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# The Rise and Development of Digital Education

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## Contents

Introduction .....	2
Digital Developments .....	4
The Web .....	4
LMS .....	6
Blogs .....	8
Social Media .....	10
MOOCs .....	12
Conclusions .....	14
References .....	15

## Abstract

Over the past 25 years, digital education has risen to prominence. It has a direct relationship with open education, which can be considered an umbrella term. In this chapter the rise of digital education is explored through five specific educational technologies. These technologies – the web, Learning Management System (LMS), blogs, social media, and Massive Open Online Courses (MOOCs) – all raise issues of control and ease of use. They also have a direct impact on different aspects of open education, which in turn helps inform their development. This chapter sets out the multiple interpretations of open education and their overlap with digital education. By then exploring five educational technologies, common themes are extracted which highlight this intersection of digital and open education.

## Keywords

Digital education · Online education · Massive Open Online Courses (MOOCs) · Learning Management System (LMS) · Virtual Learning Environment (VLE)

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## Introduction

Open education is a broad term that has itself undergone evolution and transformation. Weller, Jordan, DeVries, and Rolfe (2018) used a citation analysis method to investigate different clusters of publications which were associated with open education. This revealed eight distinct categories, namely:

- Distance education
- Open education in schools
- E-learning
- Open Education Resources (OER)
- Massive Open Online Courses (MOOCs)
- Open Practices
- Social Media
- Open Access Publishing

There was scant overlap between these clusters of publications, so authors of MOOCs articles, for instance, rarely referenced work on distance education. What this analysis reveals is that open education is not a single entity and practitioners can occupy one aspect with little or no intersection with other forms. For the purpose of this chapter, it also highlights the significance of digital education to different forms of open education. With the exception of earlier articles on distance education and open education in schools, most of these categories have arisen specifically as a function of digital technology. This can be seen with the early shift to publications focusing on “e-learning” in the late 1990s, to MOOCs and OER which are driven by the ability to share resources easily and globally.

In this chapter this trajectory of digital education will be explored through an analysis of several key educational technological developments. The term educational technology is, like “open,” a broad and contested one. In this chapter it encompasses technological developments applied in education, so includes not only specific technologies such as Twitter, but also broader applications of technology, such as learning analytics. Each of the selected technologies has an impact on some aspect of open education, but it is the cumulative effect that is most significant. The intention of such an approach is partly to provide a useful historical perspective, particularly for those new to the field, and also to provide an analysis of how open education is influenced by technology. A more detailed historical analysis from a purely educational technology perspective, rather than an open education one is provided in *25 Years of Ed Tech* (Weller, 2020). Open education, at least for some of the categories provided above, is often seen as synonymous with digital education, and so there is considerable overlap between these two accounts. Zawacki-Richter et al. (2020) note the “octopus-like” nature of the term “open” with many tentacles connected to one central concept. These tentacles reach into many different areas, such as MOOCs, OER, open scholarship and open data, each of which itself intersects with aspects of digital education.

Digital education is often, rightly, portrayed as a rapidly changing field, with new technologies, issues and developments arising every year. This sense of rapid change is sometimes used as a motivation or threat to educators to embrace the latest form of technology, otherwise it will be too late to catch up. For example, Rigg (2014) asked “can universities survive the digital age?” suggesting that universities are too slow to change and are irrelevant to young people embedded in their fast-moving, digital age. This type of article is not uncommon, for instance Janssen (2021) decries “dear professors, why are you so hesitant to learn something new? . . . Don’t you love challenging yourself to think in new and different ways? I’m baffled by some of the aversion to 21st-century demands and opportunities.” These types of articles both underestimate the degree to which educators do engage with new technology and also overestimate the digital natives-type narrative that all students want their education to be the equivalent of Instagram. Fullick (2014) highlighted that this imperative to adopt all technological change immediately and without question has a distinctly Darwinian undertone: “Resistance to change is presented as resistance to what is natural and inevitable” (para. 3).

Engagement with digital education requires practitioners to maintain a delicate balance therefore between succumbing to hype and rhetoric and rejecting all new claims and approaches. One way to navigate this tension is to acquire a certain protection afforded by an historical perspective. However, the digital education field is rather poor at recording its own history and reflecting critically on its development, as if there is no time to look in the rear-view mirror in a field that is solely interested in the future. It is easy to find books about the future of digital education, but relatively difficult to find ones about its past. This historical amnesia is in part the result of a year-zero mentality in the field, for instance, during the MOOC rush of 2012, there were many “new” discoveries about online learning reported which were already tired concepts in the online education field.

