ONLINE MEM Master of Engineering Management

DIGITAL TRANSFORMATION in GOVERNMENT

Stream 2

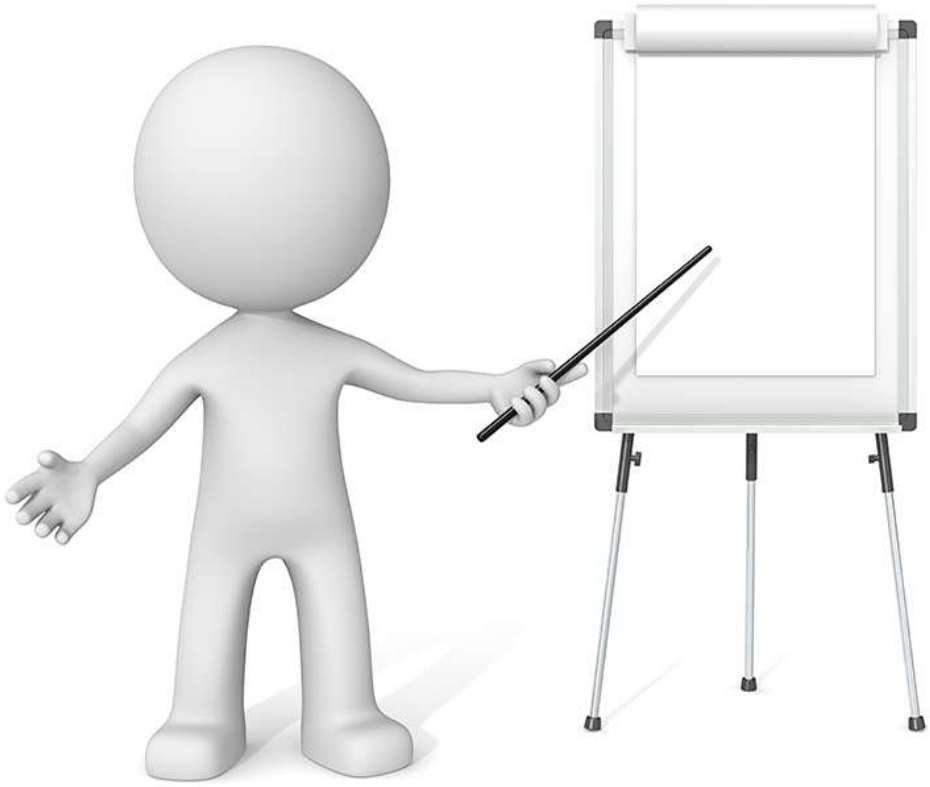
Learning in Digital Environments

June 13, 2023

uOttawa

Introduction

- Profile
- Shaping Forces and uOttawa's Evolution
- Where to Next?
- What Effect Has the Digital Shift Made on Skills in Demand?
- How Has this Change in the Job Market Affected uOttawa's Faculty of Engineering?
- On Line Masters of Engineering Management
- Getting to the Bottom Line



Profile

https://www.linkedin.com/in/jac-van-beek-fcmc-86a7624/

Executive in Residence
Director, Graduate Programs in Engineering Management
PT (Long Term) Professor of Business

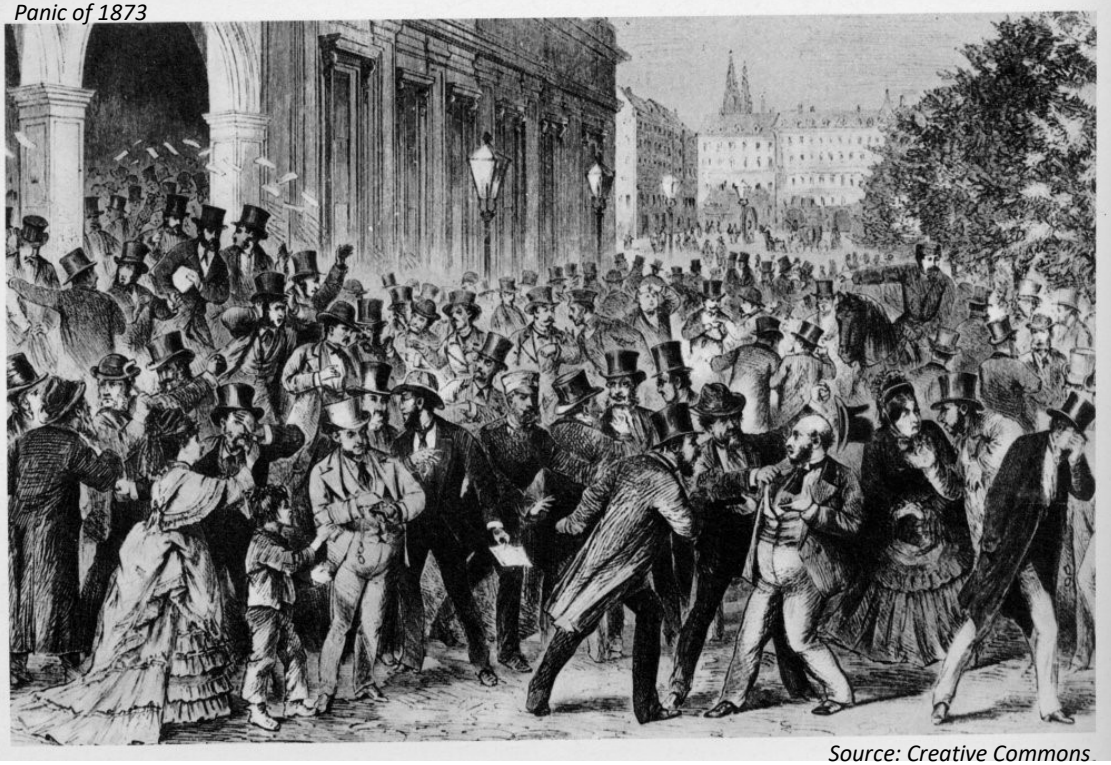
- Former executive (CEO, VP) – Canada's Research enterprise
- Social entrepreneur, start-up ventures, grocery retail
- Management Consultant (3 multinational consultancies and independent)
- Educator for 28 years – Business and Engineering
- Broad range of complex problems and national policies – emerging technologies, large science, aerospace, construction, information capture/access/processes/data storage/retrieval, certification/international standards
- Extensive experience in group problem solving, large scale facilitation, national consultations, critical conversations
- National institution strategies
- Broad, strategic perspective
- Project/initiative orientation

Impact of the information revolution

"The truly revolutionary impact of the Information Revolution … is being driven by the explosive emergence of the Internet as a major, perhaps eventually, the major worldwide distribution channel for goods, for services, and surprisingly for managerial and professional jobs."

"Beyond the Information Revolution", Peter Drucker, Atlantic Monthly, October 1999

Panic of 1873



Source: Creative Commons

University Response – Evolving Role

- Traditionally an integral part of the country's innovation system (and IP protected)….now seen increasingly as a vehicle for community and international advancement and connection.
- Changed role and digital capability is driving force for evolution:
  - Immersive learning experiences will no longer be a perk, but a necessity
  - Blending traditional and non-traditional teaching methods will become the norm
  - Moving between borders and gaining an international outlook
  - Student-focused learning will be essential
  - Strong desire for experiential approaches in a digital environment

Realizing the Possibilities: First Steps – Preparing New Graduates

uOttawa Engineering Graduate Programs 2000-2020

- **2010 –** 750 Students (mostly Canadian, 700 Thesis, 50 Professional Program)
- **2018 – present** approximately 1500 Students (mostly international, 750 Thesis, 750 Professional Program)
- **Chemical Engineering**
- **Civil Engineering**
- **Computer Science**
- **Electrical and Computer Engineering**
- **Mechanical Engineering**
- **Digital Transformation and Innovation *New since 2020**
- **Applied Artificial Intelligence**

Realizing the Possibilities: Bolder Steps for New Graduates

uOttawa Engineering Graduate Programs 2021-2022

Regular Enrollment of 1500 students plus … via strategic partnerships and signed agreements

- ~150 Egyptian Students – Digital Egypt Builders Initiative
- ~150 Working Canadians – Master of Engineering Management (online)
- ~150 Students in Faculty of Engineering "upskilling" certificate programs in partnership with Professional Development Institute and Industrial partners
- ~200 Students in Faculty of Engineering acquiring technical management skills
- **2023 –** 8,000 applicants to Engineering programs (a first!)

Planning microprograms and industry partnered training and internationally partnered training in the following areas:

- Enterprise Architecture
- Cybersecurity
- Interdisciplinary AI
- Cloud Computing
- Robotics & IOT
- Sales Engineer
- Data Analytics
- Product Development
- User Experience Design

How Are We Preparing Professional for their Changing Careers

- CloudCampus
- Cybersecurity
- Enterprise Architecture
- Digital Egypt Builders Initiative
- Expanding online programs to include Design Transformation and Innovation and AI

Microprograms

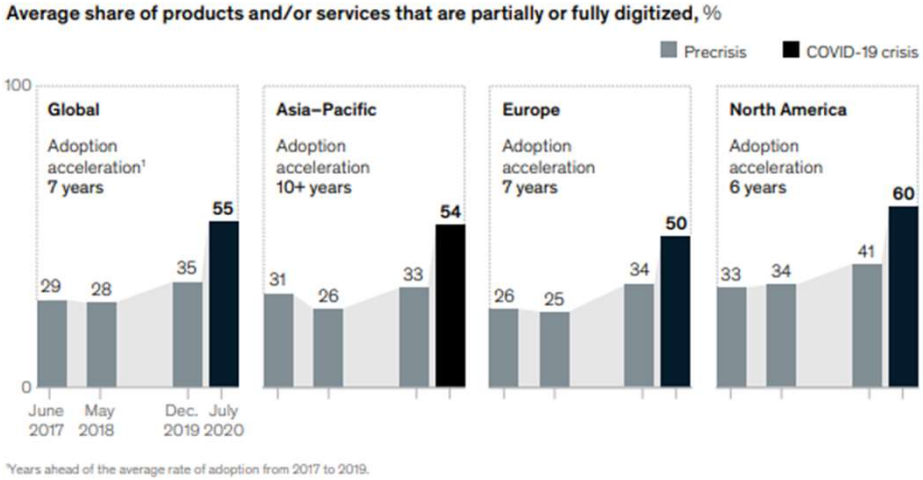
- **Professional Program and Undergraduate Students want careers in addition to a general education**
- **Employers are looking for specialized skills, not just general degrees**
- **Employers want to upskill or "right" skill existing employees … less disruptive and more cost effective than constant employee turnover (there is a lack of available talent to hire anyway…)**
- **Coursera, Udemy, Youtube, Vendor-specific options are not sufficient. The university adds value.**

Where to Next?

