x	1x	94.0	2
FNU	0.5x	1x	1x	1x	1x	1x	1x	**.88x***	0.5x	88.0	3
Paul Quinn	1x	1x	1x	0x	1x	1x	1x	0.5x	1x	84.0	4
CoA	1x	1x	1x	0.5x	1x	1x	0x	1x	0.5x	81.5	5
Hampshire	1x	1x	1x	0.5x	0.5x	1x	0.5x	0.5x	1x	79.5	6
New School	1x	1x	1x	0.5x	0.5x	1x	0x	1x	1x	79.0	7
Antioch	1x	1x	1x	0.5x	0x	1x	0.5x	1x	1x	77.5	8
ASU	1x	1x	1x	0.5x	0.5x	1x	1x	0.5x	1x	74.0	9
Bryn Mawr	1x	1x	0.5x	0.5x	0.5x	0.5x	0x	1x	1x	68.5	10
Quest	1x	1x	**.56x***	0x	0.5x	0.5x	0x	1x	0.5x	62.3	11
Alverno	1x	1x	0.5x	0x	0x	1x	0.5x	0x	0.5x	54.5	12

Table 1. Evaluation factors ranked and weighted. *Missing data were calculated by the mean per row (school).

CRITERIA SHEET

A BREAKDOWN OF EACH FACTOR USED FOR EVALUATION AND HOW THE FACTOR IS SCORED TO CREATE A POINT TOTAL FOR UNIVERSITIES.

	LEVEL 1 0x	LEVEL 2 0.5x	LEVEL 3 1x	WEIGHT
Science of Learning Methods	Science of learning principles are contradicted and/or not factored into curriculum and instruction.	Curriculum and instruction include some principles of the science of learning.	Curriculum and instruction are shaped by the science of learning.	15
Career-Prepared Graduates	No career-relevant programs; employment rate below the national average.	Some career-relevant and/or industry partnerships or programs.	Industry partnerships; career-like settings; employment rate above the national average.	14
Financial Accessibility	Graduates have beyond manageable, excessive student debt ($50,000+).	Graduates have manageable student debt ($20,000-$49,999).	Graduates have no or easily manageable student debt ($0-$19,999).	13
Indigenous Inclusion	No or tokenistic institution-led attempts to include Indigenous peoples, methods, or content.	Some inclusion of Indigenous faculty, staff, and students and/or Indigenous methods or content.	Active level-wide involvement of Indigenous peoples; inclusion of Indigenous content/teachings.	12
Mental Health Resources	Lacks proactive resources; student supports are limited, inaccessible, or unavailable.	Little to no proactive resources; available and accessible student supports.	Institutionally-integrated proactive mental health resources, and/or widely accessible student supports.	12
Admissions Transparency	Institution does not report admission criteria and/or statistics on an accessible platform.	Institution reports vague or limited admission criteria and statistics; information may be difficult to obtain.	Institution reports clear admissions criteria and statistics; information is easy to obtain.	10
Geographic Accessibility	Offers in-person instruction at one location; no remote learning options.	Offers some online, distance or hybrid options, and/or has multiple campuses	Offers online and/or distance options to all students.	9
Attrition and Retention	Graduation and/or attrition rates are at least 5% below the national average.	Graduation and/or attrition rates are 5% within the national average.	Graduation and/or attrition rates are at least 5% above the national average.	8
Technological Infrastructure	Lacks robust technological infrastructure and services; no transition to online learning.	Limited technological infrastructure, difficulties transitioning to online learning.	Online services; robust tech infrastructure and technologically advanced labs; smooth COVID response.	7

REIMAGINING HIGHER EDUCATION

Evaluation of major limitations to and within higher education institutions among 12 distinguishable universities across the globe.

FACTORS OF EVALUATION

- Science of Learning Methods
- Career-Prepared Graduates
- Financial Accessibility
- Indigenous Inclusion
- Mental Health Resources
- Admissions Transparency
- Geographic Accessibility
- Attrition and Retention
- Technological Infrastructure

University of Tech, Sydney

UTS's mission is "To provide integrative and practice-oriented business education, to be internationally recognized for relevant and innovative research, and to engage actively with business and the community."

Rank 1 [100]

Minerva University

Minerva students complete a rotational program in each of their 7 international locations, varying by semester. With a focus on innovation, Minerva's mission is to "[Nurture] Critical Wisdom for the Sake of the World."

Rank 2 [94.0]

First Nations University

A First Nations owned post secondary institution with a mission to "enhance the quality of life and to preserve, protect and interpret the history, language, culture and artistic heritage of First Nations".

Rank 3 [88.0]

Paul Quinn College

Paul Quinn College's mission is to "provide a quality, faith-based education that addresses the academic, social, and Christian development of students and prepares... leaders and agents of change in the global marketplace."

Rank 4 [84.0]

College of the Atlantic

The mission of the COA community is to prepare "students to gain expertise, breadth, values, and practical experience necessary to achieve individual fulfillment and to help solve problems that challenge communities everywhere."

Rank 5 [81.5]

Hampshire College

Hampshire College's mission is "to foster a lifelong passion for learning, inquiry, and ethical citizenship that inspires students to contribute to knowledge, justice, and positive change in the world and... to transform higher education."

Rank 6 [79.5]

New School @ Dawson College

The New School aims to offer "a different way of doing Humanities and English" and does so by considering the science of learning in their methods and promoting active learning.

Rank 7 [79.0]

Antioch College

Antioch College's Cooperative Education Program allows students and faculty to work together on learning projects. Each student creates a self-designed major, choosing courses and engaging in real-world experiences off campus.

Rank 8 [77.5]

Arizona State University

ASU aims to be a leader in filling in the achievement gap through initiatives such as their Starbucks College Achievement Plan. ASU runs three parallel programs: traditional, synchronous online, and asynchronous online.

Rank 9 [74.0]

Bryn Mawr College

Bryn Mawr College's mission is to "[educate] students to the highest standard of excellence to prepare them for lives of purpose." Bryn Mawr has a system called 360°, which is "an interdisciplinary cluster of courses."

Rank 10 [68.5]

Quest University

Quest University's mission is to "transform how our students think, question, and engage with the world through a revolutionary educational model that sparks personal growth and intellectual development."

Rank 11 [62.3]

Alverno College

Alverno aims to "[prepare] women for lives of personal and professional distinction and meaningful engagement with the world." Alverno extends their mission by educating both men and women in their graduate programs.

Rank 12 [54.5]

SCHOOL DESCRIPTORS

TYPE

- Public Institution
- Private Institution

COUNTRY

- Australia
- Canada
- United States of America

RANK

- Better than Average
- Average
- Worse than Average
- Inconclusive

Use of the Science of Learning

All programs at Minerva University use evidence-based best practices, derived from the science of learning and honed through feedback from professors and students. The core elements of its academic model include a Fully Active Learning pedagogy, curricula designed with Cross-Contextual Scaffolding, and a practice of Systematic Formative Feedback from peers and instructors. Minerva's approach to learning offers numerous benefits over traditional models. Rather than focusing solely on content, they emphasize crucial habits of mind and foundational concepts, leading to the development of adaptive skill sets and a distinct mindset. Learners at Minerva gain practical knowledge and new perspectives through classes that are discussion-driven. This approach also increases student engagement, which improves understanding, retention, and recall. Concepts are reinforced over time and students are prompted to apply those concepts in new situations. This practice of transferring learning from one context to another builds both analytical and creative problem solving skills. Student performance is continuously measured by transparently-shared rubrics. Founding Dean Stephen Kosslyn explains "We use rubrics for everything… [They] typically are five points. One means they show no evidence of understanding that habit of mind [or] a foundational concept; five is they're able to use it in creative ways. This is called *far transfer*: they're actually able to take the information and apply it in a very different context" (Kosslyn, 2015).

The 360° Course Clusters offered at Bryn Mawr College are designed to engage students in non-traditional forms of learning while they complete a cluster of related courses, following the extradisciplinary approach we outline above. These clusters also include some form of experiential learning. Kimberly Cassidy and Sarah Theobald (President and coordinator of the 360° program respectively) state, "A required element of any 360° cluster is student and faculty engagement in interactive experiences that extend beyond the typical classroom" (Cassidy & Theobald, 2017). These activities include data gathering, research trips, community-based partnerships, artistic productions, curated exhibits, and intensive laboratory activities. Together faculty and students share their work using a method determined by both the nature of the work and the pedagogical goals of the cluster. Theobold adds, "the Program fosters an unusually close and collaborative relationship between faculty and students, building a community (or circle) of scholars around the cluster's deeper questions," (Theobold, 2021).

At New School, and Dawson College more broadly, faculty have increasingly turned to Active Learning as an evidence-based instructional approach. Using a faculty-led, research-based iterative design process, Dawson has developed a series of classrooms specifically for Active Learning because classrooms that are purposefully designed can complement good pedagogical strategies, make complex activities easier for the instructor, and offer affordances that both learners and instructors can leverage in the construction of knowledge. In addition to Active Learning, Dawson has invested resources in developing pedagogical resources and capacity, again through a number of faculty and researcher-lead initiatives – including the development of SALTISE (Supporting Active Learning & Technological Innovation in Studies of Education), a learning community service for instructors and professional development staff throughout Quebec. SALTISE supports educators aiming to implement evidence-based pedagogy involving instructional innovations and to leverage educational technology to promote improved learning. According to New School Director Cory Legassic, it is also "super important you have a say in what you learn, and how you learn" (Legassic, 2015), so classes meet in informal settings where students are given a greater role in shaping the content of their courses and designing how they will study their subjects.

At Quest University, all students participate in at least one block of experiential learning. Former Quest President David Helfand (president) states that an experiential learning component "is required of all students to go out into the real world, in a research laboratory, into a K to 12 classroom, into an NGO in Kenya, into a local community organization, into a government office to see how the real world functions when dealing with issues related to the question the student has." (TEDxTalks, 2013). Their programs are designed to immerse students in a single subject, create a small and supportive learning community with smaller class sizes than most traditional lecture style classes, increase flexibility, and increase opportunities for feedback (McCluskey et al., 2020; Quest University, n.d.). The small class sizes also promote active learning. About the structure of classes, Helfand states, "We have no lecture hall on campus at all, every classroom is an oval seminar table with 21 chairs around it, never more than 21, so one faculty member and 20 students." (*ibid*). In the Block Plan at Quest University, students study one subject or unit at a time over a 3.5 to 4 week period. The evidence for the effectiveness is lacking, and it is unclear if improvements are due to the nature of the programs or simply having learned the material directly prior to the test (Bahrick & Hall 2005; Dunlosky et al. 2013). The research on retrieval practices, spacing, and interleaving raises questions about the efficacy of blocked schedules for long-term retention. Additionally, although the Block Program was designed to address cognitive overload from multitasking, it is unclear if taking multiple courses at a time is equivalent to multitasking.

University Graduates and Career-Relevant Skills

At University of Technology, Sydney, students are provided with the necessary skills to enter the workforce and thrive in professional settings. Attila Brungs (Vice-Chancellor and President) states that UTS used the COVID lockdown period to reshape the university to support people through their whole lifetime through a lifetime mentorship policy (Minerva also provides this). UTS plan to do this for past, current and future students to support them throughout their careers and lives, "in very different ways than people would ever imagine being linked to university" (UTS Alumni, 2020). Mentorship includes access to short courses, micro credentials, networking, and career advice. Students report being educated on industry-relevant skills. As one student explains, "A majority of our coursework involves academic debates and discussions of real-world issues relating to economics, politics, social issues etc. as well as practical work to produce digital content (e.g. documentaries, scripts, short films etc.). All of the content learned within our short semesters is incredibly relevant to our respective majors and careers paths and prepares us for real world situations" (Anderson, 2017).

At Quest University, career counselling and services are available in the form of one-to-one support, workshops, and counselling for graduate school applications. They offer a workshop on "marketing the Quest degree." Former President David Helfand (president) explains "What a liberal arts education does is equip you for the jobs of tomorrow. You can train as a skill set for jobs you can get when you walk out the door but that job might not exist in ten years. Labour market analysts will tell you that a graduate today will have between three and five different careers over their working lifetime and half of those careers don't exist. So there's training and there's education; both are very important but what we try to do at Quest university is open people's minds and equip them for jobs that will exist in the future" (TEDxTalks, 2013).

Students at Paul Quinn College gain work experience as they simultaneously complete their academic degree. President Michael Sorrell describes the *work college model*: "All students that live on campus are required to work. They work between 10 to 15 hours a week. Some students work on campus in jobs in our offices but the real plus of this program is the corporate work program where students go off campus. They work in schools… they work in companies… they're getting real-world experience in addition to going to class. They have a work transcript, they have an academic transcript so you know that they are taught to think and what they're taught to do" (Sorrell, 2018). Sorrell also emphasizes the importance of tailoring a liberal arts education to be oriented towards preparing students for their careers. He states, "Let's make sure you understand how you create a path forward economically for your family while also making sure that you have the capacity to participate intellectually at the highest level." (Tatum, 2019).

