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Trends in Higher Education

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Message from the Publisher

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This volume of trends in higher education focuses on the role of Technology in shaping the future of the higher education landscape. It provides a rich commentary on how new developments such as; Artificial Intelligence (AI), Virtual Reality (VR) and Adaptive Learning (AL) are shaping the new realities in the higher education space. The research is showing that, Artificial Intelligence will impact the Higher education landscape by bringing changes in knowledge delivery and research/development. Similarly, Virtual reality (VR) and augmented reality (AR) technologies will also influence the ways in which individuals teach, learn, engage with each other, and experience the world. Further, Adaptive learning technologies show great promise for improving learning outcomes. Taken together, it is clear that technology will revolutionize the education sector in the future with particular focus on individual and personalized learning. Indeed, persons who consume education services will be able to access education anywhere, anytime from anyplace in the world using online technologies from their smartphones and other computer related electronic gadgets such as tablets and laptops. The material presented in this volume is both rich in content and detailed in delivery. Managers in the higher education sector will find the information very useful as they embark on strategizing for the future of their institutions.

Technological Trends in Higher Education

The rapid adoption of Information and Communication Technologies by Tertiary Level Institutions (TLIs) will have significant impact on the education system revolutionizing teaching and learning in universities while graduating students with the skills and competencies needed for a modern, digitized society. The Society for College and University Planning (SCUP) indicates that Artificial Intelligence (AI), virtual reality (VR) and adaptive learning (AL) are some of the issues and trends that will occupy the attention of Higher Education Institutions (HEIs), in the future. In light of these developments SCUP indicates that faculty development for the digital age needs to evolve beyond training techniques that have been used over recent decades, to include online resource sites, training by videoconference, asynchronous online courses, archived peer experiences, and regular communication through multiple channels. SCUP predicts that HEIs will require a new cadre of employees who are more "learning engineers", who are experts with a knowledge base in the learning sciences, familiarity with modern education technology, and an understanding of and practice with design principles.

~ From Editorial Team

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Adaptive learning

Initially, adaptive learning was a means to help students learn in ways that best suit their learning styles with solutions for homework tools and practice or study aids to guide learning throughout a course, and in some cases, to support whole course delivery. Adaptive learning technologies are also being used for remediation and proficiency-based assessments for less-advanced students needing to reach a higher level of proficiency prior to enrolling or while enrolled in a course or programme, and more advanced students needing to demonstrate prior learning in a subject to accelerate time to completion.

Although adaptive learning technologies focuses on individual learning styles, new developments show promise in fostering collaboration in online learning environments. For example, new tools can automatically sort users into groups with shared interests and recommend information sources based on user interests and web browsing habits (Adams et al 2017, 39). A 2016 survey conducted by the Campus Computing Project found that 96% of higher education Chief Information Officers (CIOs) agreed that adaptive learning technology shows great promise for improving learning outcomes (Adams et al 2017, 38). Although more HEIs are piloting adaptive learning in 2016 compared to 2015, HEIs are still slow on the road to adoption of the tool. This is because institutions face significant difficulties integrating adaptive learning solutions into existing tools, particularly learning management systems (LMS), and into faculty and student workflows (Tyton 2016, 5). As HEIs seek to incorporate adaptive learning solutions within the short-term (one year or less) (Adams et al 2017, 3) into their workflows and training, focus will also be on cost, access and quality.

Artificial Intelligence and Virtual Reality

The World Economic Forum (2016) notes that by 2020, the Fourth Industrial Revolution will have introduced advanced robotics and autonomous transport, Artificial Intelligence (AI) and machine learning, advanced materials, biotechnology and genomics. Gartner (2016, n.p.) predicts that AI technology will focus on three areas — advanced analytics, AI-powered and increasingly autonomous business processes and AI-powered immersive, conversational and continuous interfaces – and by 2030 artificial intelligence "will increasingly blur the line between formal, classroom education and self-paced, individual learning" (Stone et al 2015, 34; SCUP 2017, 5). Artificial intelligence is set to become pervasive both in education and industry within the next four to five years.