By adopting an historical perspective in this chapter then the intention is to counter some of this year zero mentality, and demonstrate the importance of digital education to different aspects of open education. A short note on definitions first though: digital education is a loose term, and at its most literal interpretation could encompass a lecturer using a PowerPoint presentation or writing a book using Word. Such interpretations would not address the more interesting aspects of changing practice in education. Digital education should therefore be interpreted as a convenient shorthand for the intersection of digital, networked and open practices in education. For example, preparing slides for a lecture in PowerPoint to be presented in a face to face lecture and stored on the lecturer’s hard-drive is not really an aspect of digital education, but creating an online webinar which is openly accessible and sharing the content under a Creative Commons license afterward provides an example of the new possibilities (and associated issues) that are under consideration.

## Digital Developments

This section will examine the rise of digital education through the lens of different technologies. In this chapter, five significant educational technologies have been selected. The choice of these is subjective, based on the author's perception of their impact and relevance. Obviously other technologies could be proposed and might provide a different perspective.

### The Web

The web is probably the most significant of all the technologies relating to digital education, as it laid the foundations for all that followed. While the story of the invention of the web is reasonably well known, it is worth revisiting with the knowledge of how it developed, and to identify the foundations in that development that have come to shape so much of digital education.

In 1989, Sir Tim Berners-Lee was working as a software engineer at the large particle physics laboratory, CERN (Conseil Européen pour la Recherche Nucléaire, or European Council for Nuclear Research). With scientists from around the world working on different projects and generating large amounts of data and findings, Berners-Lee (n.d.) identified that they had difficulty in sharing information, saying that “in those days, there was different information on different computers, but you had to log on to different computers to get at it. Also, sometimes you had to learn a different program on each computer” (para. 1).

By 1990 Berners-Lee had developed four technologies that made the web functional and that still underpin it:

- HTML: Hypertext Markup Language, an easy to use language to produce web documents.
- URI: Uniform Resource Identifier (also known as URL for Uniform Resource Locator), a means of giving any page on the web a unique address so it can be linked to and located.
- HTTP: Hypertext Transfer Protocol, a data transfer method that allows web resources to be retrieved across the internet.
- Web browser: a piece of software that utilizes the previous three technologies to allow a user to navigate the web.

The fundamental design principles were as significant as the specific technologies in the development of the web. Berners-Lee (1989) identified that for any such system to succeed it needed to be open, and not a proprietary system owned by any one corporation. The technical attributes of the web can also be seen as giving rise to its social attributes, and why it is such a fundamental driver for openness in education. It was designed as a communication system, around principles of robustness, decentralization and openness.

From these technological features a system evolved which had no central authority, meaning that it was difficult for established agencies to control what was published on the web. What anyone could publish and debate was not governed or censored.

By 1995, the web browser was becoming reasonably commonplace, with Netscape dominating. At this stage, the web still required a degree of technical expertise and was awkward to use, but it was on the way to becoming easy enough, and sufficiently interesting, to be moving beyond purely specialist interest. People regularly made proclamations that no-one would shop online, or that it was the equivalent of Citizen Band radio. Even at the time, these seemed misguided: we could not predict smart phones and ubiquitous Wi-Fi but being able to dial up and connect to information sources anywhere was always going to be revolutionary – and particularly so for education. What the web browser provided was a common tool so that specific software was no longer required for every online function. Prior to this file transfer was performed through File Transfer Protocol (FTP), email through specific clients, bulletin board systems through software such as FidoNet, and so on. The browser provided the potential to unify all these, and more, in one tool.

Even in the simple design afforded by hand-crafted HTML pages, the nascent possibilities of the web for education were evident. Firstly, it made communication, and as a result, networking, much easier. Even though social media didn't exist yet, it was still possible to find the work of a scholar at another university and send them an email. Secondly, the uploading of publications to your own website marked the beginning of consideration about the dissemination of knowledge and the relationship with publishers which would lead to much of the open access developments. Thirdly, academics began to share teaching resources in this way, which as with publications, would plant the seeds of the open education movement. Most significantly, educators began to explore how it could be used in teaching, and the e-learning boom of the late 1990s took off.

