

The Envisioning Report for Empowering Universities

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Editors

European Association of Distance Teaching Universities (EADTU) | George Ubachs; Lizzie Konings
Dublin City University (DCU) | Mark Brown

Authors

European Association of Distance Teaching Universities (EADTU) | George Ubachs
Universidad Nacional de Educación a Distancia (UNED) | Alfonso Herrero de Egaña Espinosa de los Monteros; Miguel Rodríguez Artacho; Ángeles Sánchez-Elvira; Covadonga Rodrigo; Timothy Read; Guillermo de Jorge; José Ma Luzón
Dublin City University (DCU) | Mark Brown
The Open University (OUUK) | Andy Lane; Ormond Simpson
Università Telematica Internazionale UNINETTUNO | Maria Amata Garito; Alessandro Caforio
Universidade Aberta (UAb) | José Bidarra
The Open University of the Netherlands (OUNL) | Ellen Rusman; Slavi Stoyanov; Fred de Vries; Kim Dirckx
Hellenic Open University (HOU) | Achilles Kameas; Dimitris Kalles
Anadolu University | Serpil Koçdar; Mehmet Firat
KU Leuven | Frederik Truyen
Universitat Oberta de Catalunya (UOC) | Gema Santos-Hermosa
Open University of Cyprus (OUC) | Christos Rodosthenous

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Correspondence

European Association of Distance Teaching Universities (EADTU)
att George Ubachs, Managing Director
Parkweg 27, 6212 XN Maastricht, The Netherlands
Tel: +31 43 311 87 12 |E-mail: secretariat@eadtu.eu

www.eadtu.eu | empower.eadtu.eu

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The first envisioning report for Empowering Universities in the uptake of new modes of teaching and learning

This is a report by the expert pools of the EMPOWER programme established by EADTU to cover the latest trends and developments in new modes of teaching. New modes of teaching and learning create new opportunities for enhancing the quality of the learning experience in on campus programmes, reaching out to new target groups off campus and offering freely accessible courses nationally or worldwide through the internet. They enhance the quality, visibility and reputation of the institution.

The implementation of new modes of teaching and learning requires institutional strategies and frameworks. It cannot be successful without a strong motivation of a professional teaching staff and without a continuous commitment from the top management of a higher education institution.

The EMPOWER expert pools are working in all relevant areas for the development of new modes of teaching and learning, embracing:

- Course related expertise: course and curriculum design, access to knowledge resources on the internet and in libraries, student support, and assessment online.
- Institutional development: staff support services, enabling good teaching and learning; institutional innovation strategies and management.
- Governmental policy: fine-tuning institutional policy and governmental policy.
- Some expert areas specifically focus on applications as blended education, open and flexible distance education, continuous education/CPD, international education and OERs and MOOCs.

EADTU has conceived the action programme EMPOWER to support European higher education institutions in their transition to new modes of teaching and learning in:

- Blended education or the combination of e-learning and face to face teaching and learning on campus (in mainstream degree programmes).
- Online and flexible education for 25 + students, in short or degree programmes or in continuing education schemes (incl. CPD).
- Open education, which is freely available in the public domains (e.g. open educational resources, MOOCs).

This action programme is supporting individual universities by on site expert seminars with free independent advice, onsite and online seminars, guidance for university leaders, expert panels for targeted reviews and, support for whole of institution initiatives. It hosts the Empower Online Learning Leadership Academy on new and emerging models of teaching and learning.

We hope this first edition of the EMPOWER Envisioning Report is an inspiration for many to further innovate education and start cooperation and sharing of expertise with fellow innovators.

George Ubachs
Managing Director EADTU

Policy and Strategy

**EMPOWER expert pool:
Curriculum development
& Course design**

*Alfonso Herrero de Egaña
Espinosa de los Monteros*

**Innovative
impact**

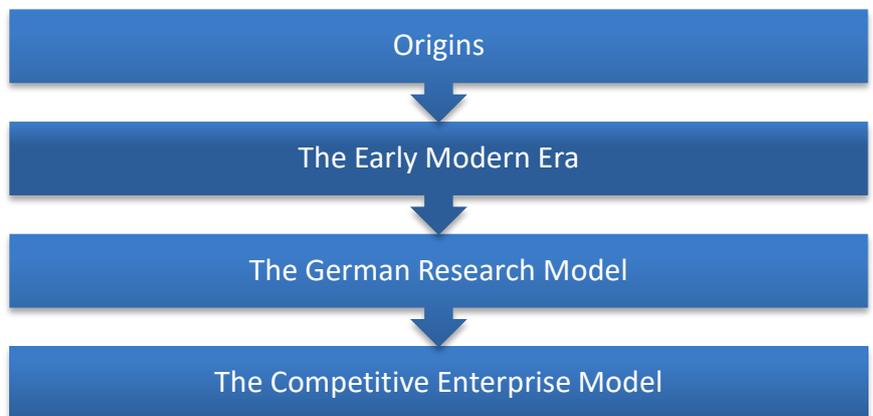
The features for the new educational system are how it should be structured, what should be taught and how it should be taught. Focusing the attention in how it should be structured, we address the need for innovative organizational structure, as an answer to the question of the rising costs of tuition.

Minerva project is just an example, and the first empirical prove, that educational costs could and should be controlled and reduced. Of course, not all of the measures taken by Minerva are thought to be appropriate, however they show that there are alternatives to doing nothing or following the trend.

If we feel that the educational performance has to be increased, putting more resources into the system does not look as the brightest solution of the problem. It seems that societies have been trying to solve the lack of results of the educational systems by piecemeal changes that have increased the cost of the system as a whole without improving its outcomes. Maybe competing in the Ivy League is not just a matter of raising the costs of education.

Organizational innovation & competitive enterprise university model

The evolution of higher education



University has evolved through four different phases. Prior to their formal establishment, many medieval universities were run for hundreds of years as Christian cathedral schools or monastic schools (Scholae monasticae). The first universities Bologna Paris, Oxford, Cambridge, Salamanca, began as private corporations of teachers and their pupils.

Although it has been assumed that the universities went into decline during the Renaissance other authors have noted the importance of the European universities in early modern period, arguing that they played a crucial role in the Scientific Revolution of the 16th and 17th centuries. Copernicus, Galileo, Kepler, and Newton were all extraordinary university products of that time.

Of course, nowadays university is far away from the German University of the thirties that was at the leading edge of knowledge in almost any field of knowledge and which is worst, not every university has entered in the era of research when in the early 21st century higher education has become a competitive enterprise. In which students compete for scarce places in top universities and universities compete for status, ranking and funding from governmental and private sources.

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Weissmann, Jordan (2012).

The Competitive Enterprise Model Problems

The competitive enterprise model faces several difficulties: the lack of adaptation of university curricula to the firm or corporation needs; the explosion of knowledge production within business and other organizations; and finally the rising cost of tuition fees. There is a general agreement that educational performance has generally declined in the world since the early 1960's, while educational costs have dramatically increased (Reigeluth, 1994).

If we centre our analysis in the increase of educational costs, it is a fact that tuition fees have been increasing. According to The Centre for College Affordability and Productivity in USA, Tuition costs as a percentage of average household income were 10% in 1980 and 25% in 2008, and tuition price increase was 757% from 1980 to 2009 (The Centre for College Affordability and Productivity, 2010).

Why are tuition fees rising so much faster than prices or even incomes in general? First, we can say definitively that the demand for higher education has risen far more than the supply. A more specific explanation is the hypothesis put forth by William Baumol of Princeton in the 1960s. Service industries are inherently inflationary. It is difficult in universities to cut costs by substituting capital equipment for labour. The Baumol thesis might explain much of the 1.5 percent increase in real fees before 1978, but cannot explain the majority of the much more rapid fee increase since (The Centre for College Affordability and Productivity, 2015). Second, faculty salaries are, at best, only about one-third the budget at a modern research university.

The chief reason why costs keep rising is that education has become a minor player in higher education; at universities, only a small part of spending goes for instruction. State aid money allowed colleges to raise fees more aggressively, and the universities, not the students, have captured these funds. Higher tuition fees have largely funded the academic arms race, but the declining state aid has ended in aggressive tuition increases. Here is some of what will come out of tuition checks: The explosion in non-instructional staff, including administrators, Seven-figure CEOs, costly varsity teams, fancy facilities and so. The German Research Model has been loaded with the costs of structure of the Modern Enterprise Model, without changing its original costs and structure.

"Can This 'OnlineIvy' University Change the Face of Higher Education?" The Atlantic. Retrieved 21 August 2014.

Resources

<https://www.minerva.kgi.edu/>

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<http://radioopensource.org/college-budgets/>

Organizational Innovation & MINERVA

Organizational innovations are essential for firms' long-term competitiveness. An organizational innovation is defined according to OECD (2007) as "...a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to non-tradable assets (such as non-codified external knowledge) or reducing cost of supplies.

Organizational innovation can refer to either 'new-to-the-state-of-the-art' or 'new-to-the firm' (Mol & Birkinshaw, 2009). This would mean that organizational innovations could be a result of existing diffused organizational ideas, but also of a more local process of inventions in a specific context (e.g. within a specific firm). The latter case could mean that the organizational innovation is not only 'new-to-the-firm' but potentially also 'new-to-the-state-of-the-art' (if the firm is the original inventor of the organizational innovation). Minerva organizational innovation belongs to the last.

Minerva's founder, Ben Nelson, has referred to Minerva as "the first elite American university to be launched in a century" (Weissmann, Jordan, 2012). There may be no brand more venerable than the Ivy League. No university has emerged to challenge its intellectual supremacy in more than a century. What Minerva is attempting to do has more in common with a classical, English model of what a college is supposed to be, however, it's being run as a for-profit enterprise.

Minerva point is to peel away extraneous costs that strangle innovation in higher education. Minerva has no classroom facilities, tenure is not available, faculty are hired under three-year contracts, professors teach from anywhere, and there is only one faculty for the different campus around the world that won't be paid to do research. There are not lab classes, no libraries, no gym, no labour unions, nor state or federal financial aid programs, but instead uses its non-profit Minerva Institute. The result is that tuition room and board will cost less than \$20,000-a -half the price of the Ivy League at current price. It is a fact that Minerva has reduced the costs of tuition through an organizational innovation that has reduced or eliminates different costs of the German Research Model and of the Competitive Enterprise Model (CEM); another question is if it will succeed in facing the other challenges of the CEM.

**EMPOWER expert pool:
Policy and strategy
development**

*Professor Mark Brown
Dublin City University*

**Innovative
impact**

The unbundling of higher education challenges many traditional assumptions and practices by opening up new business models, expanding conventional delivery modes, promoting new learning designs, and outsourcing student support services, to name a few. However, the movement needs to be understood as problematic as unbundling is not neutral or on an independent trajectory.

The key lesson is that policy-makers and institutional leaders need to understand the bigger picture of the powerful change forces seeking to re-bundle higher education for particular ends. It is essential that we promote greater debate and public awareness of the choices we face both at the national, regional and institution levels in the context of our preferred education futures and social imaginaries of the good society.

Unbundling examples

Straighterline - an example of 'the clock' being rebundled in the U.S. by allowing students to complete their degree online through over 100 accredited colleges with flexible start and stop times.

A critical guide for policy-makers on the great unbundling of higher education

Introduction

This paper provides a critical guide and helicopter view on the growth of the unbundling movement in higher education. It briefly explains the basic concept of unbundling but then illustrates how the movement is far more complex than typically portrayed in popular texts. The position taken is that unbundling is not neutral but rather imbued in economic, political and ideological language. It has many different faces, simultaneously both good and bad, which requires policy-makers and institutional leaders to view the phenomenon through a critical multi-dimensional lens.

Unbundling explained

In 2003, Apple Computer Inc. unbundled the CD with the launch of iTunes. For the first time people could purchase the music they wanted rather than the bundle pre-packaged by the record labels. More recently, in 2010 Uber fundamentally challenged the traditional business model of taxi companies by breaking down the service through dynamic prices and the use of private drivers.

These two high profile examples are often used to explain the basic concept of unbundling in the context of higher education. Put simply, the traditional degree is higher education's version of the bundle (Craig & Williams, 2015). As Craig (2015) points out, bundling has been central to the higher education business model for centuries. Institutions combine content and a wide range of products and services into a qualification package, which generates revenue.

In brief, the unbundling movement in higher education is about efforts to break apart and reconceptualise many of the traditional products and services offered by universities and institutions of higher learning. There is no question that unbundling is one of the really big issues facing governments, policy-makers and institutional leaders as it potentially challenges many traditional assumptions and taken-for-granted practices in higher education (Brown, 2016a).

Global Freshman Academy – an example of how the 'delivery mode' is being rebundled in the U.S. as learners can earn credits for MOOCs for their first year of study through Arizona State University on the EdX platform. This partnership helps to challenge traditional conceptions of credit hours and what constitutes the first year.

The MIT Micro Masters – an example of how 'the credential' is being rebundled by an elite institution in the United States as learners from around the world can complete a fully online mini programme of study which after a proctored exam then allows them to apply for an accelerated on-campus MIT masters degree.

BC Campus Open Ed – an example of how traditional 'content' is being rebundled through the adoption of open educational textbooks. This Canadian initiative helps to infuse digital resources into the curriculum whilst saving students significant money.

Epigeum.com – an example of the rebundling of traditional professional development for academic staff through global collaboration.

Tutor.com – an example of how traditional 'student services' are being rebundled by a commercial online supplier to help extend hours and increase the range and quality of solutions available to learners.

Many different faces

The unbundling movement in higher education has many different faces and is far more complex than typically portrayed through popular examples (i.e., Apple & Usher) or in descriptions of the rise of the MOOC.

In many respects the current language of disruption, democratisation and re-imagining in the age of unbundling requires a type of double vision combining both political and pedagogical perspectives. The debate is more nuanced than simple dichotomies of good or bad, as the language of unbundling is entangled in a number of interwoven and contradictory arguments.