First Nations University's focuses on reconciliation as important in preparing graduates for their careers. Bob Kayseas, VP Academic, states "Over the years there's been always a continuing push to work with communities, work with indigenous people to make sure that the programs that we offer are relevant and we offer what is needed so students/indigenous people that come here can get involved in programs that lead to good careers for them." (FNUniv CIM, 2017).

Minerva University's founders recognized that many students are unprepared for the workplace because they are accustomed to professors giving them the information that they need to pass a test, and they're not ready to transition from being passive consumers of information to active seekers of information, and beyond that, to creators of information. Minerva aims to train students for jobs that don't even exist yet (Kosslyn, 2015). They also teach a novel approach to leadership: one needs to know when it's appropriate to work with others, when it's appropriate to lead, and when the best chance for a project's success is for someone *else* to be the leader. Minerva employs a dedicated Coaching and Talent Development team that offers one-on-one and group coaching, job search and graduate school advising, career management-related workshops, and professional development opportunities, including internships. Students thus gain a deeper understanding of their motivations, interests and strengths; determine how they can make meaningful contributions across sectors; learn how to articulate their value to potential employers or graduate and professional school programs; and explore different career possibilities, including the knowledge, skills, and experiences needed to enter and thrive in those careers. They further support career exploration by curating conversations with alumni, faculty members, and a global network of professionals and industry leaders.

Alverno College's Accelerate program is dedicated to helping professional adults shape their pre-existing passions into more relevant underpinnings and to funnel their interests into more specific topics. At the end of their program, students compile a portfolio to create a coherent and cohesive narrative around what they've learned and the fundamental skills they've acquired. This affords the students the unusual opportunity to enter the workplace with a picture of themselves that doesn't feel disparate, and a narrative about where they've been and where they want to go. (Alverno College Admissions, 2020).

Hampshire College President Edward Wingenbach believes a liberal arts education should move beyond majors to help students learn how to solve problems, collaborate, gather sources, and ask questions that haven't been asked. So Hampshire

eliminated majors to encourage an interdisciplinary approach to better prepare students for life after graduation and for the jobs in the future that don't exist yet. Wingenbach states, "Majors aren't designed to do that. What we do at Hampshire is specifically designed to develop those kinds of entrepreneurial skills that students will need when they graduate and go off into a world full of uncertainty." (GBH News, 2019).

After graduation, Antioch College offers students the opportunity to complete an additional co-op called a "launch" co-op. The college has partnerships with employers that hold positions specifically for students from Antioch College. Students can complete this co-op in the same field as their major or outside of it. This program is meant to help propel students into their careers immediately following graduation.

Financial Accessibility

Here, we looked for schools that would allow students to complete a degree program without incurring an onerous debt. We defined unmanageable debt as greater than $50,000 upon graduation (see Appendix).

Minerva University was among those schools receiving the highest score possible, with lower-than-average cost, the majority of students receiving financial aid, and a transparently stated cap on maximum debt at $22,000 after four years (actual average debt at graduation is much lower). Based on research showing that students perform better when they have contributed to their educational costs, Minerva requires students to contribute at least $5,000/year from family resources or from work-study opportunities that Minerva provides.

Paul Quinn College tuition is below the national average and 100% of students are on financial aid. Their work college model guarantees students will graduate with less than $10,000 USD of debt. President Michael Sorrell explains, "We are a work college. We became a work college because there were two things that we had to acknowledge … our students couldn't afford the education, [and] our students were graduating and they weren't prepared for the workforce." PQC addressed both issues by bringing work inside the college and regulating it to fit with student's academic goals. They further reduced costs by eliminating textbooks. Sorrell continues "unknowingly and unwittingly we created a caste system in our classrooms; the students who could afford textbooks and the students who couldn't … so we got rid of textbooks, we only use open-source materials" (SXSW EDU, 2018).

At Alverno College, 93% of students are on financial aid and the Accelerate Online program is designed with a flexible schedule to support students. A strength is the flexible course schedule and low credit rate. Trish Lewis (Program Director of Alverno Accelerate), stated "Some weeks are a little crazier than others with work or with family, and in this program you're not behind [because] you just adjust your own schedule; you work on it when you can…We really want your experience to be focused on you; what you bring and your particular goals" (Alverno College Admissions, 2020). The average debt at graduation is $24,183 (Cappex, 2021a).

Antioch College offers full-tuition scholarships and covers housing costs for any student that qualifies for a Pell grant (Pell Grants, as of this writing, are limited to $6495 annually and thus do not come close to covering full costs; U.S. Department of Education, 2021b). Additionally, all students are guaranteed on campus work during study terms and are offered both an international co-operative educational experience (co-op) and a post graduate co-op job. Over the course of their four years, all students are required to complete 3 co-ops. 100% of students receive some form of scholarship. The average debt at graduation is $7,333 (Cappex, 2021b).

Indigenous Inclusion and Transforming Higher Education in Colonial Contexts

First Nations University is the first First Nations-controlled university in Canada and is a leader in Indigenous-based education. FNU incorporates Indigenous worldviews and knowledge into all aspects of the university. It aims to give First Nations, Métis and other Indigenous learners the greatest opportunity to succeed in their education and strengthen their communities through their accomplishments. FNU is open to students of all backgrounds; thousands of non-Indigenous students attend its classes, allowing them to prepare to work in their chosen fields while building relationships with Indigenous people.

At the University of Technology Sydney, the Centre for the Advancement of Indigenous Knowledges (CAIK) is an Indigenous academic expertise centre, with a core focus on Indigenous Education Research and Indigenous Postgraduate support, while the Jumbunna Institute for Indigenous Education and Research aims to support the needs of Indigenous Australians. UTS is also embarking on a ground-breaking proposal to build Australia's first truly comprehensive Indigenous Residential College. Developed and led by the Indigenous leadership team at UTS and the Indigenous community, the college aims to remove the barriers, both real and perceived, that prevent Indigenous participation in higher education and the broader

economy. Graduates of the College will have an extensive support network to guide them in the next stage of their careers and provide lifelong mentorship.

In 2016, Dawson College launched Journeys, its pathway to a DEC (college diploma) for Indigenous students. Designed as a one-year bridging pathway to provide First Nations, Inuit and Métis students with a welcoming, supportive and culturally relevant environment for learning at the postsecondary level, Journeys has had promising successes, including a 75% retention rate, more than doubling the prevailing 30% rate in previous years. Ninety-two per cent of Journeys students were accepted into Dawson programs for the Fall of 2017. Smaller class sizes, a supportive learning community, Indigenous content, and dedicated faculty, attract students from across Quebec.

One of Bryn Mawr's 360° Course Clusters, which allow students to rotate between different disciplines and complete projects with peers from different majors, is Decolonizing Knowledge. This course cluster is focused on utilizing an indigenous perspective for courses that are often taught from a western point of view such as physics, sociology, and English. Bryn Mawr also offers speaker series and presentations about Indigenous language revitalization, as well as resources specifically designed for Indigenous students.

While not one of the universities we highlight throughout our report, [University College of the North](#) in Manitoba is also combating the exclusion of Indigenous peoples, traditions, and knowledge in higher education while implementing the latest pedagogical and technological innovations. UCN is devoted to community and northern development, reflecting the Aboriginal reality and cultural diversity of northern Manitoba. UCN provides an integrated college and university approach to expand access to post-secondary education and training that is fundamental to the social and economic development of northern Manitoba in a culturally sensitive and collaborative manner. Elders play a unique role in UCN's community-centered education and training programs, which are characterized by openness, inclusiveness, tolerance, and respect for Aboriginal and northern values.

Student Health and Well-being

Poor mental health is a major issue in higher education and many students drop out of university after their first year due to emotional reasons (Goodman 2017; Baik, Brooker & Larcombe, 2019). A 2019 study examined what universities can do to promote mental health and wellbeing by asking the question: "what do students suggest would improve their wellbeing?" One notable factor the authors identified was that academic teachers actually play a critical role in student mental health and wellbeing, as their attitudes and approaches are what shape the student learning environment. Students did not suggest that teachers become mental health experts or go beyond their professional roles, but they wished that they would follow fundamental "good teaching" practices as well as engage the students more in peer activities and the social dimensions of learning. Most importantly, the authors concluded that involving students in curriculum design is crucial for two main reasons. Firstly, it recognizes that students have access to valuable information and perspectives that staff do not. Secondly, by involving students in the promotion of mental health resources, it helps to reduce the stigma (Baik, Brooker, Larcombe, 2019). Considering that one of the authors' major conclusions was that implementing student ideas may foster a more collaborative environment, parallels may be drawn to the student governance system at College of the Atlantic. At COA, there is no separate student government; rather, students, faculty, and staff alike all collaborate to make decisions. Students serve as voters on important committees and have weekly meetings to discuss school logistics and larger community issues. This in turn helps some students feel empowered and teaches them how to guide discussions in ways that allow students and faculty alike to both be heard (Brooks, 2016). Another conclusion the authors drew was that students would be happier if teachers used more activities to encourage them to interact. At Minerva, teachers use hands-on, interactive activities. For example, professors use rubrics and polls to teach habits of mind, one of their key learning objectives (Kosslyn, 2015).

Attila Brungs (Vice Chancellor and President of UTS) states that mental health initiatives begin with properly trained staff who are encouraged to talk more about mental state. UTS offers Employee Assistance Programs such as the Managers Assistance Program to help staff help people they supervise, and also enable staff to help their colleagues. The Centre for Social Justice and Inclusion offers a range of programs for faculty and staff, including mental health awareness, mental health first aid, training in unconscious bias, ability awareness, and diversity and inclusion. They also offer tailored training packages for units or faculties by request. Brungs also mentions the importance of noticing changes in student behaviour: "We are certainly not expecting our managers or our staff and colleagues to be experts in mental health. Where they're playing a crucial role is noticing behavior changes… [This is] one of the big reasons we had the 'R U OK' program earlier on this year. Showing care, showing concern, and helping your colleagues or people you supervise reach out to get the proper professional assistance is a

really big and important part of today's modern workplace" (University of Technology Sydney, 2018).

Minerva University provides a wide range of resources to support students in developing life skills, adjusting to new cultures and environments, and improving their mental health. While all staff at Minerva are responsible for contributing to the overall wellness of the community, dedicated Student Life staff play a special role in supporting these initiatives. The importance of student health and wellbeing at Minerva is highlighted by the intentional inclusion of Self-Management and Wellness as one of their Integrated Learning Outcomes. In every course at Minerva, students are encouraged to "practice self-sufficiency and effective help-seeking, and develop skills for self-efficacy, resilience, stress management, and the capacity to balance self-care with responsibilities." Students develop in these areas over all four years and graduate from Minerva with a clear sense of how to manage and prioritize their own health and wellbeing, fully prepared for post-university life. Additionally, the Counseling and Psychological Services (CAPS) directly supports students' mental health by providing a range of mental health services in an inclusive, compassionate, and culturally competent environment. CAPS has trained professionals that assist students with their mental health needs, and contracts with a range of additional services to ensure that a comprehensive program of resources is available in each rotation city.

At Paul Quinn College, a partnership with University of Texas Southwestern Medical School allows first-year students and the general student body to receive both mental health assessment and treatment on campus. There is a mental health and wellness portion of orientation for incoming students and all incoming students have a screening session with a mental health professional. As Kizuwanda Grant (Vice-President of Institutional Programs) describes, "Our goal is to bring students into Paul Quinn college during the summer bridge program and they are immediately introduced to the idea of mental health and wellness as part of our new student orientation and introducing them to the institution. A week after that mental health orientation we began our initial screens - which is what you refer to- they sit with a trained professional for about 45 minutes to an hour... and that information is used to inform both the clinic and UT Southwestern staff but also institutional programs for the college". (Carter, 2019) There is also a focus on the prevention of mental health crises. Stacia Alexander, Program Coordinator of Mental Health Services explains, "We intend to change the dialogue from illness to mental health so we explain to them that they're using it as a preventive measure not necessarily as a crisis management option for them so they can take away the stigma that you only go to counselling when something is wrong." (Carter, 2019).

At First Nations University there are Cultural and Traditional services available as support for students. The Elders' Offices also work closely with the academic departments to infuse traditional learning into the classroom. Erika Faith taught at First Nations University and in describing how she utilised traditional learning in the classroom she states, "I knew that I needed to create a classroom space in which spirituality is included, learning is collective, and hierarchies between professor and student are minimized, so that the whole being of each person, including myself, was nurtured. Early in my teaching, at the direction of an Elder, I began to practice opening each class with a smudging ceremony, led by one of my students, with the intention of creating space to center, clear, and ground ourselves" (Faith, 2007).

Admissions Transparency

Admissions at Minerva University are entirely merit-based and highly selective. According to Ben Nelson (founder) Minerva redefines the concept of elite education. "In a traditional Ivy League university, 50 percent of the student body comes from the top 1 percent wealthiest households in the world. At Minerva, about 5 percent of our student body comes from the top 1 percent wealthiest households in the world. It's not because we try to find non-wealthy students. It's because we only focus on merit and because merit is broadly distributed across geography, economic class, race, religion, creed, and gender, you get a massively diverse class." (Young, 2017). Minerva is currently the most selective school in the US but their long-term mission is to transform all of education, from high school to vocational school, two-year colleges, as well as top universities. In fact, the science of learning shows that the students who benefit most from their innovative pedagogy are those students who don't normally do well in school. So why begin with elite students? Because, as Nelson says, "like it or not, people pay attention to elite schools. There are all sorts of interesting and innovative approaches and universities all over the world that nobody cares about because they're not the 'best.'" To meet the goal of broad dissemination of their model, Minerva has partnered with a secondary school, with Paul Quinn College, and the United Negro College Fund (UNCF) and Thurgood Marshall Fund to bring their ideas to a broader array of students.

