

Chapter 2

e-Learning so Far

*If I have seen further,
it is by standing on
the shoulders of giants.*

Sir Isaac Newton

Abstract e-learning has come a long way and it is only thanks to previous versions and numerous evolutions of e-learning that we can propose new routes and design intelligent systems for future generations. This also enables us to appreciate and value the meaning of moving forward as we fully understand and acknowledge from where we are coming. A plethora of research studies have reported conflicting results over the years as some praise and applaud this medium, while others disapprove and criticise e-learning in every possible way. The fact that e-learning itself is not regulated by a specific academic body and that best practices are subjective, divergent and too generic, renders the whole playing game fuzzy, confusing and incredibly frustrating to the learners. However, pedagogical trends and technological forces have shaped the history of e-learning and will continue to do so. How have these rubbed off onto each other? And how have they influenced the following generation of e-learning? What are the factors that will impinge on the future of online education? In this chapter a deeper examination and appreciation of these changes and developments over the years is presented in an effort to understand the inevitable evolution that occurred and how this affected and influenced the whole environment surrounding e-learning. These include the social implications, the pedagogical repercussions and the technological impacts that gave rise to different e-learning generations.

2.1 e-Learning Generations

It is important to distinguish e-learning from its predecessor distance learning that can be traced back to the 1700s. Even though not electronic it still exhibited the characteristics of non face-to-face education that did not involve humans directly. The actual electronic characteristic is what distinguishes e-learning from correspondence

courses, education through post, telephone, radio and television broadcasts up until the 1970s. The fact that a different medium was being employed instead of the traditional and classical student-teacher interaction marks a departure point whereby, irrespective of the actual medium, education was being packaged for other students who for some reason or other are not in the vicinity of the educator. This demarcation in itself that simply alters a single variable, the physical location of student and teacher, effected the entire educational process as theorists and practitioners have argued and debated over the years. The fact that the educational process is a complex one and not universally defined or specified justifies the intricacies created as soon as a single variable was modified. To keep in mind that even without the alteration of this single variable the student-teacher relationship and the learning process were not always optimal and even though numerous learning theories postulated the soundest methodologies to employ, the final product left much to be desired. To such ends distance learning and eventually e-learning inherited such challenges in addition to an already herculean mission to simulate and match the human counterpart. If this was not enough a supplementary technological overhead intensifies the issues and challenges that need to be overcome. The electronic factor mentioned earlier that differentiates distance learning from e-learning is nothing more than the technological component that enabled the shift from distance learning to the first generation of e-learning. Technological evolutions that over the years have enabled the web to develop further have surely altered the medium employed and as a consequence provoked a respective development and expected progression in the e-learning camp.

2.1.1 Taking Distance Learning into the Electronic Age

The network and the existence of an electronic connection was surely the beginning of a multitude of concepts that allowed the transportation of information between two nodes. DARPA, the Defence Advanced Research Projects Agency in the United States of America spearheaded this initiative and by 1969 Arpanet was the first network that enabled the sharing of educational and research material. The medium over which learning material was being passed on and shared or traded had just been upgraded from mail to electronic networks. This same electronic network was the one to evolve and embrace the implementation of the standardised TCP/IP, the Transmission Control Protocol (TCP) and the Internet Protocol (IP), in 1974. These international protocols provided the ideal and safe connection to communicate and distribute educational material from an educator or an institution providing training to any learners who were connected over the same network. The communication part was mainly done through basic electronic mail or e-mail, while transferring of files was regulated using another important standard or protocol called FTP, File Transfer Protocol. This period demarcates the beginning of e-learning whereby electronic means are engaged to teach and employed as a medium to pass on educational material to learners. Simple as it may be this primitive and rudimentary e-learning

conveniently served its purpose and remains at the centre of all future generations of e-learning.