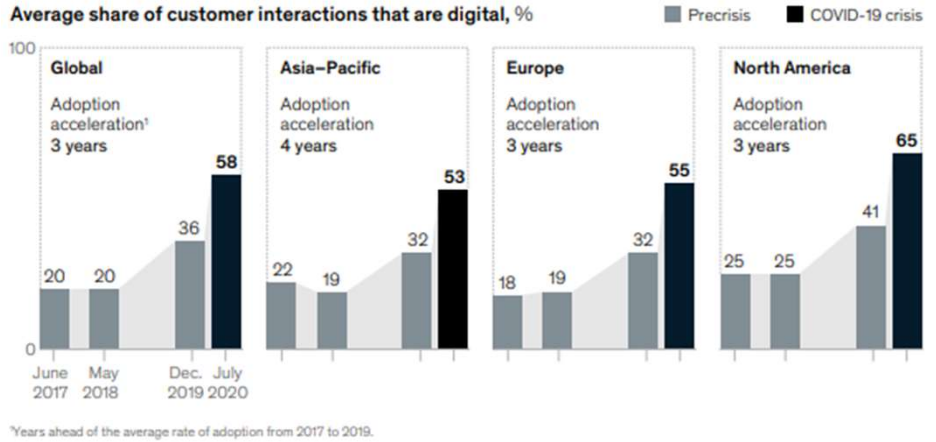
Digital Shift

Shift across all sectors

Across business areas, the largest leap in digitization is the share of offerings that are digital in nature



The pandemic accelerated the digitization of customer/client interactions by several years

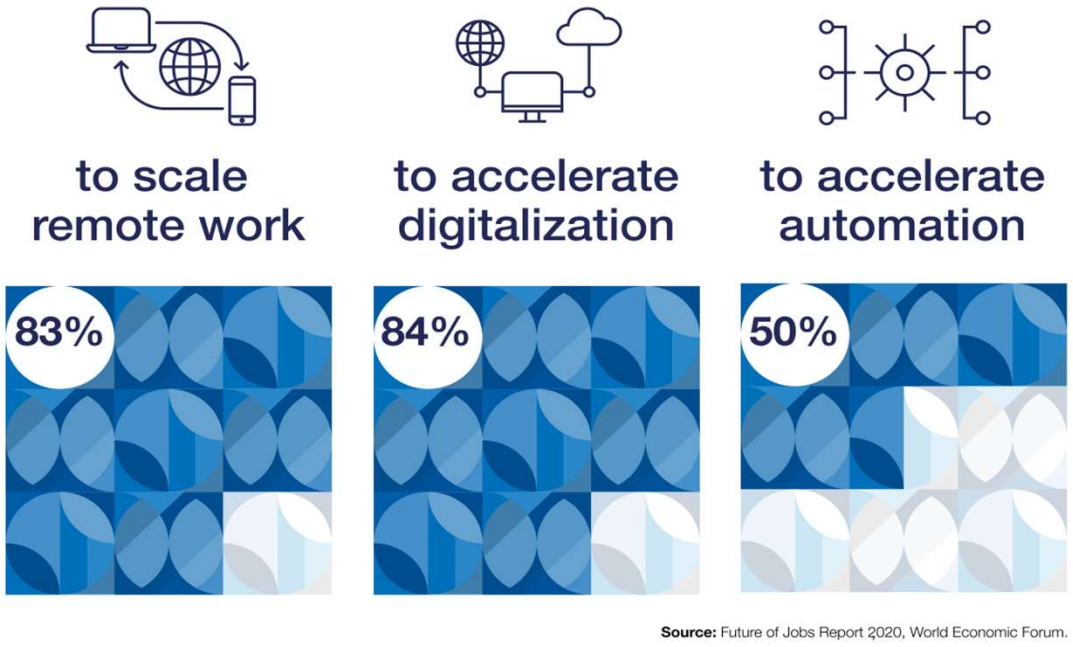


Source: McKinsey

Job Shift

COVID-19 pushed companies to shift

Workers acquiring greater literacy in digital technologies and an aptitude for using it to solve a range of organizational and community problems



Source: World Economic Forum

We Shifted Much Faster than Expected

New models are emerging as organizations struggle to build post-pandemic

Executives say their companies responded to a range of COVID-19-related changes much more quickly than they thought possible before the crisis.

Time required to respond to or implement changes,[1] expected vs actual, number of days

Organizational changes | Industry-wide changes

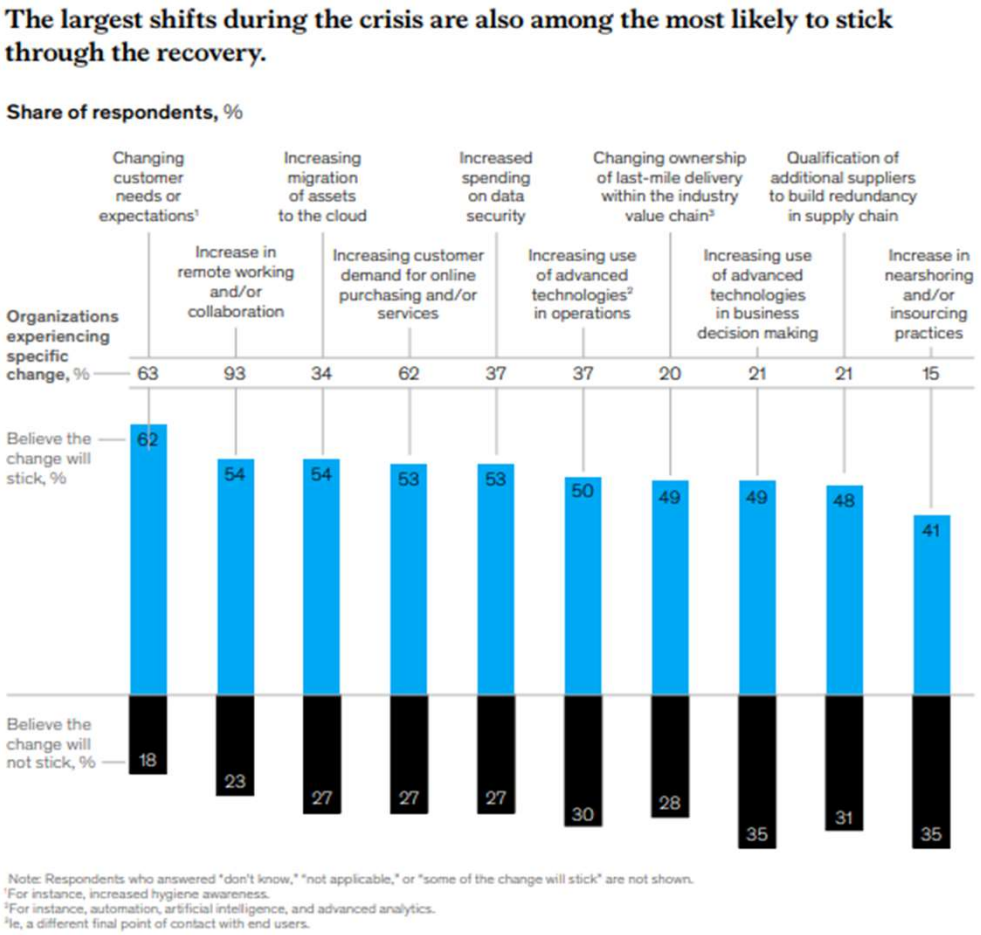
	Expected	Actual	Acceleration factor, multiple
Increase in remote working and/or collaboration	454	10.5	43
Increasing customer demand for online purchasing/services	585	21.9	27
Increasing use of advanced technologies in operations	672	26.5	25
Increasing use of advanced technologies in business decision making	635	25.4	25
Changing customer needs/expectations[2]	511	21.3	24
Increasing migration of assets to the cloud	547	23.2	24
Changing ownership of last-mile delivery	573	24.4	23
Increase in nearshoring and/or insourcing practices	547	26.6	21
Increased spending on data security	449	23.6	19
Build redundancies into supply chain	537	29.6	18

[1]Respondents who answered "entry of new competitors in company's market/value chain" or "exit of major competitors from company's market/value chain" are not shown; compared with the other 10 changes, respondents are much more likely to say their companies have not been able to respond.
[2]For instance, increased focus on health/hygiene.

Source: McKinsey

This Shift was a Break from the Past

Expect digital platform to stick

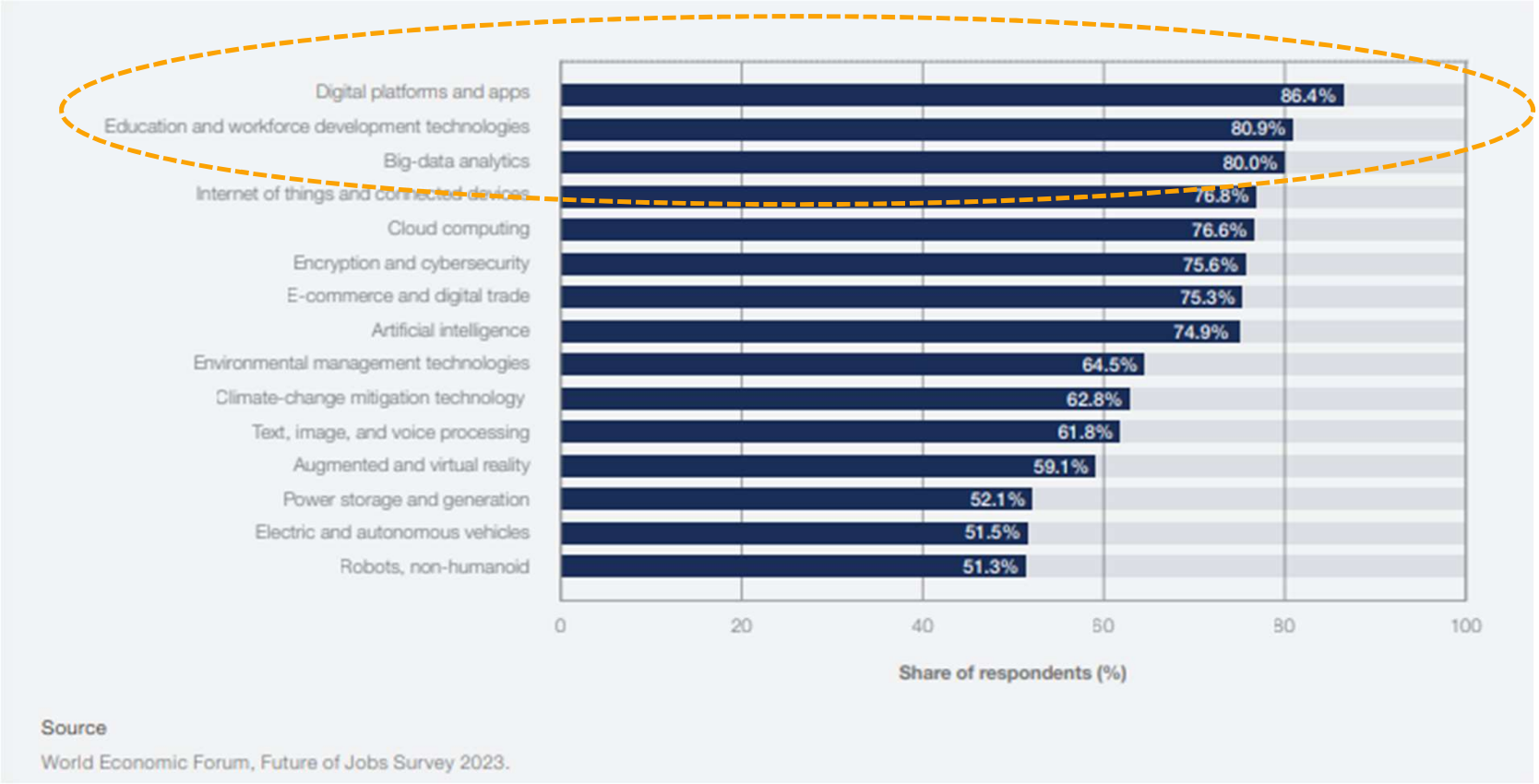


Source: McKinsey

Post Co-Vid: Technology Adoption 2023-2027

Technologies ranked by share of organizations surveyed who are likely or highly likely to adopt this technology over the next 5 years

