

The power of online learning

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We live in an era where technology is embedded in everything we do. We use the Internet and various apps numerous times every day to order our favourite takeaway, keep in touch with friends and book GP appointments. In this digital age, technology is also deeply influencing education and learning, especially in science.

In recent years, many Higher Education (HE) institutions have dramatically expanded their online offering and in line with this have developed web-based learning management systems, such as Blackboard, Canvas or Moodle, on which students can access lecture material, additional reading and exercises, timetables and much more. Lecturers can offer online support and tutorials through webinars, live-web based sessions where students can actively participate, asking questions through chats or talking directly. Distance learning courses are increasing in number, offering the option to fit studies around your life. Virtual laboratories are also becoming increasingly popular, both in science blended learning and online degrees. These fully interactive simulations can be accessed by students to perform experiments and collect and analyze data. Moreover, a few UK Universities have or are building virtual reality (VR) laboratories. VR is used to create a fully-immersive

hands-on experience, where students will be able to dissect an animal, fix an engine or walk on Mars. And, although you could spend millions creating a virtual reality laboratory, there are some cheap devices available for as little as £5 that are controllable with apps on a smart phone, making it an approach available to almost everyone. All this may sound impressive, but what's the actual impact of technology on learning and education, except wearing fancy goggles?

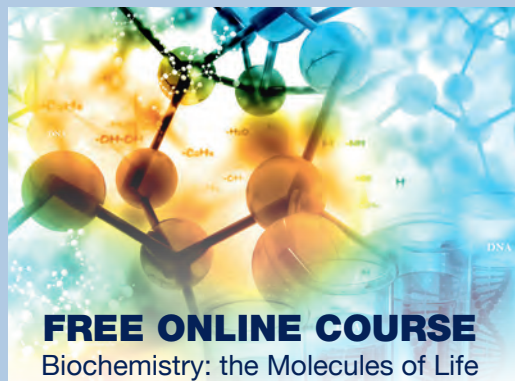
The instant impact of online learning is student engagement. The majority of today's students carry at least one device, be it a smartphone, a tablet, or a laptop, and a good educator can use this technology as part of the learning experience, instead of waiting for one of these devices to become a distraction. Such technology can allow lecturers to keep engaging students beyond the classroom and extend learning time. VR is an example of how technology can enhance and revolutionize learning: students may be able to visualize and move biomolecules in a fully-immersive setting, providing an experience otherwise impossible. Online learning can also allow students to study independently, which is beneficial for various reasons. By accessing material online, everyone can study at their own pace, for more efficient learning. Students with diverse abilities can use the available technology to improve their educational experience and access opportunities that may have been closed to them in a traditional classroom setting. Independent learning is also strongly linked with the pedagogical concept of student-centred education, which brings the focus from the teacher onto the student, for more personalized learning. Encouraging and assisting students to further explore a topic they're interested in can deepen their knowledge in a subject and, more importantly, create motivation to study and increase resilience. All students have different strengths and weaknesses and a tailored programme can help them to develop skills that they are lacking or need improvement in. Independent learning can also be easily fitted around a student's life. Students may need to work or they may have family commitments; online learning can allow them to keep up and not get left behind because of external circumstances.

Despite an undoubtedly positive impact, there are a few important aspects to consider before setting up online learning courses, especially in modules or

The screenshot displays a virtual laboratory interface titled "Running a Polymerase Chain Reaction (PCR)". It features a central control panel with a temperature graph showing a protocol with three stages: 90°C for 30 seconds, 60°C for 45 seconds, and 70°C for 60 seconds, repeated for 35 cycles. Below the graph is a "LOAD SAMPLES" tray with four wells labeled A, B, +ve, and -ve. To the right, an "Instruction" panel provides a definition of a thermocycler and a detailed protocol: 30 cycles of 95°C for 30 seconds (denaturation), 58°C for 45 seconds (annealing), and 72°C for 60 seconds (extension). A "CHECK" button is located at the bottom of the instruction panel. Navigation buttons for "BACK" and "NEXT" are visible at the bottom of the interface.

A frame from Learning Science's interactive virtual laboratory on 'Running a Polymerase Chain Reaction'. On this page, users have added all PCR reagents into microfuge tubes and now need to load and set the thermocycler. This is just one of dozens of bioscience interactive resources offered by Learning Science to support students in preparation for their laboratory experience.

The Biochemical Society has developed the Massive Open Online Course (MOOC) 'Biochemistry: the Molecules of Life', in collaboration with the University of East Anglia. Find out more at www.futurelearn.com/courses/biochemistry



degrees that are exclusively taught online. Staff members and students alike need to be trained on how to use the learning management system of choice properly. Millennials aren't necessarily as digital savvy as people think and an ability to use social media doesn't help someone to know, for example, how to access the assessment feedback on Blackboard; students need to be taught. Moreover, online learning can be challenging because of social isolation. This can be overcome by creating an online community, where the social presence of both educators and students can become central to the educational experience. This has been shown to positively influence engagement, satisfaction and peer-support. These are just a couple of aspects professionals developing a course need to consider and it is not an exhaustive list. Online learning is a powerful tool, but it can also be complicated to embed in everyday teaching, or use to completely replace traditional education.

Despite this, it is likely that technology will keep playing a central role in education, revolutionizing learning and opening the door to new horizons. FutureLearn is just one example of how online learning is providing access to diverse opportunities. This learning platform, owned by the Open University, is developing a portfolio of postgraduate degrees, professional qualifications and CPD accreditations, in collaboration with leading institutions such as St George's University of London, the Chartered Management Institute and the British Council. FutureLearn offers a variety of MOOCs (Massive Open Online Courses), and, while completing a MOOC generally doesn't lead to a qualification, the online platform has announced that users will be able to complete some of its courses to earn academic credits for degrees and MBAs. This is a step forward towards tailored learning and accessibility of Higher Education: in a few years you may be able

The Biochemical Society launched its first online training portal in October with 'R for Biochemists 101'. Check out our website for forthcoming online courses www.biochemistry.org/Events/Training



to access courses from top universities independently of where you are based. And while unfortunately HE does not yet provide open and free degrees, the 'pay as you go' approach that many Universities offer for their online programmes, especially at a postgraduate level, may provide more learning opportunities to everyone and hopefully improve social mobility. We just need to wait and see what the digital educational revolution will bring. ■

Further reading

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