2.1.2 e-Learning Through the HTML Era

As the web itself evolved from its first generation of solely network connectivity allowing academics and learners to communicate through e-mail and share resources through FTP, to the extensive use of HTML (Hyper-Text Markup Language) to display webpages. This richer interface allowed web users to browse through the different pages that mainly depicted hyperlinks to other documents and images through the use of web browsers. This was an era where few search engines and humanly compiled directory services attempted to take stock of all the webpages while connected users from any connected node started pouring masses and masses of heterogeneous marked-up pages interlinked and unstructured. Web crawlers took advantage of such hyperlinks to scan documents in an attempt to parse and index every single document and webpage that web browsers had access to. Webpage authors, especially those whose intentions were to feature high on the search engines top ten results, employed tactics and techniques to benefit from the unsophisticated web crawlers software as explicit meta-language details were mainly employed for indexing purposes.

Another important aspect of this era was the integration of both presentation and content together without any proper distinction of one from the other within the same webpage. The only way web crawlers distinguished between content and anything else was when encountering a <while parsing the webpage. This mainly meant that an HTML presentation tag was about to start and thereby not of importance to a crawler which resumed its filtering once the closing> closed the HTML tag. However even though this worked for some time web page authors quickly realised how to deceive the crawling software. The consequences of such a configuration with the content and presentation merged together were quite significant and which would characterise this particular web generation. Apart from the fact that HTML is a loosely-typed language, the distinction of where information or data starts and ends, and the details of the mark-up that pertained to the actual webpage visuals and presentation through the browser were blurred and intertwined. Furthermore, different proprietary web browsers had conflicting configuration procedures creating confusion amongst web authors and dissatisfaction and perplexity amongst web users. This was initially resolved through the arduous authoring different HTML documents for the major web browsers, and eventually thanks to the use of the Javascript scripting language it was possible to distinguish between the hosting web browser and correctly display the contents of the HTML page to the respective web browser. However, this did not resolve the issue of having the same HTML page display on different output devices especially as technology evolved and webpages were able to be displayed over a variety of devices. The fact that the academic content and the presentation of the educational environment that was to be displayed on the learners browser was

merged together created issues, repetitive work and major frustration to e-learning authoring bodies.

Another aspect of this era was the introduction of some dynamic feedback and interactive effect once a user or a learner submits personal or logging in information. This was possible through the use of the Common Gateway Interface (CGI) protocol that started and matured in the mid 1990s and which necessarily allowed web pages uploaded on a server to ask users to submit information via a form which on reaching the server it is able to execute a computer program whose output was actually a fully-fledged web page with customised details as part of this same output. Such a dynamic novelty was exactly how the search engines returned their results but this time, especially login sites, were able to personalise the content and presentation to the unique user details. This was possible as the server-side computer programme, through the CGI protocol, accessed the data saved on the server side, potentially a database, and dynamically included the user specific data, results, requests and academic record for example as part of the HTML web page output. As soon as the server dynamically generated the web page and sent it back to the requesting browser it was displayed as a standard HTML page. Even though CGI scripts were relatively easy to develop and deploy as they were language independent, they were quite slow and used a considerable amount of processing power as each request to the server a new and separate HTTP request on the server had to be done, execute the program, access the database, and output the HTML response. During the same period another methodology, Cookies, were employed to customise the content of the web pages that were visually rendered on the clients web browser. Web cookies, on the contrary to the CGI scripts, are client-side based as textual information about the user that has been issued by the web site being browsed is saved on the same users computer. Each piece of information is relevant to that specific web page and serves as a technique to persistently recall personal information respective to that web page, like logging details, progress in a course, file references, etc. Web cookies are easy to implement and do not occupy a lot of space on the clients computer, however, they have numerous restrictions and totally in control of the user rather than the web site developer. Cookies are domain specific with a limited size and lack the flexibility and capacity to store large amounts of user information, nevertheless ideal to store basic user information that would otherwise require the user to memorise or record elsewhere.

In both cases, the use of CGI scripts and/or web cookies managed to inject a taste of customisation as they contributed snippets of personal information about the user, but at the end of either one of the processes an HTML web page was nonetheless outputted and rendered on the web browser? presentation and content still merged together.