At College of the Atlantic, the admissions requirements are clearly stated. Online interviews are encouraged but not mandatory, and standardized testing (e.g., SAT, ACT) is optional. In addition to an essay and two short-answer questions, applicants are encouraged to showcase their creative passions that may not be conveyed through a standard application (a

similar approach is taken by Minerva University, which looks for "spikey" kids—students who have some special talent or spike in their distribution of abilities). Each application is assessed by admission staff, faculty, and current students who consider a holistic, broad approach toward each student. Every year, College of the Atlantic publicly provides a common data set that transparently provides details on admissions statistics such as enrollment by racial/ethnic categories, high school requirements, students receiving loans and grants, and a complete ranking of the importance of various academic and non-academic factors in the decision-making process.

At Paul Quinn College, admissions are test-optional and transparent: their website clearly lists the evaluation criteria used for each required component of the application. They clearly explain the rationale for their test-optional policy by underscoring the historical inequalities in standardized testing for students from lower socioeconomic backgrounds, Black and Brown students, and First-Generation students. Students who need to discontinue their studies for any reason can be re-admitted as long as they were not permanently dismissed (a feature that first gained prominence in elite schools such as Stanford and MIT).

Geographic Accessibility

We sought to identify schools that removed geographic barriers to higher education, ideally by putting all programs entirely online, or at a minimum, providing hybrid instruction and/or multiple campuses.

The Urban Scholars Program at Paul Quinn College is an accelerated bachelor's degree program designed to be completed in 36 months in partnership with the Minerva Project. The program is offered entirely online at an even lower cost than in-person degree programs.

Students at First Nations University can access its range of programs at any of its three campuses. The university also offers web-based classes, distance education, and community-based programs. These flexible learning environments allow students to complete their studies from locations near or within their home communities. For many, this allows connection to family and community while also providing a quality education.

The variety of course delivery methods at Arizona State University also aim to reduce geographic barriers. By offering both synchronous and asynchronous online programs in addition to traditional on-campus programs, ASU reaches a wide population of students. They have a number of initiatives that are aimed at increasing global access to higher education, one of which President Michael Crow describes by saying, "ASU wants to be a leader in developing models, forming relationships, and applying available technologies to make our knowledge resources available to those who need them. We are demonstrating this commitment through programs like "Earned Admission," which began in 2015 as the Global Freshman Academy, a partnership with edX, to make college freshman courses available through interactive, digital platforms. Enrollees can begin taking ASU classes instantly, without applications or transcripts, and then pay for courses if they pass and want academic credit. More than 230,000 students from more than 180 countries have participated." (Dusst & Winthrop, 2019).

Hampshire College is part of the Five College Consortium which is a collaboration between 5 higher education institutions in western Massachusetts. Students enrolled at each of the involved institutions are able to take courses at any of the participating campuses, participate in shared academic programs, utilize pooled library resources, and have access to free bus transportation to any of the Five Colleges. (This is not unique to Hampshire, but is an important feature for a small liberal arts college, also found at the Claremont Colleges, and other institutions.)

Attrition and Inequities in Retention

Paul Quinn College's graduation rate was 1% when President Michael Sorrell took office in 2007 and as of 2019, the graduation rate was 40% and the retention rate for first time students was 57% (Crain, 2021; Data USA, 2019). The work-college model alleviates some of the pressures caused by the cost of education. The college also works hard to help students adjust and feel comfortable in their first year at the college. In the summer, students can complete a six-week program introducing them to life at the college and creating a supportive environment. Sorrell says, "You can't allow them to not be educated, but you have to create a safe space… I spend a lot of time affirming my students. You're safe, I love you, I'm here with you for the long haul." (Connolly, 2016).

Bryn Mawr College's retention rate is 92%. In students' first year there are a number of required components that are aimed at increasing student success. All students take a first-year liberal arts seminar focused on reading and writing skills, participate in an orientation program that lasts a year, and complete a ten-week wellness program that contributes to the physical education requirement they must complete by spring break of their sophomore year. Minerva University also requires first year students to take a yearlong seminar focused on reading, writing and multimodal communication skills, in addition to yearlong

seminars in quantitative skills, complex systems, and basic scientific knowledge.

At Arizona State University, every incoming student is appointed a success coach. Traditional students have access to the First-Year Success Center (which is immersion-based), whereas ASU Online students have a success coach. Success coaches help students stay on track towards earning their degree and are there for mental support as well as goal setting. They differ from academic advisors because instead of providing the student with information, they ask thought-provoking questions that help the student independently find their own answers. Atlas Pillar (First-Year Success Coach) explains, "Holistic coaching is something that goes beyond academics, and really just tries to address the student as a person…as someone who has a personal life, who also has professional goals, who has a past. Because the university experience is difficult, and it can be really confusing and hard when you're first coming into it. I think of the First-Year Success Center as really like a one-stop shop for students to find a friend, find a mentor, find a coach. Someone that will inspire them to do greater, better things. To find their own personal strengths, and also to work through their concerns that they have, both in their personal lives and at the university" (ASU Family, 2018). Additionally, educators and course designers are dedicated to providing individualized learning platforms that help with student retention. Michael M. Crow (President of ASU) states that "Right now, ASU has more than 175 online degree and certificate programs that serve more than 46,000 undergraduate and graduate students and learners in Arizona and around the world. With the help of custom course designers using pioneering technology, we can present knowledge in new ways that empower learners to comprehend content in the manner and pace that best suits them. Students also have access to a dedicated success center that serves both an advisory and advocacy function for online students. This model has shown that students who were previously unsuccessful in passing courses taught in traditional models can now thrive and move forward" (Dusst & Winthrop, 2019).

Alverno College's "Accelerate Program" allows students to earn a bachelor's degree in 3 years or less while focusing on their career. Through Experiential Learning Modules, the Accelerate program veers away from the traditional university path and allows for more specific, professional knowledge that aims to keep students focused and on-track. As Trish Lewis (Program Director of Alverno Accelerate) explains, "You have an experienced faculty coach, and this is someone who's… going to take the big picture with you; someone who is going to be your first point of contact…There are other faculty that are [also] involved in the program that you'll be getting feedback from that you can work with one-on-one if that is more helpful for you. The other thing that really supports you is that everyone has been around a long time. We have a lot of experience teaching adult students. We have a lot of experience with innovative teaching…the program is really geared around outcomes and we develop these outcomes based on our research" (Alverno College Admissions, 2020).

Utilization of Technology for Pedagogical Improvements

Technology is potentially an equalizing platform that puts students on the same footing; used well, as in live, synchronous seminars, every student has a front row seat, and the more quickly paced classroom can make sessions more engaging and memorable. Technology-driven approaches are necessary but not sufficient in revolutionizing learning; a learner-centred approach must be used in concert with new technologies (Mayer et al., 2009).

From its inception, Minerva University designed a first-of-its-kind educational platform, called the Forum. Previously, online classrooms most often resembled traditional lecture halls, with hundreds of students in each class and passive lecture formats that prevented students from actively engaging with the material and each other. "Designing the Forum has been a challenge since the beginning because there wasn't anything like it that we could directly point to and take cues from, or generate inspiration from," says Matt Regan, Director of Product Design (Minerva Voices, 2018). The Forum was designed to bring research from the science of learning to the virtual classroom in ways that are underutilized by, and sometimes impossible because of, the limitations of a traditional lecture hall. The Forum was specifically structured around Minerva's curriculum to help students quickly think through new concepts, make and use associations, and effectively retain new knowledge. The seminar-style, small group platform features presentations, polls, and debates to keep students engaged. And every student can be seen across the top of the screen at all times, so there is no way to hide in the back of class. (Full disclosure: the last author was involved in the early phases of designing The Forum and taught from it for one year.)

UTS is one of Australia's leading universities of technology. It is known for fusing innovation, creativity and technology in its industry-focused teaching and research to create consistent, engaging student experiences that seamlessly integrate interactive learning technologies. Academics at UTS use a range of tools to create opportunities for students to collaborate and work in teams together online, make classes interactive, and help students become better writers through feedback on their academic and reflective writing. UTS Tech Lab is a multidisciplinary research facility that provides access to cutting-edge

equipment, funding opportunities, and world-class research talent to support industry-led partnerships, while UTS Startups is the largest community of student-led startups in Australia. With a range of support to help students bring their big ideas to life, it's a major component of UTS's broader commitment to entrepreneurship and innovation. In 2020, 103 technology-driven student startups joined the UTS Startups community, bringing their total to 337 active student startups. The university has a goal to reach 50% of UTS students with entrepreneurship experiences and support by 2023. In 2021, UTS introduced Portfolium, an online portfolio platform with social networking features where students can curate their profile with achievements, projects and competencies and use this to showcase their skills to their peers and potential employers.

At Arizona State University, technological platforms are also used in conjunction with the science of learning methods. When asked about ASU's personalized learning method, Crow responded by explaining that there are multiple forms of intelligence and individual differences in learning that must be capitalized on: "There are certain things everyone should know, but how those things are learned needs to be personalized and individualized around the way someone learns. We've found that through adaptive learning platforms, we can change math outcomes, physics outcomes, chemistry outcomes, and economic outcomes. We have become very focused now on trying to create as many opportunities as possible for the individualization of learning" (O'Brien, 2016). The technology used at ASU, although innovative, has a much bigger role in analytics than in delivering teaching methods. When asked how poorly-performing departments are made aware of their downfalls, Crow explained ASU's use of analytics: "We used analytics, data, and analytical tools. Analytics is essential to the process of change. If you don't know where you are in time or space, you don't know how you're performing as opposed to how you might perform or how you should perform" (O'Brien, 2016).

Research question 4: What barriers have institutions faced in designing and delivering new models of higher education?

Most universities and colleges are organized into faculties and departments. While this is useful organizationally, and convenient for the administration, it can hamper the collaborative work that is often required for holistic education (Mints, 2019) as well as for many workplaces. A lack of student involvement in governance and decision-making often means students are not considered when designing structures and strategies for innovation. Academic departments typically do not interact with each other, meaning innovation often only occurs within a given department (Swanger, 2016), and so-called "interdisciplinary programs" often do not create real cross-pollination. Universities that have maintained traditional organizational structures may not be able to serve the needs of 21st century students as well as universities that have taken steps to foster inter- and transdisciplinary approaches, such as Quest, Paul Quinn, Bryn Mawr, and Minerva. Bryn Mawr College's 360° Program, for example, brings together faculty from different departments to deliver courses in their respective fields to create a cluster of courses that together become interdisciplinary (Cassidy & Theobald, 2017), a model also used in isolated pockets of higher education, such as the Program in Human Biology at Stanford University.

The reward system for faculty can also limit pedagogical innovation. At research universities, promotion decisions are weighed heavily toward the quality of research conducted and amount of funding received, and successful researchers may be granted teaching releases. Research faculty often interact less with undergraduate students (Kirschner, 2012; Swanger, 2016). Tenure allows professors who no longer teach well to stay in their jobs as long as they want to. Minerva, Quest and Hampshire College have eliminated tenure.

Tradition and a general resistance to change are also stiflers of innovation. The prestige of many institutions has come from the tradition and culture of the school which they aim to preserve (Caruth & Caruth, 2013). Prestige and a lack of competition can protect institutions from feeling a need to change and thus quells major innovation (Kirschner, 2012).

Implications for policy, practice, or research

"It turns out that one can have terabytes of data about what people do online and very little understanding of what changes inside their heads. Rather than building lots of courses and hoping that data-driven insights appear downstream, a far more promising approach is to invest in online courses that are designed from the beginning not just for student learning but also for conducting research about learning." —Justin Reich, *Failure to Disrupt*

Institutions must fundamentally understand the science of learning and incorporate it into their curricula. Although the

science of learning has been known for a long time, there are many institutions that do not adopt it (Kosslyn, 2017). It is necessary to harness the neuroscience and psychology of learning into curricula to increase the effectiveness of delivering the content in terms of quality, not quantity. As new technologies emerge, we need to consider if they can add benefit to our instructional methods; the presence of technological infrastructure alone is meaningless when used without the science of learning techniques. For example, there is growing evidence that VR-based learning via Experiential Learning may be effective, as the enhanced vividness and interactivity in a virtual environment may enhance the learning effect as it is recognized as being closer to a direct experience (Kwon, 2019). In addition, clickers encourage student participation in a low-stakes environment and provide immediate feedback in large lecture classrooms, thus creating a sense of student-instructor interaction and encouraging reflection (Mayer et al., 2009; Knight & Brame, 2018).