Dramatic growth of education and workforce development and data analytics



Source

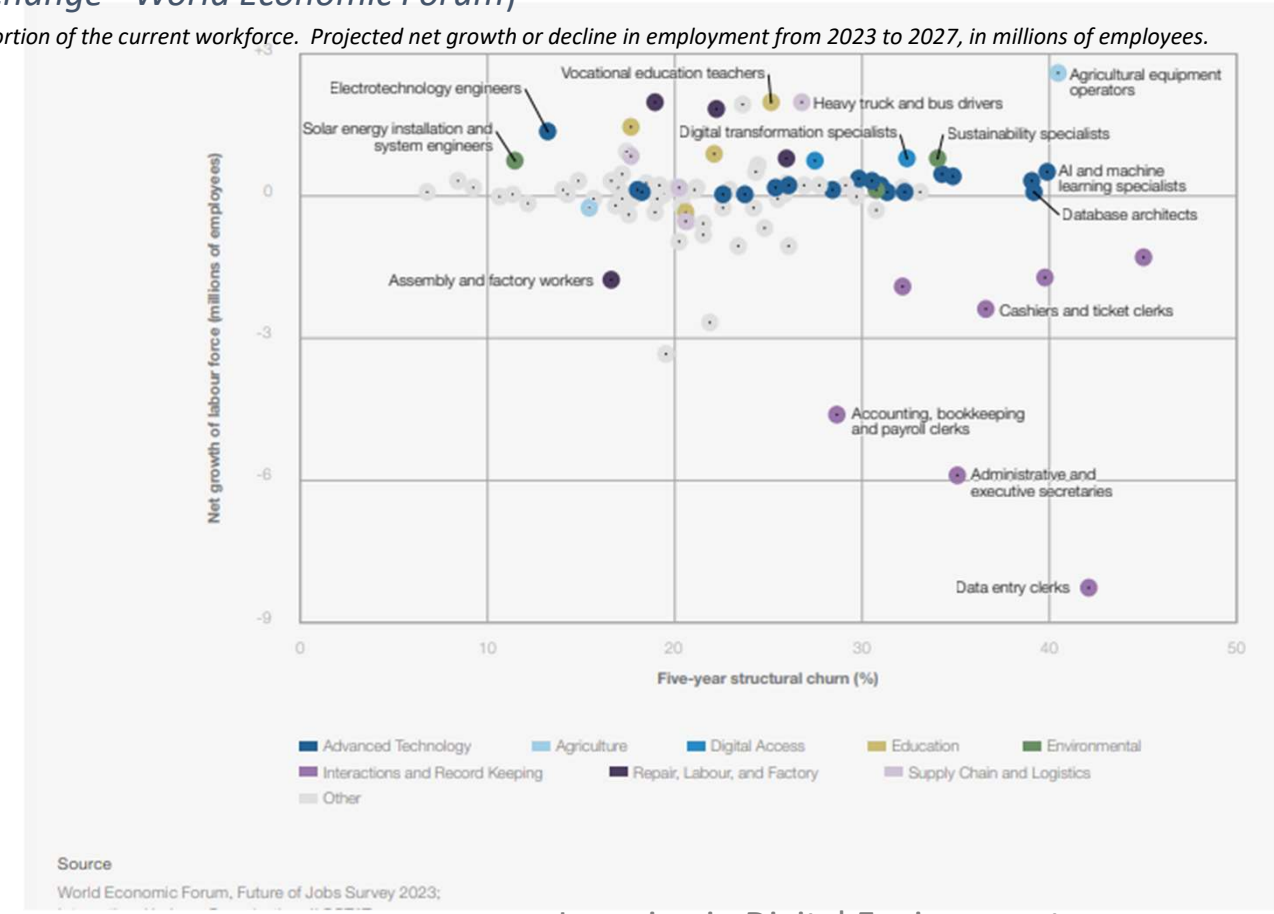
World Economic Forum, Future of Jobs Survey 2023.

What Effect Has the Digital Shift Made on Skills in Demand?

Projected churn and net growth/decline of employment 2023-2027, by occupation (Expect 23% of jobs to *change - World Economic Forum*)

Projected structural labour-market churn from 2023-2027, as a proportion of the current workforce. Projected net growth or decline in employment from 2023 to 2027, in millions of employees.

- Growth across many occupations performing in digital environments
- Decline in occupations that feature interacting with clients/the public and recordkeeping



Source

World Economic Forum, Future of Jobs Survey 2023;

There will be many traditional job casualties

Having technology know-how in digital technologies is in demand

Fastest growing vs. fastest declining jobs

WORLD ECONOMIC FORUM

Top 10 fastest growing jobs		Top 10 fastest declining jobs	
1.	AI and Machine Learning Specialists	1.	Bank Tellers and Related Clerks
2.	Sustainability Specialists	2.	Postal Service Clerks
3.	Business Intelligence Analysts	3.	Cashiers and ticket Clerks
4.	Information Security Analysts	4.	Data Entry Clerks
5.	Fintech Engineers	5.	Administrative and Executive Secretaries
6.	Data Analysts and Scientists	6.	Material-Recording and Stock-Keeping Clerks
7.	Robotics Engineers	7.	Accounting, Bookkeeping and Payroll Clerks
8.	Electrotechnology Engineers	8.	Legislators and Officials
9.	Agricultural Equipment Operators	9.	Statistical, Finance and Insurance Clerks
10.	Digital Transformation Specialists	10.	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers

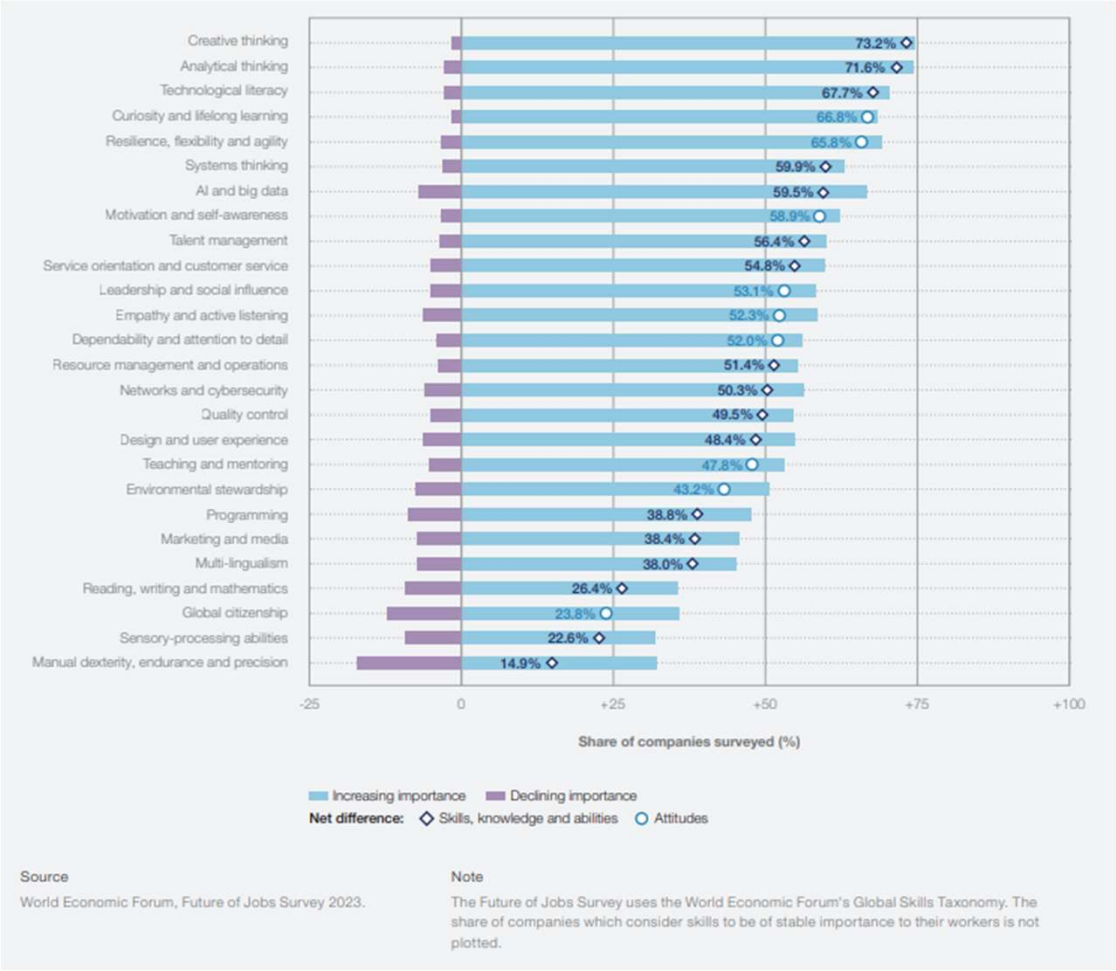
Source
World Economic Forum, Future of Jobs Report 2023.

Note
The jobs which survey respondents expect to grow most quickly from 2023 to 2027 as a fraction of present employment figures

Skills on the Rise

Share of organizations surveyed which consider skills to be increasing or decreasing in importance, ordered by the net difference.

Emerging skillset relevant to adapting to uncertainty and resolving/contributing to complex problems: a mix of technical savvy and the ability to engage others



Source

World Economic Forum, Future of Jobs Survey 2023.

Note

The Future of Jobs Survey uses the World Economic Forum's Global Skills Taxonomy. The share of companies which consider skills to be of stable importance to their workers is not plotted.

