THE UNIVERSITY OF THE WEST INDIES

# Trends in Higher Education

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## Message from the Publisher

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The rapid expansion in technology which has brought about the Fourth Industrial Revolution (4IR) since 2015 will no doubt force Higher Educational Institutions (HEIs) to rethink their pedagogy in order to remain relevant in the 21st Century. This volume of Trends in Higher Education provides a snapshot of some of the latest developments in smart automation that is disrupting all industries including the higher education sector. Improvements in wireless communication namely; 5G and WiFi 6, have the potential to improve efficiency in communication on both networks and the devices. Futurist Thomas Frey noted that it "will be adding formidable computing muscle at technology's edge, turbo-boosting the capability of every IoT sensor, blockchain transaction, payment device, and interactive dashboard" (Frey 2019, n.p.). Indeed, these developments in wireless communication will have implications for HEIs. They will boost learning opportunities via virtual and artificial reality in the classroom, expand its capacity for data collection via the Internet of Things (IoT) and it will be more robust in connecting a large number of devices in the classroom. The trends presented in this volume should be studied very closely by leaders and managers in HEIs as they seek to develop strategies and policies to make their institutions more relevant in a changing world. We do hope you find the information quite useful in your planning process.

## Technology Trends in Higher Education

The Fourth Industrial Revolution (4IR) has led to profound and rapid changes in technologies - Internet of Things (IoT), robotics, virtual reality (VR) and artificial intelligence (AI) - that has changed the way we live, learn and work. In higher education, the 4IR will present further changes to the curriculum, pedagogy/andragogy, and pathways for renewing skills. It will also necessitate higher education institutions (HEIs) to develop/enhance the digital fluency of its graduates and strengthen their digital strategy (SCUP Spring 2019, 9).

Attention is drawn to technological trends that can impact higher education and its ability to recognise and understand the usefulness of such for the success of the sector. These advancements will have implications for operations, teaching and learning, and research for HEIs and unintended consequences for resources and infrastructure. Technological trends related to expanding access and convenience for learners; protecting data/strengthening cybersecurity; and improving technology for more efficient communication will be discussed.

### Adequate resourcing for IT

Much of campus technology is distributed in departments and offices impacting business operations and activities like teaching, learning, and research. Despite the ubiquitous nature of IT on campuses, the 2018 report of the Campus Computing Project[1] found that annual and mid-year budget cuts for IT are becoming more common. More than two-thirds (68%) of IT leaders reported that their campus IT budgets had not recovered from recurring budget cuts since the recession of 2008 (Green 2018, 8, 5).

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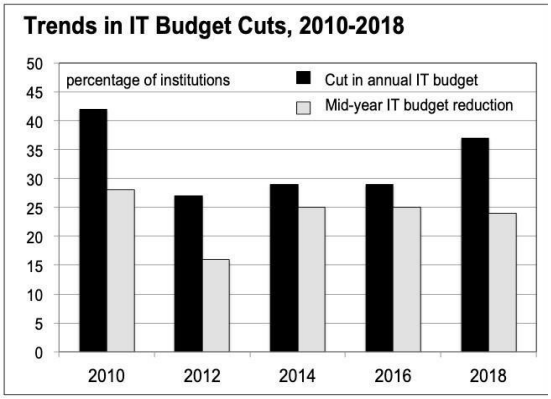
These recurring cuts have impacted on infrastructure, resources and personnel and consequences for instruction, research and services.



Source: Green, 2018, 5.

The Campus Computing Survey highlighted that 74% identify hiring/retaining IT talent is a top campus IT priority and 79% of institutions had a difficult time retaining IT talent because salaries and benefits are not competitive with off-campus job opportunities (Green 2018, 8, 10). IT departments are also experiencing significant "organizational churn" attributed to budget cuts, consolidation of units, IT personnel changes or institutional leadership. Just under half (45%) of respondents said that their department had been reorganised in the past two years. Of the departments that recently reorganised, about a third (31%) said they expected to do so again in the next two years.