Alignment between course elements is necessary to achieve a specific course's goals (Kosslyn, 2017; Heft & Scharff, 2017). Therefore, within the institution, each course should have specific activities and extracurriculars that guide students towards their target goal by the end of the semester. For example, students at Minerva are able to explore their extracurricular interests through student initiatives; they have the opportunity to organize events or workshops that pertain to their area of study, and that are aligned with their rotation city's specific culture. Just as department heads must collaborate on administrative matters, curriculum developers and educators must be on the same page regarding learning goals and student growth. Faculty members of higher education must set aside their roles as educators and instead become the fabricators of learning environments that align course content, assessment, and delivery in a systematic way (Duderstadt, 2008; Streveler, Smith & Pilotte, 2012).

Higher education must work hand-in-hand with the industry. A 2015 survey found that when looking at new college graduates to hire for jobs, employers value leadership skills as much as the ability to work in a team (AACU, 2015). As industries and recruiters' expectations change rapidly, institutions should be following these changes and adapting their curriculum to ensure the employability of their graduates. Possible alternatives can be but are not limited to: building hubs / offices that partner up industries with colleges, partnerships, internship opportunities, extracurriculars, and projects. Such opportunities not only allow students to get a taste of the professional world, but they also facilitate experimentation of learning by allowing them to test their theoretical knowledge (Emms, Laczik, & Dana, 2021). If multinational corporations affiliate with universities and shadow students in accordance with their interests, this can have implications for developing countries with unstable economies where unemployment can decrease, and international relations could improve.

Attending university can be geographically challenging for certain students from rural areas or remote Indigenous communities. Some solutions that address this problem include allowing students to remain in their communities and integrate their local works into the curriculum. In order to accommodate transnational education and improve societal development, initiatives such as partnerships with international institutions, exchange programs, and branch campuses may be employed (British Council, 2013). While online education can overcome geographic barriers, unequal access to digital platforms poses a major issue (Huijser, Bedford, & Bull, 2008).

The COVID-19 pandemic laid bare inequities, creating particular hardships for economically disadvantaged and underrepresented minorities, especially Indigenous communities (Campbell-Scherer, et al., 2021; Galloway, et al., 2020; Meneses-Navarro, et al., 2020). When opening more campuses to host more students is not an option, improving internet infrastructure is essential to accommodate geographically unavailable students. From the COVID-19 pandemic, internet space is gaining more relevance over physical space (Temes, Aw, & McGinty, 2021).

With the changing nature and rapid acceleration of knowledge, numerous scientific disciplines and subdisciplines emerge. Educators must stay up to date on the newest technological innovations and exciting areas of research to engage student interest and spark curiosity. By allowing students to work within dynamic contexts such as interacting with peers studying in different fields, students may adapt after graduation to emerging job opportunities. Teachers must read ahead and inform students of forthcoming developments. For example, before Jennifer Dounda and Emmanuelle Charpentier won a Nobel Prize in 2020 for the development of CRISPR, informed professors in chemistry, biology, biochemistry, immunology, and other relevant fields highlighted its developments in the academy. Learning about genome editing, in its early phases, during introductory biology and chemistry courses, drew attention towards the wide applicative field beyond academic theory, inspiring students to engage with revolutionary ideas such as the genetic scissors of CRISPR Cas9.

Mental health is often related to underlying inequities in background and experience, and some students are less prepared to deal with the same challenges as their peers. An equitable education requires that schools teach mental health skills to make sure every student is in the same position to succeed and have the same resources to deal with life's challenges (TEDxTalks, 2020). In addition, students often do not have time to focus on extracurricular activities due to the demanding nature of their

coursework, therefore course designers should understand that participation in extracurriculars, exercise, and down time can improve mental health outcomes.

Higher education must veer away from funneling students into more narrow disciplinary paths because this robs students of the opportunity to discover their values, assets, and interests. Open readmissions policies that allow students to take time off, without stigmatizing them, encourage students to explore other ways of learning. Many elite schools, such as Stanford and MIT allow for open-ended stop-outs or a year abroad, but it is often the students at non-elite schools who need this most.
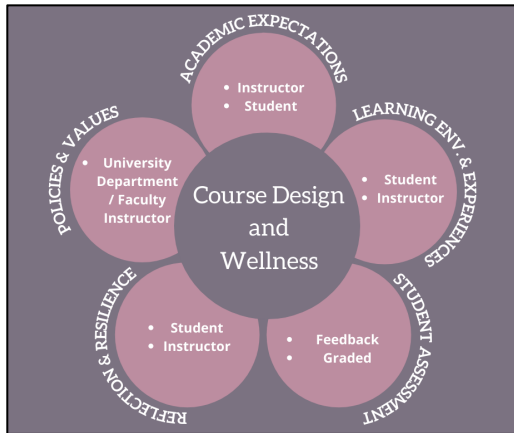
A number of models that use mental health and wellness as a framework for designing and delivering higher education have been proposed and/or implemented by other institutions across Canada and around the world. However, further research is needed to assess the efficacy of these models. Course design, and features such as social connection, participation and flexibility, have been shown to have an effect on wellness (Stanton et al., 2016; University of Toronto, 2014). Based on these findings, and drawing from the wellness and course design literature, Dyjur et al. (2017) proposed a framework for designing courses around mental health and wellness. Simon Fraser University in BC launched an initiative called "Well-being in Learning Environments." While the program is based on peer-reviewed research, its own effectiveness has not been tested to our knowledge. It has been implemented voluntarily by ~150 professors at SFU, and has inspired similar projects to be developed at other institutions including George Brown College, The University of British Columbia, Camosun College, Ryerson University, The University of Calgary, and The University of Texas at Austin.

Finally, Universities must work within the framework of indigenous reconciliation and consult with Indigenous Peoples in order to ensure inclusion and authenticity. At First Nations University, students work directly with Indigenous communities and focus on reconciliation in their academics in order to be prepared for future careers.

Cathy Davidson's important book, *The New Education: How to Revolutionize the University to Prepare Students for a World in Flux* invites us all to ask questions that can significantly push this conversation forward. Invoking the work of Randy Bass, Vice President for Strategic Education Initiatives and Professor of English at Georgetown University, she asks:

- ❖ What if the teaching and curricular structures of the university were not chained to credit hours, semesters, academic calendars?
- ❖ What if a schedule could be as flexible as the subject matter?
- ❖ What if students could gain certification in part or all of a field of study based on competency, not test scores or coursework?
- ❖ What if some courses or majors were blended with mentored, immersive learning experiences and independent or collaborative projects, including internships?
- ❖ What if in four years of school, students could work on a BA and an MA at the same time [Stanford University, among others already does this], through a combination of online learning, self-paced learning, traditional coursework and experiential learning?

We add to this list

- ❖ What if schools integrated Indigenous content, and content from a more diverse array of viewpoints and experience, into the very fabric of their regular curriculum, rather than keeping it separate?
- ❖ What if, rather than treating research and teaching as dichotomous, separate undertakings, universities made research experience a core part of their mission for undergraduates?
- ❖ What if elite universities partnered with institutions with different demographics and traditions (such as the partnership between Georgetown University and La Guardia Community College, or between Minerva University and Paul Quinn College)?

We must be bold enough to reimagine education from the ground up, to fight the inertia of "this is the way we've always done it." The old model doesn't overcome the challenges of the 21st century digital, global economy.
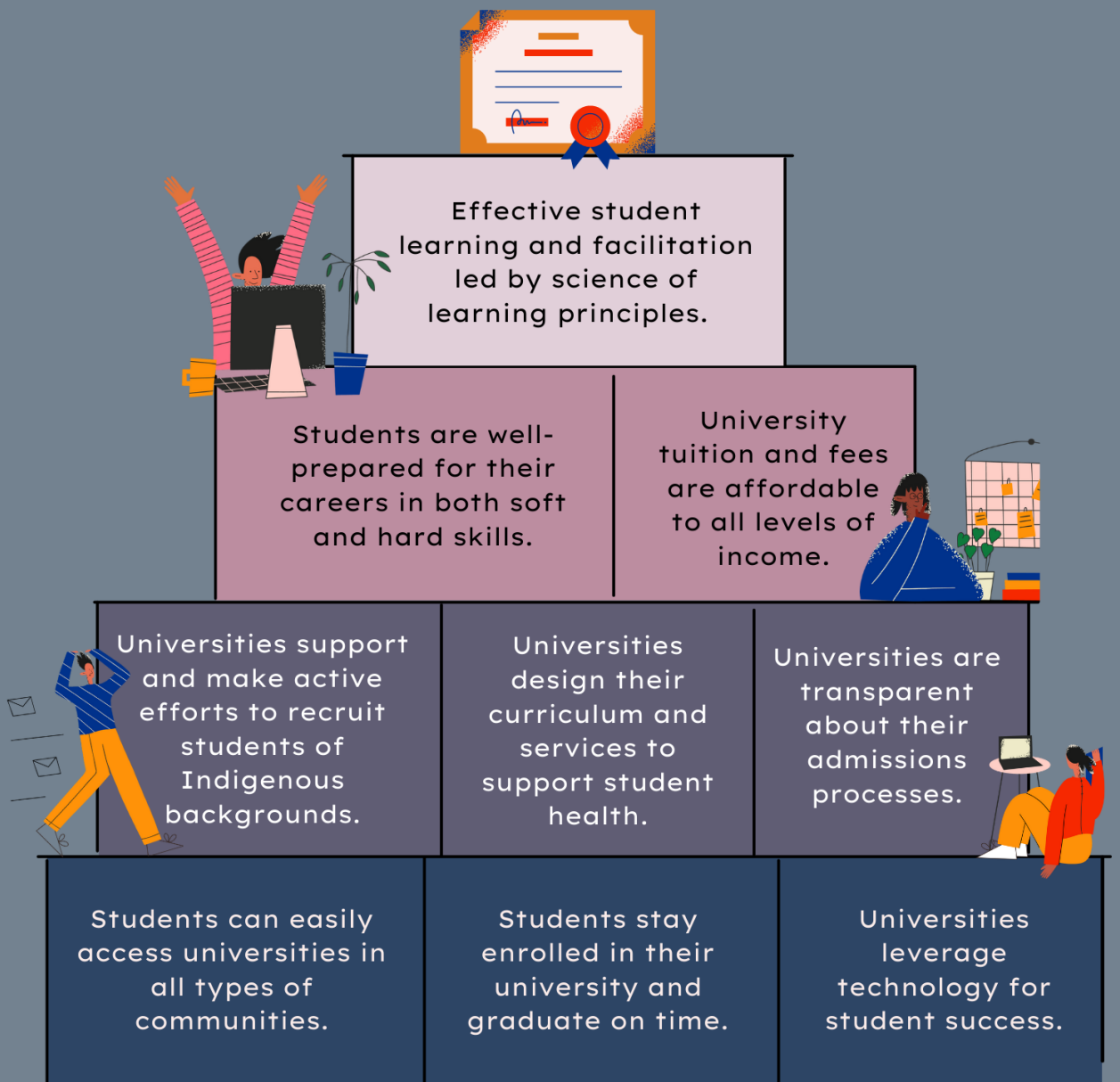
Conclusion

The purpose of this study was to characterize higher education practice in Canada and internationally and identify existing and emerging best practices that can allow for wide access to high quality post-secondary education at low costs. Specifically, our aims were to investigate key characteristics and weaknesses of higher education; promising methods, tools and approaches commonly used by reimagined models; and lessons, opportunities, and challenges, as well as critical knowledge gaps in research and practice.

We identified a number of limitations with our current project:

1. We understood our mandate as reporting on best practices for higher education. We did not attempt to rank institutions based on various outcome measures, such as mean salary upon graduation (and *x* years later), proportion of students who are admitted to graduate programs, mental health, or even life satisfaction.
2. We found a lack of consistent and accessible information across universities for reported and collected statistics. There is no standardized list of metrics and statistics that universities must collect and report across the United States and Canada. An example of this discrepancy is highlighted through the search for graduation rates, freshman to sophomore retention rates, and suicide rates.
3. Smaller and more rural universities, especially those of Indigenous teaching models and student populations under 500, often do not have comprehensive websites for us to collect data from, nor have they published studies or reports on their own. This may be due to universities not collecting these data or from not publishing them.
4. Many of the problems we highlighted are not necessarily recognized by university faculty and leadership. An example is ignoring student mental health in curriculum design. Our hope is that this report, and others like it, will change this.
5. We did not discuss particular and insidious forms of systemic biases in Canadian and U.S. culture that lead to discrimination against people based on weight, gender, sexual identity, disabilities such as hearing and visual impairment, learning disabilities, and a host of other characteristics and qualities that erect barriers to success for these individuals.
6. There are other metrics of success we did not examine. Recent Research on Global 100 Innovative Universities published by WURI (World Universities with Real Impact) examined innovation at many of the same universities/colleges, but used completely different metrics such as Industrial applications, Entrepreneurship, Ethical value and social responsibility, Mobility and openness, and Crisis management.
7. During the pandemic, all institutions went through a transition period. Much of the information gathered requires post- and pre-pandemic distinction. Some of this information was missing for some universities/colleges, but it does not change our views on the recommendations we make in this section or under **Implications for policy, practice or research**.
8. The authors are affiliated with McGill University, Minerva University, UC Berkeley and might be bringing a systematic bias through our personal experiences in these institutions to our research which other members would not recognize as they also might be subject to similar implicit biases. Similarly, author DJL brings additional teaching experience from a range of American schools that vary in pedagogical approaches, including UC Berkeley, Dartmouth, Stanford, CalTech and the University of Oregon and these may have influenced his views on what is important, what works and what doesn't. To combat these biases, we endeavored to rely on the literature and on one another to present information as fairly as possible.
9. We only looked at success stories. What might we learn if we looked at schools or programs or technologies that attempted to revolutionize higher education and failed? Are there schools doing great things that are flying under the radar?
10. The science of learning principles do not easily scale to large universities and thus there is limited data on its effectiveness in these contexts (although the work of Eric Mazur, and others cited earlier is promising).
11. We did not look for schools innovating for inclusion of students with diverse learning needs, disabilities, etc. as that was beyond our mandate, but it is an urgent consideration.