Knowing the Technologies is Not Enough

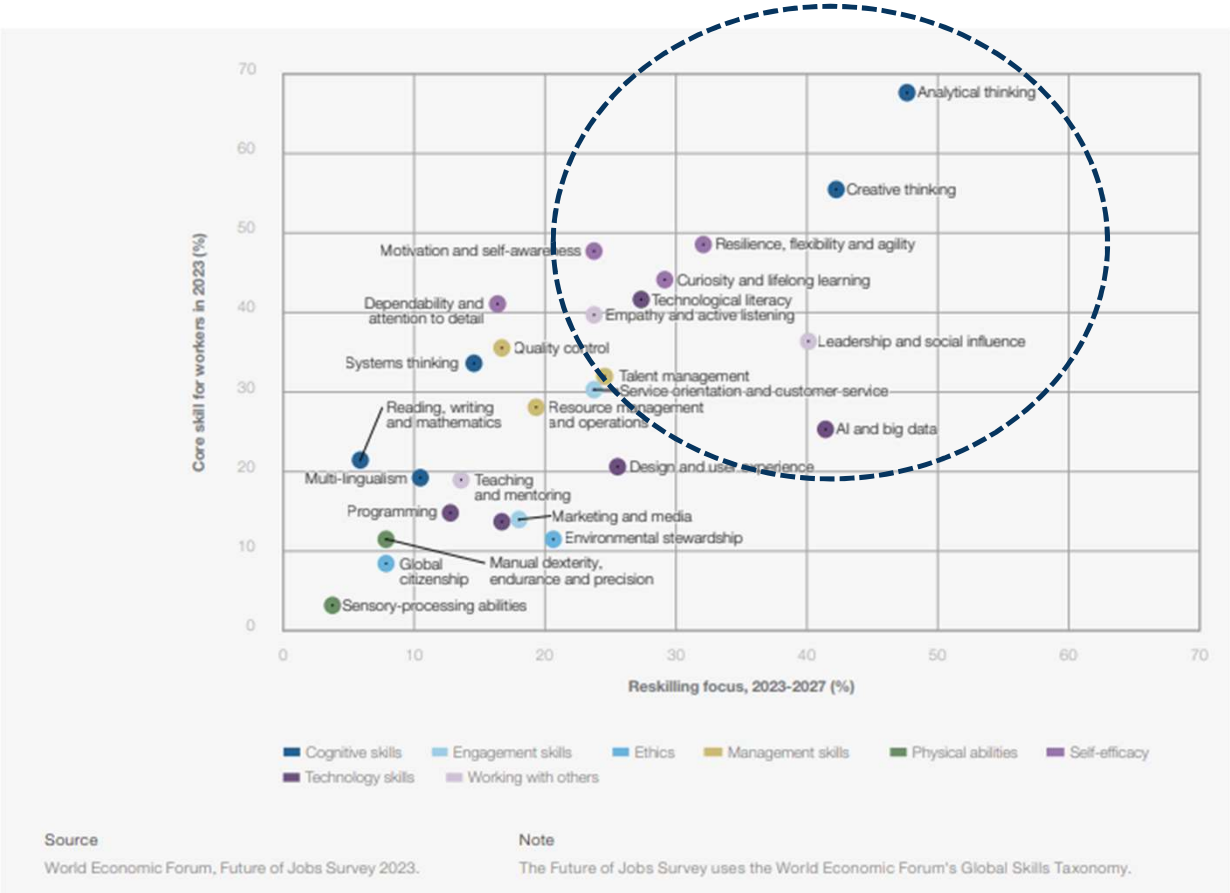
Demand for a talent pool that blends business and engineering skills and know-how

Source: Future of Jobs Report 2020, World Economic Forum

Evolving Skills

The probability of an organization surveyed evaluating a skill to be a core skill for its workers in 2023 versus the probability of the skill appearing in its reskilling and upskilling initiative in the next five years

Reskilling of an existing workforce to strengthen core skills is a major anticipated strategy



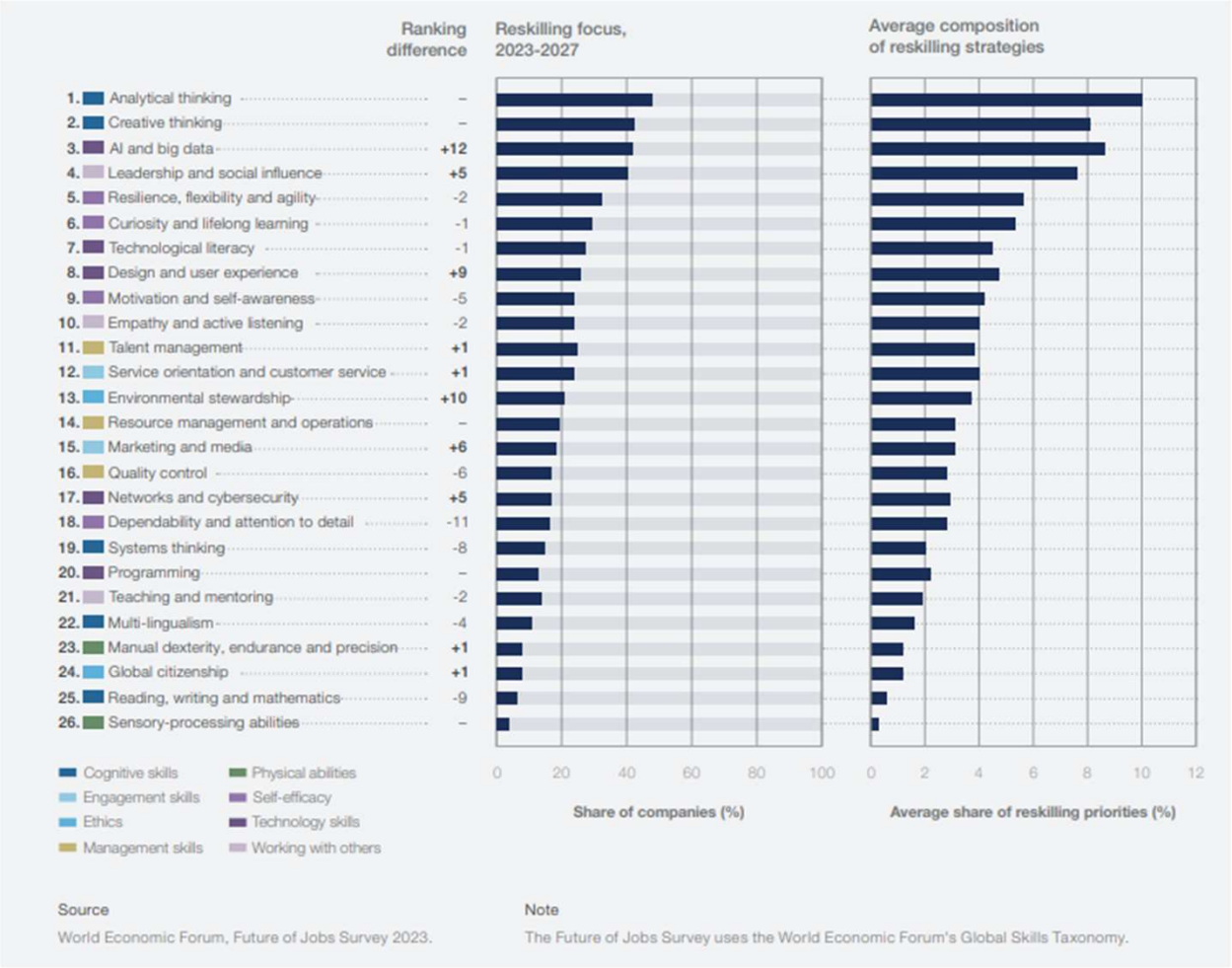
Source
World Economic Forum, Future of Jobs Survey 2023.

Note
The Future of Jobs Survey uses the World Economic Forum's Global Skills Taxonomy.

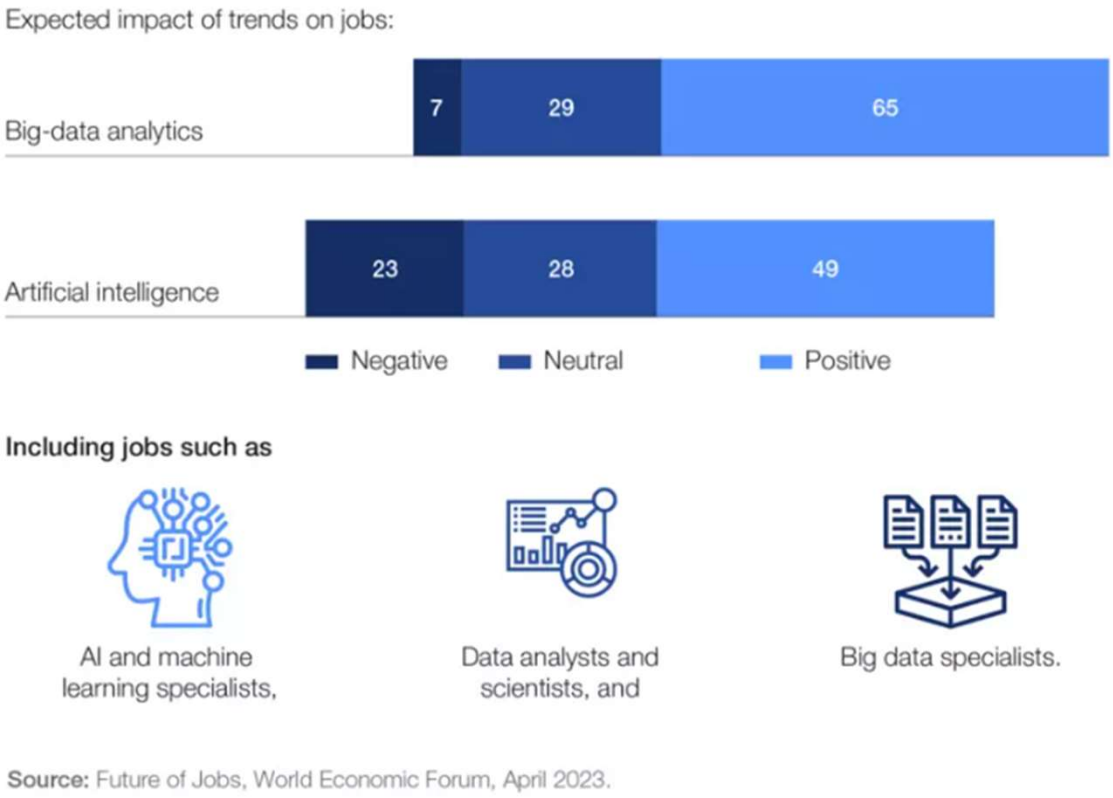
Reskilling and upskilling, 2023-2027 in 2023

Share of companies which include each skill in their reskilling and upskilling strategies for 2023 to 2027.