The report also flagged that having made significant investments in IT few campuses evaluate the impact of their IT initiatives. About two-thirds (65%) of respondents identify that assessing the benefits of campus investments in computing and technology services as a 'very important' institutional priority (Green 2018, 5). However, only a fifth of institutions (16%) have a formal process for evaluating how IT affects learning outcomes down from 21% in 2007 and only half (50%) assesses the ROI (return on investment) for IT spending and resources (Green 2018, 5).

## Analytics technologies

Analytics technologies are an essential component for collaborative, targeted strategic planning and decision-making and a key element of student success initiatives and the time-to-adoption is one-year or less. To achieve this, institutions will require new computational technologies and systems and highly skilled workforce equipped to manage and use large and complex data resources.

Higher education IT units have reported that "business analyst" was one of the most commonly added new positions to their unit within the past year, with CIOs and managers rating "analyzing data to inform strategic decisions" the single most important skill to their own professional growth (Alexander 2019, 23). Yet, campus investments in analytic tools and resources are not meeting expectations; less than a fifth of survey participants (19%) described their institution's investments in data analysis and learning and managerial analytics over the past few years as 'very effective' (Green 2019, 6).

Some HEIs have adopted analytical technologies relating to student experience and educational success in particular, recruitment, advising, or teaching and learning that identify student needs. For example, the University of Queensland's adaptive platform (RiPPLE) recommends personalised learning resources to students (Alexander 2019, 23), Georgia State University analytics system colour codes a student's risk of dropping out (Barshay and Aslanian, 2019, n.p.). In addition to concerns about student data privacy and data security, there are also concerns that algorithms may reinforce inequities in access to education based on socioeconomic data, geography (zip codes), etc.

## Artificial intelligence (AI) in practice

AI's application in the teaching and learning sector is expected to grow significantly. The time-to-adoption is estimated to be two to three years. Alexander et al (2019, 27) note that "AI in

the American education sector is expected to exceed a market value of $85 million by 2022, with a compound annual growth rate of nearly 48%, and the trend is similar globally." Its functionality, which supports pedagogical approaches (i.e. adaptive learning) and institutional data mining, "will see rapid growth in adoption" as HEIs partner with industry "to create AI-driven solutions for the purposes of reducing college costs and allowing students to personalize their learning experiences to best meet their needs" (Alexander et al 2019, 27).

Findings from the Campus Computing Project suggest that there is a rising recognition of a place for AI in analytics and in instruction. Approximately 42% of respondents believe that AI will be an "important resource of analytics in the coming years, up from 30% in 2017." However, only 30% anticipate that AI will play an important role in instruction in the next few years, up from 19% in 2017 (Green 2018, 6). Already tools like Packback support online discussion fora that heightens critical thinking and enables curiosity-based student discussion. Similarly, Eudlai helps university students and teachers monitor and measure the development of skills such as critical thinking, communication, collaboration, leadership, problem solving, and inter-culturalism. The University of Pittsburgh and the University of Washington are working with industry to supplement instruction by reverse-engineering incorrect answers to discover the source of confusion (Alexander et al 2019, 28).

AI is also being used to catch students involved in essay-contract cheating. As many as one in seven recent graduates may have recruited someone else to undertake an assignment for them (McKie (1) 2019, n.p.). Georgia Institute of Technology has developed an AI tool named Jack Watson that monitors the internet and identifies students from a particular university looking to contract cheat and provides them with a "watermarked" assignment that will reveal itself on submission" (McKie (1) 2019, n.p.). A student is then subsequently referred for investigation. The tool which has the potential to act as a deterrent has successfully identified nine cases of contract cheating since 2018. While students who use the services of essay mills may have crossed an ethical line thus violating academic integrity, critics say the approach also crosses ethical lines into entrapment.

### Bridging the gap between academy and industry

Mechanisms to support research and knowledge transfer allow for mutually beneficial collaborations among universities and the private and/or public sectors. It can also facilitate partnerships and funding opportunities; expand the workforce; and enhance overall economic growth and societal wellbeing. However, connecting the private or public sectors with campus experts can be somewhat challenging. An online research portal, Ohio Innovation Exchange (OIEx)[1], will deliver research and innovation opportunities to both industry and Ohio's academic institutions particularly in STEM areas. It consolidates academic resources from multiple universities[2] into a single, searchable, and easily accessible web portal. In so doing, it provides industry in search of expertise with free access to faculty and resources (i.e. publications, patents, and equipment) and information related to research partnerships, intellectual property, and technology licensing opportunities to business development and student internships (Ohio Higher Ed 2018, n.p.). SCUP (Spring 2019, 6) also noted there were similar initiatives in New Jersey as well as at universities in Florida, Michigan, and North Carolina.