Despite these limitations, based on our review of 12 exemplar schools, 68 academic papers, and 104 other documents, we are able to identify nine barriers to widely accessible, high quality, affordable post-secondary education and recommend corresponding best practices:

1. **Unequal financial access.** University administrators must work with government and non-government funders to reduce costs and/or offer paid work opportunities on campus and through partner organizations that are flexible and feasible with academic schedules and demands.
2. **Unequal geographic access.** Reimagined models can improve accessibility by offering parallel in-person, online, and hybrid programs with flexible scheduling options.

3. **Lack of Admissions Transparency.** Admissions processes should be standardized, transparent, and equitable.
4. **Attrition and inequities in retention.** Only 73% of students who enroll in undergraduate programs in Canada complete their degree within 6 years. Disparities in retention rates reflect and reinforce societal inequities, obstructing social progress. These disparities are correlated with socio-economic status, cultural background, and family education. We recommend that schools put programs in place to help first year students succeed, such as individualized coaching, writing classes, and first year seminars. Inequities here are also related to financial barriers (item 1 above) and mental health (item 5 below).
5. **Student health and well-being.** Most campus health and well-being programs and policies focus on responding to mental health crises, rather than preventing such emergencies in the first place. Universities should take measures to reduce environmental stressors and promote protective factors in the university

    environment. It is time that universities adopted a proactive approach to how they are structured, their strategic goals, policies and practices, and their curriculum development and pedagogical framework to address the many challenges we know students and employees face.
6. **Difficulties transforming higher education in colonial contexts.** Efforts to hire and recruit more Indigenous faculty, recruit more Indigenous students, incorporate accurate Indigenous content into existing courses or create entirely new ones, and strengthen relationships with local Indigenous communities remain tokenistic and superficial. All too often, these efforts reflect the unfortunate tendency to "cherry pick" or "whitewash" Indigenous concerns and issues. Reimagining of what the Canadian University could be ought to be approached within the frame of genuine reconciliation, in respectful, welcoming consultation with Indigenous groups and with the aim of transforming past damages into new opportunity and growth.
7. **Weak utilization of technology.** Unlike other sectors of the Canadian economy, higher education has not fully exploited the potential of new technologies. Institutions that do take advantage of technological (and pedagogical) innovations are best positioned to prepare students for skills and work in the digital economy, and the unexpected and abrupt shift to remote instruction during the COVID-19 crisis further highlighted the need to rethink our outdated and inflexible systems. Technology can and should play a role in analytics, such as tracking engagement and learning in real time. Technology also can and should be leveraged to provide access to high-quality and affordable learning opportunities, course content, and materials. However, new technologies are not going to transform how we learn, and must play a secondary or supportive role to pedagogical innovations in the future of the classroom.
8. **Outmoded teaching methods and content.** Institutions of higher education are continually challenged by the changing nature of knowledge. Educators must stay up to date on the newest research, and pedagogical and technological innovations across disciplines. The science of learning offers practices for educational institutions to put in place to foster a deep engagement with varying forms of knowledge.
9. **Graduates lack preparedness.** Employers often find recent graduates are unprepared for the types of skills and knowledge important to workplace success, such as applying knowledge and skills in real-world settings, critical thinking skills, and written and oral communication skills. And only about one third of students believe they will graduate with the skills and knowledge to succeed in the job marketplace and in the workplace (Strada-Gallup, 2017). Students who have supportive relationships with professors and mentors, and deep learning and experiential opportunities, such as internships and long-term projects that mimic real work environments, are more likely to be engaged in their work, to be more productive, are less likely to be absent, have lower turnover, fewer safety incidents and are more profitable.

We also recommend a number of areas for future research.
1. What might be the most effective way to train professors in applying science of learning principles and active learning? Minerva University explicitly trains this each August preceding the start of the school year, and professors receive feedback about their consistency in applying them.
2. There has been little research on the measures that universities could take to reduce environmental stressors and promote protective factors in the university environment. A number of models for improving health and well-being have been proposed but research needs to be conducted to establish the efficacy of these models.
3. Further research is needed on the effects of the block model on learning and long-term retention. Indeed, all new practices and policies must include research investigating the effect of these strategies on student outcomes, access, quality, and cost.
4. What do employers want from college graduates? We lack comprehensive and detailed studies on this. (Many employers don't know themselves.)
5. As mentioned in #1 of Limitations above, we recommend studies that track various outcome measures for these recommendations.
6. How can we best train students to work cooperatively with one another, to develop tolerance for viewpoints and experiences that may differ from their own, and to engage in civil discourse that is productive and not polarizing?
7. Although we began this study before the COVID-19 lockdown, we need studies on how the pandemic has impacted

students, and which institutions were most affected by it, and why.
8. New technology is needed to accommodate students with special needs (e.g., sign-to-text and text-to-sign for the hearing impaired).

Knowledge mobilization activities

Traditional and social media distribution
A key objective of our project is to develop knowledge that is of direct benefit to policymakers, practitioners, and other stakeholders in Canada and internationally. We intend to reach both academic and non-academic audiences by adjusting our formats as needed to facilitate straightforward transfer of knowledge. A combination of internet-based information distribution (e.g. newsletters and message boards; university-based websites; social media platforms where the PI has more than 30,000 followers) and placement of key messages in industry, government, and public venues are planned through 2021-2022. As we have in the past, we will also work closely with the media relations and communication officers at McGill University, SSHRC, the Royal Society of Canada, and the National Research Council to organize and promote live online events such as Facebook Live, Instagram Live, and Reddit AMAs to share our findings with a broad audience. Additionally, we plan to disseminate select project results to public policy makers, legislators, educators, the media and other interested organizations. The P.I. has published five consecutive international best-selling books and participated in over 1900 television, radio, newspaper, and online media reports on the laboratory's research. Our findings have been covered in fourteen documentary films and series, distributed worldwide through Netflix, BBC, PBS, CBC, and National Geographic. We will work closely with existing media contacts (e.g., Steve Paikan at TVO's The Agenda and Mutsumi Takahashi at CTV Montreal), the Media Relations Office at McGill University, and SSHRC's News Room to publicize and promote our findings.

Peer-reviewed journal articles
For this project, we will seek publication in a leading peer reviewed journal such as *Canadian Psychology*, *The Canadian Journal of Higher Education/La Revue canadienne d'enseignement supérieu*r, and *Canadian Journal of Education*. All publications resulting from the project will be made available through eScholarship@McGill, a digital repository that exists in an online, open-access environment, making it easy for researchers all over the world to find and access the University's published research output. In addition to scholarly, peer-reviewed publications, we intend to publish an article in the *Chronicle of Higher Education*.

Student involvement and presentations
Eleven student research assistants received high quality training and mentorship through this project. The research and teamwork skills they've gained are relevant for both academic and private/public sector career paths. Students will present select research results at the Canadian Society for the Study of Higher Education Conference and AGM, or a similar venue. Target audiences for the proposed work include, but are not limited to, provincial Ministers of Education, Universities Canada (formerly the Association of Universities and Colleges of Canada), and the Canadian Association of University Teachers.

Bibliography

AACU (2015). *Falling Short? College Learning and Career Success.* Association of American Colleges and Universities. Retrieved from
https://www.aacu.org/leap/public-opinion-research/2015-survey-results

ACHA. (2016). Ontario Canada Reference Group Executive Summary Spring 2016. Retrieved from: http://oucha.ca/pdf/2016_NCHA-
II_WEB_SPRING_2016_ONTARIO_CANADA_REFERENCE_GROUP_EXECUTIVE_SUMMARY.pdf

Adler, A. (2016). Teaching well-being increases academic performance: Evidence from Bhutan, Mexico and Peru. *Publicly Accessible Penn Dissertations.*
[PhD Dissertation, University of Pennsylvania]. ScholarlyCommons.

Alverno College Admissions. (2020, November 10). *Alverno Accelerate: Lunch and Learn* [Video]. YouTube. https://www.youtube.com/watch?v=2-
LGIRXnWhc&ab_channel=AlvernoCollegeAdmissions

American College Health Association (2016). *American College Health Association-National College Health Assessment II: Canadian Reference Group
Executive Summary Spring 2016.* Hanover, MD: American College Health Association.

Anderson, R. (2017, June 9). 5 Reasons Why I Chose To Go To University of Technology Sydney. *Society19 Ozzie*. Society19.
https://www.society19.com/au/reasons-why-i-chose-to-go-to-university-of-technology-sydney/

Arcidiacono, P.S., Kinsler, J., & Ransom, T. (2020). Affirmative Action, Transparency, and the *SFFA v. Harvard* Case. *The University of Chicago Law
Review Online.* https://lawreviewblog.uchicago.edu/2020/10/30/aa-arcidiacono/

Armstrong, L. (2016). Barriers to innovation and change in higher education. *TIAA-CREF Institute*.

ASU Family. (2018, August 14). *How ASU First-Year Success Coaches support your student* [Video]. YouTube.
https://www.youtube.com/watch?v=LKo_YM-IREU&ab_channel=ASUFamily

Bahrick, H. P., & Hall, L. K. (2005). The importance of retrieval failures to long-term retention: A metacognitive explanation of the spacing effect. *Journal
of Memory and Language, 52*, 566–577.

Baik, C., Brooker, A., Larcombe, W. (2019). How universities can enhance student mental wellbeing: the student perspective. *Higher Education Research &
Development, 38*(4)*.* https://doi.org/10.1080/07294360.2019.1576596

Bates, A. W. (2015). *Teaching in a digital age: Guidelines for designing teaching and learning* (2nd ed.). BCcampus.

Bazarevsky, V. & Zhang, F. (2019). On-Device, Real-Time Hand Tracking with MediaPipe. Google AI blog. https://ai.googleblog.com/2019/08/on-device-
real-time-hand-tracking-with.html

Bear, A., & Skorton, D. (2019). The world needs students with interdisciplinary education. *Issues in Science and Technology*, *35*(2), 60-62.

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety,
and stress in a sample of college students. *Journal of Affective Disorders, 173*, 90-96.

Bi, S. U. N. (2018). Affirmative Action Hurt the American Asian Accidentally?——Asian Discrimination and Racial Quotas in American College
Admission. *International and Comparative Education,* (2), 14.

Bok, D. (2013). *Higher education in America*. Princeton University Press.

Bowen, W. G., & McPherson, M. S. (2016). *Lesson plan: An agenda for change in American higher education.* Princeton University Press.

Bradforth, S. E., Miller, E. R., Dichtel, W. R., Leibovich, A. K., Feig, A. L., Martin, J. D., Bjorkman, K. S., Schultz, Z. D., & Smith, T. L. (2015). University
learning: Improve undergraduate science education. *Nature News, 523*(7560), 282-284.

Brame, C. (2013). Flipping the classroom. *Vanderbilt University Center for Teaching.* Retrieved from http://cft.vanderbilt.edu/guides-sub-pages/flipping-
the-classroom/.

Brighouse, H. (2020, January 26-28). *Transparency in Admissions, Higher Education and Society.* [Conference presentation]. Center for Enrollment
Research, Policy and Practice Conference 2020: Reclaiming Public Trust in Admissions and Higher Education. Los Angeles.

British Council (2013). *The shape of things to come 2*. https://www.britishcouncil.org/sites/default/files/the_shape_of_things_to_come_2.pdf

Burdman, P. (2005). The Student Debt Dilemma: Debt Aversion as a Barrier to College Access. *Center for Studies in Higher Education, 13*(5), 1-26.

Busteed, B. & Seymour, S. (2015). Many College Graduates Not Equipped for Workplace Success. Gallup. Retrieved from
https://www.gallup.com/education/243389/college-graduates-not-equipped-workplace-success

British Columbia Ministry of Health. (n.d.). *Report on Actions Taken to Support the Truth and Reconciliation Commission of Canada's Calls to Action*.
Retrieved from the Government of British Columbia. https://www2.gov.bc.ca/gov/content/education-training/k-12/administration/program-
management/indigenous-education/actions-taken-on-reconciliation.

Brooker, A., Baik, C. & Larcombe, W. (2017). Understanding academic educators' work in supporting student wellbeing. In R.G. Walker & S.B. Bedford
(Eds.), Research and Development in Higher Education: Curriculum Transformation, 40 (pp 50 - 60). Sydney, Australia.