Artificial Intelligence will impact HEIs bringing changes in knowledge delivery and research/development. Artificial intelligence is already seen in smart content creation, personalised and adaptive learning, intelligence-empowered educational games and robots. It is also expected to streamline processes from applying to college, to arriving on campus, declaring a major, signing up courses and thus simplifying university administration for students. Adams et al (2017, 46) note that AI is regularly leveraged in higher education in the form of 24/7 online help desks (e.g. IBM Watson at Deakin University) and that institutions can look to developments in the consumer sector namely; virtual assistants that can interpret verbal cues to respond conversationally, mirroring human interaction. In higher education, however, virtual tutors cannot replace educators as it requires active engagement by human teachers (Adams et al 2017; Stone at al 2015, 7).

Despite progress in the field, "schools and universities have been slow in adopting AI technologies primarily due to lack of funds and lack of solid evidence that they help students achieve learning objectives" (Stone et al 2016, 31). Given that the AI is projected to increase by 48% over the next four years according to ProctorU, a US-based edtech company providing digital solutions for identity and exam management, it means that HEIs will have to incorporate AI into higher learning and design special programmes or courses to prepare students for the labour market. Ivy league universities such as Stanford University, Ivy league universities in the USA such as Massachusetts Institute of Technology, University of California—Berkeley, and University of Edinburgh and University of Sheffield, in Europe offer graduate programmes in

AI combining principles of computer science, cognitive psychology and engineering and undertaking research to develop and extend AI technology

Virtual reality (VR) and augmented reality (AR) technologies will also influence the ways in which individuals teach, learn, engage with each other, and experience the world. While VR and AR offer powerful new tools to help students learn, the "most complex side of VR is the content itself, so in order to make this work effectively in the classroom, content needs to be aligned to curriculums as much as possible" (Pudwell 2017). Not only will educators have to determine how to integrate VR and AR into the classroom, it will also mean retraining faculty, equipping classrooms with hardware and software, which has a cost implication and can act as barrier to adoption for already cost-constrained HEIs.

SCUP (Fall 2016, 5) cites the example of the University of Maryland's Augmentarium, where researchers study how to use VR and AR to expand human intelligence and its potential across multiple disciplines, such as science, engineering, medicine, commerce, and education. For instance, an education application in medicine would demonstrate surgical techniques to budding physicians, including the intricacies of procedures they might encounter only rarely. In artistic performances, VR will move beyond the tightly-controlled imaging scenarios and deploy state-of-the-art camera arrays to produce cinematic-quality, real-time virtual worlds (U. of Maryland).

Another development is the presence of unmanned aircraft systems (UASs), better known as drones, on campuses. Timothy Chester, vice president for information technology at the University of Georgia, notes that for HEIs drone use falls into two broad categories: the design and development of UAS aircraft and infrastructure, and the use of UASs in general academic instruction and research. In the case of the latter, Chester (2016, n.p.) notes that universities are already conducting research on drones in disciplines such as agriculture, health, and the arts, but universities will also be expected to develop new applications for drones and train students in their use. SCUP (2017, 5) points out as drones become more commonplace, institutions will need policies and procedures that govern their use on campus.

Digital resources and systems

Generally, digital content is cheaper and can be more easily updated to reflect the newest research, and is more environmentally friendly than print materials. SCUP (Fall 2016, 5) notes that there is mixed signals regarding the adoption of digital textbooks. A 2013 study found that if the cost was the same for print and e-books, 87% of undergraduate and graduate students surveyed said they would prefer to read paper books for school than e-books and 92% found paper books the easiest medium to concentrate. The reasons for print preference are related to the physical discomfort from digital materials, the association of digital devices for recreational use but not for study and the extent of distraction related to reading on digital devices. Although digital textbooks will continue to grow, print will still likely remain a primary educational tool for teachers. However, students will have to be taught how to read digital material critically as was done with print.

SCUP (Fall 2016, 5) draws attention to the findings from a 2015 Campus Computing Survey where 96% of campus CIOs believe that digi tal curricula resources make learning more efficient and effective. Conversely, fewer than half of the faculty respondents reported strong support of digital course materials and their usefulness in the classroom. The Babson survey of US faculty on educational resources demonstrates a similar trend; the use of open resources is low overall but somewhat higher for large enrolment introductory-level courses (Babson 2016, 2). Cost, comprehensiveness of the resource, ease of finding open educational resources (OER), insufficient resources for subject area and the lack of a comprehensive OER catalogue were identified as barriers to use of OER. Given the relatively low level of awareness and use of digital teaching materials, it suggests that faculty is somewhat cautious and that they are yet to be convinced of the positive impact

that digital material will have on learning outcomes. As such, universities will have to encourage faculty to adopt both technology and digital material into their teaching portfolio via peer support, training programmes, faculty champions, etc.