### Expanding access and convenience for learners

Technology can be either exclusive or inclusive. Galanek et al (2018, 29) note that IT accessibility is an issue for many college students with both physical and learning disabilities. However, many HEIs remain oblivious to the needs of the sub-population. The findings from the 2018 *study of undergraduate students and IT by* Galanek et al (2018, 28-29) *show:*

- Of the 7% of student respondents who self-identified as having a physical and/or learning disability requiring accessible or adaptive technologies for their coursework, only 27% rated their institution's awareness of their needs as poor (an increase of 16 percentage points over the past three years).
- The largest group of students (42% of those reporting a disability) said their support was good/excellent, slightly fewer reported ratings of poor and neutral compared with last year.
- Far more students with physical disabilities (58%) reported poor institutional awareness of their need for accessible technologies than those with learning disabilities (7%) or with both physical and learning disabilities (8%).
- Forty-four percent of students at doctorate-granting public universities said knowledge of their needs was poor. BA institutions scored well on awareness and especially on support.
- Institution size is also a factor, as poor ratings for awareness are highest (41%) and good/ excellent ratings are lowest (32%) for institutions with full-time enrolments of 15,000 students or more.

In light of the above, HEIs will need to increase institutional awareness and provide better support to students with disabilities by *inter alia* cultivating an "accessible mind-set" among key, if not all, campus stakeholders to better understand the needs of students with disabilities, develop campus IT and instructional accessibility policies, etc. (Galanek et al 2018, 30).

### 5G- The Game Changer in the Technological Landscape

Improvements in wireless communication namely; 5G and WiFi 6, have the potential to improve efficiency in communication on both networks and the devices. It "will be adding formidable computing muscle at technology's edge, turbo-boosting the capability of every IoT sensor, blockchain transaction, payment device, and interactive dashboard" (Frey 2019, n.p.). As SCUP (Fall 2019, 9) notes "one benefit could be helping users reap more value from devices linked via the Internet of Things." These developments in wireless communication will have implications for HEIs - it will boost learning opportunities via virtual and artificial reality in the classroom, expand its capacity for data collection via the IoT and it will be more robust in connecting a large number of devices in the classroom. But, it may also require additional IT infrastructure to support WiFi 6.

Futurist Thomas Frey notes that 5G will be about "pervasiveness, capacity, durability, dimensionality, intelligent machines, privacy, security, trust, ethics, tons of new standards, and finding new ways to transform our own human experience" (Frey 2019, n.p.). He continues that the "coming decade will see 5G unfold in ways hard to imagine", but identifies the following mind-bending changes for education:

- Virtual apprenticeships for job positions that employ the use of rare or expensive equipment;
- Situational testing where candidates are examined during their normal daily routine as they face real life challenges;
- Virtual sensory reducers will help students manage their distractions;
- Brain stimulators will become commonplace to momentarily amp up a person's cranial inputs;
- Virtual involvement training apps will offer a new kind of learning experience;
- Gamified micro-credit systems will give people additional credits for the way they handle specific situations;
- New micro-learning processes will be gamified with rewards to help those in need of job-ready skills; and
- Sensory enhancement helmets will make you the protagonist of your own heroine/hero's journey.

Miniature wireless devices, which have sensors, cameras and communication mechanisms to collect, process, store and communicate data have been developed at the University of Michigan and measures 0.3 mm to a side. It is said to be dwarfed by a single grain of rice (SCUP Fall 2019, 10). Microelectromechanical systems (MEMS) or motes have the power to potentially lead to the "exponential expansion of the Internet of Things" (SCUP Fall 2019, 10) as well as be disruptive. However, the technology is still more than 10 years away from mainstream adoption according to Gartner's Hype Cycle (Goldsmith 2019, n.p.).