Brooks, R. (2016, August 25). So Many Access Points. *College of the Atlantic*. https://www.coa.edu/live/news/1251-so-many-access-points

Brown, J. C., Gardner, K., & Levitin, D. J. (2017). Multimodal Communications and Effective Communication. *Building the Intentional University: Minerva
and the Future of Higher Education,* MIT Press.

Campbell-Scherer, D., Chiu, Y., Ofosu, N. N., Luig, T., Hunter, K. H., Jabbour, B., ... & Hama, Z. (2021). Illuminating and mitigating the evolving impacts
of COVID-19 on ethnocultural communities: a participatory action mixed-methods study. CMAJ, 193(31), E1203-E1212.

Cappex. (2021a). Alverno College After Graduation. https://www.cappex.com/colleges/alverno-college/after-graduation

Cappex. (2021b). Antioch College After Graduation. https://www.cappex.com/colleges/antioch-college/after-graduation

Carey, K. (2015). *The end of college*. New York, NY: Riverhead Books.

Carter, J., Sr. [Jarrett Carter Sr.]. (2019, July 9). *Paul Quinn President Michael Sorrell* [Video]. YouTube.
https://www.youtube.com/watch?v=Zaq2T4PIEdg&ab_channel=JarrettCarterSr.

Caruth, G. D., & Caruth, D. L. (2013). Understanding Resistance To Change: A Challenge For Universities. *Turkish Online Journal of Distance Education*,
14(2), 12-21.

Cassidy, K., & Theobald, S. (2017). The Bryn Mawr College 360° Program: Implementing High-Impact Educational Practices. *Liberal Education*, *103*(1),
n1.

Chamorro-Premuzic, T., & Frankiewicz, B. (2019). Reasons Why Higher Education Needs to Be Disrupted. *Harvard Business Review.*

Connolly, M. (2016, August 29). Labor of Love. *Washington Monthly.* https://washingtonmonthly.com/magazine/septemberoctober-2016/labor-of-love/

College of the Atlantic. (n.d.). College Governance. Coa.edu. https://www.coa.edu/our-community/college-governance/

Craig, R. (2015). *College disrupted: The great unbundling of higher education*. New York, NY: Macmillan.

Craig, R. (2017, January 27). Make America first in higher ed: Open the door. *Inside Higher Ed*. https://www.insidehighered.com/views/2017/01/27/us-
should-ease-not-restrict-access-its-colleges-international-students-essay

Crain, Z. (2021, April 26). *How Michael Sorrell is Remaking Education at Paul Quinn - D Magazine*. D Magazine
https://www.dmagazine.com/publications/d-ceo/2021/april/how-michael-sorrell-is-remaking-education/

Crouch, C. H., & Mazur, E. (2001). Peer instruction: Ten years of experience and results. *American Journal of Physics, 69*(9), 970-977.
https://aapt.scitation.org/doi/pdf/10.1119/1.1374249

Crouch, C. H., Watkins, J., Fagen, A. P., & Mazur, E. (2007). Peer instruction: Engaging students one-on-one, all at once. *Research-Based Reform of University Physics, 1*(1), 40-95.

Das, A., Yadav, L., Singhal, M., Sachan, R., Goyal, H., Taparia, K., ... & Trivedi, G. (2016, December). Smart glove for Sign Language communications. In 2016 International Conference on Accessibility to Digital World (ICADW) (pp. 27-31). IEEE.

Data USA. (2019). Paul Quinn College | Data USA. Datausa.io. https://datausa.io/profile/university/paul-quinn-college

Davidovitch, N., & Shiller, Z. (2016). Skill-Based Teaching For Undergraduate STEM Majors. *American Journal of Engineering Education (AJEE)*, 7(1), 29-36.

Davidson, C. (2017). *The New Education: How to Revolutionize the University to Prepare Students for a World in Flux.* New York: Basic Books.

Di Placito-De Rango, M. (2016). Acknowledge the Barriers to Better Practices: Support for Student Mental Health in Higher Education. *The Canadian Journal for the Scholarship of Teaching and Learning*, 7(2).

DiPlacito-DeRango, M. L. (2018). Situating the post-secondary instructor in a supportive role for the mental health and well-being of students. *International Journal of Mental Health and Addiction*, *16*(2), 284-290.

Donovan, T., Bates, T., Seaman, J., Mayer, D., Martel, E., Paul, R. H., Desbiens, B., Forssman, V., & Poulin, R.(2019). *Tracking online and distance education in Canadian Universities and Colleges: 2018.* Retrieved from https://eduq.info/xmlui/handle/11515/37136.

Dunderstadt, J. J. (2008). Engineering for a changing world: A roadmap to the future of engineering practice, research, and education. The Millenium Project, The University of Michigan. Retrieved from http://milproj.dc.umich.edu/

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4-58.

Dusst, E., & Winthrop, R. (2019, May 17). Revolutionizing online education: A conversation with President Michael Crow of Arizona State University. *Brookings.* https://www.brookings.edu/blog/education-plus-development/2019/05/17/revolutionizing-online-education-a-conversation-with-president-michael-crow-of-arizona-state-university/

Dyjur, P., Lindstrom, G., Arguera, N., & Bair, H. (2017). Using mental health and wellness as a framework for course design. *Papers on Postsecondary Learning and Teaching*, *2*, 1-9.

Education Policy Institute (EPI) (2018) Prevalence of mental health issues within the student-aged population. https://epi.org.uk/publications-and-research/prevalence-of-mental-health-issues-within-the-studentaged-population/.

Eisenberg, D., Hunt, J., & Speer, N. (2013). Mental health in American colleges and universities: variation across student subgroups and across campuses. *The Journal of Nervous and Mental Disease*, *201*(1), 60-67.

Emms, K., Laczik, A., & Dana, D. (2021). *Rethinking higher education: Case studies for the 21st century*. Edge Foundation. https://www.edge.co.uk/sites/default/files/documents/edge_-_rethinking_he_case_studies_web-2.pdf

Erwin, T. D. (1986). Students' contribution to their college costs and intellectual development. *Research in Higher Education, 25*(2), 194-203.

Fagen, A. P., Crouch, C. H., & Mazur, E. (2002). Peer instruction: Results from a range of classrooms. *The Physics Teacher*, *40*(4), 206-209.

Faith, E. (2007). Finding healing and balance in learning and teaching at the First Nations University of Canada. *First Peoples Child & Family Review: A Journal on Innovation and Best Practices in Aboriginal Child Welfare Administration, Research, Policy & Practice*, *3*(4), 8-12.

Farr, M. (2018). What role should faculty play in supporting student mental health? *University Affairs.* Retrieved from https://www.universityaffairs.ca/features/feature-article/what-role-should-faculty-play-in-supporting-student-mental-health/

Fernandez, A., Howse, E., Rubio-Valera, M., Thorncraft, K., Noone, J., Luu, X., Veness, B., Leech, M., Llewellyn, G. & Salvador-Carulla, L. (2016). Setting-based interventions to promote mental health at the university: a systematic review. *International Journal of Public Health, 61*(7), 797-807.

Findlay, L. (2017). *Depression and suicidal ideation among Canadians aged 15-24* (Catalogue no.82-003-X). Retrieved from Statistics Canada: https://www150.statcan.gc.ca/n1/pub/82-003-x/2017001/article/14697-eng.htm

Finnie, R., Mueller, R. E., & Wismer, A. (2015). Access and Barriers to Postsecondary Education: Evidence from the Youth in Transition Survey. *Canadian Journal of Higher Education, 45*(2), 229-262.

First Nations Post-Secondary Education. (2018). *Fact Sheet*. Assembly of First Nations. https://www.afn.ca/wp-content/uploads/2018/07/PSE_Fact_Sheet_ENG.pdf.

FNUniv CIM. (2017, May 12). *Bob Kayseas* [Video]. YouTube. https://www.youtube.com/watch?v=d8jWI3TP51s&ab_channel=FNUnivCIM

Franklin, H., & Harrington, I. (2019). A Review into Effective Classroom Management and Strategies for Student Engagement: Teacher and Student Roles in Today's Classrooms. *Journal of Education and Training Studies*, *7*(12), 1-12.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, *111*(23), 8410-8415.

Frenette, M. (2006). Too Far to Go On? Distance to School and University Participation. *Education Economics ,14*(1), 31–58.

Fulton, K. (2012). Upside down and inside out: Flip your classroom to improve student learning. *Learning & Leading with Technology*, *39*(8), 12-17.

Galarneau, D., and Gibson, L. (2020). Trends in student debt of postsecondary graduates in Canada: Results from the National Graduates Survey, 2018. *Insights on Canadian Society, 75*(6), 1-12.

Galloway, T., Bowra, A., Butsang, T., & Mashford-Pringle, A. (2020). Education in uncertainty: Academic life as Indigenous health scholars during COVID-19. International Review of Education, *66*(5), 817-832.

Gallup/Purdue University (2014). The 2014 Gallup-Purdue Index Report. Retrieved from https://www.gallup.com/services/176768/2014-gallup-purdue-index-report.aspx

GBH News. (2019, December 23). *Hampshire College President Edward Wingenbach On The School's New Beginnings* [Video]. YouTube. https://www.youtube.com/watch?v=oVAUv64cnSA&ab_channel=GBHNews

Gibbons, S., & Vignoles, A. (2012). Geography, choice and participation in higher education in England. *Regional Science and Urban Economics*, *42*(1-2), 98-113.

Goodman, L. (2017). Mental Health on University Campuses and the Needs of Students They Seek to Serve. *Building Healthy Academic Communities, 1*(2)*, 31-44.*

Government of Canada. (n.d.). *Post-Secondary Student Support Program*. Retrieved from https://www.sac-isc.gc.ca/eng/1100100033682/1531933580211

Gray, E. (2019, October 21). The downfall of Hampshire College and the broken business model of American higher education. Washington Post; The Washington Post. https://www.washingtonpost.com/magazine/2019/10/21/downfall-hampshire-college-broken-business-model-american-higher-education/

Greer L., Heaney, P. J. (2004). Real-Time Analysis of Student Comprehension: An Assessment of Electronic Student Response Technology in an Introductory Earth Science Course. *Journal of Geoscience Education, 52*(4), 345-357.

Hartocollis, A. (2020). Justice department accuses Yale of discrimination in application process. *New York Times*, August 13, 2020, p. A1.

Harward, D. (2016). *Well-being and higher education. A Strategy for change and the revitalization of education's greater purpose.* Association of American Colleges and Universities.

Heft, I. E., & Scharff, L. F. V. (2017). Aligning Best Practices to Develop Targeted Critical Thinking Skills and Habits. *Journal of the Scholarship of*

Teaching and Learning, *17*(3), 48–67.

Herreid, C. F., & Schiller, N. A. (2013). Case studies and the flipped classroom. *Journal of College Science Teaching*, *42*(5), 62-66.

Hill-Mey, P. E., Kumpfer, K. L., Merrill, R. M., Reel, J., Hyatt-Neville, B., & Richardson, G. E. (2015). Worksite health promotion programs in college settings. *Journal of Education and Health Promotion, 4*, 12.

Horn, M. B., & Dunagan, A. (2018). Innovation and Quality Assurance in Higher Education. *Clayton Christensen Institute for Disruptive Innovation*. https://www.christenseninstitute.org/publications/quality-assurance/

How, Z. J. (2020). A Systematic Review of Scholarship of Teaching and Learning Research in Higher Education Institutes from 2014–2019. In S. C. Tan & S. H. Chen (Eds.), *Transforming teaching and learning in higher education*, (pp. 11-43). Springer.

Huijser, H. J., Bedford, T., & Bull, D. (2008). OpenCourseWare, Global Access and the Right to Education: Real access or marketing ploy?. *The International Review of Research in Open and Distributed Learning*, *9*(1).

James, K. H. (2017). The importance of handwriting experience on the development of the literate brain. *Current Directions in Psychological Science*, *26*(6), 502-508.

Jewell, E., Mosby, I. (2020). Calls to Action Accountability: A 2020 Status Update on Reconciliation. Yellowhead Institute. https://yellowheadinstitute.org/wp-content/uploads/2020/12/yi-trc-calls-to-action-update-full-report-2020.pdf.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Research, 38(5)*, 365–379.

Kaplan, J., Azish, F. (2017). Head to Head: a Conversation on Behavioural Science and Ethics. Ethical Systems. Retrieved from https://www.ethicalsystems.org/wp-content/uploads/2017/06/ES_HeadtoHead_PDF_0.pdf

Kaneko, K., Saito, Y., Nohara, Y., Kudo, E., & Yamada, M. (2018). Does Physical Activity Enhance Learning Performance?: Learning Effectiveness of Game-based Experiential Learning for University Library Instruction. *The Journal of Academic Librarianship, 44*(5), 569-581.

Kelly, A. P., & Carey, K. (2013). *Stretching the higher education dollar: How innovation can improve access, equity, and affordability*. Harvard Education Press.

King, A. (1993). From sage on the stage to guide on the side. *College Teaching, 41*(1), 30-35.

Kirschner, A. (2012). Innovations in higher education? Hah. *The Chronicle of Higher Education*, *8*.

Kitrow, M. A. (2003). The Mental Health Needs of Today's College Students: Challenges and Recommendations. *NASPA Journal*, *41*(1), 165-179.

Knight, J. K., & Brame, C. J. (2018). Peer instruction. *CBE - Life Sciences Education, 17*(2).