Currently, LMS that enable the online delivery of course materials allow students to access syllabi and readings, submit assignments, check grades, and contact peers and instructors through their institution's system, while faculty monitor student engagement and performance at individual and course levels (Adams et al 2017, 44). If LMS is to cater to mastery and competency based education (CBE) these elements are limited and too focussed on the administration of learning. As such, the next-generation digital learning environments (NGDLE) seeks to expand LMS to support personalisation, learning analytics, adaptive learning, and dynamic social exchanges and play a larger role in formative learning assessment (Adams et al 2017, 44).

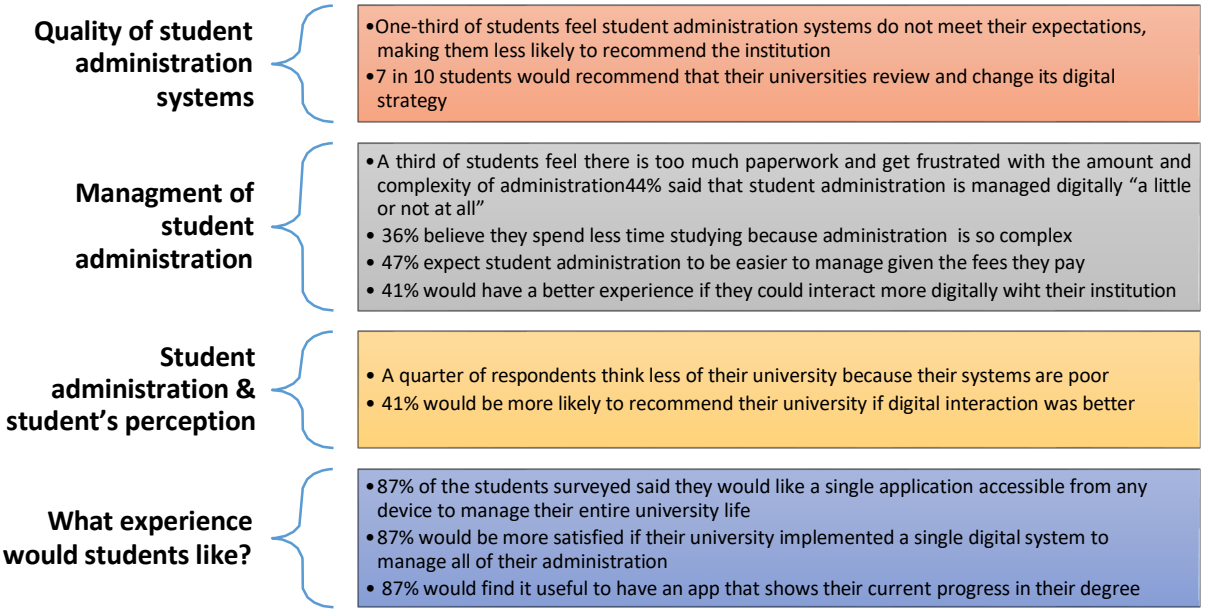
The findings of a 2016 survey of more than 2,000 full time and part time students studying in the US, Canada, United Kingdom, France, Germany, Benelux (a politico-economic union of three neighbouring states in western Europe: Belgium, the Netherlands, and Luxembourg), Singapore, Australia and New Zealand on the digital experience around university administration found that globally student administration systems are not meeting the expectations of students (see Chart 2). Given that universities are facing competition for students, the results suggest that HEIs should embrace the modern, digital solutions available on the market to allow students to spend less time dealing with administrative tasks and more time learning.

Internet of things

According to Adams et al (2017, 42), the "Internet of Things (IoT) consists of objects endowed with computing power through processors or imbedded sensors that are capable of transmitting information across networks." These connections allow remote management, status monitoring, tracking, and alerts and the time-to-adoption of the IoT is two-to-three years. At present, IoTs are seen in wearables like Apple Watches, Fitbits, etc. As such, HEIs will likely face a large number of students with smart devices, especially if cost falls. As with the Bring Your Own Device (BYOD) phase, bandwidth needs and accessibility to campus networks will be a concern. In relation to higher education, these devices will generate data on student learning and campus activity and inform content delivery forcing HEIs to address the pedagogical issues surrounding the use of IoTs.