2.1.3 *Semantic Web Takes over*

The dynamicity generated through the employment of the CGI protocol and web cookies was not enough to inject enough personalisation to take e-learning from its static state to a more attractive and effective personalised delivery. Additionally the fact that content and presentation were still fused together in an HTML document that rendered delivery and adaptation of the content laborious and problematic. If that was not enough, all this made searching, indexing and retrieving the exact material and content that a user is looking for or that an educational environment needed to make use of was unclear and inaccurate due to the unstructured, inexpressive and lacking meaning as well as context. The solution that surfaced towards the end of the 1990s was the use of another mark-up language, XML, or the eXtensible Mark-up Language. Even though XML is a mark-up like HTML, it is a lower-level tightly-typed language which has a stricter set of rules to encode documents that are still readable by people but most importantly can be parsed by a computer or machine-readable. The beauty of XML includes the distinction between the presentation and the content and this means that once the educational content is authored and generated it can be rendered and presented numerous times on different platforms and devices by simply employing the respective presentation medium to render the same content. Another benefit of XML is that it is extensible with the potential to generate appropriate and relevant tags that are precisely fitting to the content that they describe. An XML document with precisely tagged content within is required to be well-formed and valid before it is published. To such extents XML documents have to strictly satisfy all the syntactical rules specified by the World-Wide Web Consortium (W3C) that internationally regulates the use of XML and all other web standards. Additionally the XML document is required to follow the structure or scheme as defined within an accompanying document called the Document Type Definition (DTD) in order for it to be validated and published. The DTD specifies what element and attributes can be used together with any grammatical rules that need to be followed. This is what makes XML documents so expressive and useful as they enable parsers, not only humans, to make sense out of them and ensure that they relate to exactly what they are meant to be associated with. XML enabled and assisted the setting up of the Semantic Web concept, the web with a meaning. To such extent any educational material be it courses, resources, content, and any other academic matter can be meaningful used and reused by online system without the direct intervention of people. This is possible through the effective use of the DTD files that contain specific elements with their respective attributes, which in this case will be associated to an educational setting. The way this is possible is through the use of Ontologies that represent the position and use of the same elements referred to in the DTD to other academic terms and elements. A comprehensive education ontology explicitly species every conceivable academic term and describes how all these terms are related to each other in a tree-like way to simplify the meaningful and accurate use of the same academic terminology in a precise and coherent way.

In reality the Semantic web technologies as described above did not reach their expected potential as e-learning systems were not developed enough to employ software, like say pedagogical agents, to exploit the advantages of a machine-readable web. More on pedagogical agents and how the Semantic Web can still directly assist, facilitate and contribute to the evolution of e-learning will be discussed in Chap. 5. However the semantic web still added value to the web as everybody knew it as a web of meaning gave rise to the second generation web or Web 2.0 that carried with it related technologies and functionalities.

2.1.4 Empowering the Learner Through Social Networks

Much of the technologies related to Web 2.0 are socially enabled applications that empower and endow every web user by transforming each and every one of them from passive receivers and online content consumers to active and dynamic contributors. Learners have been transformed into authors and providers as they interact, socialise and share their work, experiences, and knowledge with other learners. The role of social networks within e-learning systems did not replace any conceptual or pedagogical notion from previous e-learning systems mentioned earlier, but took advantage of our human and social instincts to communicate with each other as learners and fellow students. The possibility of creating exclusive and focussed academic gatherings as well as public and unrestricted opportunities for others to contribute has never been possible within an e-learning environment. Students had no idea of other fellow course participants let alone sharing and contributing of ideas, offering feedback to each others work, and collaborating together to achieve a common goal. Such empowerment fosters bonding amongst learners that eventually supplements the learning process with additional interaction, knowledge exposure and a reassuring sense of achievement and accomplishment. Additionally through the use of ubiquitous hand-held devices online students can integrate the learning process seamlessly and effortlessly as part of their on-going daily activities by posting short messages, snippets or images of content related to the academic domain at hand, as well as bolster their rapport with their peers and trainers. Some networks enable learners and educators to reveal their professional profile and career achievements thereby promoting a hierarchy of knowledge and experience. This could add value to the e-learning process but tends to stir together the personal aspects of people with their role and participation in a course. Some other social networks, on the contrary, promote the anonymity of the participants by distinguishing between the learners and instructors personal social lives and their academic activities.