Therefore, in this early development of what became known as Web 1.0 we can see the important aspects of what the web gave education – the freedom to publish, communicate, teach and share. For distance education, which had previously relied on expensive broadcast or shipping physical copies of books, videos, and CDs, this was a significant change. It not only altered how single function distance education institutions such as the Open University operated, but also lowered the cost of entry into the distance education market, so now all other universities could effectively become distance, or hybrid, education providers.

In summary, the web laid the foundation for nearly all the technologies that follow in this chapter and is the one we are still feeling the impact of most keenly. Much of digital education is essentially a variant on the question: what does the web mean for us? In teaching, the development of Learning Management System (LMS), OER, and MOOC, as well as related pedagogic approaches, are all examples of this. In research, the use of blogs, analytics, and Web 2.0 tools have all been significant. For academics and universities responding to the cultural shifts caused by social media, video, and the dark side of the web an understanding of these tools has become

strategically important. The removal of the publication filter that the web provided was often touted as the most significant socio-technological change since the invention of the printing press (e.g., Giles, 1996) and even now that view does not seem like hyperbole.

## LMS

Arguably the most successful education technology and the one that has had the biggest impact (for good and bad) is the LMS or Virtual Learning Environment (VLE). The LMS provided an enterprise solution for e-learning for universities. It stands as the central e-learning technology, despite frequent proclamations of its demise. Prior to the LMS, e-learning provision was realized through a variety of tools, for instance, a bulletin board for communications, a content management system, and home-created web pages. The quality of these solutions was variable, often relying on the enthusiasm of one particular devotee. The combination of tools would also vary across any one university, with the medical school adopting a different set of tools to engineering, which varied again from humanities, and so on. A number of tools such as Virtual-U and FirstClass began to emerge in the 1990s which combined some of these functions.

As e-learning became more central to university provision, both for blended learning and fully online, this variety and reliability became more of an issue. The LMS offered a neat collection of the most popular tools, any one of which might not be as good as the best of the breed-specific tools but good enough, as the web browser had done earlier for internet functions. It allowed for a single, enterprise solution with associated training, technical support, and helpdesk to be implemented across an institution. The advantage of this was that e-learning could progress more quickly across an entire institution if it was driven by strategy. However, over time this has come to seem something of a Faustian pact, with institutions finding themselves locked into contracts with vendors.

LMS uptake grew significantly over the first half of the 2000s, and by 2005 nearly all higher education institutions had deployed an LMS, but only 37% had a single one, with others operating multiple systems, with the intention to move to a single system (OECD, 2005, p. 124).

It has often been noted that when a new technology arrives, it tends to be used in old ways before its unique characteristics are recognized. This approach applied to much of the early implementation of the LMS. In order to smooth the transition to the online environment, developers started by implementing a familiar model, the virtual classroom. Conole, de Laat, Dillon, and Darby (2008) found that the LMS was often used as a place to dump notes and to replicate lectures rather than engage in more experimental pedagogies. In this approach, content that can be analogous to lectures is laid out in a linear sequence with discussion forums analogous to tutorials linked to this. This approach should have been an initial step to greater experimentation with online learning, but many institutions became “stuck” at this stage, and the LMS is a primary cause of this. As was seen in the COVID-19 pandemic, this

model was still in operation with most universities adopting online lectures via technologies such as Zoom.

One of the issues with enterprise systems such as the LMS is that they require significant investment in terms of finance, expertise, time, and resources. They thus gain a momentum of their own. The reservation many educators have with the LMS is not necessarily the actual technology but rather the institutional “sediment” that builds up around it. For the LMS, this sediment can be seen in the structures that accrue around the system. Institutions invest significant amounts of money on technology and employ people who become experts in using that technology. Accompanying this, they develop administrative structures and processes that are couched in terms of the specific technology. There are roadmaps, guidelines, training programs, and reporting structures, which all help to embed the chosen tool. This creates a form of tool-focused solutionism – if an educator wants to achieve something in their course, and they ask their information technology (IT) services department or educational support team for help, the answer will often be couched in terms of the question, “What is the LMS way of implementing this?”