As new technologies develop, HEIs will need to address legal, financial, and technical implications of use and collection of data, etc. Connected learning environments can generate student profiles with data on attendance, performance, and productivity while machine learning capabilities will enable data analysis, helping institutions personalise the student experience. Adams et al (2017, 42) note that with educational applications of networked objects issues around data security and ethical questions surrounding collection and use of student data have risen. Gartner (2016, n.p.) and SCUP (2017, 6) also highlight concerns regarding data in particular data privacy and liability. Moreover, protection of the institutional digital footprint that students, faculty, and staff inevitably leave behind and policies to protect data while also fully tapping into data's potential for learning remain critical. IoT's development will impact the curriculum development and renewal. The growth of IoT is increasing demand for skilled workers in areas including hardware engineering, sensors development, and systems design and integration requiring HEIs to support the development of multidisciplinary curricula to address workforce needs. Adams et al (2017, 42) note that "some technologists predict explosive growth in this area [privacy and security], which will impact the goals of engineering education." Moreover, it is projected that there will be a total of six million jobs in global information security by 2019, with a talent pool falling short of this demand by 1.5 million people (Adams et al 2017, 42). As such, HEIs may scale-up their STEM programmes. At the University of Sydney

Chart 2: Students' perceptions of their university's digital strategies



Source: Unit4, 2016.

students can major in IoT, an interdisciplinary course of study encompasses electrical and computer engineering, wireless communications, and data analytics. Additionally, IoT can enhance campus student life including safety by tracking student movement and activity, and student learning and well-being. For example, at Virginia Tech students, faculty, and staff receive emergency notifications via smartphone or smartwatch (VT Alerts system), while researchers at the University of Texas Arlington's LINK Lab are studying how emotions affect learning, using wearables to monitor biological factors that correspond to emotional states.

Mobile learning

The prevalence of mobile devices (e.g. smartphones, smartwatches, and tablets) has enabled mobile learning or m-learning. This is expected to become more prevalent in the next two-to-three years. It has fostered new approaches to learning impacting both the delivery and creation of educational content. Citing the findings of a study conducted by McGraw-Hill Education and Hanover Research of over 2,600 US college students, Adams et al (2017, 40) note "nearly two-thirds reported using their smartphones to study." Moreover, the authors note that "the global market for mobile learning is predicted to grow by 36% annually, increasing from $7.98 billion in 2015 to $37.6 billion by 2020." This suggests that HEIs are well-positioned to tap into that market to enhance teaching and learning.

While m-learning can boost equity particularly in developing countries, affordability of smartphones and bandwidth remains a concern. Nevertheless, m-learning is a pathway to increase access to education. In Kenya, Daystar University launched Daystar Mobile, a programme in which students can earn a bachelor's degree in education primarily through their smartphones. A mobile app will deliver videos and interactive course materials on demand; faculty use the platform to interface with learners and provide additional support. A study of a South Korean online university found that learners with full-time jobs were 48% more likely to use a mobile LMS than non-working students; suggesting that the flexibility afforded by on-the-go access to lectures and learning materials can aid students better integrate academic

pursuits into their schedules. Further, students can use mobiles to enhance 21st century skills including communication, collaboration, and creating content. For example, at RMIT University in Melbourne, Spanish language students produced autobiographical videos on their phones, describing their personalities and neighbourhoods, which help learners increase their vocabularies and offered a practical application of course content through the perspective of their own lives (Adams et al 2017, 40).

m-learning has also created opportunities for students to connect with course content allowing for two-way communication in real time, helping educators to effectively respond to student needs. For example, Hotseat, an app developed at Purdue University, allows students to post questions and comments in real time during class, anonymously or via their social networking accounts. Learners can participate via SMS or the mobile app. Through Hotseat, students answer each other's questions, "like" posts, and respond to polls and quizzes. Faculty cite benefits including increased engagement, the ability to refine their instruction based on student feedback, and helping introverted students find their voices.

However, there is still need for technical and pedagogical support from institutions in integrating mobiles in their curricula (Adams et al 2017, 40). Professional training to understand mobiles in the context of pedagogies is essential to ensure positive learning outcomes. The University of Central Florida's Center for Distributed Learning has created a Critiqueat- a-Glance mobile checklist that allows instructors to quickly evaluate a mobile app for adoption into course curriculum based on metrics including price, privacy policy, content rating, opportunity for student feedback, and more (Adams et al 2017, 41). Other potential challenges impeding adoption of mobile learning include concerns about how to mitigate student distraction, students' lack of clarity on classroom policies, and a lack of support for instructors.