Motes (also referred to a smart dust because it can stay suspended in an environment just like a particle of dust) can potentially "collect information about any environment in incredible detail could impact plenty of things in a variety of industries from safety to compliance to productivity" (Marr 2018, n.p.). Despite the practical application of motes to collect information, there are privacy and control concerns. Nevertheless, there are possible opportunities for use in higher education operations – **provide climate control to classrooms**/offices, monitor facilities usage, monitor equipment to facilitate more timely maintenance, enhance inventory control, enhance alert and alarm system to improve campus safety; - or for research - monitor the conditions of a wildfire or give early warning of a natural disaster.

### Mixed Reality

Mixed reality (MR) is an umbrella term for a range of technologies including virtual reality (VR)[3], augmented reality (AR).[4] It is "the intersection of the online and offline worlds"…., "where digital and physical objects coexist uses a headset or a smartphone to overlay images or other content onto the physical world" (Alexander et al 2019, 25). MR offers interactivity, which provides great opportunity for learning and assessment as learners can construct an understanding based "on experiences with virtual objects that bring underlying data to life" (Alexander et al 2019, 25). The MR market is projected to grow to $100-200 billion globally by 2022 and MR in education is projected to grow to over $7 billion globally in that time frame (Alexander et al 2019, 25). The expected time-to-adoption is two to three years.

MR technologies are well suited for experiential education such as those that benefit from repetition (e.g. clinical skills) or develop design sense (i.e. to model and remodel entire environments). Through simulations and 360° video, VR can enable users to visit places they might otherwise not be able to access, such as art museums, archaeology sites, a refugee camp, or Mount Everest, as well as places that are entirely inaccessible, such as on board the Titanic. At the University of Canterbury students participate in a virtual field trip to Iceland through geological landscape, hazard management, and geothermal power. The EdTech Lab (Imperial College Business School) is enhancing the use of VR by way of presentations, a key component of business education. The size and mood of the audience can be adjusted (McKie (2) 2019, n.p.). Learners can develop scientific literacy, problem-solving skills, and content knowledge by interacting with simulated objects. However, for MR to be incorporated into the teaching and learning environment it requires instructional designers/technologists to assist faculty to integrate MR into their pedagogy.

The use of holographic[5] technology in the classroom adds value to online learning especially, as "students not only enjoyed the "sense of presence" provided by the hologram – of an academic "live" elsewhere – but also found the experience fun and engaging" (McKie (2) 2019, n.p.). Imperial College London's EdTech Lab, which has been using holograms in one of the university's lecture theatres over the past year, found that:

- 75% of the 102 student participants agreed that holograms were more likely to facilitate engagement, and
- 70% said that holograms enhanced the effectiveness of interaction between student and instructor (McKie (2) 2019, n.p.).

### Protecting data/strengthening cybersecurity

Data security emerged as the top institutional IT priority with 85% of institutions saying it was 'very important' according to the findings of the 2018 Campus Computing Project (Green 2018, 14). Hacking, phishing and cyber-threats have become a risk to universities given that HEIs are rich data storehouses (research results, staff and students personal information, etc.). This has led HEIs to develop/update their cybersecurity plans. The Campus Computing Project (Green 2018, 14) found that:

- 35% of institutions rated their IT security as 'excellent';
- 11% of institutions said they had not updated their cybersecurity plans in the past two years; and
- 31% have not updated the IT disaster recovery plan in the past two years.

It is expected that the challenge to data protection will become greater as technology becomes more sophisticated and the number and type of internet-enabled devices on campus increases (Busta 2018, n.p.). HEIs are caught in a quagmire to protect data yet provide the space for sharing knowledge and ideas (Busta 2018, n.p.). It is imperative that HEIs know what data they have, who is accessing it, and ensure that the data stays exactly the same both in storage and after use (SCUP Spring 2019, 7). This requires a secure system with access control, encryption both at rest and in flight, and logs that show who has been in the data and what their authorisations and credentials are, and having up-to-date operating systems. Moreover, having a sophisticated data-management system for deleting old data and/or software to reduce the risk of data theft or reputational embarrassment. SCUP (Fall 2019, 11) advocates that as data is fluid and accessible institutions embrace heightened IT security protocols including zero-trust.