There have been premature proclamations of the death of the LMS (e.g., Clay, 2009; Weller, 2007) but it is still going strong. Much like the lecture in higher education, reports of its demise, it seems, are always overstated. The Irish Learning Technology Association published a special issue in 2018 which highlighted the ongoing impact of the LMS, by analyzing responses to the VLEIreland survey, a cross-institutional survey of students in Irish higher education over a number of years. McAvinia and Risquez (2018) concluded that far from fading, the VLE has evolved:

The newer VLEs and upgrades of the “traditional” brands offer features such as integrated social media tools and e-portfolios, and have lost the visual cues tying them to the classroom, such as book and blackboard imagery. The regeneration of the VLE is remarkable. (p. ii)

Indeed, the robustness of the LMS is one of its main attractions. As institutions begin to offer more provision through their LMS they are also acquiring more reliable data, which enables them to understand learning patterns and behaviors better (e.g., Holmes, Nguyen, Zhang, Mavrikis, & Rienties, 2019). The LMS is at the centre of much of the work in digital education, and it can often be an unglamorous role ensuring that a system works effectively for thousands of students. Like universities themselves, part of the appeal of the LMS is its steadfast nature: experimenting with people’s education is not something to be done lightly. But there is a balance to be struck between allowing freedom, innovation, and experimentation and maintaining the core functions. It may be a question of time; education moves slowly, and now that there is a level of stability with the LMS, more experimentation can happen around the fringes.

In summary, the LMS provided a useful means of rapidly developing and unifying e-learning delivery which led to increased uptake of digital education. Much of open education relies on the type of stable platforms provided by the LMS, for example providing OER in formats which can be easily deployed within



standard LMS. However, this has sometimes come at the price of a lack of innovation in digital education, and by extension open education.

## Blogs

Blogging developed alongside more education-specific developments, and it was then co-opted into ed. tech. In so doing, it foreshadowed much of the Web 2.0 developments, with which it is often bundled. Blogging was a very obvious extension of the web. Once people realized that anyone could publish on the web, they inevitably started to publish diaries, journals, and regularly updated resources. Blogging emerged from a simple version of online journals when syndication became easy to implement. The advent of feeds, and particularly the universal standard RSS (Really Simple Syndication), provided a means for readers to subscribe to anyone's blog and receive regular updates. This was as revolutionary as the liberation that web publishing initially provided. If the web made everyone a publisher, then RSS made everyone a distributor.

People swiftly moved beyond journals and in education the ability to create content freely, and have it immediately distributed to a specific audience offered potential teaching opportunities. The use of blogs in education began in the early 2000s and a fledgling community of educational bloggers emerged. This potential to expand the academic community through the informal use of blogs that were external to formal university systems was powerful and would be repeated later with social media. From the perspective of today, with ubiquitous social media, it is difficult to appreciate how liberating the advent of blogging was in higher education.

Blogging provided a new form of academic identity, and one that increasingly became as significant as the traditional identity that is formed through publications, teaching, and research grants. It came with its own cultural norms of informality, acknowledgment, experimentation, and support. This was known to produce tension. For instance, Costa (2013) has argued that "Higher Education Institutions are more likely to encourage conventional forms of publication than innovative approaches to research communication" (p. 171). The online academic has had to negotiate two worlds simultaneously, which can have different modes of operation and value systems, as Costa (2016) put it, they end up being double gamers. There is some effort to reconcile these modes with increasing recognition of the value of network identity in achieving scholarly goals, although most remuneration is still linked to traditional outputs, such as published articles and successful research grant income. This is in contrast with the online world that determines prestige through identities and attention (Stewart, 2015).

Blogs can be seen as the start of what would become a networked academic identity, which would become more prevalent with the Web 2.0 and social media boom. Veletsianos and Kimmons (2012) used the term Networked Participatory Scholarship (NPS) to encompass scholars' use of social networks to "pursue, share, reflect upon, critique, improve, validate, and further their scholarship" (p. 766). This has become a rich area for research as academics wrestle with some of the issues it

raises. On the positive side, Stewart (2016) noted that establishing such an identity increases visibility for pre-tenure academics, and this can offer some protection in a climate of precarious academic labor: “Among the junior scholars and graduate students in the study, opportunities including media appearances, plenary addresses, and even academic positions were credited to long-term NPS investment and residency, and to resultant online visibility” (p. 76).

However, on the negative side, the online world is one which Stewart (2016) notes can be characterized by “rampant misogyny, racism, and harassment” (p. 62). For all their potential to democratize the online space, such tools frequently reflect and reinforce existing prestige, with higher-ranked universities having more popular Twitter accounts (Jordan, 2017a), and professors generally developing larger networks than other positions in higher education (Jordan, 2017b).