On the one hand, unbundling provides a real opportunity to reduce costs, enhance quality and address increasing global demand for higher education. As many educators observe, it will not be possible to satisfy the rising demand for higher education, especially in developing countries, by relying on traditional models. Thus there is a moral imperative for exploring the potential of new unbundled models of higher education, including public-private partnerships, adoption of open educational resources, outsourcing of student support services, and so on.

On the other hand, arguably, unbundling has its roots in the contested terrain of globalisation, neo-liberalism and the decline of influence of the small nation-state. Put another way, many of the drivers for unbundling promote *laissez-faire* principles of individual freedom, education as a personal commodity, and the ultimate goal of an unrestricted global market for higher education (Brown, 2016a).

The key point is that unbundling is not on an independent trajectory, but rather entwined within a complex constellation of social, technological and educational change. Accordingly, the challenge for policy-makers is to steer a path between the language of opportunity, firmly anchored in a re-conceptualist mission of promoting wider access to life-long learning through new unbundled models of higher education, set against the need for a deeper level of critique.

The bigger picture

Taking a look at the bigger picture two grand narratives can be seen as underlying the unbundling movement: the tradition of the Learning Society and the growing influence of the Knowledge Economy.

Although overly simplistic, and not mutually exclusive, the former views education as a public good, with the goal of more equitable, inclusive and socially just futures for all. In contrast,

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Resources

The unbundled university

Unbundling education: Mapping the changing nature of higher education in South Africa

the latter perspective treats higher education as an individual commodity through which a competitive global market can help to increase quality, reduce costs and establish a larger pool of 'high-tech' workers capable of keeping countries and major economies competitive (Brown, 2016b).

While on the surface the language of 'unbundling' promotes democracy, opening access and new learning pathways in the traditional of life-long learning, many initiatives actually end up re-bundling higher education to support the goals of deregulation and the free market. For example, the move to introduce digital badges and nano-degrees appears to challenge the protected status of traditional university-level qualifications. A more agile "just-in-time" and "just enough" education is emerging in response to what we are told is growing demand from learners (consumers) and employers (customers). However, the growth of such bite size courses from a metaphorical supermarket shelf of offerings where learners collect digital badges (coupons) along the way is arguably an example of how neo-liberal principles, disguised in hegemonic language, infuses the unbundling movement.

It follows that the concept of hegemony—in which dominant groups in society seek to establish the common sense, define what counts as legitimate areas of agreement and disagreement, and shape the political agendas made public and discussed as possible—is central to understanding the unbundling movement within the bigger picture of educational reform. Put more simply, it is fair to say that a strong Knowledge Economy discourse is imbued in the dominant languages of persuasion promoting unbundling in higher education. The risk is that policy-makers and institutional leaders seeking to re-imagine higher education in the tradition of the Learning Society may end up collaborating with the enemy.

Conclusion

The unbundling movement should not be viewed as a single or monolithic entity, as it has many different faces. Nevertheless, unbundling is not on an independent trajectory and cannot be uncoupled from wider debates over issues of power and the struggle over who will win control of the higher education system. The key point for policy-makers is to reframe the current debate away from unbundling *per se* and rather locate discussions about the movement in bigger ideas, broader social imaginaries and our preferred education futures.

Innovative impact

OER and MOOCs are often considered in isolation or only as being of relevance to teaching and learning. To do so is to fail to think about them in terms of all the activities that a Higher Education Institution is involved in and in particular in relation to the stated mission of that institution. This paper uses the idea of business models as applied to HEIs and locates OER and MOOCs within this purposeful system and its wider context, as exemplified by the Open University UK.

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Business models for OER and MOOCs beyond monetary incentives

What are business models?

The primary aim of a business model is to identify the main products or services offered (such as teaching, research and knowledge exchange) and the sources of funding that pay for the activities that provide the product or service (such as 'sale' price, 'subscription' fees, advertising, grants, and donations).

Organisations can have very different missions (economic, social, and environmental) but all have reputations or brands that can support or undermine their monetised business models.

What are the business models for higher education?

Higher education institutions (HEIs) have more than one business model covering three main types of activity that variously fulfil their diverse missions:

- Teaching and learning (e.g. undergraduate students; postgraduate students; executive education; continuing professional development).
- Research and scholarship (e.g. doctoral studentships; research council grants; industrial partnerships; foundation grants)
- External engagement and knowledge exchange (e.g. national or local government schemes; charity campaigns; social organisations; community groups; the 'public').

The diversity of HEI business models is both a strength and a weakness. HEIs have to deal with many different 'stakeholders' with different perspectives on those business models (e.g. Chan et al, 2014). HEI business models are as much about relationships as monetary transactions (but unless truly pro bono all business models are sustained by a mix of funding source(s)). The varying degrees of openness inherent in Open Educational Resources (OER) and Massive Open Online Courses (MOOCs) offer new ways to support those relationships and support HEIs' diverse missions that goes beyond the direct monetary incentives but looks at the more indirect and intangible benefits to reputation and mission.

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Resources

Fuller details of the Open University UK's work with OER and MOOCs can be found at <http://www.open.ac.uk/about/open-educational-resources/>

How OER and MOOCs can support teaching and learning

OER and MOOCs can showcase the teaching of an HEI to wider audiences around the world and in effect replicate or reinvent the 'public lecture' as an extra mural public good (Lane, 2008).

At the same time they offer staff development opportunities and enable experimentation in technology enhanced or online learning as well as provide opportunities for non-degree focused educational collaborations with non-commercial organisations.

The sharing of effort between HEIs (and other organisations) in developing openly licensed materials can potentially lower the lifetime costs of developing effective self-study rich media educational resources (Lane, 2013).

How OER and MOOCs can support research and scholarship

In the same way that OER and MOOCs can showcase teaching and learning they can equally showcase research programmes to new audiences around the world as well as providing the means to promulgate research findings from those programmes to a global audience (a part of what is called 'research impact').

They can also improve working relationships if they act as a platform or mechanism for involving the 'public(s)' in research e.g. citizen science; or enabling innovative collaborations between HEIs and Industry.

Lastly they can link teaching and research by providing a 'laboratory' for technology enhanced or other educational research (Lane, 2013).

How OER and MOOCs can support external engagement and knowledge exchange

The ways in which teaching and research can be promoted to new audiences around the world through OER and MOOCs has already been covered but some more specific ways in which this can be achieved are through enabling collaborations with public and commercial organisations in new ways through open innovation; extending outreach activities to community groups for particular social purposes; and supporting knowledge transfer partnerships between HEIs and Industry (Lane and Law, 2012).

Case study: The Open University UK

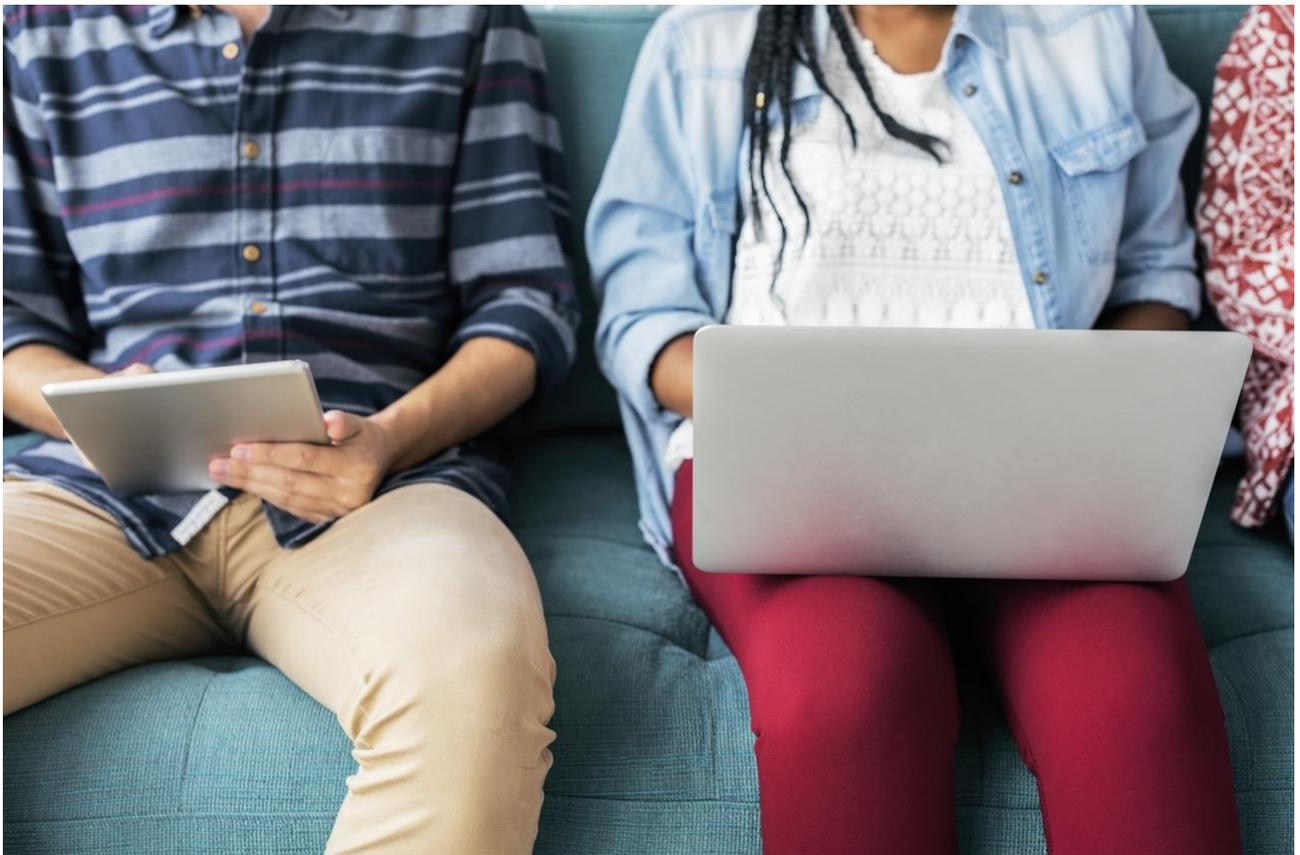
The Open University UK's (OUUK) Royal Charter states that it has 'to provide for the educational wellbeing of the community generally'. This social mission fits alongside the business mission of being a financially sustained organisation providing economic benefits to students, staff and others (Gourley and Lane, 2009).

Our 10 year involvement with OERs and MOOCs has been based on aligning these developments with the overall mission of the OUUK, not only by doing OER and MOOCs but also by researching their impact on students, teachers, other organisations and the OUUK itself, in order to understand the benefits they provide.

The fee income from students recruited via our OpenLearn platform and the grant income from different organisations for specific projects using OpenLearn means OpenLearn 'pays its way' and is not subsidised by the OUUK. FutureLearn is much younger (3 years) and is still in the investments phase. However, both OpenLearn and FutureLearn benefit greatly from a range of internal and external relationships/partnerships that enhance their value and perceived reputation.

Conclusions

OERs and MOOCs can enable or strengthen (transactional) relationships with people, communities and organisations. Some of these transactions are monetary in nature in which the HEI and the people, communities and organisations involved largely benefit economically. Some are non-monetary in nature and provide social benefits that derive from (mediated) interactions with the free and openly licensed content across all three main activities of HEIs – teaching, research and knowledge exchange. Visibility and reputation are particularly valuable non-monetary by-products of OER and MOOCs.



Innovative impact

- Fostering refugees and immigrants access to the educational institutions of the Euro-Mediterranean Region at different levels, paying particular attention to the University and vocational training and re-training courses;
- Helping immigrants and refugees in learning the language of the hosting countries;
- Spreading Arab World language and culture courses among the citizens of the hosting countries;
- Making people learn the notions that help immigrants and refugees access healthcare services, treatments and first aid;
- Promoting the knowledge of the rules and laws regulating the mutual rights and duties.

Internationalization models with non-ECTS / non-EU universities: the UNINETTUNO experience

Models of Internationalization of UNINETTUNO

The University UNINETTUNO has made internationalization one of its most important strategic pillar. The internationalization process has been developed and continues to develop through two models that are very different.

The first model is characterized by a completely new phenomenon and is bound to the Internet: Net users explore and select the information and services available on the Web, by making choices no longer tied only to their country but mainly according to their interests. Internet and, in particular, the social networks allow users to take an active role in promoting, suggesting and enhancing the information, content and services directly used. They are the same people to give value to the "network nodes" find interesting and worthy of being mentioned and recommended to their social network. This new comprehensive quality promotion model happens via social bookmarking, sharing a links and likes on social networks like Twitter, Facebook, LinkedIn or Google+, active participation in discussion groups, thematic forums and social review services. It is through this spontaneous mechanism of networking word of mouth, a global one, not controlled from above, that in a few years the International Telematic University UNINETTUNO has managed to have students enrolled from 163 different countries around the world, giving its identity a truly global character. The second model of internationalization is based instead on international agreements

with universities and ministries of different countries of the world and especially the Arab world, in order to create, harmonize and share curricula that enable students to acquire a valid title to his country of origin, in Italy, and then in Europe. The dialogue between cultures is not a utopia but it is really possible. UNINETTUNO has really managed to create new alliances between universities and educational institutions, to develop together real and virtual spaces, to build common

networks of knowledge. Today we work together and we operate in a Euro-Mediterranean common area in order to kick-off a fascinating path of training and educational systems and to adapt them to the changes that the global world has produced.

Together, the intelligences of interconnected teachers and students of the north and south shores of the world create new knowledge and develop a network of skills and knowledge, based not on the imposition of cultural models or the other, but on the comparison of cultures and training models. Together they created an actual laboratory for intercultural and inter-linguistic cooperation that enables the development of a new virtual space, where you process content to be included in the curricula of study and teaching and learning models, to make the young generation capable of becoming leaders in the change.

Teachers and students of UNINETTUNO of the euro-Mediterranean are aware of the fact that this cooperation allows not only to create a new balance between unity and diversity: the unity of values and traditions that memory leaves us and the diversity of cultures and languages, but also allows to create, virtually, a new model of university where skills for the development are being built and the grounds for building the future together are being determined.