### Providing opportunities to learners

The world of esports—competitive video gaming—is expanding. According to SCUP (Spring 2018, 7), esports has annual revenues topping $900 million with an estimated audience approaching 600 million. Moreover, this growth will likely continue as 72% of teenagers aged 13 to 17 consider themselves to be gamers. In light of that, the University of California, Irvine, Boise State University and others have developed esports facilities. Other HEIs like Ohio State University, Ashland University in Ohio and others are offering programmes in gaming and esports management. Esports facilities include high-quality video editing software, **advanced audio-visual systems** and sophisticated hardware that provides new digital opportunities for students and staff to utilise and access for teaching and learning.

Recently, focus has shifted to whether bootcamps, which offer short, intense, workforce-aligned training programmes, can upend traditional degree programmes. SCUP (Fall 2019, 8) notes that bootcamps are graduating over 36,000 students each year. Also, the online programme management (OPM) company, 2U, spent more than $750 million to acquire a company that partners with some 36 colleges and universities to provide bootcamps (SCUP Fall 2019, 8). The Clayton Christensen Institute recently applied "disruption theory" to test that hypothesis. The researchers note that disruption is not inevitable, but bootcamps are leveraging technology for skills-based training as well as expanding their online presence. As such, it is possible if certain factors (such as federal funding or "if bootcamps become a key channel for delivering lifelong education to employees" across a number of fields or industries) are present then bootcamps can "disrupt and permanently change the landscape of education and training" (SCUP Fall 2019, 8). The Institute recommends that HEIs can address this

disruptive threat by investing in the bootcamp business model through an autonomous unit informed by the example of Northeastern University, which has built its own bootcamp, Level (Price and Dunagan 2019, 19).

While massive open online courses (MOOCs) may not have disrupted the higher education business model, it has provided campuses the means to use MOOCs as an on-campus learning resources (SCUP Spring 2019, 6). The latest approach encourages students to take MOCC courses to fulfil prerequisites. Staff can also take MOCC courses for personal enrichment. The University of Michigan through Michigan Online lists MOOCs that the university has developed, and offers links where current students, faculty members and alumni can earn MOOC credentials for free. At Duke University through the Coursera for Duke Portal, the most popular MOOC among on-campus users is a statistics course within the university's Statistics with R course series. Among the other colleges piloting the approach include University of California at San Diego, Johns Hopkins University, Hong Kong University of Science and Technology, and three universities in Latin America (Tec de Monterrey in Mexico, Universidad de los Andes in Colombia, and Pontificia Universidad Católica de Chile) that opened a portal together for their students (Young 2018, n.p.).

## Conclusion

5G and Wifi 6 will be changing the way technology is used to deliver benefits to the globe. The changes will have tremendous impact on the organization and structure of HEI's offering in the education sector. These developments will facilitate broadening student access and improving learning outcomes, streamlining operations and decision-making, and enabling collaborations. As technology expands HEIs will continue to face the impact of these changes and will have to design new strategies and policies to deal with the consequences of the changes on all modes of their operations and mission.

**UWI "Triple A" Strategic Plan: Revitalizing Caribbean Development**

Did you know the three goals of the current Strategic Plan are: **Access**, **Alignment** and **Agility**.

To learn more about the Plan, click on the following link http://www.uwi.edu/uop/strategic-plan-about-plan

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[1] For information, see www.ohioinnovationexchange.org.

[2] These include Case Western Reserve University, Cleveland State University, The Ohio State University, Ohio University, The University of Akron, and University of Cincinnati. See Ohio Higher Ed. 'New Online Platform Drives Innovation by Connecting Ohio's Research Universities with Industry.' Ohio Department of Higher Education. Press Release. 27th Sept. 2018. https://www.ohiohighered.org/press/new_online_platform_drives_innovation_connecting_ohio's_research_universities_industry.

[3] Virtual reality immerses the user in a simulation, such as the experience of flying or being on Mars (Alexander et al 2019, 25).

[4] Augmented reality layers information over physical spaces and objects, such as labels and other supplementary data over museum displays (Alexander et al 2019, 25).

[5] Holographic devices are used to create mixed environments, as video displays project 3D images into a physical space (Alexander et al 2019, 25).