

Recommendations for Future Digital Curricula in Computing Education and Training 2020 (FETCH)

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Abstract: *The aim of this paper is to provide a set of recommendations regarding the future of digital curricula for Computing Education 2020. The recommendations focus not on the technological aspects nor on the approach to a digital curriculum in terms of course design, instead the report considers the peripheral aspects to designing and delivering a digital curriculum. These areas are the key to producing a successful course.*

Keywords: *Digital curricula, recommendations, issues.*

INTRODUCTION

The work presented here is part of Work Package 5 of the European Thematic Network project Future Education and Training in Computing: How to Support Learning at Anytime Anywhere (FETCH). Work Package 5 was an implementation package which covered Digital curricula in Computing Education and Training, in particular the aim was to: “address the changing nature of “curriculum” as course textbooks and other associated learning resources go digital”. Part of the Work Package was to produce some recommendations with respect to digital curricula and its future. The fundamental nature of a digital curricula is to use computing as its basis – and this technology is changing at a pace that cannot be kept up with let alone predicted. For example, the first commercial smartphone was the Ericsson R380 in 2000. By 2010 the Apple® iPad was introduced, since then there has been an exponential increase in the use of smart devices, with a corresponding interest in online learning from both academics and the general public. The first Massive Open Online Course (MOOC) was created in 2008, although they only became popular in 2012. Since then they have grown at an exceptional rate (Figure 5).

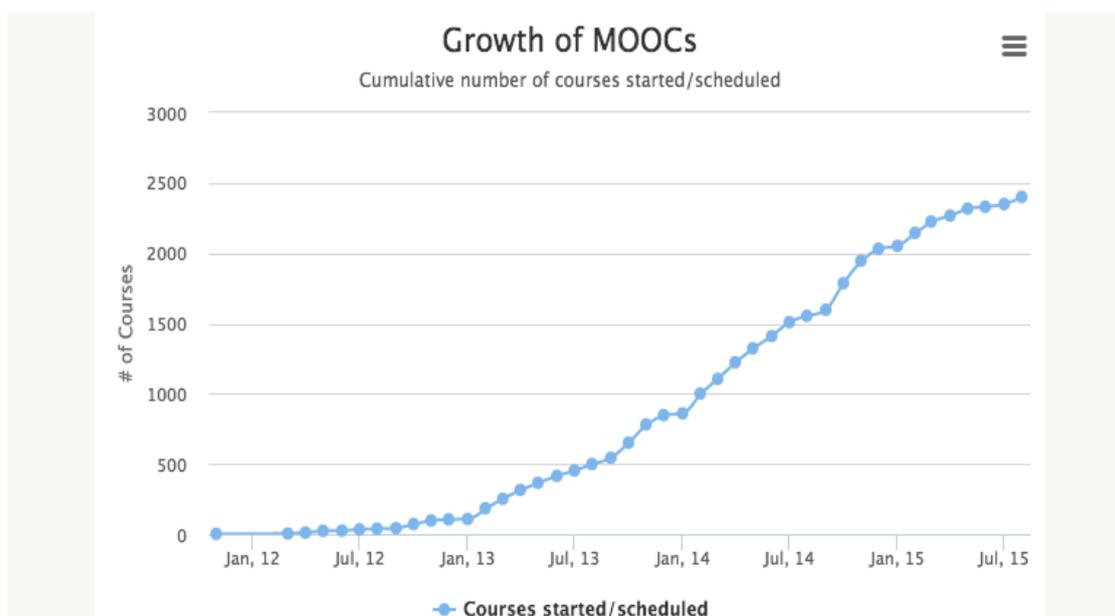


Figure 5 Growth of MOOCs

Similarly the technological approaches utilised in e-learning have developed over the last decade, and are continuing to develop at a fast pace. There has also been a change in the type of providers, as well as the mode of availability. That is, in the early days e-

learning opportunities were offered by Universities, while now commercial organisations, such as Pearson, are offering online learning and resources.

Thus, owing to the fast changing face of online and e-learning, the direction of the recommendations contained herein are focused on the elements that could be considered peripheral to the digital curricula area but are in fact the backbone of a mature and professional educational system, such as providing suitable student welfare support.