Immigrants and Refugees

It is precisely this belief that has driven UNINETTUNO University to engage in giving a contribution to the big question of the refugees and immigrants realizing the first Internet-based portal, **“The University for Refugees – Education without Boundaries”**. This portal allows refugees and immigrants to access the University from anywhere across the world.

This tool allows for the recognition of study titles previously earned by the refugees and immigrants in their countries of origin and the recognition of their professional skills to make their access to educational institutions, school and universities of the hosting countries easier.

The University for Refugees – Education without Boundaries is developing a big laboratory for true integration, for valorising good immigration, dialogue, a peaceful coexistence among peoples and international cooperation and, more specifically, Education, Knowledge and Healthcare.

“The University for Refugees – Education without Boundaries” has already achieved its first results.

His name is Harout Marderossian and he is the first Syrian refugee who has enrolled in the degree course in Computer Engineering, delivered by the International Telematic University UNINETTUNO, thanks to one of the 50 scholarships made available for free by the University and aimed at refugee students entitled to international protection. Harout is thirty-year old; he was born in the city of Aleppo where he got a three-year degree in Chemistry. At present he has the status of political refugee in Lebanon and, hoping that peace will be restored in his country, he will be able to realize his dream: completing the study path he started in Syria by earning an academic qualification recognized in Europe. This young man will be able to access UNINETTUNO's e-learning platform.

Apart from Harout Marderossian, 60% of the students enrolled in the portal “Education without Boundaries” are Syrian refugees living in Germany; they searched Google to find out how to resume the study path they gave up and, realize their dream of studying in spite of their status of refugees.

Giving refugees and immigrants the opportunity of earning a study title means giving them back again their dignity and encourage them to go ahead trusting humanity and with hope of building a better future for themselves.

It was the Web that made these students know about the University, but, it was mainly in UNINETTUNO's portal that they could find the digitized video lessons of their own professors who cannot deliver their courses any longer in many Syrian universities, and above all in Aleppo, which has been completely destroyed by the war. UNINETTUNO has always entered into agreements with the Arab World to make the enrolments of their students easier, but it has also involved their teachers in realizing the contents of some courses in Arabic in order to concretize a real model of co-participation in the creation of knowledge, sharing and comparing our histories and our cultures in order to build a future of peace.



Learning Designs

**EMPOWER expert pools:
Institutional Support,
Curriculum development
& Course design**

*José Bidarra & Ellen
Rusman*

Innovative impact

This summary describes a new design framework to support science education through blended learning, based on a participatory and interactive approach supported by ICT-based tools, called *Science Learning Activities Model* (SLAM). This design framework is important as a response to complex changes in society and education (e.g. high turnover rate of knowledge, changing labour market), which require a more creative response of learners to the world problems that surround them. The framework is concerned with the assumption that science-learning activities should be applicable and relevant to contemporary life and transferable to 'real-world' situations. The design framework proposes three design dimensions: context, technology and pedagogy, and aims at integrating learning in formal and informal contexts through blended learning scenarios by using today's flexible, interactive and immersive technologies (e.g. mobile, augmented reality, virtual reality).

Key Pedagogical and Technological Factors for Effective Blended Learning Design

Introduction

Teaching and learning opportunities for youth are now available in an expanding learning ecosystem (Guertl & Chang, 2008), next to the traditional educational institutions, for example, encompassing science discovery centres, community spaces, social networks and non-profit organisations. So, considering the gap between education for a changing society and current educational models, we started the development of this design framework as a response to complex changes such as high turnover rate of knowledge and changing labour market, which require a more creative response of learners to the world problems that surround them. Many of these challenges are related to science and it would be expected that students are attracted to science, however the contrary is the case. One of the origins of this disinterest can be found in the way science is taught.

We cannot ignore that students are no longer the same target population for which our education systems were designed a few decades ago. These students grew up in a new technological environment, with its own techno-culture, and they will live in a demanding, competitive, complex and increasingly connected world. The technological revolution has produced a generation of students who grew up with multidimensional and interactive media sources, a generation whose expectations and perspectives are different from those that preceded it. Unfortunately, the majority of universities does not support a guided exploration of the real world, with authentic tasks, that allow for the development of skills to face this societal complexity; currently it looks like many curricula are just dispersed pieces of a puzzle. This suggests the need for convincing learning scenarios and designs that will engage learners, with emphasis on science topics and curricula.

Blended Learning

Online interaction has become a way of life for students wherever they are: at home, on the move, or in schools. For the

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institutions this is good news, as for the first time in history we have educational technologies that cost (almost) nothing to governments and schools: smart mobile phones (most students have one), networking software (freely available, e.g. Hangouts, Messenger, Skype), learning applications (freely and increasingly available, e.g. Apple Store, Google Play) and open educational resources (in growing supply, e.g. MOOCs, iTunes U, Khan Academy). There are other free tools available for learning organizations, such as collaborative tools (e.g., blogs, wikis, knowledge-building software), immersive environments (e.g. virtual worlds), media production and distribution tools, and many more. Furthermore, teachers and educators have always emphasized the importance and need for "authentic learning activities", where students can work with real world problems (Brown, Collins & Duguid, 1989). Therefore, the development of educational activities for students, that combine learning resources from the real world with those from the digital world, has become an important and challenging research topic for science educators. Online activities may be accomplished, for example, through the use of mobile communication and wireless technologies, allowing for experimentation, inquiry, data collection, knowledge sharing, and communication with other students, anytime and anywhere (Sharples et al., 2015).

The SLAM approach

Following up on this, taking a learner-centred approach to connect three umbrella concepts – context, technology and pedagogy – we propose a new blended learning design model. The *Science Learning Activities Model* (SLAM) has ten seamless dualities that may co-exist in multimodal activities, explicitly indicating the extremes of a continuum. These may originate learning scenarios that contain multiple learning activities set within the boundaries of the indicators. For instance, a learning scenario may consist of a learning activity where learners explore the various types of architecture, and the structural principles that underlie those buildings. More informally, learners are asked to bring in their experiences with the construction of structures (e.g. building a tree house facilitates learning of the structural principles of a real building).

Context

- | | |
|--|---|
| 1. Formal, non-formal, and informal learning | Specification of topics and types of activities and how they fit together in a learning scenario. |
| 2. Individual and collaborative learning | Specification of study modes and related resources (allowing for learners' PLEs). |
| 3. Open and closed learning environment | Structure of free and restricted access to learning environment and resources (e.g. MOOC and SPOC). |

Technology

- | | |
|--|---|
| 4. Synchronous and asynchronous learning | Technology supporting learning modes (time dimension in Johansen's matrix). |
| 5. Virtual and physical interaction | Technology for blended learning interaction (space dimension in Johansen's matrix). |
| 6. Single platform and multi platform | Online learning platform integration (e.g. Moodle, Moodle Mobile, Elgg, Edmodo). |

Pedagogy

- | | |
|--|---|
| 7. Theoretical and hands-on activities | Mix of learner-centred activities set in a blended learning programme (including activities based on PLEs). |
| 8. Restricted and open learning design | Design of structured activities for restricted outcomes (e.g. multiple-choice tests and tutor marked assignments), and design of open activities (e.g. games, simulations, portfolios, and open discussions). |
| 9. Centralized and open assessment | Modes of learner assessment components in a learning scenario with many activities (e.g. formative and summative assessment, peer assessment, self-assessment). |
| 10. Pre-structured and open guidance | Modes of scaffolding the learning process and tutoring of activities. |

The SLAM model will help design and explore learning activities and ensure the attainment of specific learning objectives based on the seamless integration of new technology in blended learning, and if backed by an appropriate pedagogy will enable authentic learning experiences.

Innovative impact

This paper introduces a methodology that is based on Learning Outcomes and uses ontologies to achieve common representation of course related knowledge. It can be used to design learner-centred courses, as it results in a learner-centred continuum that includes learning subjects, learning outcomes and learning objects, while it can be extended to include job role descriptions.

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Course design methodology based on Learning Outcomes

Introduction

According to Cedefop, Learning Outcomes are defined as a statement of what a learner is expected to know, understand, or be able to do at the end of a learning process. Learning Outcomes enable educators to clarify educational intentions, to identify and sequence content, to decide on most appropriate teaching media, to select the most appropriate activities, to decide on suitable ways of assessing learning and to evaluate the effects and effectiveness of materials. On the other hand, they assist learners in acquiring new concepts and skills and enable their self-evaluation, so that they can achieve better performance in the educational process. An educational process that is based on Learning Outcomes and competences is considered to be adaptive, flexible and efficient.

Methodology

The proposed methodology aims at modelling all components of a study programme (teaching subjects, student profiles, expected outcomes, teaching material, teaching strategies), while it can be extended to include qualifications. The methodology consists of phases, each of them addressing measurable objectives by using specific inputs and producing distinct outcomes.

Modelling the domain

The objective of this phase is to produce a comprehensive model of the teaching subjects of the course. Inputs to this phase can be the experience of the team or of experts, teaching material used or available, courses in similar domains, etc. The output is a set of Teaching Domain Ontologies (TDO). A stepwise process can be applied in order to engineer the final version of the TDO, starting from recording the main components of the domain and gradually refining them.

Modelling the students

In this phase, the Instructional Designer analyses the profiles of learners, aiming to collect useful information about the

Panagiotopoulos, I., Kalou, A., Pierrakeas, C., & Kameas, A. (2012). An Ontological Approach for Domain Knowledge Modeling and Management in E-Learning Systems. In L. Iliadis et al. (Eds.), 1st Artificial Intelligence in Education Workshop: Innovations and Applications (pp. 95-104), 27-30 September 2012, Halkidiki, Greece: Springer-Verlag Berlin Heidelberg.

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characteristics of the audience (target group) to which the course is directed. The collection and recording of these characteristics enables the adaptation of Learning Outcomes and Learning Objects, according to the needs and particular characteristics of learners. Input to this phase can come from questionnaires completed by the students, student models as they appear in the literature, or even student log files, if available. The outcome is a taxonomy of student profiles in XML notation.

Modelling the course outcomes

The objective of this phase is to produce a model of the outcomes that learners will achieve when finishing the course. In order to produce this model, the TDO is used (and possibly refined). The output is a semantically rich network that combines TDO with Learning Outcome Ontology (LoutO). To realize this phase, a repetitive process is applied.

Structuring the teaching material

The objective of this phase is to specify the teaching material that will be used to achieve the goals of the teaching domains of the course, as they have been recorded in the respective Learning Outcomes, tailored to the specific characteristics of course students, as they are recorded in the taxonomy of profiles. The outputs of the previous three phases are used as inputs to this phase, which produces a set of digital Learning Objects. This is the longest and more time consuming phase; a repetitive process is applied, based on Learning Outcomes.

Encoding teaching strategies

The objective of this phase is to produce learning activities, which are based on Generic Learning Designs (GLD), each of which encodes elements of one or more teaching strategies. A four stage process is used in order to develop GLDs.

Modelling qualifications

The objective of this phase is to associate the learning process with market needs, as they are reflected in job profiles. To this end, job profiles are encoded in Job Profile Ontologies (JPO), which make use of the TDO concepts and the knowledge, skills and competences in LoutO.

Conclusions

We presented a methodology for course design based on semantically rich representations of teaching domain, learning Outcomes and learning Objects. Learning Activities can be

designed based on these, taking into account the student profiles. The methodology can be extended to include descriptions of job profiles. The methodology has been applied to the design of courses offered by the Hellenic Open University with encouraging results..

In this way, course design becomes contextualized to the specific structure of the domain, the available material and the student profile. Moreover, a continuum from teaching domain to employment is created. At the heart of the approach lie the Learning Outcomes, a contemporary powerful approach that describes the learning process in a learner-centred way. The outcomes of the stages of the proposed methodology are semantically rich descriptions of course components using ontologies. This powerful knowledge representation tool makes possible the ad-hoc combination of knowledge modules in the context of a specific course, thus combining robustness with flexibility.



**EMPOWER expert pool:
Institutional Support**

Dimitris Kalles

Innovative impact

Realistic simulation of laboratory equipment and experiments can significantly enhance the skills of distance-learning trainees before actual on-site experimentation.

Training institutions can invest on a variety of simulation-based development activities, to span the spectrum of educational activities, trainee involvement and course depth, which allows them substantial control over the extent of blended learning they might opt to inject in a curriculum.

Mapping the spectrum of available simulation tools and development efforts should be carried out at an inter-institution level, to maximize impact potential.

Simulation for blended-learning laboratory education

Science and Technology Universities deal constantly with the problem of training their natural/physical sciences and engineering students in how to make proper use of their laboratories and successfully conduct experiments, eliminating the risk of accidents and damages to the equipment.

This problem is exacerbated for distance-learning students who might visit the laboratory facilities considerably less often. It is also exacerbated in budget-strapped institutions; in several cases, the laboratory equipment is sensitive and expensive and it is not affordable for trainees to have the opportunity to make improper use and learn by “trial-and-error” – rather they are instructed what to do and what not to do and, usually, this does not result in the best learning outcome.

The problem is becoming even harder when the number of trainees is large and their training takes place simultaneously at the same lab, where the chances of causing damages and accidents are high but, also, the learning result is most of the time not the desired one. Thus, a virtual world providing with an interactive simulation environment of the lab in which the trainee is allowed to experiment and make an unlimited number of mistakes in order to learn, where no time or space restrictions exist, would absolutely help the trainees prepare themselves before they make use of the on-site laboratory.

The Hellenic Open University, in its quest to open-up its admissions to an as-wide-as-possible audience, has been recently researching the extent to which a 3D game-like virtual laboratory can be a valuable supplement to conventional laboratory training. Our virtual laboratory, called **Onlabs**, allows students to learn by interacting with virtual lab instruments and by performing virtual experiments, before actually travelling to university premises to carry out the experiments live. **Onlabs** was initially developed using Hive 3D (by Eyelead Software) but recent releases have been also developed using Unity.