2.2 Technological Evolution Analysis

The evolution of the web and technology in general these last decades is amazing, breath taking and indisputably on-going. The parallel evolution of e-learning as it piggy-backed the technological advancements and the flourishing web has already been highlighted earlier in the chapter and acknowledged by numerous researchers amongst which are Hussain [1] and Miranda et al. [2] particularly underline the exact duality as the bi-evolutions are enumerated and categorised. The exact generations of both technologies, summarised in Fig. 2.1 are not only incrementally described and crisply interpreted in their own way, but also categorically distinguished from each other as if they were paradigm shifts that specifically happened at an exact point in time. In reality the evolution of technology evolved over long periods of time and eventually influenced the entire world around them including the way e-learning was performed. This does not mean that the technological advancement had a direct and immediate effect on e-learning systems but simply that the technological environment within which the e-learning platforms were implanted in changed and transformed into something else over time. The e-learning environment did not necessarily change due to the technological transformation and not did it adjust simply because a new technology was now around, but mainly due to functional and operational enhancements that rendered e-learning either more effective or easier to conduct. Intrinsically the quest has always been to simulate a human teacher and diminish as much as possible the rift between computer-based education and face-to-face delivery. The use of technology was not only intended as a teaching aid within an academic environment, but mainly to optimise the electronic medium being employed, and that

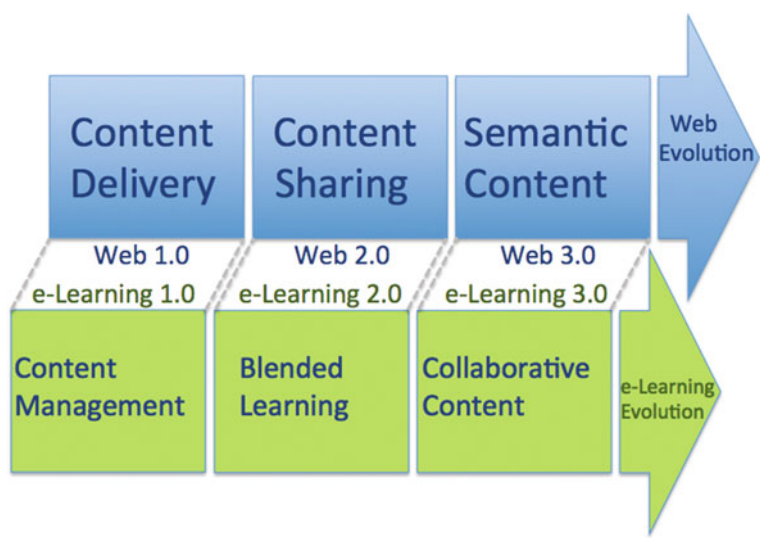


Fig. 2.1 Web and e-learning generations adapted from [1, 2]

is replacing the classical way educator and learners communicate. The point being made here is that technology led e-learning and the evolution of hardware, software and communication predisposed e-learning to conveniently adopt them in an attempt to improve and progress. Very few instances in the evolution of technology has e-learning imposed on the course of its development and perhaps it is proper to give tribute and praise the role of the University of Illinois (UoI) with its Illiac supercomputers and the different versions of the PLATO computer-based education system 1960s. Academics at UoI led by Donald Bitzer in the early 1960s designed the initial Illiac versions to specifically accommodate the requirements set by PLATO and thereby set a precedence of technology adapting to e-learning rather than the other way round. Ironically since then much of the e-learning evolutions simply happened as an adaptation to the continuous and relentless development in technology. Major shifts in technology that have definitely left their impact on e-learning have been highlighted at the beginning of this chapter. These technological evolutions invariably created a shift within the functionality of e-learning systems as a result of which it evolved they adapted, evolved and morphed over time. The network radically set the scene for e-learning and a solid foundation upon which future technologies could incrementally build layer upon layer. From HTML technology that allowed connected learners not only to communicate but access information, to XML that enabled meaningful interactivity thereby enhancing the educational environment, and eventually to Web 2.0 technologies that empowered e-learning students transforming them from simple recipients into creative and social contributors.