DIGITAL and e-LEARNING

As society moves more into the digital era, the landscape of learning resources has been changing dramatically. Also, the way in which the people used to learn is changing rapidly especially with the coming of age of the digital generation. This radical change in the way in which students learn not only opens up opportunities for educators and HE institutions being able to reach a far wider audience and beyond any geographical boundaries, but also brings with it the challenges for innovative solutions for engaging delivery, fair and secure assessment, and the ability to adapt to a varying demography of audience. A UK Skills Commission report [1] has identified that, the ways in which people work are changing, with flexibility characterizing more people's working patterns. These changes present significant challenges and the skills system must respond. At present, the skills system in the UK is not adequately matched to the modern structures of work, and will become further misaligned in the coming years unless action is taken now. Within the UK, this potential has been identified by the Department for Business, Innovation and Skills (BIS) in their response to the FELTAG recommendations [2] and is providing the impetus for the Further Education and skills sector to deliver more learning online, to develop the capability and capacity of the FE and skills workforce to empower learners to exploit technology. The UCISA digital capabilities survey [3] makes recommendations to HE on creating effective, strategic cross-institutional approaches to developing digital capabilities.

DIGITAL CURRICULUM

Learning and teaching have moved on from the classical approach that has been in use for thousands of years (Figure 6) – it is now moving wholeheartedly into the digital age.

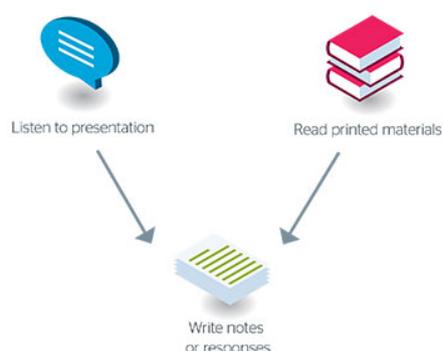


Figure 6 Traditional teaching styles rely heavily on spoken input, printed materials and learners' writing (Alistair McNaught)

Digital curriculum is not a set curriculum that you teach with content and lessons already chosen. It is not something you can take off the shelf and insert into your course. It is not a pedagogical learning theory, although it does rely on learning theories such as connectivism and constructivism. Neither is it a list of technology tools to use. Rather it is a conceptual framework: an approach to structuring a course. Consider the following analogy: the move from analogue music (vinyl records) to digital music (iPods and MP3 players). Analog music was static; it was almost impossible to mix, manipulate, or transfer. With the invention of CDs and later on iPods, music became digital. It was easily to access

the whole or a particular individual part of a piece of music. Songs thus became mobile: you could carry an almost infinite amount on a small device. Music could be mixed together easily with other digital tracks, or even with video and images. Thus we have moved from what is represented in Figure 6 to something that is far more complex as illustrated in Figure 7.

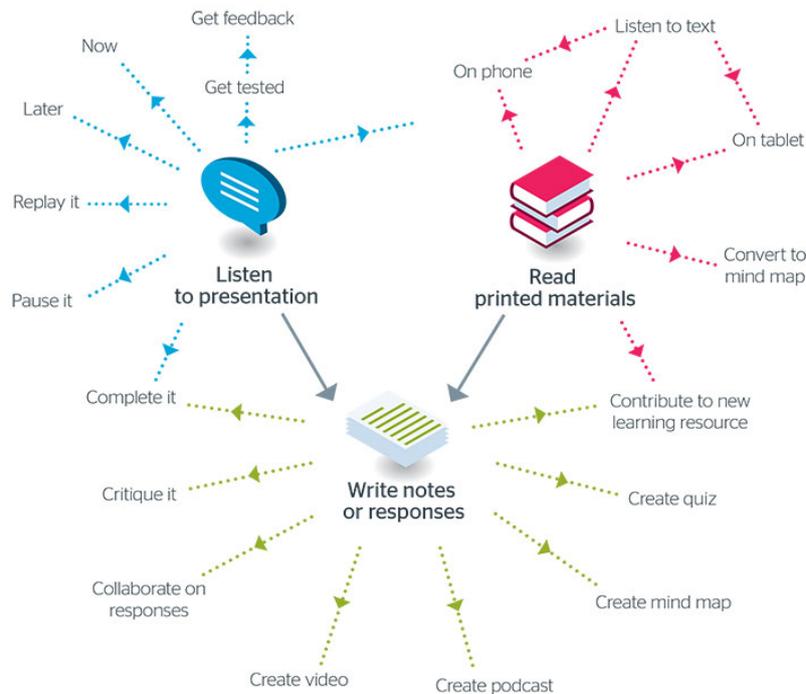


Figure 7 Technology allows presenting, reading and writing to be supplemented by alternative media and activities (Alistair McNaught)