Koedinger, K. R., Kim, J., Jia, J. Z., McLaughlin, E. A., & Bier, N. L. (2015, March). Learning is not a spectator sport: Doing is better than watching for learning from a MOOC. In Proceedings of the second (2015) ACM conference on learning@ scale (pp. 111-120).

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development* (1st ed.). Prentice-Hall.

Kosslyn, S. (2015). Minerva: A New Kind of Higher Education. UC Berkeley Events. [Video]. Youtube. https://www.youtube.com/watch?v=5-NRAg0_y1I

Kosslyn, S. & Nelson, B. (Eds.) (2017). *Building the intentional university: Minerva and the future of higher education*. MIT Press.

Kwon, C. (2019). Verification of the possibility and effectiveness of experiential learning using HMD-based immersive VR technologies. Virtual Reality. Retrieved from https://link.springer.com/article/10.1007/s10055-018-0364-1#citeas

Landauer, T. K., & Bjork, R. A. (1978). Optimum rehearsal patterns and name learning. In M. Gruneberg, P. E. Morris, & R. N. Sykes (Eds.), Practical aspects of memory (pp. 625– 632). Academic Press.

Larcombe, W., Finch, S., Sore, R., Murray, C. M., Kentish, S., Mulder, R. A., ... & Williams, D. A. (2016). Prevalence and socio-demographic correlates of psychological distress among students at an Australian university. *Studies in Higher Education*, *41*(6), 1074-1091.

Lederman, D. (2021, July 22). Minerva, a higher education outsider, now an accredited university. Insidehighered.com. https://www.insidehighered.com/news/2021/07/22/minerva-higher-education-outsider-now-accredited-university

Legassic, C. (2015). The New School Trailer. [Video]. *Vimeo.* https://vimeo.com/12947032

Logan, T. (2015). Settler colonialism in Canada and the Métis. *Journal of Genocide Research*, *17*(4), 433-452.

Looker, E. D. (2009). Regional Differences in Canadian Rural-Urban Participation Rates in Post-secondary Education. MESA Project Research Paper 2009-3, *Canadian Education Project,* Toronto, ON.

MacDonald, M. (2016). Indigenizing the academy: What some universities are doing to weave Indigenous peoples, cultures and knowledge into the fabric of their campuses. *University Affairs*, April 6, 2016. https://www.universityaffairs.ca/features/feature-article/indigenizing-the-academy/

Marin, M. F., Lord, C., Andrews, J., Juster, R. P., Sindi, S., Arsenault-Lapierre, G., Fiocco, A. J., & Lupien, S. J. (2011). Chronic stress, cognitive functioning and mental health. *Neurobiology of Learning and Memory*, *96*(4), 583–595.

McCluskey, T., Smallridge, A., Weldon, J., Loton, D., Samarawickrema, G. & Cleary, K. (2020). Building on the VU Block foundations: Results from the inaugural first year cohort. In E. Heinrich and R. Bourke (Eds.), *Research and Development in Higher Education: Next generation, Higher Education: Challenges, Changes and Opportunities, 42*, 61–72.

Meneses-Navarro, S., Freyermuth-Enciso, M. G., Pelcastre-Villafuerte, B. E., Campos-Navarro, R., Meléndez-Navarro, D. M., & Gómez-Flores-Ramos, L. (2020). The challenges facing indigenous communities in Latin America as they confront the COVID-19 pandemic. *International Journal for Equity in Health, 19*, 1-3.

Menken, S. D. R., Keestra, M., Rutting, L., Post, G., Keestra, M., Roo, M., Blad, S., & Greef, L. (2016). An Introduction to Interdisciplinary Research: Theory and Practice (Perspectives on Interdisciplinarity) (3rd ed., Vol. 2). Amsterdam University Press. https://philarchive.org/archive/MENAIT-4

Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology, 52,* 397–422.

Matilpi, M. (2012). In Our Collectivity: Teaching, Learning, and Indigenous Voice. *Canadian Journal Of Native Education*, *35*(1), 211-220.

Mayer, R. E. (2011). Applying the Science of Learning. *Pearson.* Retrieved from https://vetu.pw/applying_the_science_of.pdf

Mayer, R. Stull, A. Almeroth, K. Bimber, B. Chun, D. (2009). Clickers in college classrooms: Fostering learning with questioning methods in large lecture classes. *Contemporary Educational Psychology, 34,* 51-57.

Mazur, E. (1997, March). Peer instruction: Getting students to think in class. In AIP Conference Proceedings (Vol. 399, No. 1, pp. 981-988). American Institute of Physics.

McDonnell, L., & Mullally, M. (2016). Research and teaching: Teaching students how to check their work while solving problems in genetics. *Journal of College Science Teaching, 46*, 68–75.

McIntyre, L (2019). *The scientific attitude.* MIT Press.

Minerva Schools at KGI. (2021). *Minerva Schools at KGI Undergraduate Student Handbook.* Retrieved from https://minervaschools-production-cms-uploads.s3.amazonaws.com/documents/2021-22_Minerva_Schools_at_KGI_Student_Handbook_6_8.pdf

Minerva Voices. (2018). The End of Lectures: The Science of Learning and Human-Centered Design at Minerva. *Medium.* https://medium.com/minerva-university/goodbye-passive-lectures-combining-the-science-of-learning-with-human-centered-design-6210f6d2c5c6

Morgan, H. (2009). What Every Teacher Needs to Know to Teach Native American Students. *Multicultural Education, 16*(4), 10-12.

Nascimento, D.V., Mutize, T., Chinchilla, J.F.R. (2020, November 16). *Towards universal access to higher education: international trends.* UNESCO IESALC. https://www.iesalc.unesco.org/eng/wp-content/uploads/2020/11/Towards-Universal-Access-to-HE-Report.pdf

Nemiroff, G. H. (1990). *From humanistic education to critical humanism: The dialectics of theory and praxis*. Bergin & Garvey.

Nobel Prize in Chemistry. (2020). Press release: The Nobel Prize in Chemistry 2020. The Nobel Prize. https://www.nobelprize.org/prizes/chemistry/2020/press-release/

O'Brien, J. (2016). Innovative Cooperation, at Scale: An Interview with Michael M. Crow. *EDUCAUSE Review* er.educause.edu/articles/2016/10/innovative-cooperation-at-scale-an-interview-with-michael-m-crow.

Orygen. (2017)). *Under the radar. The mental health of Australian university students*. Orygen. The National Centre of Excellence in Youth Mental Health.

Plutarch, "On Listening" c.f. Sweeney, J. J. (1968). Vision and Image: A Way of Seeing. Simon and Schuster.

Quest University. (n.d.). The Block Plan - Quest University Canada. Quest University Canada. https://questu.ca/academics/the-block-plan/

Ran, F., Hsu, P., Wright, J. Agarwala, V., Scott, D. A., Zhang, F. (2013). Genome engineering using the CRISPR-Cas9 system. *Nature Protocols, 8*, 2281–2308. https://doi.org/10.1038/nprot.2013.143

Robson, K., Anisef, P., & Brown, R. (2016). "Identifying the Complexity of Barriers Faced by Marginalized Youth in Transition to Postsecondary Education in Ontario," in Wolfgang Lehmann (Ed), *Education and Society: Canadian Perspectives*. London: Oxford University Press, 2016.

Roediger, H. L. 3rd, & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences*, *15*(1), 20–7. https://doi.org/10.1016/j.tics.2010.09.003

Roediger III, H. L., & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications for educational practice. *Perspectives on Psychological Science*, *1*(3), 181-210.

Rohrer, D., & Taylor, K. (2007). The shuffling of mathematics problems improves learning. *Instructional Science, 35*, 481–498.

Royal College of Psychiatrists. (2011). *Mental health of students in higher education*. (College report CR166). London: Author.

Santelises, L. A., Ortega, M. T. C., Margarita, C., Rojas-Fernández, A. G., Santelises, M. A., del Valle, A. G. (2015). Keeping Teachers Up-to-date is essential to reach and maintain a High Quality University Education. *Multidisciplinary Journal for Education, Social and Technological Sciences, 2*(1).

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, *124*(2), 262.

Schmidt, F. L., Oh, I. S., & Shaffer, J. A. (2016). The Validity and Utility of Selection Methods in Personnel Psychology: Practical and Theoretical Implications of 100 Years. [Working Paper.] Retrieved from https://www.researchgate.net/publication/309203898

Schmidt, H. G., Wagener, S. L., Smeets, G. A., Keemink, L. M., & van der Molen, H. T. (2015). On the use and misuse of lectures in higher education. *Health Professions Education, 1*(1), 12-18.

Selingo, J. J. (2013). *College unbound: The future of higher education and what it means for students*. Seattle, WA: Amazon Publishing.

Shi, Y. Ma, Y. MacLeod, J. Yang, H. H. (2019). College students' cognitive learning outcomes in flipped classroom instruction: a meta-analysis of the empirical literature. J*ournal of Computers in Education, 7*(8).Shukla, N.J., & Mcinnis, E. (2021). Flipped Classroom: Success with First Year Mathematics Students. *International Journal on Social and Education Sciences. 3*(1), 32-47.

Silverthorn, D. (2016). *Hungry for knowledge: Assessing the prevalence of student food insecurity on five Canadian campuses.* Meal Exchange.

Specht, L. B., & Sandlin, P. K. (1991). The differential effects of experiential learning activities and traditional lecture classes in accounting. *Simulation & Gaming*, *22*(2), 196-210.

Stallman, H. M. (2010). Psychological distress in university students: A comparison with general population data. *Australian Psychologist*, *45*(4), 249–257. doi: 10.1080/00050067.2010.482109

St. Amour, M. (2019, October 19). Accreditation works for innovation but can slow it down, ACE report says. Insidehighered.com. https://www.insidehighered.com/news/2019/10/02/accreditation-works-innovation-can-slow-it-down-ace-report-says

Stanton, A., Zandvliet, D., Dhaliwal, R., & Black, T. (2016). Understanding students' experiences of well being in learning environments. *Higher Education Studies, 6*(3), 90-99.

Statistics Canada. (2010). Youth in Transition Survey (YITS) – Cycle 6. Retrieved from http://www23.statcan.gc.ca/imdb-bmdi/pub/document/4435_D25_T1_V6-eng.htm

Statistics Canada. (2014). Graduating in Canada: Profile, Labour Market Outcomes and Student Debt of the Class of 2009-2010. Retrieved from https://www150.statcan.gc.ca/n1/pub/81-595-m/2014101/section04-eng.htm

Statistics Canada (2018). *National Graduates Survey.* Statistics Canada. Retrieved from https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3710003001

Statistics Canada. (2021). The Daily — Student pathways through postsecondary education, 2011 to 2018. Statcan.gc.ca. https://www150.statcan.gc.ca/n1/daily-quotidien/210609/dq210609d-eng.htm

Stein, S. (2020). 'Truth before reconciliation': The difficulties of transforming higher education in settler colonial contexts. *Higher Education Research & Development*, *39*(1), 156-170.

Sterzuk, A., & Fayant, R. (2016). Towards reconciliation through language planning for Indigenous languages in Canadian universities. *Current Issues in Language Planning, 17*(3-4), 332-350.

Strada-Gallup (2017). Strada-Gallup 2017 College Student Survey. Retrieved from https://news.gallup.com/reports/225161/2017-strada-gallup-college-student-survey.aspx

Streveler, R. A., Smith, K. A., & Pilotte, M. (2012). Aligning course content, assessment, and delivery: Creating a context for outcome-based education. In Mohd-Yusof, K., Ahmad Azli, N., Mohd Kosnin, A., Kamilah Syed Yusof, S., & Mohammad Yusof, Y (Eds.), *Outcome-based science, technology, engineering, and mathematics education: Innovative practices* (1st ed., pp. 1-26). Information Science Reference.

Sukumar, P. T., & Metoyer, R. (2018). A visualization approach to addressing reviewer bias in holistic college admissions. In *Cognitive Biases in Visualizations* (pp. 161-175). Springer, Cham.

Swanger, D. (2016). Innovation in Higher Education: Can Colleges Really Change? Retrieved from https://www.fmcc.edu/about/files/2016/06/Innovation-in-Higher-Education.pdf

SXSW EDU (2018, March 6). *Michael J. Sorrell | WE Over Me: From College to Movement | SXSW EDU 2018* [Video]. YouTube. https://www.youtube.com/watch?v=snE6nBlwSxY&ab_channel=SXSWEDU

Tatum, C. (2019, December 19). How Dallas' Paul Quinn College became America's first urban work college. The Texas Tribune; The Texas Tribune. https://www.texastribune.org/2019/12/19/how-dallas-paul-quinn-college-became-americas-first-urban-work-college/

Taylor, M., Atas, S., & Ghani, S. (2017). Exploring the experiences of students and professors in a blended learning graduate program: A case study of a faculty of education. *International Journal of Mobile and Blended Learning (IJMBL), 9*(1), 1-15.

Temes, P., Aw, F., McGinty, F. (2021). *The Impact of COVID on the University Student Experience Webinar* [WeWork].