Reskilling focus follows the same pattern as skills on the rise – it will not be back to the same office that was abandoned during the pandemic



Businesses expect Big Data and AI to Drive Job Growth



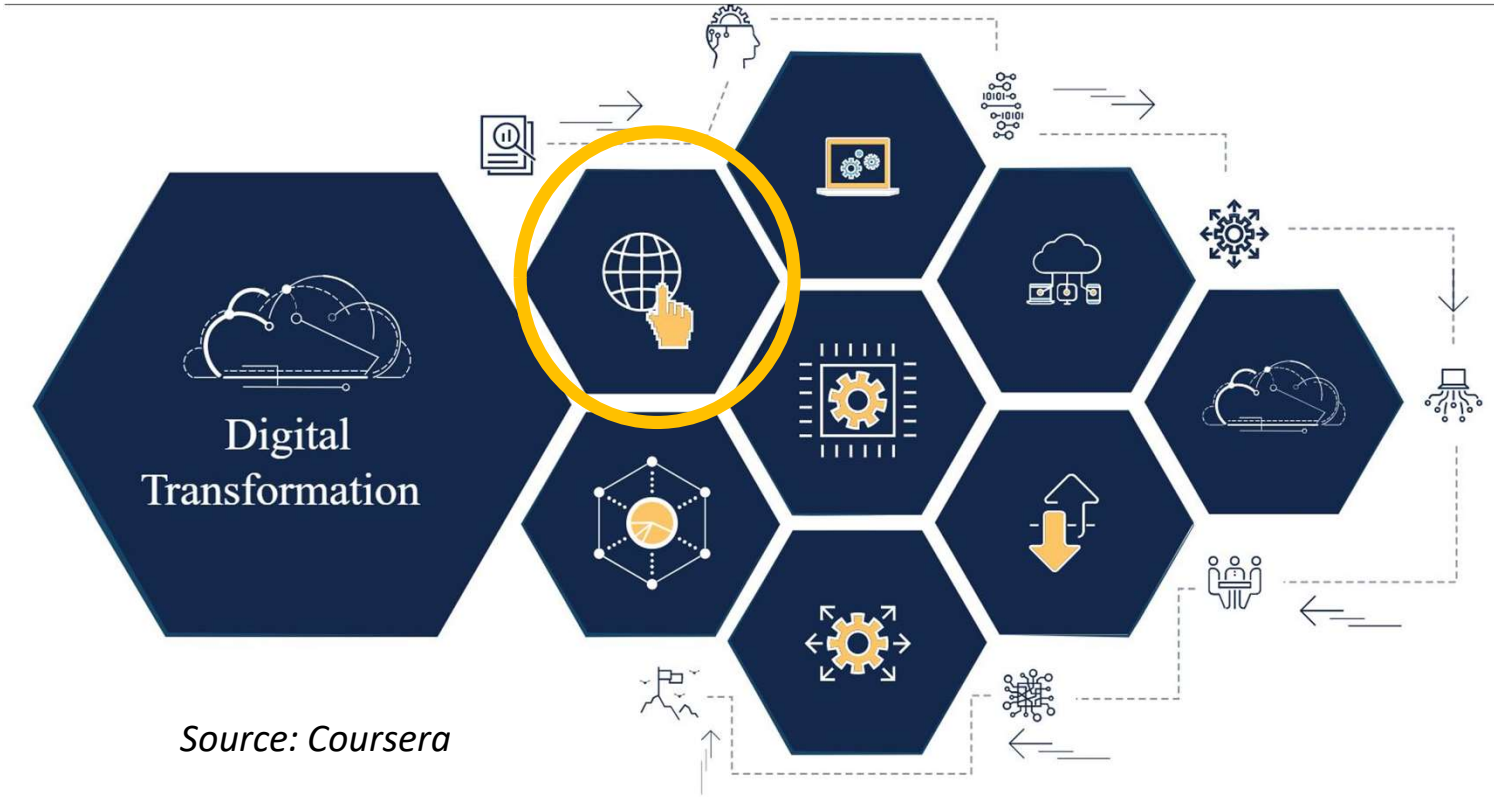
Source: Future of Jobs, World Economic Forum, April 2023.

How Has this Change in the Job Market Affected uOttawa's Faculty of Engineering?

A Digital Transformation is Where We Seem to be Going

Not a policy but rather an inevitability – growing demand, increasing capacity and then an accelerant

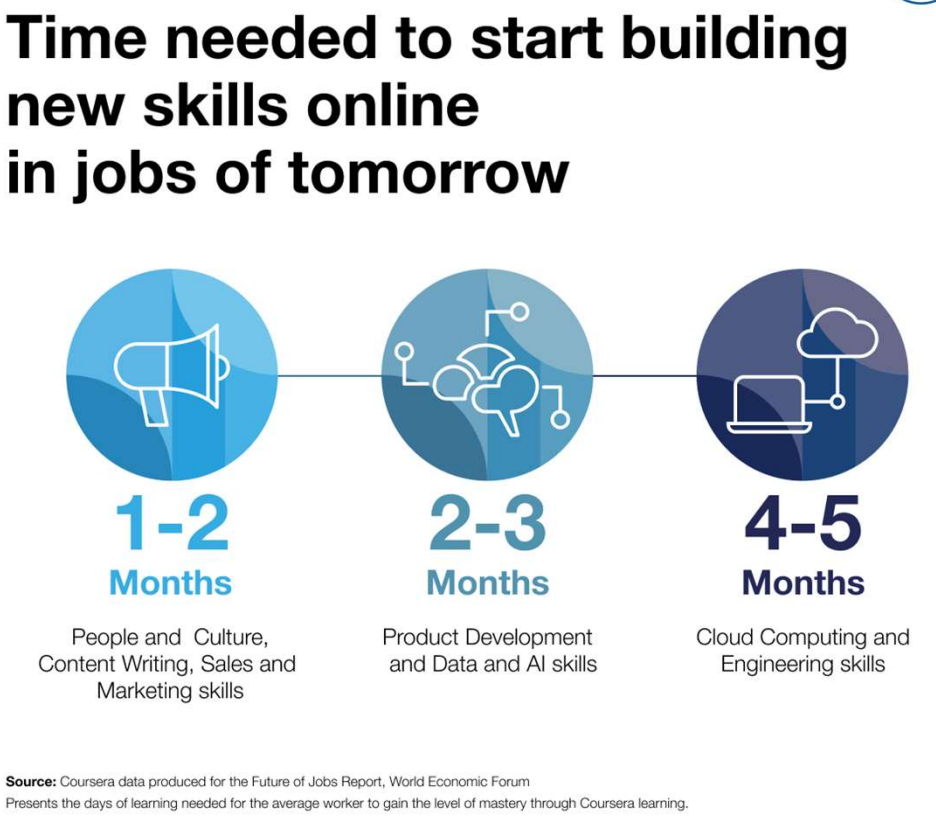
How to proceed?



Source: Coursera

Online course/training is a preferred mode of instruction

Difficulty in filling jobs is compelling firms to supplement new hires with upskilling existing employees and online training is the preferred option



We are Post-Crisis and Now Need a More Enduring System

Online Learning (Now!)

" Typical planning, preparation, and development time for a fully online university course is six to nine months before the course is delivered. Faculty are usually more comfortable teaching online by the second or third iteration of their online courses."

Remote Learning (March 2020)

"In contrast to experiences that are planned from the beginning and designed to be online, emergency remote teaching (ERT) is a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances."…

"The primary objective in these circumstances is not to re-create a robust educational ecosystem but rather to provide temporary access to instruction and instructional supports in a manner that is quick to set up and is reliably available during an emergency or crisis. "

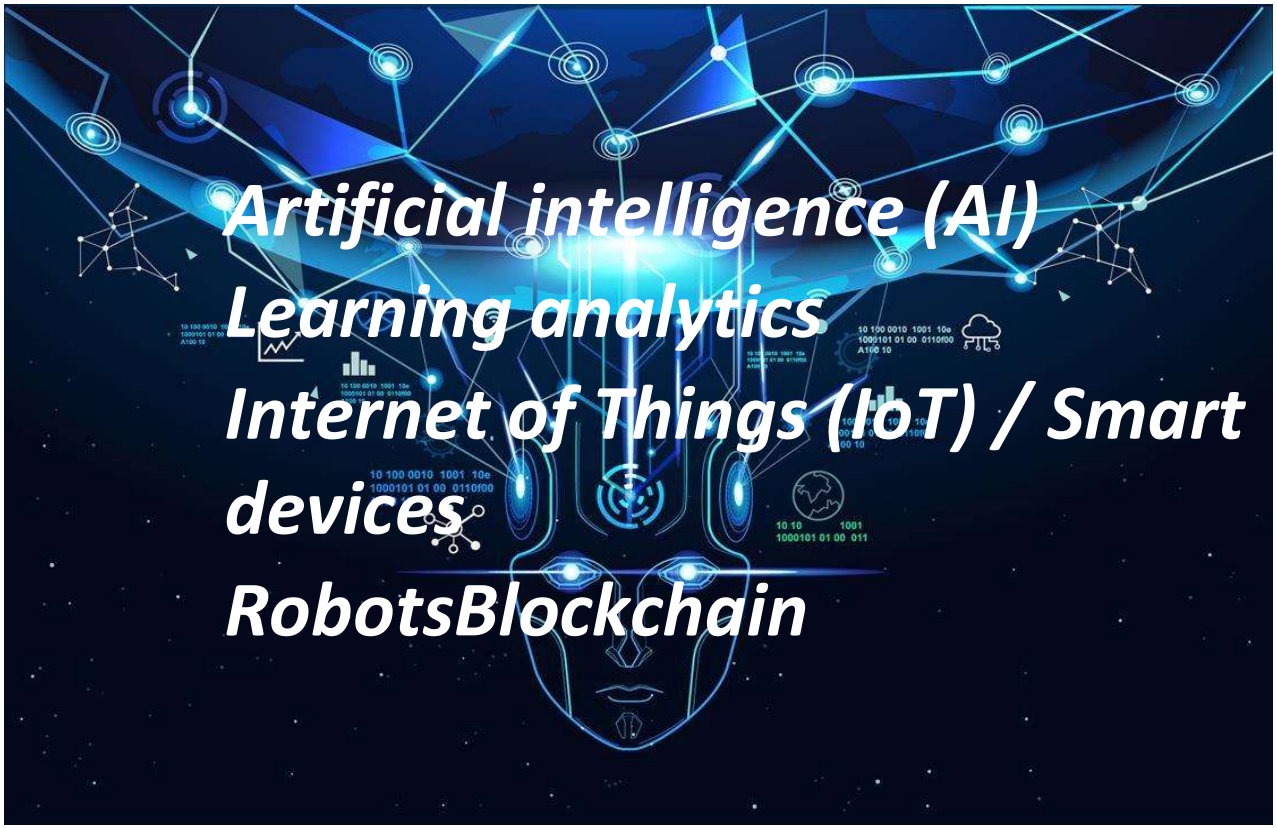
Hodges, C., Moore, S., Lockee, B., Trust, T., and Bond, A,. **(Mar 27, 2020) .The Difference Between Emergency Remote Teaching and Online Learning,** Educause Review. Available https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning?fbclid=IwAR3TEbjw3Y31SBaZoNabi3vr4WoUVUqF3_LR9cAuY8EoUEh2nD_APFXaiOw

The Challenge We Face

- **Slowly moving away from the past teaching formula**
- **As digital natives take the place of current students, current stop gap adjustments are just not engaging enough.**
- **Education at its heart is about human connections and relationships**

Technologies Being Integrated into Education

The following technologies are rapidly progressing and various jurisdictions are experimenting with how to adapt them to education and student learning



How Does this Translate into Education (for now)

A lot of opportunity; many possibilities; it is clear that digital technology has great potential to improve education.