2.3 Unfolding Social Implications

The same technological conception of a network that launched the web as we know it today and triggered off e-learning per se, can be considered the inception of a society as it connected learners in one way or another who could communicate in rudimentary ways. Even though e-learning was merely accessing educational information and downloading academic content, learners would have initially been enrolled as part of the educational institution student body and thereby part of a social group. Initially such a social group had no real communal interactions between the learners who barely knew about each other however one was admitted, enrolled and felt part of the educational institution. Eventually as the technology progressed it became possible to enable a higher level of interaction with fellow students who could relate to each other and communicate in some way amongst themselves apart from their educator. With the introduction of social networks and the adoption and integration of such media within e-learning environments the learners acquired a new dimension of communication. The social implications that unfolded as the technology progressed and evolved empowered learners but most of all energised e-learning to a levels never attained before. Students could now emerge from their isolated learning environments to collaborate together while interacting through a variety of media. Online social networks took the world by storm at the beginning of the 2000s and it was only

natural that e-learning takes advantage leaving an incredible impact as it did on all matters related to society. Around 2005 education theorists like Siemens [3] and Downes [4] felt the need to propose an educational theory related to this contemporary pedagogical phenomenon which was coined as the Learning Theory of connectivism. The basis of this theory is founded upon the network technology and the capabilities enabled by networked computers. Due to its dependency on the electronic technology it has also been termed as a learning theory for the digital age as it relies on the simple and rapid collation of information and knowledge dispersed around the web and that is derived from knowledge bases and fellow online learners, experts and knowledge-providers. The importance of setting up and maintaining a healthy personal learning network is imperative for every learner who is now empowered to take control and manage the sequence of events and processes that determine ones own education.

As the technology evolved and e-learning matured the social state of affairs unfolded in a way that benefitted the learner but which indirectly impinged on the on-going educational process and its respective pedagogical practices.

2.4 Pedagogical Repurcussions

The state of e-learning pedagogies followed their face-to-face counterparts as e-learning was not even considered as a distinct discipline but simply an extension of traditional learning methodologies. Initially e-learning designers were inexistent and eventually as the domain matured and developed into an entity of its own designers attempted to optimise on previous versions of e-learning systems.

The classical behavioural and constructivist learning theories influenced and left their mark as technologically-inclined developers rather than educationally-minded theorists assisted in the first proper designs of e-learning systems. This can be evidenced in the typical e-learning platforms that simply transformed and regurgitated traditional learning courses into their electronic counterpart. Learners had access to their academic notes that they could download while accessing reading lists and following a sequential set of educational materials. Pedagogically such a scenario is no different from a face-to-face learning environment with the only difference of having access to the knowledge at any time, at any place, and as many times as they like. The pervasiveness that the technology enabled has no effect whatsoever on the pedagogical properties of e-learning. Similarly the availability of multimodal resources that the technology supported did not change the way an online course was being designed and delivered.

All this brings into perspective the fact that even though different technological evolutions occurred over the years together with sociological implications as interpreted in the previous sections, the e-learning pedagogies did not evolve or accommodate the transformations of the medium employed. Numerous researchers [5, 6] consider technology to be pedagogically neutral especially when the design is entirely focussed on the organisational structure of content rather than on the specific educational activities. The imbalance occurred when content was not only provided

by the educator on the server-side but was now also dynamically provided from the learners client-side within the same e-learning environment. The educational impetus that Web 2.0 technologies brought about was tremendous with pedagogical ramifications that markedly challenged the traditional e-learning pedagogies to an extent that, as mentioned earlier, brought about the proposition of the constructivism learning theory to sustain such e-pedagogies.

This did not change the fact that a mixture of learning theories that sustain e-learning models and pedagogies that complement each other. A creative and pragmatic combination of learning theories that include behaviourism, constructivism, cognitivism and constructivism that support the best pedagogical practices that have been specifically prepared and distinctly intended to be employed within an e-learning environment.

2.5 Conclusion

In this chapter a deep analysis of how e-learning evolved over the years as a result of a parallel technological evolution has shown that the design and development of e-learning systems was unfortunately an afterthought. This will inevitably impinge on the overall success of these e-learning systems that had their share of issues and student concerns as will be pointed out in the following chapters. This book is an effort to address these e-learning issues and concerns by reversing the dysfunctional modus operandi of designing an e-learning system on the basis of the available technologies, and on the contrary strongly support and advocate the notion of adjusting and conceiving adequate technologies to optimise e-learning systems and their overall effectiveness.

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