A snapshot of an earlier release is shown in the figure below to highlight the level of realism required in the manipulation of equipment. Note, for example, that in the microscope, one proceeds by plugging the socket and turning the AC switch on, configuring the light intensity, opening the iris diaphragm by turning the aperture knob to the most leftward position, lifting the condenser lens to its highest point, setting an objective lens

Comparable example

LABSTER is an award winning laboratory simulation product, pioneered by a company in Denmark, which has achieved global reach by implementing virtual laboratories for a variety of natural science courses. We view Onlabs as being complementary to a LABSTER-based solution, since Onlabs places great emphasis on specific handling activities for equipment.

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Resources

<http://onlabs.eap.gr>

<https://www.labster.com/>

as active, successively testing the coarse focus knob, the fine focus knob and the x-axis and y-axis knobs of the microscope's stage, before actually preparing and using a specimen for microscoping.

The basic release features a straightforward simulation. We are currently expanding it to include a scoring mechanism, based on the formulation of the experiment to be carried out as a sequence of steps and on the subsequent weighted accumulation of credit and penalty points to capture the effectiveness and efficiency aspects of the experimentation. While scoring in virtual labs is not a substitute for scoring by an instructor, just like the virtual experiment is no substitute for the actual live session, our scoring mechanism will allow student to self-assess their familiarization with the equipment and the experiment. In a yet further variant we allow the user to be guided into the virtual lab by a wizard, which instructs the user on what has to be done next, much like a scripted play.

Simulation is a powerful tool which can and should find its way into a variety of curricula; however, in the long run, the questions which each institution will have to address revolve around some major topics on what constitutes "blended" learning:

- 1) Probably the most plausible interpretation of "blendedness" has to do with the ability to provide a mixed portfolio of user experiences for the same underlying activity. In our scenario, this would mean that, on the way to the actual laboratory, we develop a scaffold of experiences, which eventually culminate in actually "being there" at the lab and using one's own hands for manual work (the low-budget extreme of the spectrum would involve just sending some text to the student and expect that by reading a book one might become familiarized with how to handle specialized equipment).
- 2) An alternative notion of "blendedness" refers to a variety of engagement levels. While simulation itself has certain connotations, topping it up with assessment means that we are now delving into more delicate aspects of the educational experience. Providing the right amount of assessment, at the right time and at a precision level that helps a student without stifling his/her attempts to experiment can be viciously hard. On the other hand, one can use a simulation environment as a vehicle to implement guided tours, with the expected benefit of taking the sting out of assessment and the plausible risk of delivering a patronizing message to students.
- 3) Moving out of the activity level and into the course level, "blendedness" necessarily has to deal with prioritization and cost-benefit analysis. Once a student arrives in a physical lab

for a 5-day 40-hour training session, experience starts flowing in and information is easier absorbed, just because lab supervisors are also present and the environment is more conducive to learning. The hot issue is to decide which parts of equipment and which experiments to simulate, in advance, so that the on-site experience is as fruitful as possible. Selecting equipment which is used across a variety of experiments is likely to be a good bet as far as cost-effectiveness is concerned, especially if one expects that the simulated experience might allow a student to move faster and more productively into other experiments. Sooner or later, this will lead to the question of whether to compress the actual physical time spent in the lab or to augment the activities one does within the initially given time frame. Quite predictably, educators cannot be the sole decision makers.

Simulation allows one to experiment with equipment and experiments which he/she might never actually get involved with in the physical lab. While this might seem a far-fetched scenario as far as university education is concerned, it cannot and should not be ruled out; universities have a mission to educate people thoroughly and industry has an incentive to bridge theory and practice. The rising quality of simulation software means that we are, now, at a most promising point of actually witnessing high-end interactive 3D technology fast becoming a commodity. The key to leveraging these developments will, likely, lie in the ability of institutions to synchronize their development efforts and avoid duplication; for that reason, standards-based development and liberal IPR protection might be quite as important as technical skill and agility.



**EMPOWER expert pool:
Curriculum Development
& Course Design**

Achilles Kameas

Innovative impact

The graduate course on Mobile and Pervasive Computing Systems is being offered by HOU since 2010.

It is the only graduate distance learning course on the topic

It aims to educate new scientists to identify and deal with the problems that arise when designing pervasive or mobile systems.

The course goes beyond mere transfer of knowledge to facilitating the acquisition of skills for designing pervasive and mobile computing systems, evaluating technological offers, requirements engineering, achieving service quality and enhancing interaction.

It is addressed to the graduates of courses in Computer Science or Engineering, Electrical Engineering, Telecommunications Engineering, or other similar disciplines.

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MSc course on Mobile and Pervasive Computing Systems

Introduction

The Course aims to establish systematic training of students on the design and development of Pervasive and Mobile Computing systems. It builds upon students' prior knowledge of Computer Science and Telecommunications and expands on issues such Software System Design, Computer Networks, Digital Systems, Human-Computer Interaction, Operating Systems and Distributed Systems. The Course is not limited to providing knowledge but also focuses on skill acquisition in designing mobile and pervasive computing systems, requirement analysis, evaluation and selection of technology solutions, analysis of service quality and performance systems, application and service design, through real-life case studies and applications.

Course outline

The course consists of 5 Units and a Diploma Thesis. The first 3 together with the Thesis are mandatory; based on the desired specialization, the students can select 1 of the 2 available electives during their second year of study.

Unit50: Software and networking technologies

Unit 50 expands on topics such as protocols, services and applications of wireless networks, advanced issues in designing distributed systems and middleware design.

On completing this Unit, the students are able to identify the basic concepts of pervasive and mobile computing, understand the importance of addressing privacy issues, explain the techniques for multi-sensor data fusion, understand the role of distributed systems and middleware, review specialized topics on distributed systems (system models, inter-process communication, operating systems, distributed file systems, peer-to-peer networks, web services), analyse case studies on distributed systems and select the most appropriate technologies and tools, understand the role of wireless networks, identify the basic concepts of wireless networking technologies, express the

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<https://www.eap.gr/en/courses/423-pervasive-and-mobile-computing-systems-msc/1408-pervasive-and-mobile-computing-systems-msc>

operation principles of mobile cellular networks and ad hoc wireless sensor networks, etc.

Unit51: Pervasive and global computing systems

Unit 51 expands on topics such as architecture of pervasive and global computing systems, issues in their design and programming and other specialized topics regarding their development.

On completing this Unit, the students have gained knowledge of various domains of application and different architectures, development methodologies, operational models and design principles of pervasive and mobile computing systems, understanding of basic principles of "Internet of Things, the notion of context and human-computer interaction in pervasive computing systems, the ability to apply design and development principles for context-aware pervasive computing systems, understanding and application of methodologies and criteria for evaluating pervasive computing systems, ability to synthesize design principles, methodologies and technologies for the development of low and mid-fidelity prototypes (mock-ups, Android apps) of pervasive computing systems, etc.

Unit60: Analysis and design of hardware/software systems

Unit 60 expands on topics such as interaction and appliance design and performance analysis of large scale systems, supported by case studies and applications

On completing this Unit, the students are able to analyse the purpose of interaction design, understand the tools that can be used, identify user needs and program interaction with pervasive and mobile computing systems, etc.

Unit61: Mobile computing

Unit 61 is an elective that leads to the specialization on Mobile Systems. It expands on topics such as design issues of advanced mobile and wireless network and developing mobile computing applications, supported by case studies and applications.

After completion this Unit, students are able to discuss and describe design issues for wireless mobile networks and identify their application, analyse, study and evaluate specialized topics of wireless mobile networks such as quality of service and security, assess and evaluate the user friendliness and non-functional requirements of mobile computing systems, prepare, organize, experiment and design mobile computing services,

understand the need of adaptation of mobile computing applications to the user demands, analyse, assess and discuss problems and case studies of mobile computing applications as well as to select, modify and develop the appropriate implementation technologies, etc.

Unit62: Embedded systems

Unit 62 is an elective that leads to the specialization on Embedded Systems. It expands on topics such as design of digital and embedded systems, supported by case studies and applications.

After completion this Unit, students are able to understand the basic design principles of embedded systems, design embedded systems hardware, implement digital circuits and design special processors using FPGAs, apply architecture design techniques and methodologies for the development of embedded systems, evaluate the performance of applications that use embedded systems, etc.

Unit99: Dissertation

Students are asked to tackle open research and development topics, preferably related to real life applications.

Teaching method

Students study from home following a Study Schedule. The total duration of a Unit is 10 months, during which students submit 5 written assignments, each one addressing a specific portion of the study material. Special efforts are made to engage the students in both theoretical and hands-on issues and to make them familiar with the relevant scientific literature. Assignments account for 30%, while the final exam taken at the end of the academic year accounts for the remaining 70% of the final grade. It comprises a 3.5-hour written exam that covers topics from the entire study material of the Unit. Statistics show that after two exams, the success rate is around 70% (this figure is somewhat lower in the first 2 Units).



**EMPOWER expert pool:
Curriculum development
& Course design**

Slavi Stoyanov and Fred de Vries

Innovative impact

The innovative impact of the paper can be highlighted by the following statements:

1. Applying the Group Concept Mapping, a non-traditional and power research methodology for objectively identifying the shared vision of a group of experts on MOOC didactical principles.
2. Defining MOOC didactical principles and their operationalisations in more concrete guidelines.
3. Formulating suggestions for combining xMOOC and cMOOC

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Designing MOOC: a shared view on didactical principles

Introduction

The paper reports briefly on the results of a study that applied the Group Concept Mapping (GCM) (Kane & Trochim, 2007; Stoyanov, Hoogveld, & Kirschner, 2010; Trochim and McLinden, 2017), to identify some didactic principles for designing MOOCs. It addresses the following research issues as found in the literature: (a) the discussion on MOOC didactics has been often replaced by debate on technological platforms; (b) the discourse has been on a very general level (e.g. xMOOC vs cMOOC); and (c) the research methods applied are mostly qualitative (Bali, 2014; Bayne & Ross, 2014; Kop, Fournier & Sui Fai Mak, 2011) or surveys by questionnaires (Margaryan, Bianco & Littlejohn, 2015). We first present the GCM, our main research methodology for data collection and analysis. Next, we describe the procedure and participants. Then we discuss some of the results. Finally we formulate some conclusions.

Group Concept Mapping

Group Concept Mapping is a mixed methods participative research methodology that facilitates a group of experts to arrive in an objective way at a shared vision regarding a particular issue (e.g., what are MOOC didactic principles). While the participants generate, sort and rate ideas independently and anonymously of each other, two advanced multivariate statistical techniques - multidimensional scaling (MDS) and hierarchical cluster analysis (HCA) - aggregate the individual contributions to identify patterns in the data and show the group's common understanding on the issue under investigation. Whereas GCM builds upon the strengths of other methods such as interviews, questionnaires, affinity diagram and Delphi method, it mitigates some of their weaknesses. The GCM shows how individual ideas are related to each other, how they are grouped in more general categories and how ideas and categories are prioritised.

Procedure and Participants

We invited all of the HOME project partners (<http://home.eadtu.eu/>) to take part in the study. 35 of them

Higher Education Online: MOOCs the European way (HOME). European funded project, initiated and coordinated by *EADTU*, 2014-2016. Retrieved from <http://home.eadtu.eu/>

Kane, M., & Trochim, W. M. K. (2007). *Concept mapping for planning and evaluation*. Thousand Oaks, CA: Sage.

Kop, R., Fournier, H., & Sui Fai Mak, J. (2011). A Pedagogy of abundance or a pedagogy to support human beings? Participant support on Massive Open Online Courses. *The International Review of Research in Open and Distance Learning*, 12(7), 74-93.

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education*, 80, 77-80.

Stoyanov, S., Hoogveld, B., & Kirschner, P.A. (2010). Imaging future learning: mapping major changes to education and training in 2025. *eLearning Papers*, special edition. European Commission, 9-23.

Trochim, W.M & McLinden, D. (2017). Introduction to a special issue on concept mapping. *Evaluation and Program Planning*, 60 (2017) 166-175.

register to the study's web environment for data collection and analysis (Concept System Global Max, 2015). 25 of them participated in the brainstorming phase by generating ideas about specific instructional guidelines that should be taken into account when designing a MOOCs. 113 ideas were generated that were then a subject of editing for clarity and appropriateness to the project and reducing the raw statements to a group of unique ideas. The remaining 79 ideas were sent back to the participants for grouping the ideas on similarity of meaning and to rate them on importance (1 = relatively unimportant; 5 = extremely important) and difficulty/easy to apply to the MOOC didactic design (1 = very difficult; 5 = very easy). A group of 12 dedicated project' partners were involved in these two activities.

Results

The Multidimensional analysis (MDS) and Hierarchical cluster analysis (HCA) on the MDA coordinates identified 9 themes related to MOOC didactical principles, which could be further operationalised by the individual statements that each theme consists of. They are: Learning design, Curriculum design, Methodologies, Learning Network, Self-regulated learning, Assessment, Technology & scaling, and Participation and Organisation. See Figure 1.