Classroom Frontiers

- Adaptive learning technology to personalize learning – intelligent tutoring systems
- Measuring engagement and interventions to keep students engaged
- Social robots (powered by personalization systems) as instructors or tutors for individuals or small groups and also as peer learners allowing students to 'teach' them
- Human-in-the-loop technologies enable students with special needs to participate – speech-to-text, text-to-speech, auto-captioning etc; AI allows blind, visually impaired, deaf and hard-of-hearing to participate

How Does this Translate into Education (for now)

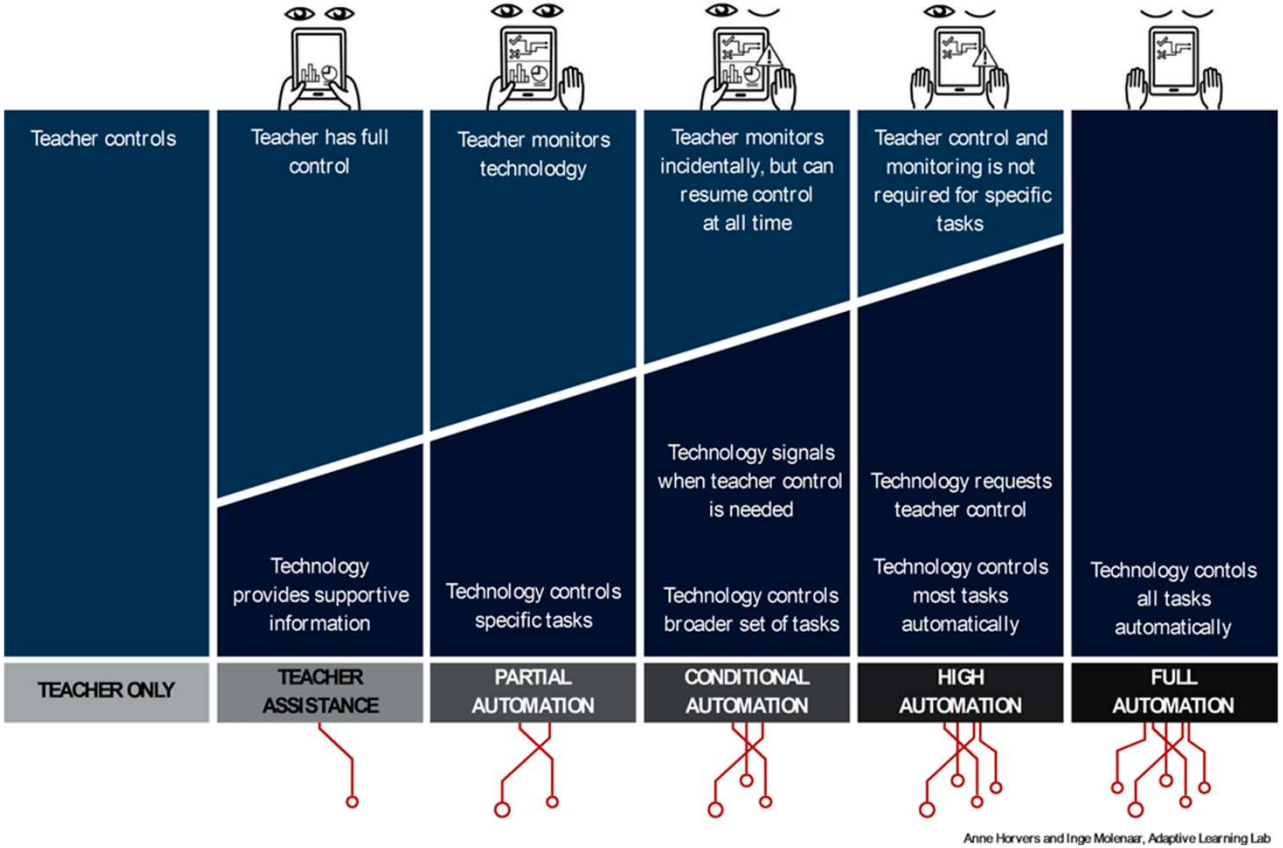
A lot of opportunity; many possibilities; it is clear that digital technology has great potential to improve education.

Organization and System Frontiers

Smart technologies allow for management of education organizations – enhance curriculum, based on an analysis of student learning and study paths (expanding to learning analytics); early warning systems that identify students at risk of dropping out; game-based standardized assessments to expand assessments to skills (creativity, emotional or behavioural such as collaboration) that cannot be measured by traditional tests; blockchain technologies opens new doors for credentialing to prevent diploma fraud

The Path We Are On

With technologies increasingly gaining more data and intelligence, a new era of Human-AI interaction is emerging.



On-Line Masters of Engineering Management

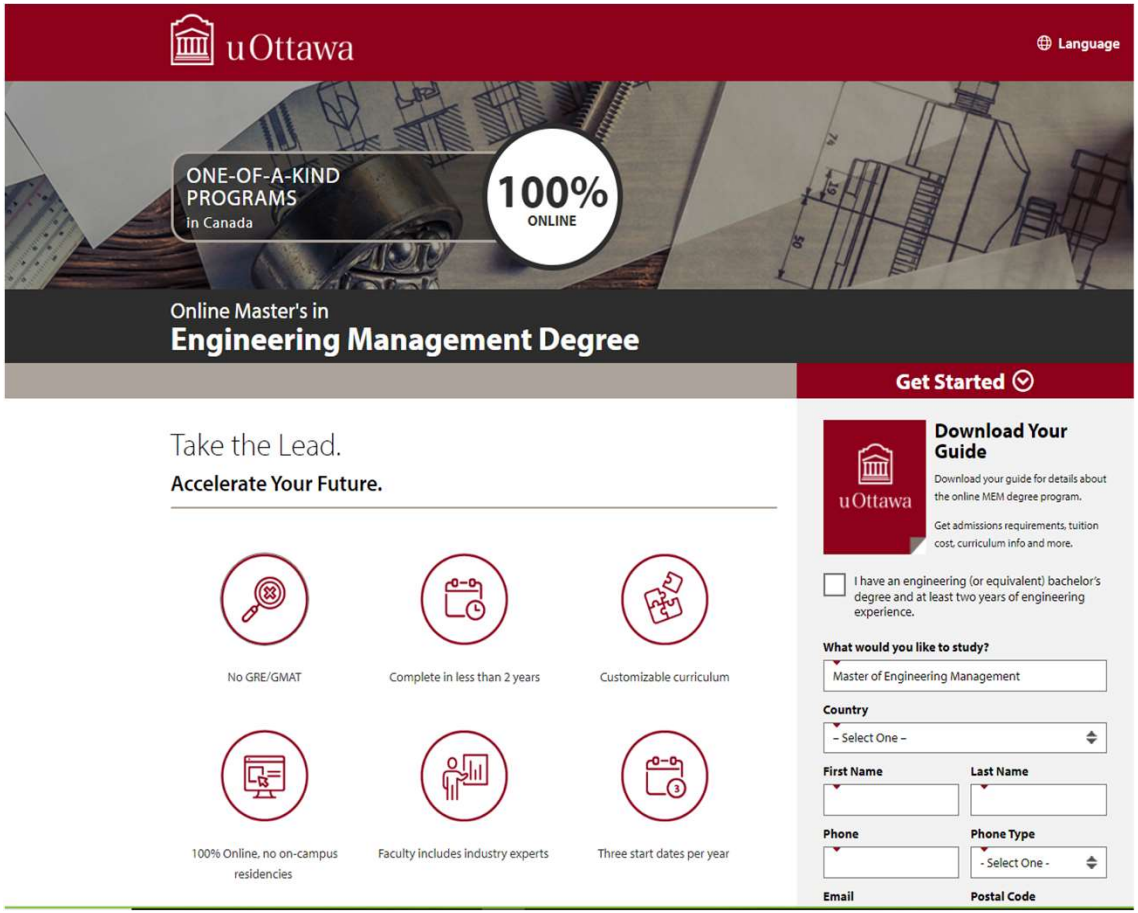
Lessons (Already) Learned - It's Already Digital

- **A lot of working professionals cannot afford to walk away from work and home to sit in a classroom**
- **We already had many elements of a digital system when we shifted**
  - **Learning Management Systems, eMail/MsTeams/Calendars, Social Media**
  - **Face Time, Chat GPT**
  - **Optics**
  - **Recorded lectures/recorded student presentations**
  - **Textbooks offered digitally to manage costs for students**
- **What was in the textbook and discussed in class was already readily available on line**
- **Students get access to deep and rich dBases on campus**
- **Had to change our game to teach a class where students are ahead of you before you introduce yourself** (Discipline, constant two way communications, variety of delivery vehicles, focus on application, sesame street pace)