Increasingly, as data capitalism and the nefarious uses of our data have come to light, there has been a movement to “own your own domain,” with a blog at the center. That is, to host your own tools on a web domain that is under your control, rather than simply using a third-party service. Watters (2016) has emphasized that this control and ownership of data is an educational imperative:

When one controls—albeit temporarily—a domain name and a bit of server space, I contend, we act in resistance to an Internet culture and an Internet technology and an Internet business model in which we control little to nothing. We own little to nothing. (para. 04)

Blogs are not just a tool for educators, but increasingly for students also. It is interesting to speculate what the current digital education environment would look like if, in the early days, institutions had adopted blogging platforms as their LMS rather than the commercial products. This is not as far-fetched as it might seem – blogging tools such as WordPress can be constructed to deliver course content and have embedded discussions, and they are easily extendable with plug-ins for specific functions, resembling the sort of service-oriented architecture that was deemed desirable. Templated versions can be implemented for all students, so they have their own space to develop their identity, create assignments, and develop something akin to an e-portfolio (more on this later). In 2008, Jim Groom (2008) and others were promoting the idea of blogs as educational platforms:

This model puts the power in the hands of the authors, which in turn provides the possibility for a far greater level of educational openness. These are platforms that provide many, if not all, of the features of more traditional LMSs, but exponentially move beyond them given the fact that they benefit from huge open source communities that are constantly enhancing the applications. (Groom, 2008, para. 01)

What this comparison between the LMS and blogs reveals is more than a difference over software preferences; it reveals differing visions about the nature of digital education, with blogs more aligned to many of the characteristics of openness. For many of the advocates of blogs, the vision of ed-tech is one that embraces the open aspects of the original web. To return to Watters’ (2016) post on owning your own domain, she claims,

The *rest* of ed-tech—the LMS, adaptive learning software, predictive analytics, surveillance tech through and through—is built on an ideology of data extraction, outsourcing, and neoliberalism. But the Web—and here I mean the Web as an ideal, to be sure, and less the Web in reality—has a stake in *public* scholarship and *public* infrastructure. (para. 26)

Groom and Lamb (2014) also bemoan this loss of the original vision of the web in how educational technology came to be deployed, and see the LMS as a key component in this:

[h]igher education overall, perhaps concerned about the untamed territories of the open web and facing unquestionably profound challenges in extending its promise beyond the early adopters, cast its lot with a “system” that promised to “manage” this wild potential and peril. (p. 29)

It is not necessarily a binary divide. For instance, there are commercial applications of blogs and of the open-source LMS, so it is more of a continuum. It represents something of a philosophical divide about how people view e-learning, and at its center are degrees of control.

In summary, blogs can be seen as highlighting some of the tension that the previous two educational technologies have brought to the fore. The web provides almost uncontrolled freedom, which comes with issues and implications, while the LMS offers control which can be stifling. Blogs operate somewhere in the middle ground, which is perhaps why they are often a preferred tool for open practitioners such as Groom and Lamb.

## Social Media

If the LMS represents the dominant educational technology, then social media tools such as Twitter and WeChat represent the kind of third-party technology that has been adopted in education. Social media represents the culmination of the paradox that the web unleashed for education, and society in general, in that it is both a toxic, damaging environment that spreads disinformation, but also a useful tool for connecting, sharing and engaging.

Initially Twitter and other social media saw a democratizing effect: formal academic status was not significant since users were judged on the value of their contributions to the network. In educational terms, social media has done much to change the nature of the relationship between academics, students, and the institution. It remains a means of creating a valuable and rewarding network for scholars that brings real benefits. How, then, are we to resolve this quandary of benefit and damage? For some, the benefits are no longer significant enough and they have quit social media.

Educators, then, are faced with having to negotiate complex paradoxes for both themselves and often on behalf of their students. There are several potential uses for social media in teaching and learning, which can be framed as a set of hypotheses.

These are not guaranteed findings, but rather potential impacts for which there are some tentative reasons to propose them.

