Chapter 6
An Online Education Toolbox

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Abstract Advances in technology and in associated online education technological capacities are contributing to the rapid growth and increasing effectiveness of online education. The rapidly expanding digital landscape is allowing online education to achieve equivalence and in some ways beyond equivalence with traditional learning, including by enhancing collaborative learning opportunities and by removing geographical and other barriers, including those relating to the COVID-19 pandemic, and providing a custom learning experiences for varied learners. Increasingly commonly used online education features include state-of-the-art Learning Management Systems, eWorkbooks, teleconferencing systems including Zoom and eTutorials. Emerging online education features include open-source collaboration frameworks such as the HTML5 Package (or H5P), simulation and Artificial Intelligence (AI) features. This chapter describes some increasingly widely used and also emerging online education technological features, as convenient resources for online education developers, teachers and students.

6.1 Technological Advancement and Innovations in Online Education

Online education has seen tremendous growth in recent years (Grinder et al. 2019) and this growth has recently been accelerated by the COVID-19 pandemic. Advances in information and communication technology supporting online education have helped to accelerate the delivery of educational curricula outside of traditional classrooms and help online courses provide their students with an optimal balance of study and potentially competing life priorities including work and family (Croxton 2014). Furthermore, the recent growth and rapid expansion in the development and use...
Digital technologies such as tablet computers, smartphones, interactive whiteboards with multimedia functions (internet access, images, sound and video files), robotics, 3D printers, social media platforms, professional broadcasting communication equipment, gamification tools, augmented and virtual reality applications and wide variety of other educational software programs have contributed to this digital revolution. Mobile application development and cloud computing have further paved the way for online education, opening doors for need-based, self-paced and self-guided learning.

There are a variety of ways that educational technology is defined in the literature (Kurt 2016). In its simplest form, it is ‘the disciplined application of knowledge for the purpose of improving learning, instruction and/or performance’ (Spector 2015). Kurt describes the evolution of the definition of educational technology over the last half-century (Kurt 2016), from learning processes (Ely 1963) to a field facilitating human learning through learning resources and processes (AECT 1972), to the use of educational technology as a conceptual framework (Davies and Schwen 1972) to a theory and practice of design, implementation and evaluation of learning resources and processes (Seels and Richey 1994), to a study and ethical practice of dealing with technological processes and resources (Hsu et al. 2013).

The ever-evolving nature of the field of educational technology has not only changed the traditional approach to teaching but it also provides innovative ways to allow learners to engage and interact with learning content, enhancing the overall learning experience (Antonenko et al. 2017). Online education programs can be valuablely supported by educational technological tools that are specifically designed with an understanding of the desired students’ experiences, which are easy to adopt, and are scalable. The remainder of this chapter describes some valuable online education technological tools which recent educational technology advances have allowed and which together can help develop student-centric customised experiences and create optimal virtual learning classrooms, learning communities and campuses.

### 6.2 Learning Management Systems (LMS’s)

The growth and expansion of education technology and its increasing adoption and diffusion worldwide have led to the development of learning systems that have revolutionised the delivery of academic content, both in blended and online learning spaces. In higher education, this need is fulfilled by the creation and implementation of learning management systems such as Moodle, Opingo and Canvas.

Learning Management Systems (or LMSs) are defined as a ‘software application for the administration, documentation, tracking, reporting, and delivery of educational courses, training programs, or learning and development programs’ (Ellis 2009). Online LMSs have emerged from the concept of ‘e-Learning’ that focuses on utilising electronic technologies and resources in accessing educational curriculum
Since its first emergence in the late 1990s, continuous efforts have been made by the education community for enhancing its design, resulting in tremendous growth and development in online education. The opportunities and interest in its development and collaboration between technology developers, educational designers, teachers and educational administrators have enabled continuous improvements and innovations in this space (Watson et al. 2015).

Traditionally, LMSs are used by universities globally to deliver educational content and facilitate the administration of educational programs. Through the implementation of modern learning systems, there is a huge opportunity to mirror an equivalent on-campus or traditional classrooms experience for students enrolled in online or blended learning courses.

The widespread adoption of online LMSs is influenced by several important factors such as modern education interfaces, student-centric course design and structure, online assessment methodologies, opportunities for social presence through discussion forums, and integration of gamification technologies (as an educational approach) to enhance learning through video game design. Digital simulations or simulation-based learning that utilises the notion of ‘learning by doing’, provide effective virtual learning experiences aimed at improving both knowledge and skills of learners. Simulations also help teachers to easily and effectively explain otherwise difficult theories and concepts (Watson et al. 2015).

Students are at the heart of any learning system. The structure and design of academic content are presented within LMSs in a way that provides a personalised learning experience for students. Modern LMSs allow tailoring to each student’s personal learning needs based on their interactions with the learning content, providing them with personalised learning plans as well as tracking their progress. For example, adaptive assessments feature categorised assessment questions based on each student’s skills and provide tailored feedback based on their responses.