Online education

Based upon a survey of technology leaders, UB (2016) reports that 75% anticipate higher
enrolment in online courses and 60% expect that their college or university will expand online programme offerings in 2017. Additionally, 49% said there will be an expansion of online learning infrastructure at their college or university and 32% said there will be additional resources devoted to online learning in 2017. The same survey also asked respondents about significant IT investments anticipated for 2017and 49% identified academic technology. These findings suggest that HEIs see the online market as viable.

The Babson Survey Research Group *Survey of Online Learning* shows that students taking at least one distance course increased between 2012 and 2015. While distance education enrolment showed just under 4% growth between 2012 and 2015, public institutions experienced a 13.4% growth in distance education enrolment during the same period (Babson 2017, 11, 15). Table 1 shows that in 2015 there were nearly five times as many undergraduate enrolments (4,999,112) as graduate enrolments (1,022,993) taking at least one distance education course (Babson 2017, 20).

SCUP (2017, 6) highlights that MOOC or Massive Open Online Courses are making a comeback. It noted that MIT, Harvard, and their partners at edX have launched "MicroMasters", modular graduate programmes, largely in business and technology, designed to help learners enhance their workplace skills affordably and on their own schedules. It allows students the option of matriculating in and paying only for courses they need (Grant Thornton 2017, 7). These courses are the "big next step in the evolution of education" as it offers a personalised pathway that students can tailor to fit their interests or career aspirations and provides a pathway to completing a master's degree from an institution that has agreed to accept the credits. There will also be HEIs that will re-package their courses into clusters and offer them to many non-traditional, older students as professional development solutions, according to

eCampus News (2017). Further, there will also be the non-traditional actors who are "highly focused on workforce alignment and outcomes…. [and] who can define their target market and target

Table 1: Trends in Online Learning in US Colleges and Universities				
Indicators	**2012**	**2013**	**2014**	**2015**
Total enrolment	20,928,443	20,680,352	20,508,530	20,266,367
Online enrolment as a percent of total enrolment	25.9%	27.2%	28.1%	29.7%
Annual growth rate of students taking distance education exclusively	12.6%	13.1%	13.9%	14.3%
Annual growth rate of students taking at least one distance course	13.3%	14.1%	14.2%	15.4%
Total number of students taking distance courses	5,425,406	5,611,551	5,795,730	6,022,105
Number of students taking at least one distance course – undergraduate	4,559,495	4,706,277	4,833.989	4,999,112
Number of students taking at least one distance course – postgraduate	865,912	905,274	961,741	1,022,993

Source: Babson Survey Research Group. *Digital Learning Compass: Distance Education Enrolment Report 2017*.

student along defined industries, geographies or career pathways will have the greatest success moving forward" (eCampus News 2017). For example, LinkedIn through its online learning platform Lynda.com is offering more than 50 "learning paths", that is packages of educational material in areas as 3-D animation, music production, small-business ownership, graphic design, software development, and IT that help users update or learn new skills.

Fears about both online and face-to-face programmes competing for the same pool of students are not uncommon. SCUP (2017, 6) cites the National Bureau of Economic Research (NBER) study that analysed the impact of a new, low-cost online master's programme in computer science at Georgia Tech. It found the programme had most likely not cannibalised students from the residential programme on which it is based, but instead appears to have tapped a new student population.

Challenges in IT Adoption

Adams et al (2017, 22-36) notes that there are solvable (i.e. those that we both understand and know how to solve), difficult (i.e. those that are well-understood but for which solutions remain elusive) and wicked (i.e. the most difficult, are categorised as complex to even define, and thus require additional data and insights before solutions will be possible) challenges within the higher education industry).

Conclusion

It is conclusive that ICTs will revolutionize the education sector in the future with particular focus on individual and personalized learning. Students will be able to access education anywhere, anytime from anyplace in the world using online technologies from their smartphones and other computer related electronic gadgets such as tablets and laptops. Digital courses will be automated and delivered in a virtual classroom with the use of artificial intelligence supported by adaptive learning technologies. Very soon brick and mortar universities will be replaced by virtual education hubs and students will not be required to attend classes in universities, rendering many universities obsolete. It is important that universities embrace the changing dynamics of the education sector as a result of the impact of technology on teaching and learning in order to survive in the long run.

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