- *Social media increases student recruitment.* The use of Twitter, Instagram, Facebook, and other social media by universities, students, and staff provides potential students with a good insight into student life and can act as an effective marketing tool (Constantinides & Zinck Stagno, 2011).
- *Social media increases student engagement.* The use of social media helps blur boundaries between study and other aspects of life and provides an element that can be fitted in-between other activities in a way that more concentrated study activities cannot, and as such can improve student engagement (Roopchund, Ramesh, & Jaunky, 2019).
- *Social media increases student retention.* Students who make social connections tend to stay with their studies (Astleitner, 2000). Conventionally, this is realized through societies and social functions. Social media provides a further means to enhance these bonds, and particularly for distance or part-time students.
- *Higher education has a duty to develop expertise in fake news and misinformation.* Mike Caulfield (2017), who has done much of the work in exploring the impact of misinformation, has developed an online book and a wide range of activities to help develop these skills. They are likely to become increasingly significant as the quality of fake videos and sophisticated targeting improve.

Social media such as Facebook, Twitter, WeChat, and KakaoTalk have often achieved an infrastructure-like status for much of the online experience. For instance, for a significant number of users, Facebook is viewed as the entirety of the Internet. Reporting on surveys in Indonesia and Nigeria, Farrell (2015) stated that “large numbers of first-time adopters come online via Facebook’s proprietary network, rather than via the open web” (para. 08). While these corporations have inveigled their way to infrastructure status, we should remember that providers of physical infrastructure systems such as water, roads, and power have responsibilities and accountability placed upon them. This is relevant to online education, because it highlights the responsibility in mandating the use of such systems and thus increasing their infrastructure-like status and stresses the importance of developing a critical approach to technology in all subject areas.

What social media ultimately provides online education with is a set of tools and possibilities, but these are not without risks and issues. The clearer distinction between professional and personal is deliberately blurred on social media. This can be beneficial, but it also leads to “context collapse.” Marwick and Boyd (2011) highlighted this issue:

We present ourselves differently based on who we are talking to and where the conversation takes place—social contexts like a job interview, trivia night at a bar, or dinner with a partner differ in their norms and expectations . . . . The need for variable self-presentation is complicated by increasingly mainstream social media technologies that collapse multiple contexts and bring together commonly distinct audiences. (p. 01)

In other words, we communicate in social media with one audience in mind, but several different audiences might access that content. This context collapse provides both an opportunity, for example in reaching new audiences for research dissemination, and a risk, for example trolls searching for terms to harass people. This is a reflection of what social media does for education as a whole – the context between the university and the rest of society is collapsed. That may be beneficial generally, but when it means conspiracy theorists arrive in a geology discussion to insist the world is flat, it raises problems that we are still incapable of solving.

In summary, social media provides a means of disseminating knowledge and a medium through which much of open practice can flourish. However, it also represents the more extreme aspects of the freedoms that the web originally provided and as such its usage in digital education is complex.

## MOOCs

The MOOC phenomenon is an interesting case study in the rise of digital education, particularly how it relates to open education. Such was their growth and hype during 2012 that *The New York Times* declared it to be “the year of the MOOC” (Pappano, 2012). MOOCs can be viewed as the combination of several preceding technologies: some of the open approach of OER, the application of video, and the revolutionary hype of Web 2.0. Early experiments by educators such as George Siemens and Stephen Downes with course design had examined connected pedagogies. These had attracted attention within the online education community, but MOOCs were still widely unknown outside of the field. However, once Stanford professor Sebastian Thrun’s course on artificial intelligence attracted over 100,000 learners and almost as many headlines (Raith, 2011), they gained media interest and significant venture capital. Now that the initial flurry of activity has died down, what can we say about MOOCs?

First of all, their impact has been far less dramatic than was often projected at the start. Sebastian Thrun famously declared that there will only be 10 global providers of higher education by 2022 (Leckart, 2012), and that was not the case. Morgan (2016) argued that “MOOCs prove that universities can and should embrace online learning,” and Godin (2016) proclaimed MOOCs to be the “first generation of online learning.” As well as overclaiming for the impact of MOOCs, what many of these pieces have in common is a conflation of online learning with MOOCs. For instance, it didn’t take the development of MOOCs to show universities that they should embrace online learning, as Morgan contended.

A consequence of this conflation is that, if MOOCs and the online courses are synonymous, then MOOCs become seen as the *only* way of realizing online learning. For example, Lewin (2013) published his article entitled “After Setbacks, Online Courses Are Rethought” in *The New York Times* on the problems of Thrun’s company, Udacity, and its approach to MOOCs. In this narrative, MOOC failures become the failure of all online learning, and the future of MOOCs becomes the future of all online learning.