The most prominent feature of any online LMS is its use as a collaborative tool or a mini-communication network, where students and teachers interact by sharing ideas and information, and by asking and responding to questions in a self-paced environment. The ability to present interactive and collaborative content means that learners are more engaged with the content and can collaborate with other learners using the same platform. Additionally, built-in class discussion and networking forums enable flexible, local and social ways of learning for otherwise diverse and geographically dispersed learners and teachers.

The use of gamification tools in the context of education (such as scoreboards, ranking ladders and task completion badges), keep students motivated and engaged, and provide enjoyable ways for students to learn while engaging with the course content. Similarly, prototyping or 3D printing has been extremely beneficial in enhancing engagement through more concrete experience and interactive learning.

Mobility and accessibility of content are other important features of online learning systems, providing students with on-the-go access to course material from multiple devices including mobile phones. Also, the ability to access (and update) material to suit learners’ and teachers’ own flexible schedules provides unprecedented flexibility and convenience in tertiary education.
From the teachers’ perspective, online LMSs provide a full suite of services to manage and deliver course content, for example, via built-in course templates that allow the maintaining of a consistent structure across individual courses. Some online LMSs also support the structure and layout of academic content through e-workbooks. e-Workbooks allow a highly structured way to organise the course content and provide flexibility to students to hover around resources when navigating the content.

Modern learning systems also support a variety of learning formats including text, audio, video and other interactive 3D materials. Interactive videos have increasingly been used in the delivery of online education creating a sense of cognitive and social presence connecting students with content (Garrison et al. 1999). Online students can play videos as many times as needed to understand a certain concept, offering an alternative approach to enhance their learning compared with static course materials. For teachers, online LMSs conveniently provide means of engaging with their students, particularly in off-campus courses where the feeling of isolation and disconnectedness is commonplace.

There are also numerous benefits of implementing an online LMS from course administrators’ perspective. Many LMSs now provide an ability to present course quizzes, group activities, tests and assignments through online assessment activities. They also have an in-built capacity to automatically score certain types of online assessments such as multiple-choice questions, along with providing feedback and report creation, creating efficiency and cost-effectiveness in marking a huge number of students’ assignments in a timely manner. Some special LMS features are described below.

### 6.2.1 HTML5 (H5P)

An important feature of online LMSs is their ease of integration with the HTML5 Package (H5P) that enables the creation and sharing of interactive educational content. Driven from the HTML programming language, it enhances the appearance of web pages by structuring and presenting the content in a clean and modern front-end design, as well as adding interactive activities within the content. For example, pop-up quiz question during or at the end of a video or advanced interactive activities such as virtually dissecting images to enhance learning. Being able to dynamically interact with educational videos engages learners with their content in meaningful ways than engaging with them statically, such as by reading from a textbook.

### 6.2.2 e-Assessments

LMS’s assessment applications allow universities to move away from paper-based exams to more streamlined online assessments that are easier to manage, mark and
store. In addition to easy facilitation of exams, in some cases, it also enables tracking of the time spent on each exam question, as well as the ability to benchmark the results with other classrooms.

The ability of online LMSs to display students’ progress dashboards indicating their engagement with the specific content and tracking whole class’s progress is a valuable feature for course teachers and administrators, as it gives useful insights about the usability of content and students’ engagement with it.

### 6.2.3 Student Communications

With minimal efforts by administrators, LMS systems can be set to send out automatic emails/notifications regarding important course-related dates and notices, and can keep a structured record of past discussions. Students are also able to self-serve basic admin tasks for themselves, saving course administrators’ time. The ability to deliver and store results from a large number of learning materials, seamless reporting, and learning analytics generated from huge amounts of data collected through students’ interactions with these online LMSs provide important education benefits, including personalised learning and helping students feel supported in their learning and a part of their learning community.

### 6.3 Mobile Apps

Mobile education applications (mobile apps) have transformed online education by expanding its reach and scale to diverse student populations. These educational apps provide interactive experiences for learners in the most user-friendly and creative ways. According to Statista 2019, mobile education applications have been the third most popular categories in the Apple app store, with the total time spent on educational apps continuously increasing worldwide.

Through an interactive user-friendly interface specifically designed to enhance learners’ interaction and engagement with the given content, education apps can enhance the online learning experience and allow learners to engage with content at their own pace and time. The content provided by these apps needs to follow a careful and logical design to promote systematic learning. Some of these apps are also designed to enhance communication between learners and teachers as well as between learners. For example, online chatroom apps mimic face-to-face group discussions in traditional classrooms, online discussion board apps serve as physical notice boards placed in classrooms, instant notifications through mobile apps replace emails and written memos, and e-book apps replace hard-bound textbooks. Furthermore, the integration of Artificial Intelligence (AI), virtual reality (VR) and augmented reality (AR) features have further enhanced learning experiences through these apps (Brown and Green 2016).
6.4 eWorkbooks

eWorkbooks provide a convenient synthesis of all the learning materials students need to cover in an online course and could be seen as equivalent to the study guides that were once provided in earlier forms of off-campus education. eWorkbooks use a text narrative to guide students through their learning experience and provide a conceptual framework for linked multi-media learning resources, including videos, structured learning activities, readings discussion forums and eTutorials. The eWorkbook narrative provides a context to learning material that is equivalent to what on-campus students would receive via their Lecturer. For example, students may be introduced to a particular topic via the narrative, emphasising its significance and relevance, and summarising up-to-date information. Students may then be asked to read a journal article presenting evidence on this topic, before completing a learning activity to consolidate their learning.