TEDxTalks. (2013, June 8). *Designing a university for the new millennium: David Helfand at TEDxWestVancouverED* [Video]. YouTube. https://www.youtube.com/watch?v=DZQe73IXZtU&ab_channel=TEDxTalks

Teuber, H-L. (1976). Personal communication to author DJL, February 16, 1976.

TEDxTalks. (2020, February 19). *How College Fails Us | Reimagining Higher Education | Leah Goodman | TEDxRushU* [Video]. Youtube. https://www.youtube.com/watch?v=n9MeA6uejGU

TRC. (2012). *Calls to Action*. Retrieved from http://trc.ca/assets/pdf/Calls_to_Action_English2.pdf

Turley, R. N. L. (2009). College Proximity: Mapping Access to Opportunity. *Sociology of Education, 82*(2), 126–146.

Turley, R. N. L., Desmond, M., & Bruch, S. K. (2010). Unanticipated Educational Consequences of a Positive Parent-Child Relationship. *Journal of Marriage and the Family, 72*(5), 1377–1390.

Twigg, C. A. (2015). Improving learning and reducing costs: fifteen years of course redesign. *Change: The Magazine of Higher Learning, 47*(6), 6-13.

Universities Canada (2019). *Equity, diversity and inclusion at Canadian universities: Report on the 2019 national survey*. Universities Canada, https://www.univcan.ca/wp-content/uploads/2019/11/Equity-diversity-and-inclusion-at-Canadian-universities-report-on-the-2019-national-survey-Nov-2019-1.pdf.

University of Calgary. (2016). *Campus mental health strategy: Creating a community of caring*. Retrieved from https://www.ucalgary.ca/provost/files/provost/15-unv-018-mental_health_strategy_final.pdf

University of Technology Sydney. (2018, June 14). *Mental Health and Wellbeing at UTS* [Video]. YouTube. https://www.youtube.com/watch?v=vXBn6Mp5msg&ab_channel=UniversityofTechnologySydney

University of Toronto. (2014). *Report of the provostial advisory committee on student mental health: The University of Toronto student mental health strategy and framework*. Retrieved from: http://www.provost.utoronto.ca/Assets/Provost+Digital+Assets/REPORT+OF+THE+PROVOSTIAL+ADVISORY+COMMITTEE+ON+STUDENT+MENTAL+HEALTH.pdf

U.S. Department of Education (2021a). IPEDS (Integrated Post-secondary Education Data System). https://nces.ed.gov/collegenavigator/?id=238193#netprc Accessed August 12, 2021.

U.S. Department of Education (2021b). Federal Student Aid. https://studentaid.gov/understand-aid/types/grants/pell, retrieved August 25, 2021.)

UTS Alumni. (2020, November 15). *Alumni insider: five questions with UTS Vice-Chancellor Attila Brungs* [Video]. YouTube. https://www.youtube.com/watch?v=9xEGSEGKN4w&t=138s&ab_channel=UTSAlumni

Vaccaro, A. (2012). An Analysis of Access Barriers to Post-Secondary Education. *College Quarterly*, *15*(4), n4.

Varenne, H. & McDermott, R. (2018). *Successful failure: The school America builds.* Routledge.

Wadhawan, A., & Kumar, P. (2020). Deep learning-based sign language recognition system for static signs. *Neural Computing and Applications, 32*(12), 7957-7968.

Wallace, R. (2011). Power, Practice and A Critical Pedagogy for Non-Indigenous Allies. *Canadian Journal of Native Studies*, *31*(2), 155-172.

Wang, S., Murota, M. (2016). Possibilities and limitations of integrating peer instruction into technical creativity education. *Instructional Science, 44*(6), 501-525.Watkins, K. (2013, January 16). Too little access, not enough learning: Africa's twin deficit in education. *Brookings*, https://www.brookings.edu/opinions/too-little-access-not-enough-learning-africas-twin-deficit-in-education

Wieman, C., Perkins, K., Gilbert, S. Benay, F., Kennedy, S., Semsar, K., Knight, J., Shi, J., Smith, M., Kelly, T., Taylor, J., Yurk, H., Birol, G. Langdon, L., Pentecost, T., Stewart, J., Arthurs, L. Bair, A., Stempien, J. … Chasteen, S. (2017). Clicker Resource Guide: An Instructor's Guide to the Effective Use of Personal Response Systems (Clickers) in Teaching [PDF File]. *Carl Weiman Science Education Initiative.* Retrieved from https://cwsei.ubc.ca/sites/default/files/cwsei/resources/instructor/Clicker_guide_CWSEI_CU-SEI.pdf

Wiens, K., Bhattarai, A., Dores, A., Pedram, P., Williams, J. V., Bulloch, A. G., & Patten, S. B. (2020). Mental health among Canadian postsecondary students: a mental health crisis?. *The Canadian Journal of Psychiatry*, *65*(1), 30-35.

World Bank. (2020). School enrollment, tertiary (% gross) | Data. Worldbank.org. https://data.worldbank.org/indicator/SE.TER.ENRR

WURI. (n.d.). Global Top 100 Innovative Universities. https://www.wuri.world/global-top-100-innovative-2021

Wyatt, T. (2009). The Role of Culture in Culturally Compatible Education. *Journal Of American Indian Education*, *48*(3), 47-63.

Young, J. R. (2017). Three Years In, Minerva's Founder On For-Profits, Selectivity, and His Critics. *EdSurge* www.edsurge.com/news/2017-05-10-three-years-in-minerva-s-founder-on-for-profits-selectivity-and-his-critics

Zadra, A., & Stickgold, R. (2021). When Brains Dream: Exploring the Science and Mystery of Sleep. WW Norton.

Zandvliet, D. B., Stanton, A., & Dhaliwal, R. (2019). Design and validation of a tool to measure associations between the learning environment and student well-being: The Healthy Environments and Learning Practices Survey (HELPS). *Innovative Higher Education*, *44*(4), 283-297.

APPENDIX (Supplementary Material)

Defining excessive debt

A number of sources have attempted to define how much student debt is too much with answers varying widely. According to Statistics Canada[1], small student debt can be defined as less than $10,000 and large debt as greater than $25,000. The Social Research and Demonstration Corporation (SRDC)[2] defines manageable debt in a number of ways. For Canadian earners at the 50th percentile for income, the maximum debt would not exceed $16,622 with 5.5% interest rate according to the "rule of thumb 8 percent" definition. The over-indebtedness definition of manageable student debt requires that individuals not spend more than 25 percent of gross income on credit commitments. The threshold for student debt under this definition would be the difference between 25 percent of gross income and Statistics Canada's estimated average consumer debt load. For Canadian earners at the 50th percentile for income, the maximum debt then would not exceed $33,000 with 5.5% interest rate. A third threshold definition is maximum discretionary income available for debt repayment with respect to Low Income Cut Offs. The maximum monthly "discretionary income" available for debt repayment for the 50th income percentile is $2,404. Alternatively, the maximum "discretionary income" available for debt repayment at each income percentile could be calculated as the difference between disposable income and the Moderate Standard Of Living. Using this formula, the maximum monthly "discretionary income" available for debt repayment for the 50th income percentile is $1,294. Respondents in the SRDC study indicated that debt in the amount of $20,000 did not seem unreasonable for a student after completing their studies, but that amounts above $40,000~$50,000 become much more unreasonable for a student to manage. Respondents were from consumer credit or credit counselling organizations; private sector lenders including banks and credit unions; student counselling and support; academic experts in student financial aid; and credit bureaus.

Considering all this information together, we defined easily manageable debt as <$20,000, manageable debt as $20,000-49,999, and excessive debt as >$50,000.

Weighting the 9 Factors for Evaluating the 12 Institutions of Higher Education

Our research identified nine factors that are crucial for positioning Canada as a leader in higher education for the 21st century. We considered the possibility that some of the factors might be more important than others for reimagining higher education, and so should not be equally weighted in evaluating currently operating institutions. We recognize that any such weighting involves some subjectivity. To minimize this, we consulted widely with colleagues inside and outside of higher education, and the PI assembled a research team representing diverse backgrounds and experiences (although due to longstanding inequities in higher education, our team did not represent the Canadian population because it was limited to individuals enrolled in college and majoring in psychology or a related field). The eleven project team members who had participated in the Phase 1 research (the seven authors plus four additional laboratory members) met on four separate occasions to discuss the importance of each factor. Each team member proposed a weighting factor by secret ballot, and the weights were determined by averaging those scores.

The nine factors' weights' sum to 100, creating a reference point for the scores of universities according to the Criteria Sheet. Once each factor was ranked from most relevant to least relevant, the highest ranked factor was weighted 15/100, with each succeeding factor's weight decrementing by 1/100. Indigenous Inclusion and Mental Health Resources are tied for 4th place, both weighted at 12/100. The following [6th] factor: Admissions Transparency, is therefore decremented by two points, rather than one to account for the tie.

We do not argue that the method was infallible, nor that a different group of researchers would come up with the same weightings. We do however, feel there is value in being able to rank these 12 institutions from most to least successful (based on our criteria). We emphasize that the difference between the 12th school on the list and the first is small in the larger context of schools worldwide—these are the 12 institutions worldwide that we identified as succeeding mightily along the dimensions that we care about, and that the research literature indicates are critical to removing barriers and creating value for all.

The first four factors relate directly to improving institutions of higher education in ways that will help us train the next ~~generation of Canadian leaders, wo~~rkers, and citizens. Factors 5–9 relate broadly to barriers to becoming admitted in the first

[1] Ferguson, S. J., & Wang, S. (2014). *Graduating in Canada: Profile, Labour Market Outcomes and Student Debt of the Class of 2009-2010.* Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/pub/81-595-m/81-595-m2014101-eng.pdf

[2] Social Research and Demonstration Corporation (2013). *Manageable Student Debt Threshold Research: Final Report.* Social Research and Demonstration Corporation. Retrieved from https://www.srdc.org/media/199685/student-debt-report.pdf

place and so are weighted lower, on the belief that there is no motivation for many students to attend colleges and universities in the first place when the experience cannot deliver on its promise.

1) Science of Learning: 15/100 points. We gave this factor the highest weight because the fundamental job of colleges and universities is to educate students—to learn the skills and mindsets necessary to become better citizens, and to succeed in the workplace. The science of learning informs educators and faculty about how to facilitate effective student learning, but few institutions of higher education are paying attention.

2) Career-Prepared Graduates: 14/100 points. With increasing globalization, digitization, and the growth of artificial intelligence and "smart systems," the 21st century graduate will need to be a life-long learner, able to teach themselves what they need to know, and to update their knowledge as new information becomes available. This requires very different preparation than the general education expected of college graduates 50 or 100 years ago; students must develop the skills necessary to adapt to the constantly changing global and emerging digital economy to prepare for careers that don't even exist yet.

3) Financial Accessibility: 13/100 points. Finances are one of the tallest barriers for students aiming to access higher education, particularly due to the increasing average tuition and costs of attending college. The cost-benefit analysis of pursuing higher education can leave students wondering: is this degree really worth the cost?

4) Indigenous Inclusion (tie): 12/100 points. This factor is no less important than the previous ones but uniquely among those on the list, it is covered by legislation (cited in the report). Any reimagining of the future of Canadian higher education must create space for meaningful inclusion of Indigenous cultures, languages, practices, and knowledge(s). Approaches for inclusion must not be tokenistic and shallow; instead, we must pursue genuine reconciliation and collaboration with Indigenous voices, with the goal of integrating Indigenous knowledge(s) as part of the institutional fabric of higher education, and causing no further harm.

5) Mental Health Resources (tie): 12/100 points. Higher education is failing to implement mental health infrastructure in a way that students can access and benefit from. Competitive curricula design and inaccessibility of health resources lead to adverse effects on student mental health. Higher education institutions must prioritize student health to maximize student success.

6) Admissions Transparency: 10/100 points. Students are not privy to the evaluation process of admissions, and therefore struggle to gain access to higher education. Clearer expectations of students can be communicated through transparency in application, admittance, and acceptance processes.

7) Geographic Accessibility: 9/100 points. Many rural communities lack access to good quality higher education due to lack of transportation services, on-campus housing, and online degree options. While these services are expanding, many universities and colleges are still inaccessible for those who are not mobile or who have other responsibilities (e.g., work, children). Higher education must be accessible to any and every community so that all individuals have the opportunity to access education.

8) Attrition and Retention: 8/100 points. One measure of success that colleges and universities use is the proportion of students who complete their training within x years of matriculation, or its complement, the number of students who drop out. These data are messy—someone who drops out after 2 days may be counted the same as someone who completes all but one final exam; students who drop out for health or financial reasons may be counted the same as students who have come to believe that they are wasting their time. Importantly, the statistic does not capture students who transfer out of one institution and complete at another. Despite these problems, we felt the metric deserved inclusion because it is what most institutions (and many rating sites) use to compare their success to others.

9) Technological Infrastructure: 7/100 points. In response to the COVID-19 pandemic, most universities transitioned to remote and distance learning, leveraging technology for learning and teaching with widely varying degrees of success. With widespread digital proficiency and accessibility, technological infrastructure is not as representative of university and student success as the other factors listed above. Nonetheless, it is important that institutions have robust technological tools available to students, faculty, and staff, to enhance the facilitation of curricula and student experience.