Online Masters of Engineering Management

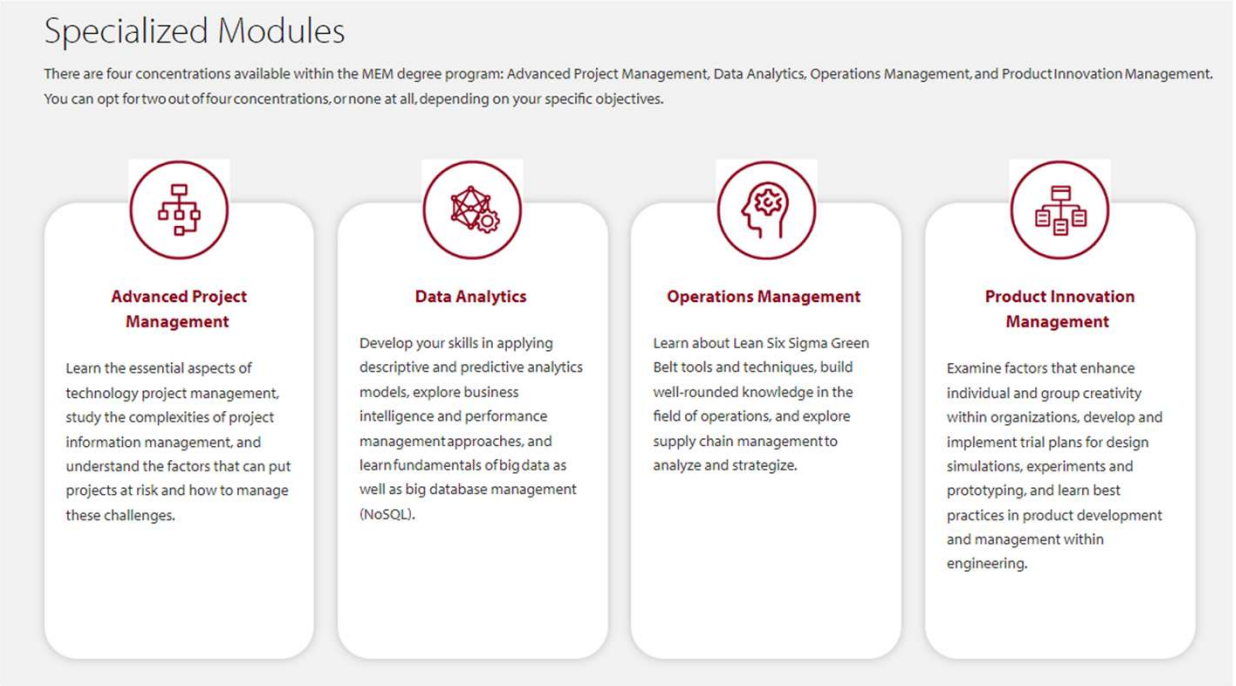
Launched a program last year that fits today's needs

A major step forward/break from the university path



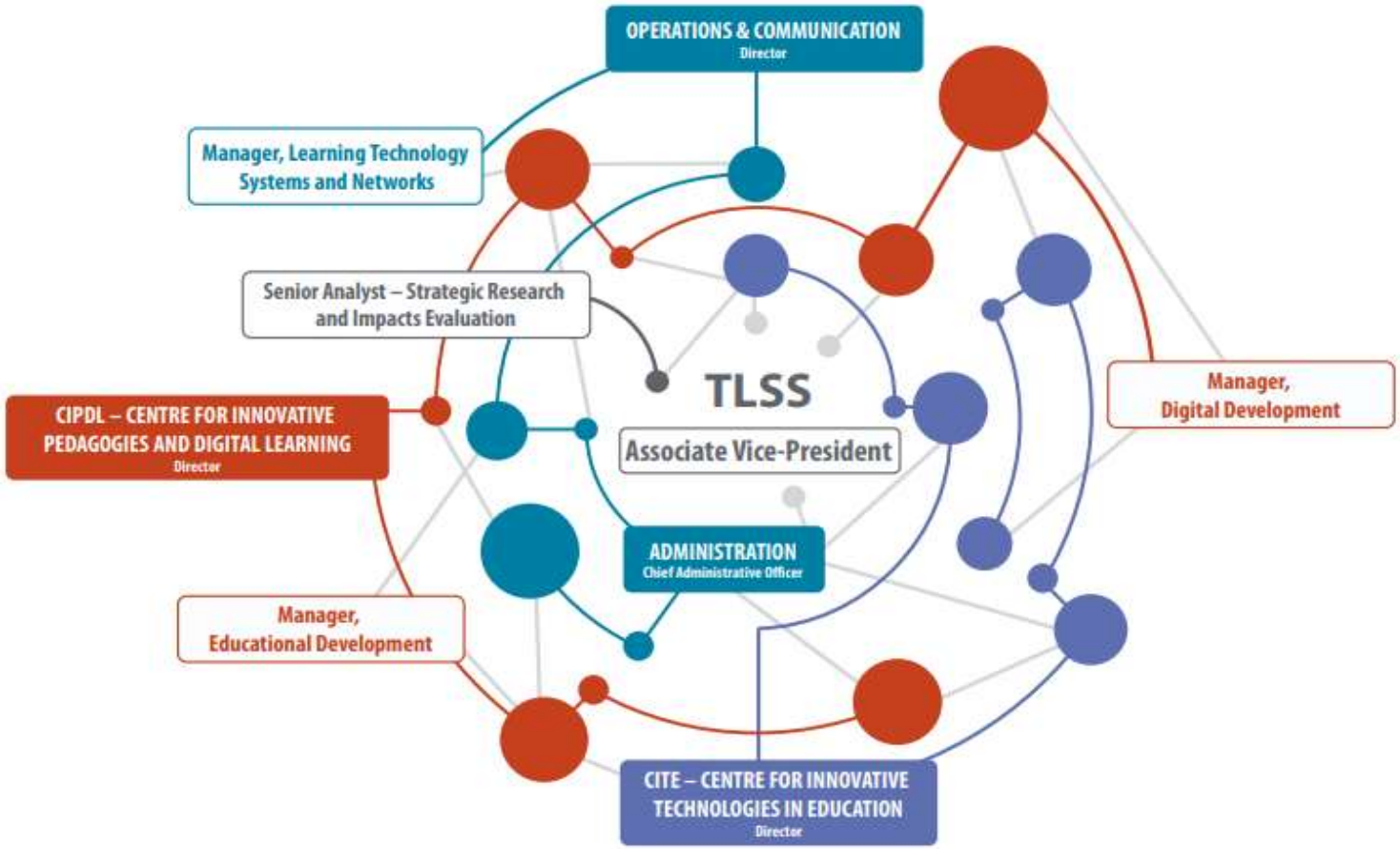
The Design Works – Online Masters of Engineering Management

- **Student reactions positive**
- Three intakes a year (160 students)
- Currently have 400 registered students
- 4 Mandatory/6 electives
- 10 courses/5 terms
- Maximum 2 courses per term (average 1.8 courses per term)
- First graduating class last weekend!



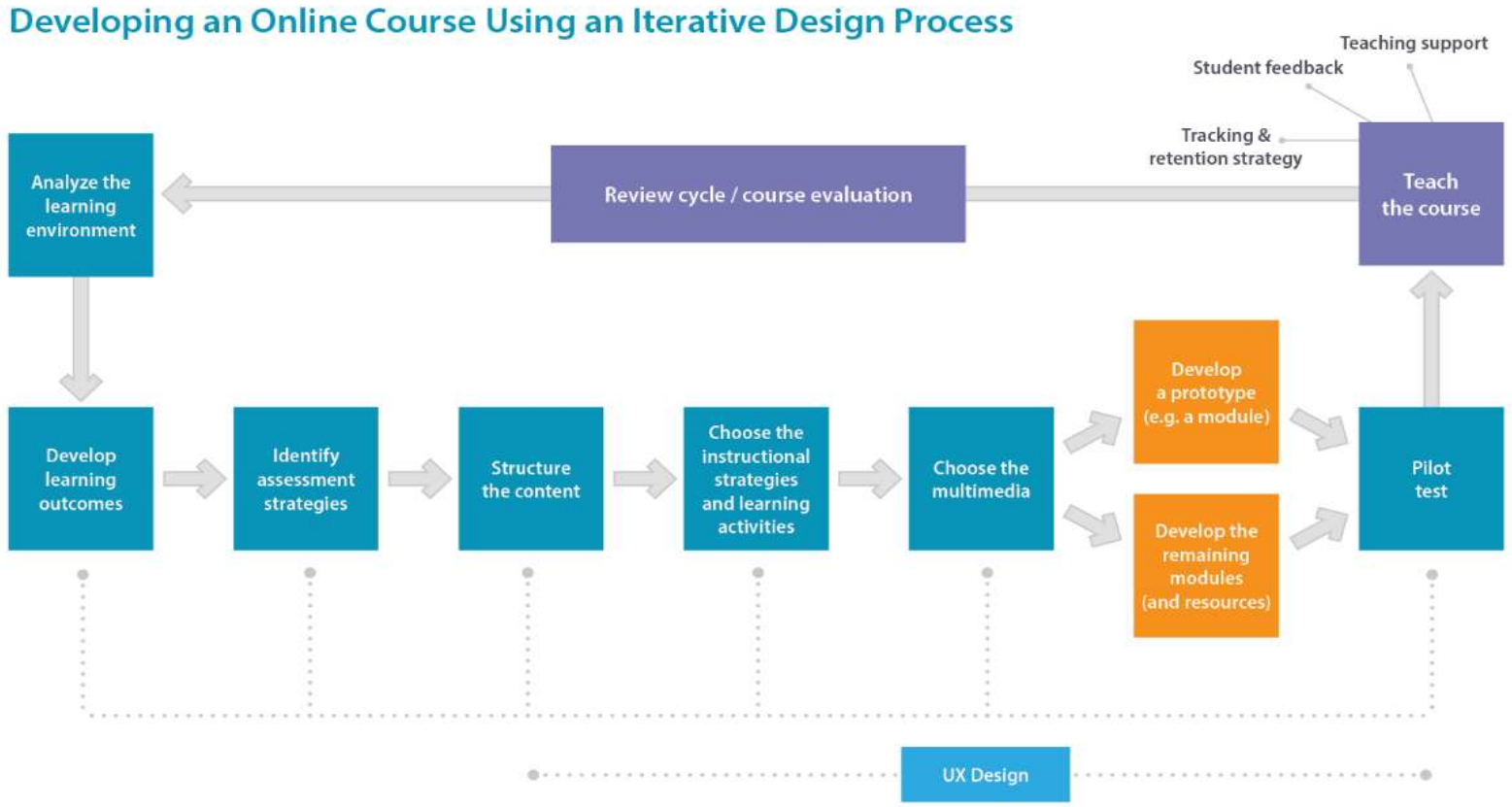
Transforming Course Delivery– Online Masters of Engineering Management

The uOttawa Teaching and Learning Support Service (TLSS) critical to development of the program by blending curriculum design with technology



Current State of Play - Online Masters of Engineering Management –
Our On-Line Development Laboratory

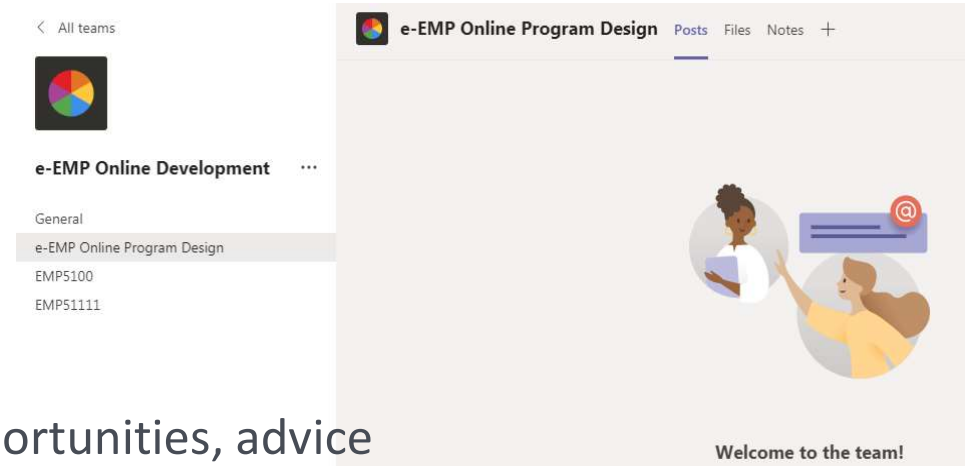
The course development timelines may range from 26-weeks, to 8-12 months depending on course readiness and the availability of the Course author.



