Educational technology infrastructure to enable learning

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Educational technology infrastructure is more than having an information technology helpdesk, it is about changing the way learners understand their own learning towards a real-world transferable experience. It means having access to the right tools and systems to support learners in learning and in contributing to a society where technology is ubiquitous and essential.

The pandemic and the subsequent response have highlighted the importance of educational technology infrastructure in higher education. In the pivot to remote learning, institutions discovered that a flexible approach to the existing infrastructure eased the shift to digitalising learning and teaching capabilities. This flexibility is a key capability of any institution, where not only the tools need to be considered to provide deep learning that is contextually and disciplinarily rich but also the pedagogic designs.

Generally, educational technology infrastructure refers to the connectivity within the learning environment. However, connectivity can manifest in many forms, but typically references the digitising of activities through the use of information and communication technologies. Solutions in this space are not constrained by the generalised definitions, as there is room to broaden this understanding, where support services are needed to facilitate the learning environment's ability to afford and, in some places, transform into connected learning ecosystems. As an ecosystem, the influence of its individual components can be measured through:

- access (e.g., data storage and backup systems, firewalls, cybersecurity)
- cost (e.g., paywalls)
- data literacies (e.g., analytics, apps)

Although Australia, New Zealand and neighbouring countries are situated south of the equator, they are known as part of the group called the Global North. This term, used to identify countries that are socially and technically well-developed, should also highlight that Australasia has several differences from the other countries in this group. Universities in New Zealand receive funding from the government as well as learner fees, whereas Australia's universities are mostly not-for-profit. This combination can suggest how resources – and by association, what factors –influence how infrastructure is provisioned. The understanding of governmental policies and laws guiding how and where data is stored, who can have and should have access to data, and when, and how costs are assigned and distributed, creates much to consider when looking at the infrastructure that should support educational technology-enabled learning environments.

The last 2 years have highlighted how different factors influence how learning is proffered. No longer can we only blame learners for their learning ability, as there is a need for learners to be embedded into

Purpose-built facilities

The University of Technology Sydney opened UTS Central in 2019. The building features two 350-person capacity and a 198-person capacity collaborative teaching spaces designed with acoustic considerations and the 270-person capacity Hive Superlab for science laboratory teaching.

Filling a niche

Pedestal 3D is an educational technology company founded at Macquarie University. The solution filled a gap in 3D object -based learning in archaeology, anatomy, geology and other disciplines at the university before incorporating in 2018.

learning systems that are sustainable, supported, sufficiently resourced and meaningful for society. Thus, a shared responsibility to create a learning environment that is conducive to the knowledge, skills, abilities and attitudes is a goal worth acknowledging. We all live in a connected world, and there is an expectation that learning in institutional environments should be transferable and reflect industry needs. This means that implementing technologies, new or otherwise, to enhance learning experiences is expected to support and prepare learners for the world they take part in. As such, what is important now is how does the infrastructure support the future of learning in this sector, and how does infrastructure, known for its physicality, embrace technology so that the sector is not reactionary but responsive, agile and reflective. Being responsive, agile and reflective requires constant recognition of the issues of access, cost and data literacy abilities as these will provide the necessary support.

With the efforts to ensure that institutional strategies are in alignment with the source of revenue streams, there may be a need for a shift in strategising as economies recover and re-engineer societal needs towards course offerings. Shifting fields of studies, re-calibrating research and teaching loads, adjusting for a variety of needs means that infrastructure projects may look different; for example, physical buildings which use traditional methods of delivery may require retrofitting to adjust for flexibility and access towards an appropriate service design. Flexibility could mean the need to adjust to the size of cohort, delivery methods (face-to-face, blended, hybrid, online), curriculum designs (e.g., co-designs or participatory designs with learners, industry, military and other stakeholders) and most of all interactive engagement (e.g., collaborative learning, cooperative learning) using technology tools (virtual reality and augmented reality, games, simulations). This is evident in the exemplars, where the transformation of teaching practices and the integration of software and hardware to support the learning experience took many forms; for example, creating online tools to publish 3D object data that were notoriously challenging online at Macquarie University, implementing apps such as Zoom and Padlet to create a Virtual Exhibition Poster hub at the University of Melbourne. There were some institutions like the University of Technology Sydney, with collaborative rooms created for multi-cohort size, group collaborations in both the science labs and general teaching spaces in place prior to the pandemic. These rooms mixed physical designs with technology to simulate a real-world working environment.

These exemplars create a new way to respond to the societal needs for more entrepreneurial learning spaces which are situated in transdisciplinary and interdisciplinary spaces. By considering the value of sustainable physical infrastructure, educational technologies, and the cognitive and pedagogical conditions to support an integrated approach in learning and teaching, we can create an enabled and empowering learning environment. It can in turn offer to learners a beneficial learning ecosystem in which they can with instructors create, extend, and innovate to grow the most important asset in any economy – knowledge.

Illuminated whiteboards

James Cook University adopted the Learning Glass illuminated whiteboard technology to improve learner engagement and understanding of statistical and mathematical concepts. Learners can see the neon marker on the glass surface with no occlusion. Lightboard drawing can be captured via video or transmitted through web conferencing technologies, such as BlackBoard Collaborate or Zoom.

As the educational technology industry continues to grow exponentially, so too will the educational possibilities for institutions to integrate varied technologies – digital and otherwise – into teaching and learning. Institutions may consider the following regarding their own educational technology infrastructure:

- **Equity and secure access:** As institutions continue to evolve their educational technology infrastructure, they must also consider the implications for learner and facilitators of integrating technology into the learning environment. As additional technologies are employed, the need for skill enhancement throughout the workforce will compel new ways of observing, applying, measuring, evaluating and researching. This is a core need to encourage equity with acknowledgement to differences, as it relies heavily on devices and secure and sufficient Internet access and bandwidth. It is hoped that access will be afforded with true understanding of the factors that characterise all stakeholders involved (i.e., learners, instructors, administrators) as the goal towards safety and accountability is addressed with regard to the complexity of each learning environment.

- **Context and complexity:** Higher education preparing learners for a digitally enabled world of work: Higher education institutions have widely invested in physical campuses for decades. With the renewed vision of higher education institutions preparing society for the world of work, how we support these ecosystems will be of high importance. A review of the current needs of higher education institutions will assist by addressing some long-standing discussions, such as academic integrity, encouraging designs that are grounded in problem-solving methods to embrace critical thinking and providing a curriculum that is authentic by aligning assessments with the world of work. This highlights the importance of flexibility and responsiveness in working with industry leaders to understand what technologies are on the horizon and how, from an educational technology infrastructure perspective, we prepare for them.

- **Flexible and evolving strategies:** Although educational technology can enhance the learning experience considerably, so too will the cost to implement and then support technology grow and maybe challenge this want. From licensing to capability building and infrastructure, the cost can be considerable. It is important for the sector to recognise the opportunity to maintain flexibility in offerings in alignment with societal needs, yet at the same time, have a strategic vision that evolves to create a stable educational economy. For example, microcredentialling is demonstrating how we might competitively offer just-in-time learning within the university model. The key is to expand into areas that will support a strategic vision for learning experiences that are wanted and valued.