The organised nature of the eWorkbooks and their narrative means that students can efficiently focus on using meta-cognitive skills to reflect on, plan, and implement their learning (Khiat 2015). eWorkbooks provide structure and context to enhance online student’s learning experience, and provide education intangibles that need to be present in online courses for them to provide an optimal education experience, including the what, why, and when students need to learn what they are asked to learn. The optimal eWorkbook format needs to provide a format that achieves a balance in the quantity and variety of material provided that meets the needs of various learners.

6.5 Teleconferencing

Teleconferencing tools such as Zoom allow the collaborative conducting of online meetings and also online teaching and supervision sessions including online lectures and eTutorials. Zoom is a widely used and easy to use teleconferencing tool which can support up to 300 participants in standard meetings or more participants via online webinars. Zoom can be accessed via desktop or laptop computers or via a mobile device and sessions can be recorded, locally or to the cloud, and shared with students including within LMS course materials.

Zoom teleconferencing can be used to host lectures or conduct one on one or group research supervision sessions and also to conduct eTutorials, which are a valuable form of synchronous online learning and typically include up to 25 students. Zoom teaching and learning features include:

- Screen sharing including slide presentations
- Chats, which allows questions and information to be posted and responded to.
- Breakout rooms, which allow small group activities.
- Polling, which allows surveys and quizzes.
- Muting attendees microphones to eliminate background noises.
- Virtual hand raising for attendees to ask questions.
6.6 Simulation

Simulation is an educational technique that consists of creating a virtual version of a real-life behaviour such as interactions between health practitioners and clients via the use of recordings of actors performing scripts. This technique is becoming increasingly widely used (Lateef 2010; Aebersold 2018) and offers important benefits for online education, as well as for non-online education, and for non-clinical as well as clinical courses. Technological advances including in ease of recording and in the use of Virtual Reality are allowing the increased use of this teaching technique which is well suited to online education and which is improving the equivalence of online education with traditional education in areas which remain challenging to provide equivalence, including courses with clinical or other interactive content. As well as extending the range of online education use of the simulation technique has advantages over other techniques including the practical and ethical advantages of not requiring students to interact with real people. Simulation can replace and amplify real experiences with guided, often ‘immersive’ experiences that simulate aspects of the real world in a fully interactive and protected environment. The technique can be used to provide structured and dynamic course content that will engage students and help them develop professional skills and understanding in an increasing range of disciplines, without exposing clients to any risks.

6.7 Artificial Intelligence

In recent years, the most revolutionary evolution in teaching and learning methodologies has been the integration of Artificial Intelligence (AI) features including voice recognition and predictive analytics engines that have enabled the creation of virtual assistants facilitating the enhanced learning experience (Roll and Wylie 2016). In this regard, Apple’s Siri is the most common and widely used AI feature globally. These virtual assistants not only recognise voice commands and respond accordingly but are also able to convert speech to text, making writing or notes-taking easier. In an educational context, building on the success of the first virtual teaching assistant for an AI course at Georgia Tech called ‘Jill Watson’, the application of AI has been consistently increasing in the field of education. For example, Georgia State University uses an AI chatbot to respond to questions about enrolment and financial aid. When the system is less than 95% confident of an answer, the query is passed on to a staff member. Similarly, Deakin University has created a platform called ‘Genie’ that acts as an intelligent virtual assistant that provides students with general advice. Virtual assistants have consistently helped ease the student support burden on the academic and professional staff helping them optimise their time.
6.8 Reflections and Recommendations

In the last decade, there has been an increase in the literature describing the creation, implementation and adoption of various educational tools in teaching and learning with the emphasis on the role of content design and structure in enhancing learning experience as well as improving students’ outcomes. Research has consistently shown that quality innovative virtual environments facilitate learners’ engagement and enhance learning opportunities. Carefully designed, student-centric technological innovations provide opportunities for learners to imagine and recreate application of skills and knowledge in their specific disciplines in creative ways, and more importantly in retaining new concepts in an interactive and engaging manner.

In the last decade, educational learning systems have continued to evolve incorporating numerous functionalities and features. These technological innovations have changed the digital landscape of online learning and teaching. This chapter has focused on some of the innovations and explores how traditional classrooms and roles are being transformed and how learners engage in different digital spaces to manage and enhance their learning. As we enter the third decade of the twenty-first century, online education space will continue to grow with more innovative educational technologies, catering to further growth in online education. To support this growth, the learning analytics space will need to be strengthened to drive the way that online education programs are delivered, evaluated and improved. For a relatively small investment of online education time and resources, the incorporation of technology advances in new and existing online courses can provide substantial education investment returns, including engaging, dynamic and educationally powerful learning environments.

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