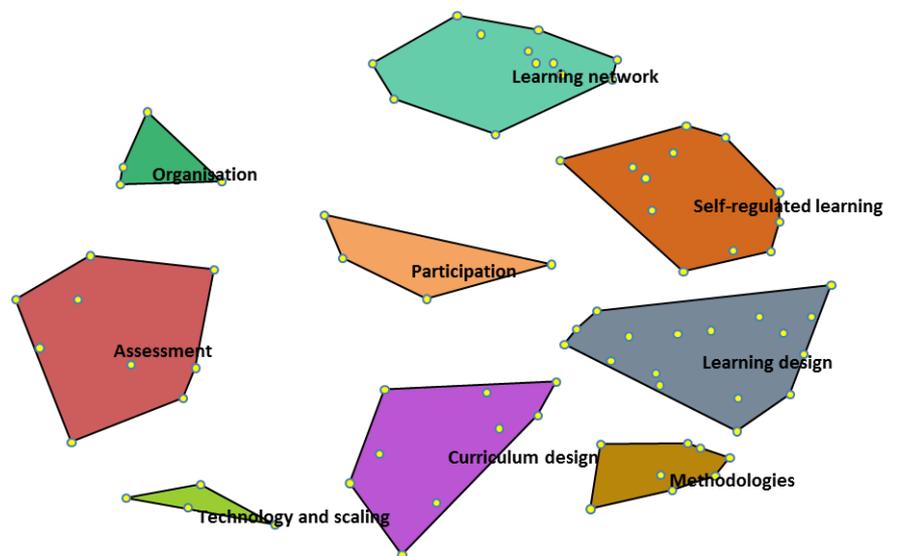
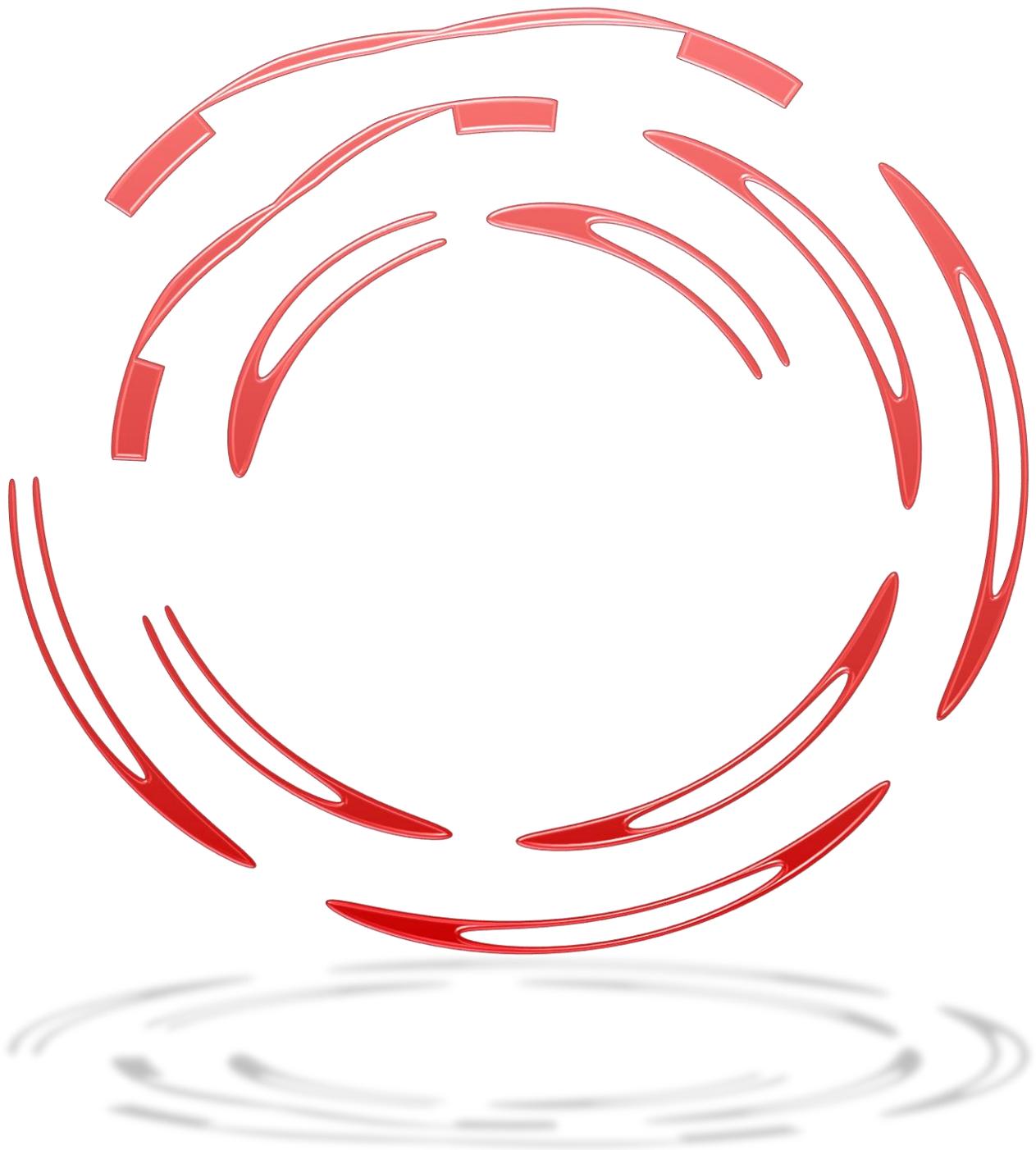


Figure 1. Themes MOOC didactical principles

Methodologies, Curriculum design, Learning Design, Self-regulated learning, Learning Network and Assessment are closely related to each other and specify directly MOOC didactical principles at different levels: macro, mezzo and micro. The other three, namely Participation, Technology & Scaling and Organisation, could be considered as supportive. The results of this study clearly suggest combining the instructional principles behind xMOOCs and cMOOCs and some concrete steps are proposed how it can be done.

Conclusions

The study identified some concrete guidelines for MOOC didactics, which are grouped into more general categories to be taken into account when designing a MOOC. The results clearly indicate the need for combining the instructional principles behind xMOOCs and cMOOCs and suggest some concrete measures for that. Self-regulated learning and the ideas inside this cluster plays a bridging role between more instructivist zone on the map (Curriculum design, Learning design Methodologies) and more connectivist zone (Learning network).



**EMPOWER expert pool:
Curriculum development
& Course design**

Alessandro Caforio

Innovative impact

While data has been always used in studies about educational technologies and distance learning, the amount of digital data about students' behaviours, performances, activities available today on online learning environments are unprecedented.

Learning analytics and Educational Data Mining are evolving and, specifically in Higher Education, studies and applications of data analysis techniques are emerging. These applications are focused on drop-outs prevention and on automatic alerts for both students and teachers, triggered by students' patterns performed on the online learning environments.

The convergence between Learning analytics and Artificial intelligence applications (natural language processing, cognitive computing) is creating new scenarios in which the role of the course designer will be crucial, having to deal not only with students but also with the "automatic" component of the Learning management system used.

Data science and instructional design: possible applications of educational data mining

Data analysis and distance education

Gathering data about students' performances and behaviours is a process started before the global spread of Internet access and the worldwide provision of online learning technologies. The correlation between cognitive styles, learning materials, students' performances is a classical approach to educational studies at every education level. In 1979, the Survey Research Department of The Open University UK published a study analysing 10 years of data about didactic activities and performances of thousands of students (McIntosh, 1979). The amount of available data was so huge that McIntosh admitted he was facing a "data explosion".

In the late 90ies, Tinto (1997) published a study identifying relevant factors triggering students' constancy, exploiting the possibility to access to a big database of different studies, covering 20 years of activities in different institutional context.

With the increased availability of large sets of data to analyse, the field of Data Mining in the educational sector gradually emerged (Romero and Ventura trace its origins to 1995, but only cite two documents before the year 2000).

While "Data mining" is a set of informatics techniques, ranging from decisional trees to artificial intelligence, used to provide meaning and visualization opportunities to datasets in previously unexplored ways, Educational Data Mining is a "sub-sector area that is responsible for developing methods to explore the specific data types that come from educational settings, use these methods to better understand students and the contexts in which they learn" (Zaiane, 2001).

Zaiane in 2001 identified as the "goal of the Educational Data Mining the transformation of students into better students", focusing research on "data-mining and machine-learning techniques that can be used to improve Web-based learning environments for the benefit of educators, to better assess the learning process, and for the benefit of students, to help them in learning activities" (Zaiane, 2001).

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Romero, C. and Ventura, S. (2007). Educational Data Mining: A Survey from 1995 to 2005. *Expert Systems with Applications* 33, 125-146.

Tinto, V. (1997). Classrooms as Communities. Exploring the Educational Character of Student Persistence. *The*

The age of Learning analytics

For Learning Analytics we are referring to "the measurement, collection, analysis and presentation of data on students and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs ", according to the definition given by Society for Learning Analytics Research (SOLAR) in the 2011 Educase International Conferences on Learning Analytics and Knowledge (LAK).

The widespread diffusion of Virtual Learning Environment (or Learning Management Systems) let all the institutions active in the training/education field nowadays manage large datasets. Every day, these systems accumulate an increasing amount of data regarding user interactions and online behaviors, personal data, system information, and academic information (Mazza & Milani, 2004).

Although the ability to track students are generally included under the generic capabilities of those online learning platforms, the specific features about data aggregation, reporting, analysis and visualization are often very basic or non-existent (Dawson, 2009).

One of the educational sectors presenting the most promising developments in data exploitation is the Higher education. In some Higher education institution, Learning Analytics begins to be used in a number of applications aiming to define the students' performances, their results and their commitment. The Learning Analytics become so capable to provide real-time "alert" allowing tutors to intervene promptly.

Cases of real-world applications

An interesting application of Learning Analytics has been developed at the Rio Salado Community College in Arizona. Rio Salado counts more than 41,000 subscribers to its online courses. The college has implemented an automated tracking system of the student's progress, the Progress Course And Engagement (PACE). PACE developer, Michael Cottam, writes "We can predict, after the first week of the course, with 70% probability, which will be students who complete the course successfully with a grade greater than or equal to 'C'".

A specific tool, Signals, developed at Purdue University, became a showpiece for Academic Analytics and is also cited as an example of "Action Analytics" that leads to useful results (Norris, Baer, & Offerman, 2009). Signals explores large sets of data and applies statistical tests to predict, during the courses, students

who risk being left behind. The goal is to produce "actionable intelligence" guiding students to appropriate resources and

Journal of Higher Education
Vol. 68, No. 6 (Nov. - Dec.,
1997), pp. 599-623

Zaiane, O. 2001. Web usage
mining for a better web-based
learning environment. In

Proceedings of conference on
advanced technology for
education, 60-64.



explaining how to use them.

Other applications worth mentioning: the Grade Performance System, adopted by the Northern Arizona University, which sends alerts to students on academic issues, exams and feedback on their preparation; or the one developed by the University of Madison-Wisconsin, that since May 2012 launched the Pilot Learning Analytics, a data-driven system capable to report to the teacher students at risk of dropping out.

Future evolutions

The full exploitation of the large amount of data available in online learning environments is far to be completed. According to the Analytics Maturity Model proposed by Gartner (2016), the most advanced applications of analytics in educational context available today are limited to the 3rd or 4th stage of the proposed scale. In this sense, analytics are mainly used to track students' activities, to certify their participation to a course and, in more advanced application, as a dynamic dataset capable of acting as an alerting system preventing students' drop-outs (which is, anyway, a great result).

The convergence between the acquisition of larger amounts of real-time data also in the educational field and the evolution and availability of AI-related solutions (**cognitive computing, machine learning, natural language processing**) opens new scenarios. While instructional design should take into consideration data and analytics also today, it's easy to predict, for the next years, improvements and evolutions impacting directly course and curriculum design:

- **Recommendation system** integrated in the Course authoring tools will let teachers receive suggestions based both on learning contents' metadata and students' usage and success rate related to contents;
- **Adaptive learning environments** will challenge teachers to create "liquid" courses and contents, defining learning outcomes and progressively letting LMSs guide students to their best learning path;
- **Over-clustering**: if an "intelligent", adaptive LMS classifies a student with a specific cognitive style, the risk is to never "challenge" that student letting him or her learn new ways of learning. Teachers and designers will play a key role in driving the AI revolution.

Assessment for Learning

Innovative impact

Online assessment becomes more and more important. The TeSLA system combines different technologies in one system (TeSLA system) and can be used in any LMS. Through TeSLA educational institutions are able to implement e-assessment in an accredited and certified way.

Comparable examples

There are several instruments on the market for authentication and authorship such as Safe Exam browser, ProctorU or Kryterion but these are either more intrusive, lack scalability or are solely based on final examination.

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Innovative Practices in e-Assessment: The TeSLA Project

e-Assessment is playing an increasingly important role in the transformation of higher education (Romeu-Fontanillas, Romero-Carbonell, & Guitert-Catasus, 2016; Whitelock, 2009). It has the potential to offer new ways of assessment with immediate feedback to students (Whitelock, 2009). However, e-assessment also creates many challenges for higher education (Al-Smadi & Gütl, 2008; Olt, 2002; Romeu-Fontanillas, Romero-Carbonell & Guitert-Catasus, 2016; Rowe, 2004; Whitelock, 2009). Most confronted issues in e-assessment are cheating, authenticity of users, security, and privacy (Al-Smadi & Gütl, 2008; Olt, 2002; Rowe, 2004). In order to overcome the disadvantages of e-assessment, innovative practices are needed.

The TeSLA project is one of the world-wide initiatives that is working on an innovative solution for e-assessment in online and blended educational settings. The TeSLA project is funded by the European Commission in the context of H2020 and coordinated by Anna Elena Guerrero, lecturer at the Open University of Catalonia (UOC) whereas the complete consortium comprises 18 expert organizations from twelve countries, including eight universities, both on-site and online, three quality assurance agencies, four research centres and three technology companies. The participating universities are the UOC (Spain), the Open Universiteit Nederland, Welten Institute (Netherlands), Sofia University and the Technical University of Sofia (Bulgaria), the Open University: Institute of Educational Technology (United Kingdom), IIR Telecom Bretagne (France), the Anadolu University (Turkey), and the University of Jyväskylä, Open University (Finland). The quality assurance agencies are the Catalan University Quality Assurance Agency (Spain), the European Association for Quality Assurance in Higher Education AISBL (Belgium), and the European Quality Assurance Network for Informatics Education EV (Germany), while the research centers are the University of Namur (Belgium), the Instituto Nacional de Astrofísica Óptica y Electrónica (Mexico), the Fondation de l'Institut de Recherche IDIAP (Switzerland), and Imperial College London (United Kingdom). Finally, the technology companies are Protos Sistemas de Información (Spain), LPLUS GmbH Company (Germany) and Watchful (Portugal).

The TeSLA project strives to develop a trust-based system for authentication and authorship of e-assessment in online and

Romeu-Fontanillas, T., Romero-Carbonell, M., & Guitert-Catasus, M. (2016). e-Assessment process: giving a voice to online learners. *Journal of Educational Technology in Higher Education*, 13(20). DOI: 10.1186/s41239-016-0019-9

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Resources

An Adaptive trust-based e-assessment System for Learning TeSLA: Technical Annex. Sections 1-3. <http://tesla-project.eu/>. TeSLA press release

Further information and developments on the TeSLA project can be found on the website (<http://tesla-project.eu/>) or from the following social media accounts:

Twitter: @teslaprojectEU;

LinkedIn:

<https://www.linkedin.com/company/10643342>.

blended learning environments. It combines different innovative technologies to authenticate and ensure authorship of students such as facial recognition, voice recognition, typing patterns or anti-plagiarism. The system will support diagnostic, formative, summative and continuous assessment models. During the project, ethical, technological and legal aspects, such as data protection are taken in serious consideration and get much attention. Moreover, the TeSLA system is being designed with attention for students with special educational needs and disabilities.