THE STUDENT EXPERIENCE

The student experience encompasses many aspects of academic and intellectual development; social and emotional life; and the growth and refinement of cultural, political, sporting and artistic interests. A University should aim to ensure that all students have an exceptional and distinctive experience. The University should take a cohesive, inclusive and personalized approach to enhancing this experience - one that encompasses all subjects, all modes of learning, and all student services. The experience of being a University student, from applicant to alumni should prepare students for life beyond their studies.

Students should benefit from excellent teaching, both on-campus and online, and a strong academic and pastoral support framework which responds effectively to the range of individual circumstances, experience, expectations and interests. Extensive curricular and co-curricular opportunities might include opportunities such as the chance to study abroad, learn a language, or develop skills to improve employability. When leaving the University, students should be equipped with the expertise and graduate attributes needed to achieve their full potential within the global community. Delivery of academic content through a digital curricula approach must provide these students with the same experience as those students who study on campus through a more traditional teaching approach, such a face-to-face.

Personal Tutor

Programmes should operate a Personal Tutor system which requires regular meetings between a student and their Personal Tutor (an academic). The Personal Tutor system does not sit in isolation to the reflective and developmental nature of the learning

which characterises a degree. Students have regular opportunities as part of wider assessment and feedback strategies to reflect and forward plan. The Personal Tutor system complements a core curriculum approach. The Personal Tutor is also key in the process of Personal Development and Planning, which is 'a structured and supported process undertaken by an individual to reflect upon their own learning, performance and achievement, and to plan for their personal, educational and career development.' [4]. As stated by ESECT *"Students seeking employment need to be aware of the need to put a compelling and robust case to employers, which implies a good understanding of their achievements in and beyond H.E. and how these match the intended employer's requirements, and also the capacity to present their case cogently and succinctly"* [5].

UNIVERSITY SENIOR MANAGEMENT CONSIDERATIONS

Efficient and Effective For Academics

University management must ensure that academics involved not only in the design and creation of a digital curricula, but also those expected to deliver the material, are fully engaged with the process. This can be achieved if the academics are certain of the value of the exercise in terms of efficiency of work and effectiveness of teaching.

Underpinned by Educational Theory (Pedagogy and Learning for Adults)

Courses that are successful have an educational philosophy that from the outset is distinctive, actively debated and developed. The ambition to prepare students for sustained work should have a focus on a number of key concepts. Central to success for students is the notion of deliberate practice. Students are encouraged to understand the value of continuous, challenging practice of skills. This when allied to the language of feedback as an indicator of achievement means students can reflect and prepare for further practice.

Long Term Sustainability Management

With the speed of change for technology still apparently following Moores Law, the conundrum for an HEI in terms of long term sustainability management is often a difficult one for current administrative and budgeting systems to cope with. The effect can be twofold in that it can create gaps in funding and often leave the educator with a gap in their skills the new equipment and application. Many HEIs have to plan for an uncertain future and ring fence budgeting for the predictable processing performance expectations of new machines and equipment, and the often unpredictable changes in student expectations and platform delivery. Many HEIs tackle the hardware software problem by initiating a 3 to 5 year upgrade schedule to combat obsolescence, which can put enormous pressure on budgets and a learning facility's ability to react to the latest developments in equipment and materials. Should for instance a major supplier have a new version of its system released at the wrong part of a HEIs equipment renewal cycle it is automatically putting the learning providers at a disadvantage in the eyes students and can adversely affect the HEI in satisfaction ratings.

Legal Considerations

There are a number of legal aspects that must be considered and appropriately addressed if an Institution wishes to move more towards a digitally based interaction with its students. A further complication comes from using the internet as the means for student interaction with the study material, staff and institution, since the internet is notoriously difficult to control with legislation. Even if we are not yet able to regulate the internet as other media or communication technologies we cannot give up certain core values in this digital age. Internet law is closely related to the laws that relate to other similar areas of broadcasting, retail, and information handling, and in many cases, internet laws are

identical to those covering the offline world for such things as data protection, defamation, copyright infringement and trademarks.