Several problems began to emerge with MOOCs after the initial enthusiasm, leading to the reining back on some of the ambitions. The key ones were:

- Low Completion Rate – With around only 10% of registered students finishing the course, completion rates have been problematic for MOOCs (Jordan, 2014).
- Learner Demographics – Most successful MOOC learners were already well educated (Christensen et al., 2013), and this finding undermined claims of the MOOC democratizing learning.
- Sustainability – As MOOCs became industrialized and required high-quality media outputs, their costs varied considerably, particularly when staff time, marketing, and support were factored in (Hollands & Tirthali, 2014). Finding sustainable business models that justified this expenditure has proven problematic.

These issues saw a change in tone around MOOCs, with MOOC provider Coursera (2013) announcing that it was going to “explore MOOC based learning on campus.” This proposed system resembled conventional blended learning, or e-learning, but on a new platform. Similarly, Georgia Tech announced it was offering a masters-level MOOC, which was not free (costing US\$7,000), once again conflating online learning with MOOCs, and Thrun’s company Udacity “pivoted” to focus on corporate training.

Aside from all the hyperbole, what practical applications of MOOCs have emerged? The most obvious one is that millions of people signed up for them and found them an enjoyable and useful learning experience. For example, Farrow, Ward, Klekociuk, and Vickers (2017) reported on over 11,000 participants in a MOOC on understanding dementia. As educators, the rise of such courses and increased knowledge has to be seen as a positive outcome. There are also examples of their use in formal education to expand the curriculum; for example, the Delft University of Technology offers a “Virtual Exchange Programme,” whereby its campus-based students can take MOOC with other accredited providers and receive credit at Delft (Pickard, 2018). Other providers offer routes by which learners’ gain credit for studying in MOOCs and transfer these into a university to count toward a degree. While such models will not appeal to everyone, they do allow increased flexibility in the higher education offering. The more recent interest in “micro-credentials,” i.e., shorter courses that carry university credit can also be seen as a consequence of the MOOC approach.

MOOCs also raised the profile of online education, and open practice in particular. Even if MOOCs themselves are only open in terms of enrolment and not in terms of licensing, their presence has a knock-on effect. For example, for many university libraries, curating their open access resources is not a priority because fee-paying students have access to those resources anyway. So, there is no real driver for educators to focus on open access above other resources. But when universities started creating MOOC, this placed pressure on people to use open access resources, because the open learners probably wouldn’t have privileged library access. While

we may bemoan that MOOCs themselves are not really open in the sense of openly licensed, they do form part of a larger system, which helps drive openness.

In summary, MOOCs might seem to represent one of the successful alignments of digital and open education. However, many proponents of open education would not consider them truly open, and their commercial drivers have often pushed them toward increasingly conventional models of education.

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## Conclusions

In this chapter, five significant technologies for digital education have been considered, namely, the web, LMS, blogs, social media and MOOCs. Many other educational technologies could have been addressed also, for example wikis, computer games, mobile technology, learning analytics, and virtual reality. These have all raised the profile and range of possibilities for digital education. In this concluding section analysis can turn to what they represent collectively for open education in particular. The five technologies highlighted here have a number of features in common. First, they lowered the participation barrier, making it easier for educators and students to engage in digital education. The web, social media and blogs all made publishing and sharing a democratized activity. This meant that not only could educators experiment, but that learners were operating in a context where online activity was increasingly the norm. Digital education therefore is not struggling as an unfamiliar concept. Second, they all have elements of control as a central proposition. For the web and social media there is a lessening of control, while the LMS is a means to explicitly regain that control from the “wild web”. MOOCs are an interesting microcosm of this tension, as the early experimental MOOCs (sometimes referred to as cMOOCs) were much more open in terms of pedagogy, community and technology. The later commercial MOOCs (also known as xMOOCs) are delivered in a much more uniform, linear, controlled manner. Lastly, the combination of these two features – ease of use and control – lead to reflections on openness.

At the start of this chapter eight areas of open education were proposed. The five educational technologies presented here map much of this trajectory. The web was crucial in the transformation of much of distance learning into e-learning, which led to the LMS. Blogs and social media have informed open practice, which was a driving factor for OER and MOOCs. It is a mistake to see open education as synonymous with only one of these eight sub-topics, just as it is also not synonymous with digital education. However digital education and open education are intricately entwined. Digital technologies give rise to development in education which seeks to explore aspects of the openness these technologies afford. The practices developed in open education themselves then go on to influence the development of further technologies. It is through this lens of iterative influence that we can best consider future developments in open education.

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