The project began in January 2016 and will last three years. During those three years, the TeSLA system is being tested by more than 10,000 students across Europe in three different project phases. The first phase - which ran from October 2016 till December 2016- involved small educational pilots with 600 students from 7 universities. During those pilots no technology but the coordination between all the partners and the defined protocols and data flows (learners, teachers, auditory, etc.) were tested. Valuable experiences from the first pilot have been gathered through focus group interviews and online questionnaires. From an educational perspective the process of inviting teachers for the first pilot and discussing the TeSLA aims and instruments provided valuable insights as well. In the second phase - which runs from March 2017 till June 2017 - medium test-bed pilots are conducted involving about 3,500 students. During those pilots the different technologies such as biometry, security and integrity, and document analysis instruments will be tested. The third and final phase consists of large scale pilots involving more than 16,000 students. During that phase the TeSLA system will be refined and the integration, reliability and scalability of the system will be tested.

The TeSLA system will be designed in such a way that educational institutions can choose to connect or integrate TeSLA within their existing learning environments. There will be both LMS plug-ins and standard LTI connectors available. As such, the teacher can import or create an assessment and choose him/herself what level of assurance and security (which instruments) (s)he wants to include for this specific assessment. The students complete the assessment as they would normally do. Afterwards, faculty members can access a full report of work authenticity and authorship together with the assessment responses.

The innovative impact of the TeSLA Project is to take advantage of the benefits of different technologies in one system (TeSLA system), through its integration and its application for e-assessment processes in any LMS. This will allow educational institutions to obtain evidence for e-assessing their learners during their learning process in an accredited and certified way.

Innovative impact

Assessment and evaluation of students' performance has always played an important role in the learning process, specially detecting the thematic core in which the students have learning flaws.

Innovative feedback considers a combination of elements: item Response Theory to measure accurate skill levels for every concept, a taxonomy of the content domain to scaffold flaws of knowledge acquisition and a clustering mechanism to identify groups sharing the same instructional needs.

The purpose of this research is to diagnose students' cognitive problems and provide personalized and intelligent learning suggestions.

References

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Student feedback based on concepts' assessment using calibrated tests

Innovate feedback and intelligent diagnose

The relevance of balanced tests

No matter the method used to apply a test (system-conventional pen and paper or digital, or through an STI), the student is assigned a score that reflects the state of learning. According to the results, the student should receive feedback, guidance, supervision, support and/or additional training to overcome the issues in which he had flaws. The score by itself is not enough to improve the learning achievement of students, unless appropriate guidance can be given.

The IRT has developed a set of mathematical models that assume that the probability that a person issues a response to a particular item can be described in terms of the position of the person on the latent trait or ability (named θ), and one or more characteristics of item: difficulty index, discrimination, and probability of hitting.

To estimate the level of skill, the items parameters must be calibrated, and the value of θ will be estimated using the response given by the student on each item. Resulting work material is a set of vectors containing the responses of students tested, a hierarchical structure that represents the issues that are evaluated, and a relation table that contains the rate at which a subject is evaluated within an item.

Semantic scaffolding of knowledge acquisition

To reach this level of analysis, it is necessary that the teacher or the expert on the subject to be evaluated considers the following

- Create a semantic representation of the subject to be evaluated
- Build a pre-requisite taxonomy showing the relationship between the concepts (a matrix).

- Each concept is evaluated by at least one item.
- Construct a matrix showing which concepts are evaluated in each test item (Items versus Concepts).
- Each value of Item-Concept represents the relationship between the test item i and the concept j , and represent a integer value from 0 to 5, where 0 represent 'no relationship' and 5-'very strong' relationship.
- The title of the issue to assess is treated as a concept within the system, but does not contain items to assess.
- According to prior knowledge of the population to evaluate, establish a threshold (0 to 1) by default, representing the minimum value that a concept must reach to ensure that the concept has been learned. This research assumes a threshold of 0.6, but this can vary depending on the level of past performance presented by the population.

On this basis, it is expected to estimate the skill level of students through the IRT, generate intelligent diagnosis of the student (indicating unknown issues, and ways of learning that will enable him to reach achievements), and apply the technical data Mining Clustering to generate groups of students who have cognitive weaknesses on the same or similar concepts.

Clustering the students

The cluster analysis search patterns in a data set by grouping the observations into clusters. The objective is to find an optimal grouping for which the observations within each cluster are similar, but different in the other cluster.

The required elements in the cluster analysis are two: first, the measure, which indicates the degree of similarity between objects; and second, the procedure for the formation of groups or clusters (methods).

The distance measures, correlation coefficients, coefficients of association and probabilistic measures of similarity are within the group of similarity measures. This approach works with distance measurements using the Euclidean distance of the characteristics of the variables with which it works in this test.

The hierarchical methods are most suitable, and more specifically, the method of Ward because it looks for a high variability within clusters. Thus, the generation of the cluster is essential, as it identifies the 'weak concepts' of each student, and calculates total weight of each weak concept within the test.

Conclusions

Combination of semantic representation, accuracy on test building and clustering techniques are a consistent cycle to provide student feedback.

Domain representations based on ontologies or taxonomies are a key ingredient of student diagnosis, as long as machine learning techniques, such as clustering according to concept assimilation, provide excellent results if the concept assimilation is recognized and evaluated separately.

With the above tools available for teachers, a system can provide feedback on the assessed needs identifying the cognitive level of the assessment of each student generating automatically a feedback process.

The New Digital Library

Innovative impact

I argue that Libraries should adapt to changing realities in research production, in supporting the development of social, database-driven networks of research.

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Santos-Hermosa G., Bacsich P., Rodosthenous C., Lappa E., Bitter-Rijpkema M., Truyen F. (2016). Library's Knowledge Resources for students and teaching staff in digital universities from EADTU. In Ubachs, G. (Ed.), Konings, L. (Ed.), *Enhancing European Higher Education* "Opportunities and impact of

Transforming research through the digital library, how can the library support Digital Humanities research?

Changing reality of research production in the Humanities

A new research paradigm

With the massive availability of multimode communications tools on the internet, the production cycle of new scientific insights has changed profoundly, even in the most traditional humanities research fields. While one would follow-up peer reviewed journals, and then digest what is read, combine it with proper source research and submit new articles that often taken up to 2 years to get published, a dynamic knowledge exchange biotope has been created in which science is cultivated at a much faster pace and with a much broader scope despite the ever growing specialisation.

The researcher is no longer individually browsing through the wealth of relevant publications: this is done by Google, JSTOR and comparable databases in the digital library. Search engines perform the first selection of relevant articles based on keywords and full text search. This is quite important: whereas titles and keywords were in the past the main tools to identify a possible article as a match for your inquiry, full text search means you can actually find relevant information in articles that before would never have caught the attention. This also allows one to do innovative comparative research, unearthing similarities in publications that do not necessarily share common references.

However, relying on search robots to do part of the essential heuristics in the research means that someone needs to verify whether the search algorithms do their job! This, amongst other, is already an example of a new task for library professionals as they aim to support researchers in a particular domain.

Competitive, project-based funding also means researchers work in teams, not only in particle physics but in art history and literature studies as well. Research today means direct communication with colleagues interested in the same domain,

new modes of teaching”
OOFHEC2016 Proceedings.
OOFHEC. Rome, 19-21
October 2016 (pp. 268-284).
Maastricht: EADTU.

Resources

Zotero: <http://www.zotero.org>

Pandoc: <http://pandoc.org/>

Markdown:

<https://daringfireball.net/projects/markdown/>

The Library Thing:

<https://www.librarything.com/>

MDRN: <http://www.mdrn.be>

Project Cornelia:

<http://www.projectcornelia.com>

Programming Historian:

<http://programminghistorian.org/>

CIVIC Epistemologies:

<http://www.civic-epistemologies.eu>

Riches: <http://www.riches-project.eu>

Trismegistos :

<http://www.trismegistos.org>

with a continuous exchange of information, often in project repositories, project reports, forums etc. This also leads to micro-publication: many projects share documents online, which are continuously edited, updated and annotated. These repositories yield valuable information sources, as some examples can show, see the websites of the projects CIVIC Epistemologies and Riches.

The availability of huge data sources online, e.g. with resources like Europeana, Gallica, the DPLA etc., confront the humanities researcher with a wealth of information that he/she can no longer oversee on his/her own. It necessitates the use of software tools to do the research, and leads to new methodologies making use of such tools such as Topic Modelling.

Web portals, databases and tools

I will give three concrete examples of changing practices in humanities research, one from literary studies (web portals), one from art history (databases), and one from history (tools), that show just how the internet environment impacts research strategies, and then will discuss how the library can support this.

MDRN is the result of a well-funded research project on modernity in literature. MDRN studies the literature of a key period in European cultural history: the first half of the twentieth century. All the different publications, events, journals, conferences in many languages are brought together in a database-driven web portal, from where it can be accessed. This ongoing repository of research production is an integral part of the output, and the starting place for new projects and future collaborations. The massive number of outputs made it imperative to build a database of e.g. the published books. Similarly, online book databases exist, also outside of the world of publishers, such as “The Library Thing”.

A second example is project Cornelia, where a social network analysis is performed on Art production in the 17th century. In this example, it is not so much the outputs that are published in a database, but the research data, i.e. the information from the sources. These kinds of databases are of growing importance in humanities research. While in the past the source materials used to produce an article were often not published, it is now possible to share them at relatively lower cost than printed publication, and make them available to fellow researchers. Project Cornelia will publish its database online, in such a way that other researchers can contribute and that links can be made with other, complementary databases produced elsewhere – e.g. by The Getty Institute; It will provide in state-of-the-art visualisation tools to help interpret the data. A similar effort is Trismegistos, a portal giving access to a wealth of research data from antiquity.

A third example comes from history, and highlights yet another aspect of the change in academic practices in the humanities: the use of software tools. In the website "The Programming Historian", researchers learn to use interesting tools such as Zotero, Pandoc and Markdown, but also learn new methods such as Topic Modelling to scan large text repositories for matching themes. Again, this website is conceived in such a way that research communities can contribute.

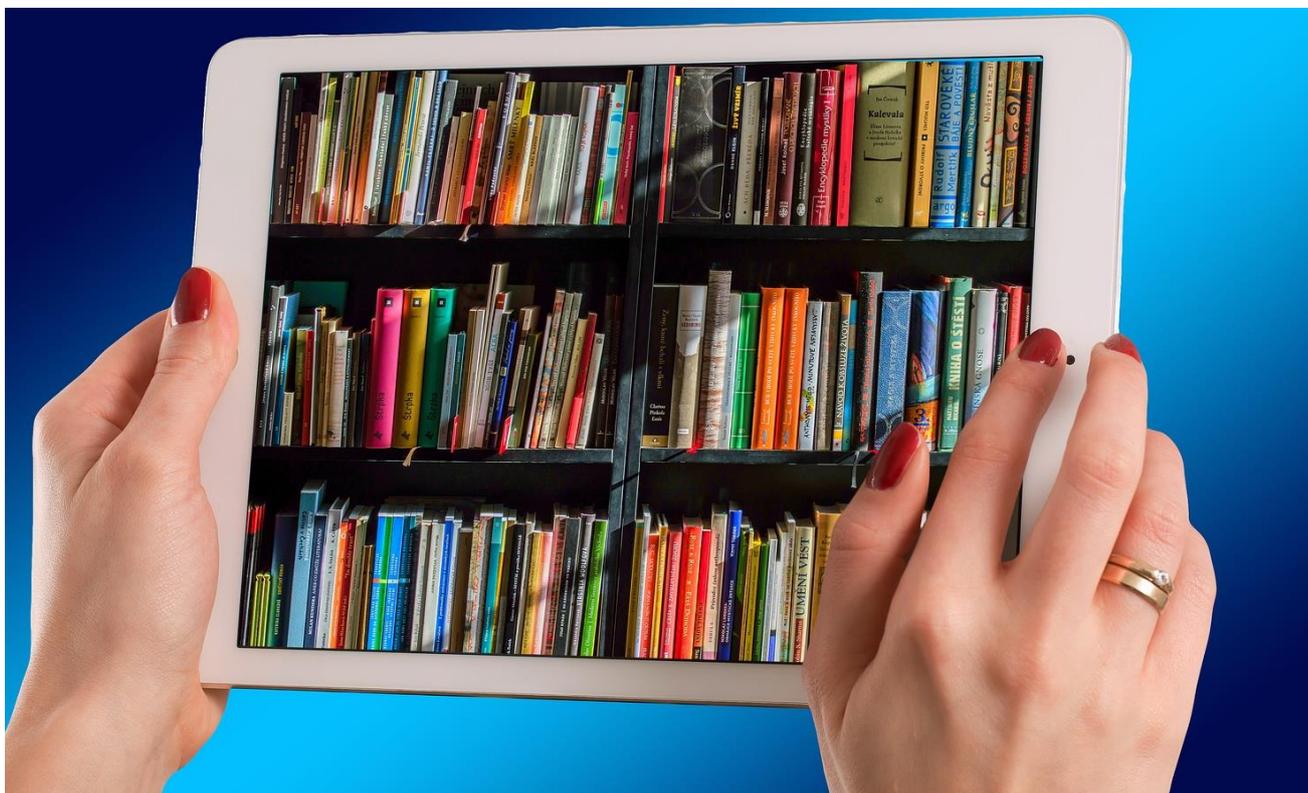
Role of the library

The library is moving towards a digital library that offers services to this kind of researchers. This means it offers no longer just a library catalogue and an increasing number of digital holdings, but offers instead the digital research environment that hosts and brings together the resources, the people, the primary and secondary sources in to one research network.