Online Masters of Engineering Management – Working Remotely

Online collaboration platforms:

- MS Teams
- Brightspace



Learner support:

- Student support – issues, opportunities, advice
- Simulations and laboratories
- More direct connection with professors – email, Teams chat, file transfers, Zoom sessions

Online Masters of Engineering Management – Experiential Learning Tools

- Immersive experience/game play
- Asynchronous learning
- Practical applications
- Analogies, alternative perspectives
- Authentic conversations
- Virtual Team Work

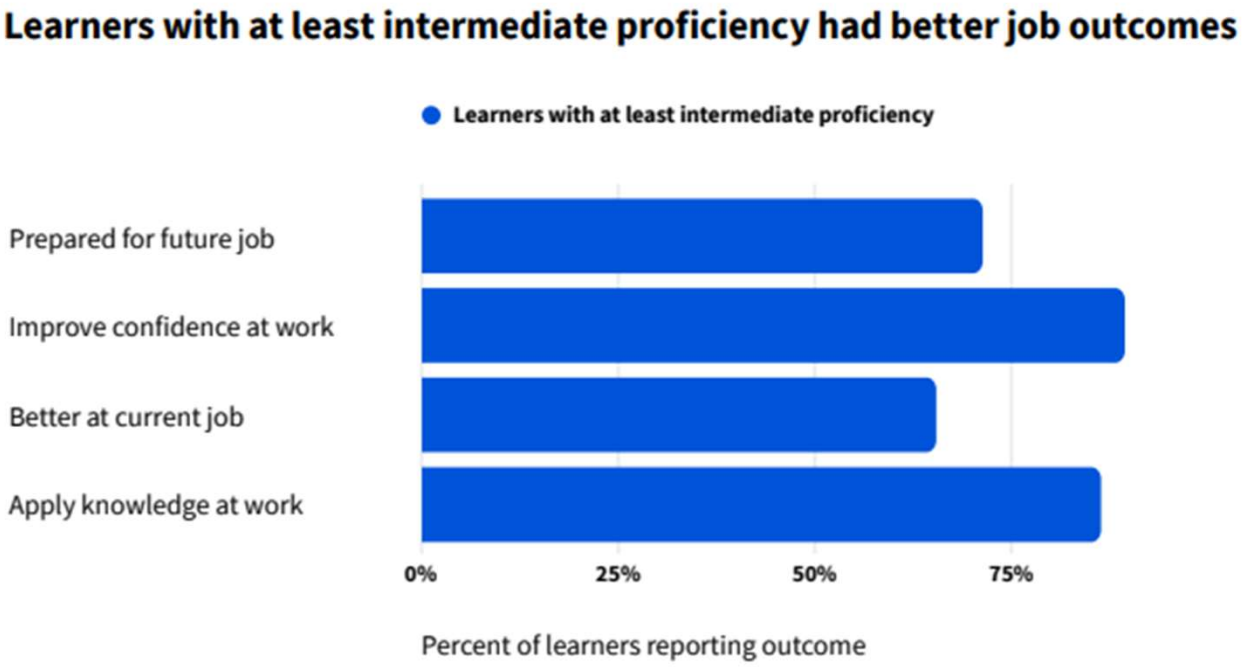
Virtual Course Secret Ingredients

- **Strong faculty**
- **Online students can test learnings in situ**
- **Courseware is organized and designed to deliver stated learning objectives tailored to learner needs**
- **Immediate student feedback** (Student Success Function)
- **The quantity of our domestic students and our research**
- **The opportunities for our students**

Bottom Line

Bottom Line: Learning investments contribute to a positive work environment

- The share of enrollments in personal development courses has risen dramatically – 3.1% to 5.5% between 2019 and 2020
- Improves economic mobility and growth for employees, an effective engagement and retention strategy/performance strategy for managers and a growth and cost savings strategy for organizations

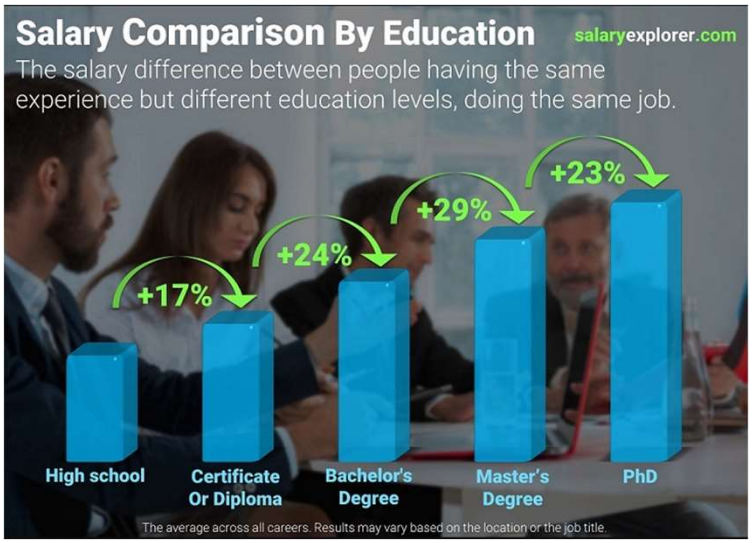


Source: Coursera Industry Skills Report, 2021

Bottom Line: Engineering Experience and Level of Education Matter

- Average yearly salary for engineers is $101,000 CAD (highly variable – ranges from $32,000 to $213,000)
- Upskilling and offering an online Masters degree presents another incentive to employees as work experience and level of education matter in the workforce

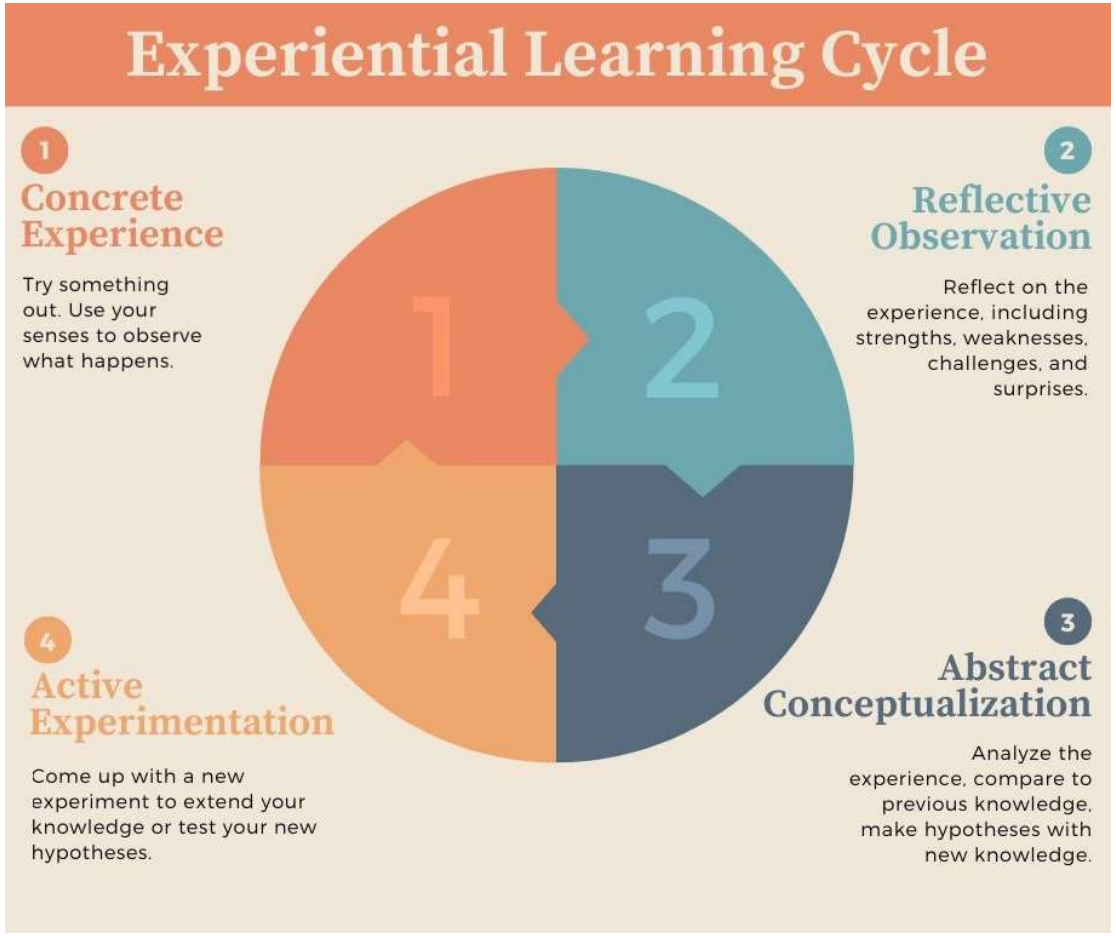
http://www.salaryexplorer.com/images/salary-by-experience.jpg



http://www.salaryexplorer.com/images/salary-comparison-by-education.jpg

Bottom Line: Reskilling and Enhancing Skills in a Digital Environment Must be Experiential

Digital skills can incorporate everything from social media to cybersecurity, and are increasingly central to a thriving workforce, particularly as businesses have accelerated digital transformation in response to the pandemic and now to a new normal.



Same philosophy but….more skin in the game and much faster

- A Learning outcome is not the endpoint, but simply a resting point of an ongoing learning process
- As we learn new ideas we also modify and dispose old ideas
- Effective learners are capable of balancing opposing learning modes
- Learning never ends – it encompasses all life stages
- When learners and the environment interact, both are changed
- Every field requires unique skills and a special learning process

Our online learning frontiers

Building new capacity

- Maintenance
- Governance
- Student recruitment (social media to human contact to screening to application to registration)
- Student retention (support, mitigating problems, ongoing program adjustment, scheduling)

Integrating new techniques and approaches

Wrap Up

- We had a well developed teaching model based on in-class instruction with asynchronous activities to enhance lectures and discussions
- The world went indoors on March 20, 2020 and we had to follow our students there or perish
- It took us a weekend to switch to a virtual format
- Initially we adopted a digital version of what we did (remote learning)
- It had to be changed as it became clear that this is an expected form of education
- It has become a feature of education, is expected by all university students and it has expanded the markets for education (skilling, re-skilling)
- We are now designing, organizing and delivering online learning programs
- We can see even more possibilities and approaches to using the medium
- Digital natives want more!