New Electronic Commerce Regulations came into force in August 2002 [6] and implement the European E-Commerce Directive. One of their main aims is to ensure that electronic contracts are legally binding and enforceable throughout Europe. The Regulations apply to businesses that sell goods or services to businesses or consumers on the internet, or by email or SMS messages. It also covers businesses that advertise on the internet, or by email or SMS; or convey or store electronic content for customers, or provide access to a communications network. Thus the Regulations apply to Universities. Among other things, the Regulations identify specific information about a business that must be provided to recipients of online services, and set down guidelines regarding advertising and promotions.

Data Protection

As students use computing devices to access their study materials, their results, interact with staff and other students, and so on, there is an increase in the amount of personal information stored and used. This means that there is a requirement to comply with appropriate legislation. A University should maintain student data in secure conditions and only process and disclose data within the terms of its data protection notification (as prescribed by University Policy and/or national & EU legislation).

As an example, in the UK there is the Data Protection Act (DPA) [7] which controls how personal information is used by organizations, businesses or government, it also requires an organization to ensure that the data they store is kept safe. Everyone responsible for using data must follow strict rules called 'data protection principles'. This law requires an Institution to maintain student data in secure conditions and only process and disclose data within the terms of its data protection notification. There is stronger legal protection for more sensitive information, such as:

- ethnic background
- political opinions
- religious beliefs
- health
- sexual health
- criminal records

Data Security

Computer security for any businesses can be multi-layered, from using desktop security products such as antivirus, antispam and firewalls, to network intrusion detection, and hardware technologies such as security tokens and disk encryption. For a University, the need for computer security with respect to a digital curriculum is vitally important, since it needs to cover personal data, performance results, assessment questions, lecture notes and so on. Any breach of security can have a significant impact on the University's reputation, as well as on its ability to operate.

Intellectual Property Rights and Copyright

Intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images. IP rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of their creation for a certain period of time. Any material produced for a course of study is also covered by IP. The first issue is whether the material created by an academic belongs to that person, or to the University that employed them to create the material – this will usually be addressed in the employment contract. Copyright applies to work that is recorded in some way; rights exist in items such as literary, artistic, musical

and dramatic work as well as films and sound recordings. It gives the author specific rights in relation to the work, prohibits unauthorized actions, and allows the author to take legal action against instances of infringement or plagiarism. Once again the ownership of the copyright (academic or University) will usually be addressed in the contract of employment.

In an increasingly competitive environment where more and more learning content is digital, institutions need to know how to maximise the value of their assets and how to make best use of resources they licence. They need to be able to share and protect their own intellectual outputs while not infringing the rights of others. Recently there have been instances of online courses being plagiarised, such as Udemy (an online learning service) providing courses that were plagiarised from other organisations [8]. In this case the law enforced to close the copied courses was the Digital Millennium Copyright Act [9].

Equality and Diversity

Providing a Digital Curriculum provides an Institution with the opportunity to recruit students from a broader variety of backgrounds, and with a range of abilities. This improvement in student diversity is a positive for digital curricula. Recruiting students who have disabilities is also a positive aspect of digital curricula. However, diversity also requires strong support for the individual. Within the UK the Quality Assurance Agency (www.qaa.ac.uk) monitors student support especially in relation to diversity and equality. Frequently UK Universities offer a highly developed student support culture and are able to provide one to one support in most cases. Where student welfare support is offered during the normal University teaching day, these services can be commended in QAA reviews on institutions. This in turn provides reassurance for students wishing to enrol at that university. However, a digital curriculum could produce a scenario where the more specialised one-to-one support required by particular students is not available at the time that the students requires it owing to the 24 hours a day 7 days a week nature of an on-line course.

CLOSING COMMENTS

The dominant trends in the FETCH thematic network enable learners with different learning styles to utilize technology so that they can make progress effectively, but in a guided way. Delivery of content is achieved via a variety of channels to meet the needs and engage learners with different learning styles.

Probably one of the biggest concerns for an Educational Institution is the legal aspects, especially those relating to operating on the World Wide Web. It is without doubt that issues of copyright, data protection and so on will make or break the move toward a digital curriculum. Online content is available anywhere and anytime. There are no national borders. There are even few language barriers given the translation systems available online. Thus people have a new approach and a new view to the consumption of online material, and especially online media. This perception of material being freely available poses new challenges for companies, governments and legal experts in determining issues such as privacy, copyright, censorship and so on.

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The paper has been reviewed.