It is this social information network that forms the backbone of the current library. This is achieved by offering e.g. a repository with the publications of researchers, like lirias.kuleuven.be, which connects to social reference networks like academia.edu and ResearchGate.

The university library can give added value to bibliographic output by linking it to information about the researchers and research units themselves. This way, it fills a gap between what an individual researcher can do with tools like Academia.edu and on the other hand the big reference repositories like JSTOR. Supporting researchers to publish their outputs embedded in the context of the research unit offers more credibility to the individual papers. This allows readers to better estimate the impact of this research.

Of course, not all universities have the resources to build their own tailor-made social library research services, but by smartly integrating existing tools such as Zotero, The Library Thing, Academia.edu etc. the library can help researchers to make the most of the technology currently available.



**EMPOWER expert pool:
Knowledge Resources**

*Santos-Hermosa, Gema
and Rodosthenous,
Christos*

Innovative impact

Examples:

The case of the Open University of Cyprus (OUC)

[<http://www.ouc.ac.cy>]

The Open University of Cyprus (OUC), is the country's state university dedicated entirely to open and distance education. An Open University is a typical setup that requires learners and instructors to have digital skills for using the eLearning tools and enroll in distance learning programs of study. Learners of different ages and background choose to study a program of study. They do not have to be physically present at the University, but they have to learn how to use the eLearning tools available and more specifically the eClass eLearning Platform. To accomplish that, the eLearning team has prepared a special course (delivered online) using the same tools the learners use during their studies. Instructors are also enrolled in a similar course, for learning how to use the eLearning tools and services to maximize the learning possibilities of their classes and to help their students.

Moreover, learning analytics are available in all courses, for monitoring the learning process and detect possible

The 7 steps to support teaching, learning and research from Digital Libraries

Introduction

Libraries are well-positioned in order to work in cross-disciplinary teams in teaching and learning as well as in research landscape.

The new trends and significant challenges in education and the important developments in technology are drivers for developing and changing libraries. For instance, among others, the economic and political pressures, the evolving nature of the scholarly record and the research data management are examples of areas that are affected by this change.

The seven steps described in the following pages were selected by the authors after a thorough bibliography review, the application of previous professional knowledge and experience within the field of libraries and further discussion of the topic. These steps are intended to be a roadmap to accelerate the transformation of digital libraries aiming to support teaching, learning and research.

Seven Steps:

- 1) Increasing costs for access to academic journals make access to research data even harder for the smaller Institutions worldwide and restrict access to only the privileged few researchers. **Open access** and **Open resources** publishing models are a good solution to this problem and expand research accessibility. Even though this idea was introduced in earlier days, current status shows that we have not achieved a good level of adoption (NMC, 2017). Libraries should provide guidance to authors on how to publish under an open access model and promote the Open Access Repositories available. Moreover, libraries have another important role to play, in managing and promoting the distribution of **Open Data**. Libraries and information experts should aim in the release of Public Government data in a machine-readable format that allows digital citizens to consume them for promoting research, innovation and transparency.
- 2) One of the major assets of an academic institution is its educational content. Currently, a lot of it is delivered in an

problems.

Examples of current actions/projects that follow these steps:

- Open Access repository that holds Thesis & dissertations, publications, and cultural heritage artifacts
- Development of Open Data Portal (in progress)
- Integration of a Learning Analytics solution to monitor the learning process (early stages)
- Online training for instructors and learners to develop digital skills both for their studies and their careers
- Librarians offer remote personalized help to instructors for choosing suitable research material for delivering it to learners
- Integration of specialised tools to the eLearning Platform for importing bibliographical resources to each course and allowing easy search to the Library resources
- Promotion of Open Access publication models, in line with the European Union policy for research
- Focus on open technologies and open source tools that are expandable and adaptable to new modes of learning

electronic format and is constantly updated. The effort needed to create good educational material is huge and hence difficult for smaller institutions to absorb it. The use of **Open Educational Resources (OER)**, that is content for teaching, learning, and research resources available in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others, can be used as a potential solution for reducing costs. Libraries should guide instructors to use such content while preparing their courses and also promote Cross-Institution Collaboration for creating networks of open content.

- 3) The use of technology requires a digital skillset and practices that are crucial for success in the workplace and beyond. Academic institutions are responsible for developing students' **digital skills**, ensuring mastery of responsible and appropriate technology use, in blended and online learning settings and beyond. Libraries should provide the necessary frameworks and guidance for helping institutions assess current staff capabilities, identify areas that need improvement, and develop strategies to implement **digital literacy practices** (NMC, 2017)
- 4) Understanding how, when and where people learn is not an easy task. Today, we have the opportunity to use the vast amounts of data captured from online learning platforms using **Learning Analytics** that come with online learning for achieving this goal. Artificial Intelligence algorithms can be set up to predict a learner's future studying behaviour based on the historic activity. Libraries should be able to read these data and also train instructors to read and use them for setting up interventions (Kellam & Thompson, 2016) to support "at-risk" students and hence decrease dropout rates.
- 5) Pedagogical trends in higher education are decidedly more focused on the students and their learning activity. **Student-centred libraries** should offer flexible and adaptable resources to different study routes and particularities of each student ('**adaptive learning**') and services for creating or providing richer and varied learning. More flexibility is needed in how, when, and where people learn in online environments. However, students not only want the flexibility to fit learning around their lifestyles; they also are interested in a personalised learning experience (OU, 2017). This need is not only related to the always-connected devices but also with different formats and types of resources which are not supposed to be for learning (games, films, gadgets, software, simulations, etc). The e-learning model ensures that information is not consumed in the same way and format neither at the same speed. Adapted learning resources encourage people to become self-directed learners.

- Cooperation's between other Institutions for offering joint degrees and sharing resources and expertise

The case of the Open University of Catalonia (UOC)

[<http://www.uoc.edu>]

UOC is an online university founded in 1995 with the mission to provide students with lifelong learning, personalization, and educational opportunities through a Student-Centered educational model. It is based on three main elements: accompaniment, collaboration and knowledge resources. The UOC virtual library is involved in two of these elements: as a provider and manager of learning resources and also for supporting teachers in their teaching action.

Some actions, in line with steps included in here, that UOC Library is already developing are:

- The participation in learning materials creation and electronic edition.
- Adaptive learning support service: different patron-driven acquisitions, such as contracts with films and games platforms, software licenses, agreements with cultural institutions in order to use their resources, etc.
- Online Teaching Support Services tailored for

6) In relation to the above, there are a series of identified innovation areas in education (Santos-Hermosa, Bacsich, Rodosthenous et al., 2016) that are directly related to the library field of expertise. Libraries should work with teachers, educational technologists and designers in order to strengthen these advancements; such as providing "alternative" environments outside the classroom (**'cross-learning'**). These are suitable for students seeking information and trusted sources, as well as some training in digital and literacy skills in order to move easily during their learning process. The physical or online library spaces would allow students to interact with other resources and colleagues in order to create their own context of learning (**'context-based learning'**).

7) Library services platforms (LSP) and Integrated Library systems (ILS) represent a new conceptual approach to library automation, online service delivery, electronic resources management and provision of information access. Online learning requires new approaches to content collection management and curation of **digital libraries**. Library automation systems have emerged in order to satisfy this claim but they are not enough for becoming digital libraries. The information technologies enable a technical interoperability of content but digital libraries also need an **'user-oriented interoperability'** (Papy & Dinet, 2016), in order to allow the adhesion of a public connected to very different information profiles and techniques where the questions of consultation interfaces and content description processes are crucial.

Conclusions

New trends in education and important developments in technology, including the area of Artificial Intelligence, make the need of Lifelong Learning more evident than ever before. People need to constantly educate themselves to keep up with the technology evolution and minimize the risk of unemployment (Frey & Osborne, 2015). The role of Libraries is crucial in this domain for informing and guiding learners and instructors. In addition, libraries should be willing to join to the continued development train, in terms of challenges related to big Data, online identity, the evolving nature of the Scholarly Record and the Research Data Management and new patrons in the creation of content.

educators throughout the whole teaching process:
conceptualization and design of the courses, search and selection of specific learning resources, monitoring the use of them and Course assessment.
<http://biblioteca.uoc.edu/en/teaching>

- Digital literacy training
- Open Access initiatives: Institutional repository management, Guidelines for the deposit of students' final works, Plans to boost the OERs created inside the institution, Open data projects, etc.
- Research Data Management and provision of a range of services: searching for bibliometric data and assessing the quality of scientific output, support for publication - retrieving quality indicators-, assistance with the ORCID registry, bibliographical reference management, etc
- Developing measures to increase the international impact and visibility of UOC R&I
Open Access Journals:
<http://www.infographics.showroom.cat/uoc.html>

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Supporting the Success of 21st Century Learners

EMPOWER expert pool: Student support

*Ángeles Sánchez-Elvira,
Covadonga Rodrigo,
Timothy Read, Guillermo
de Jorge, José M^a Luzón,
Mehmet Firat.*

Innovative impact

Although ICT irruption has dramatically changed the educational landscape, many years before MOOCs phenomenon unveiled the global potential of online education in the educational horizon, open and distance education (ODE) universities had been dealing with large number of students during decades. Therefore, before the term "**Massive Open Online Courses**" was coined and rapidly adopted and expanded by traditional face-to-face universities (which discovered the potential of their opening-doors to the world), quite recognized ODE institutions had been already massive for years (mainly those placed in Asia, such as India or China universities), being considered as mega-universities.

Although not all of them have been integrating ICT at the same rhythm, many ODE universities have been among the first institutions in addressing online education improving student support services and giving raise to different educational modalities (e.g. blended, purely online, open, etc.).

Innovative Student Support Solutions for Large Groups

FAQ System and Short Videos: Orientating thousands of students

Anadolu University is considered one of the mega universities of the world due to its large number of students. Growing numbers are differentiating and diversifying the student profiles. These students' needs also vary considerably. Structurally, the Open Education System serves about 3 million students enrolled in the system. However, the number of people who want to join the system or who want to get information to know about the system is unclear. If each question is not clarified, it will create different problems. The information about the Open Education System must be provided via different channels by the university. Otherwise, students may suffer from unreliable sources of information (Firhat & Okur, 2016). Providing student support to millions of students requires, then, of well structured, ICT supported innovative tools and technologies such as **Frequently Asked Question Systems** and **informative short videos**.

Hashtag-based FAQ systems can be highly helpful especially for institutions offering open and distance education to large numbers. Frequently Asked Question service of the Open Education System is an asynchronous web environment. As explained in Firhat & Okur, (2016) the system has several components: (1) Hashtag; (2) Search engine; (3) Question archive; (4) Fixed question; (5) Social media share; and (6) I Want to Ask a Question section. Regarding issues about the Open Education System, the Hastag component can send a message via social media by attaching the #AskAndLearn tag on all the questions. Questions are further reviewed by the system staff and added to a question database. Then, if there is a previous answer for a specific question, students are guided to that answer. A further explanation can be found in Firhat & Okur, 2016 and the video in this report.

Consequently, ODE mega-universities, have been investing and developing innovative technologies to give answer to the new challenges they are coping with, improving, thus, their academic offer, resources and student support services, as well.

Now, immersed in the trend of a rapid digitalization of the whole educational world, ODE achievements and expertise can definitely be of great help for the rest of HE institutions in their transition to a digital education, giving response, for instance, to some of the difficulties that MOOCs are revealing, as well, dealing with large numbers of participants.

In the present report, the 3rd and 29th universities in the list of the HE institutions by enrolment, according to the Wikipedia, that is ANADOLU University, Turkey, and UNED, Spain, (both of them members of EADTU), introduce some main innovative solutions mediated by technologies, whose aim is to improve student support and the services to large numbers of students in blended and online environments.

Contributions are focused on:

- Optimization of online students' information and orientation strategies.
- Synchronous and asynchronous video-tutoring.
- Automatic formative assessment for open answers.
- A technologically-controlled system for face-to-face exams.

Short Videos are also very useful tools for students' support in open and distance education settings. One simple, clear short video can be more effective than many traditional student support services. That means more efficient service with faster and less effort to the larger number of students. Some examples provided by Anadolu University can be found in this report.

Online video tutoring services

Technological innovation in the UNED has enabled to go beyond the concept of virtual courses (implicit in eLearning) to cover the transactional distance present in eLearning which is greatly reduced by application of specialized ICT permitting the same types of interaction in distance learning context that are possible in traditional face-to-face learning scenarios.

Virtual presentiality features, impelled the creation of an **educational platform with synchronous IP videoconferencing** technology allowing Study Centers and their related Extension Centers to provide better services and broadcast tutoring services to new territorial areas not cover before. Tutoring sessions are undertaken once every week at UNED in more than 60 national study centers distributed throughout the country.

This possibility is achieved by the integration of synchronous communication and learning resource generation and management capabilities into the university intranet. The ICT architecture underling virtual attendance, namely **AVIP (Audio Video over IP)** tool combines **high-end video-conferencing with low-end web-conferencing, together with smart board-based learning resource manipulation**. These classrooms are interconnected by the use of MCUs (multi channel units) using the H.323 protocol to connect groups located in different areas together, sharing images and sound.

Related web applications have been developed and integrated into the open source educational platform aLF/dotLRN. At present, different combinations of video tutoring are offered connecting face-to-face remote classrooms, face-to-face with online video tutoring and completely online video tutoring. AVIP tool is currently being used for different **synchronous academic activities** such as online assessment, seminars, online meetings, conferences, etc., as well. Also, **recording sessions are stored in a digital repository**, increasing the flexibility of the tool and allowing students to view them at their pace (just as video on demand), even though interactivity is kept in live sessions.

Quite recently, automatic semantic indexing techniques have been applied to improve accessibility to the resources by semantically integrating the professionally produced video content and the user-generated content via multilingual

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Olmos, R., Jorge-Botana, G.,

curriculum-related metadata. Related to this, accessible mobile apps to easily navigate through the content have also been launched in Apple Store and Play Store following **Design For All principles** and responsive design.

Automatic Evaluation System for Open Answers

G-Rubric is an automatic evaluator of discursive texts that provides a minimalist workspace in which students, alone or in the company of other colleagues and teachers, perform exercises based on academic writing of any educational level, subject and degree of difficulty. **G-Rubric**, its materials and how to use them are ordered according to a serious and consolidated **model of instruction**, where the guided practice of writing in combination with the real-time **formative assessment** becomes an exceptional tool also for the **acquisition of thematic knowledge** and the **development of thinking skills**. **G-Rubric** is on the Internet and its access is universal; it is always available, your results are instantaneous and never get tired. **G-Rubric** is a multi-lingual student-centred learning tool that provides multiple opportunities, personalized feedback, and ratings on the correctness and adequacy of the content of your "open" responses.

To get people (students) to express themselves in writing properly, that is, to reach an adequate writing competence, is an educational objective that cannot be waived, prioritized and, of course, ambitious. Because writing competently is not offering correctly linked words in phrases, paragraphs and documents according to the syntactic and grammatical rules. **Writing competently** is something immensely more complex and cognitively demanding: to express adequately in writing is to know how to translate a portion of our thinking (Foltz, 2015) impregnated with facts, concepts, opinions, valuations, inferences, feelings, etc., in a clear, precise, structured and intentionally adequate manner. **Learning to write** requires frequent practice, personalized mentoring (Mazzie, 1987) and personal effort to improve and **G-Rubric** provides the "tailor-made" opportunities that each learner needs and helps the teacher in his or her task of personalizing their teaching and directing progress of their students.

G-Rubric is a computer solution developed by **Semantia Lab**, a technology-based company specializing in **natural language processing** created with the academic and institutional support of the **Universidad Nacional de Educación a Distancia (UNED)**. **G-Rubric** is the result of the **research activity** has been going on for the last 9-10 years on processing, analysis and troubleshooting related categorization, classification, indexing, evaluation of large volumes of information, as well as modelling and storing numerical and linguistic knowledge.

Luzón, J.M. Martín-Cordero, J.I. & León, J.A. (2016). Transforming LSA space dimensions into a rubric for an automatic assessment and feedback system. *Information Processing & Management*, 52(3), 359-373. DOI: 10.1016/j.ipm.2015.12.002

Resources

What is AVIP?

<https://www.intecca.uned.es/inteccainfo/plataforma-avip/que-es-avip/>

G-Rubric

www.grubric.com

Semantia Lab

www.semantialab.com

Interest Group in Latent Semantic Analysis

www.elsemantico.es

Videos

Innovative Student Support for Large Groups. Full video
A.Sánchez-Elvira y C.Rodrigo

Anadolu University

- FAQ System
- Short videos
- Large Numbers and Diversity

UNED

- The Technological Framework Underlying the UNED Examination System
Timothy Read
- G Rubric: Automatic evaluation system for open answers. An exceptional tool for teachers and students. Guillermo de Jorge & José María Luzón Encabo)

Technological Solutions for face-to-face exams

The technological framework underlying face-to-face exams in UNED is extremely sophisticated, as well as effective, taking into account the complexity of its organization.

Face-to-face exams are undertaken three times a year at UNED in more than 60 national (and some international) study centres. The online distribution of these exams to the centres, the management and control of the actual examination sessions, and the online return of the scanned exams to UNED is undertaken by a computer system called The UNED Virtual Exam Management System (or VEMS), developed at the technological development centre of the UNED at Barbastro. The system functions in six phases.

Firstly, the lecturers prepare the exams and upload the different models to the system where they are encrypted and stored. Secondly, during the exam period, the relevant exams are decrypted in real time, to be printed by the exam board and given to the students. For students with disabilities that would make it impossible for them to undertake them in normal conditions, the exams can be decrypted directly onto a computer so that the student (depending upon his/her disability) can answer using a word processor or a combination of text-to-speech and voice recording software.

Thirdly, once an exam is finished, it is scanned and returned digitally to Madrid for correction. Fourthly, the exams can then, be corrected by the teachers using the corrector software present in VEMS.

Fifthly, the grades from the exams are combined with the continuous assessment grades taken from the university's LMS. Sixthly, the overall grade can be communicated to the students via a mobile app, messaging, email or upon access to the virtual student academic record.

Analytics are used to model student attendance to the different exam periods in the different regional study centres so an appropriate number of university staff can be sent to invigilate them. In the academic year 2015-16 the system processed almost 300,000 exams. The use of software developed in house for this purpose is very important due to the specific nature of the problems that need to be addressed, making the use of off the shelf commercial software impossible.

Innovative impact

This paper looks at some of the potential innovations in distance education support and estimates the chances of them being mainstreamed in DE within five years.

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Innovations in Distance Education Student Support: What are the chances?

Virtual reality (VR)

One innovation likely to make a big impact in the next few years is virtual reality where you strap on headset and are drawn into an increasingly realistically feeling visual and auditory environment in which you can be involved in very convincing ways. You can see the possibilities for teaching in all sorts of environments - undertaking scientific experiment, engineering, architecture and so on. It might also be possible to use in social science and humanities teaching - why not allow students to be virtually involved in architectural digs?

But costs of VR are high; the sets currently cost US\$400 or so, and they need powerful computers and very high speed broadband. VR environments are also very expensive for distance institutions to produce. Costs will come down a little but will they reduce enough? And one writer who has experienced a VR history activity worried about 'the nagging doubt that, used clumsily or simply for its own sake, VR could overwhelm students, distracting them from the need also to learn things that are not visual, and leaving them with the wrong kind of memories' (Matthews, 2017).

Chance of VR being widespread in distance education in five years - 20%

Artificial intelligence systems

These are IT systems where humans are replaced by highly sophisticated computer programmes. This is already happening to relatively routine occupations - getting information about - for example - getting your broadband fixed. Some commentators believe that AI is the biggest threat to employment since automation.

But can human tutors in distance education be replaced by artificially intelligent programs? An institute of technology in the US has just announced that it had developed such a program in a course on artificial intelligence ('Artificial Intelligence' 2016) The program is called 'Jill Watson' (as it used the IBM 'Watson' platform) and was developed over several years by looking at the questions posted on the course online discussion forums and

Resources

Book

Simpson, O (2013) '*Supporting students for success in online and distance education*'. Pub Routledge, New York (2013) ISBN 978-0-415-50910-7

Book chapter

Simpson, O. (2012) 'Technology supported assessment for retention' chapter in '*Captivation: Student Engagement and Development through Assessment*' Ed. Clouder, Brougham, Jewell, and Steventon iPED Coventry University, pub. Routledge ISBN 978-0-41561820-5

Website

'Supporting Students at a Distance'
www.ormondsimpson.com

feeding 'Jill' the answers. She (it) was useless at first but it's now claimed she (it) can answer student' questions with a 97% certainty. It's claimed that students have only just learned that Jill is a program, but are happy with the discovery.

So are distance tutors at risk of replacement? A recent report on which jobs are most likely to be computerised in the next few years found that 'higher education teacher' was amongst the least likely to be automated (Frey et al, 2013) So I suspect that except for some fairly specific topics (such as AI) human beings will be needed in online education for many years to come.

Chance of AI being widespread in distance education in five years - 30%

Emotion detection systems

A recent online teaching development involves webcams. A student's webcam is used to focus on the student's face and sophisticated software is used to detect when the student was experiencing difficulties. Presumably the program could analyse expressions such as puzzlement, frustration, boredom - even anger. The program would then send an appropriate response. The UKOU is working on such a program, although a commercial version already exists - see www.emotuit.com.

Chance of emotional detection systems being widespread in distance education in five years - 10%

Learning analytics

This is defined by one UKOU researcher as 'the measurement, collection, analysis and reporting of data about learners ... for purposes of understanding and optimising learning...' (Clow, 2016). It's not yet easy to find examples of the use of learning analytics in enhancing student retention, but one example is using statistical analysis of previous student results in order to predict current students' chances of success. That enables support to be focused on the most vulnerable students in any cohort (Simpson, 2006).

Chance of Learning Analytics being widespread in distance education in five years - 80%

MOOCs

Until recently MOOCs (Massive Online Open Courses) were thought to be the future of distance education both in terms of accessibility and success. There now appears to be some scepticism about this possibility based on two factors:

- Completion rates in MOOCs often appear to be 7% or less (Bothwell, 2016)

- More than 80% of the people taking MOOCS are already well qualified to at least first degree level.

Both these factors suggest that MOOCS are not widening successful access to distance education in any meaningful way, but are being used by already qualified people to undertake some modest upskilling or updating.

In addition it is proving challenging to 'monetise' MOOCS in a way that maintains their essential characteristics of accessibility and efficiency, whilst making an adequate return to the presenting institutions.

Chance of MOOCS being the dominant force in distance e education in five years - 10%

Online feedback and assessment development

Feedback and assessment area are key areas for retention in distance education and there are some hopeful developments such as interactive computer marked assessment where students are offered rapid feedback to multiple choice quizzes, and polling where students can be asked questions or indicate understanding online.

Chance of online and feedback and assessment becoming more essential components of successful distance education in five years - 90%

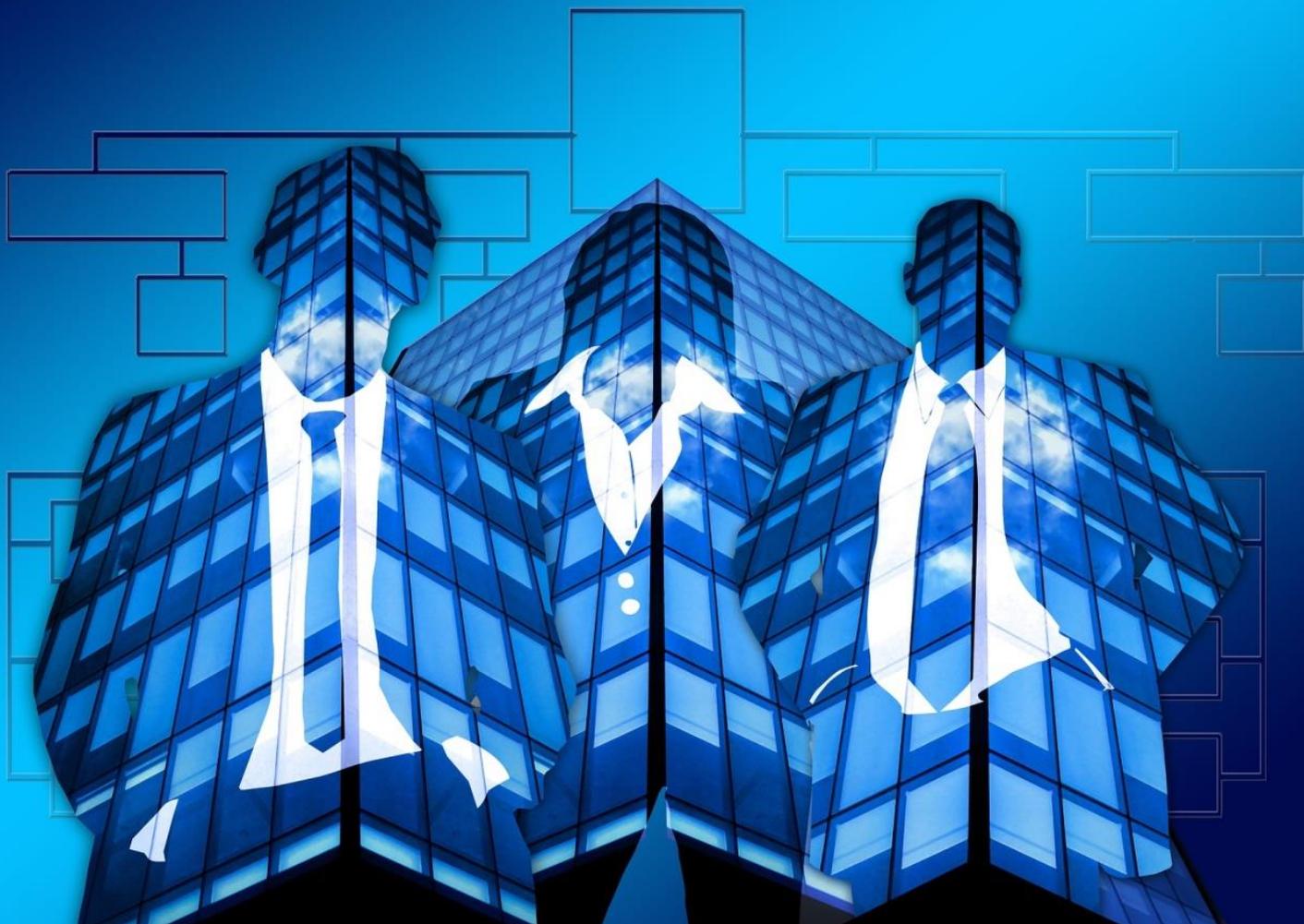
Communication and Social software

The biggest technical advances are likely to come from developments in communication and social software such as Facebook. But social software is also one of the most confusing areas for any distance educator - which to use? Email now appears to be 'old hat' for many students who are not only using Facebook, but text messaging, WhatsApp, Yik Yak, SnapChat, Twitter, Instagram and Yammer. Nevertheless this is where distance educators are most likely to be able to 'personalise' distance education, the most essential step in transforming the problem of distance education retention.

Chance of communication and social software becoming even more absolutely essential in distance education in five years - 100%

Something else

There may well be other developments coming along which I've missed. I still hope that there will be a breakthrough in what we know about motivating students to learn at a distance for instance. But as the Nobel -winning physicist Nils Bohr once said 'Prediction is very difficult, especially if it's about the future'.



Contributing institutions

European Association of Distance Teaching Universities (EADTU) | The Netherlands
Universidad Nacional de Educación a Distancia (UNED) | Spain
Dublin City University (DCU) | Ireland
The Open University (OUUK) | United Kingdom
Università Telematica Internazionale UNINETTUNO | Italy
Universidade Aberta (UAb) | Portugal
The Open University of the Netherlands (OUNL) | The Netherlands
Hellenic Open University (HOU) | Greece
Anadolu University | Turkey
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