What is the innovation beyond the 'state of the art' in e-learning?

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Abstract

The motivation for this discussion paper comes from the recent FP7 framework ICT call for technology-enhanced learning applications for the 21st century that go beyond the current "state of the art" in e-learning. In this paper the question of the innovation beyond the "state of the art" in e-learning is considered along with identification and discussion of some of its defining characteristics in the context of higher education. A review and analysis of innovative learning applications and models is presented, with a specific focus on learning environments, and learning interactions. The University of Hertfordshire is used to provide an example of a "state of the art" University regarding the adoption of e-learning applications and methods in day-to-day learning and teaching practice. It is suggested that innovative and "beyond the state of art" e-learning models, tools and applications will be required to support high degrees of personalization and collaboration.

Introduction

The motivation for this discussion paper comes from the recent FP7 framework ICT call (ICT-2009.4.2) for technology-enhanced learning applications that go beyond the current "state of the art" in e-learning. The scope of the paper considers the first part of the call, "Learning in the 21st Century", that focuses on:

> "the design of the future classroom (exploring both technology and teaching practices, for teachers and students, their orchestration for specific, justified age groupings or subjects), supporting individualization, collaborations, creativity and expressiveness in more active, reflective and independent learning activities" (European Commission, 2008).

The remaining objectives of the call such as, links between individual and organizational learning, adaptive and intuitive systems for learning (including games), revolutionary learning appliances (including toys) are not discussed in the paper.

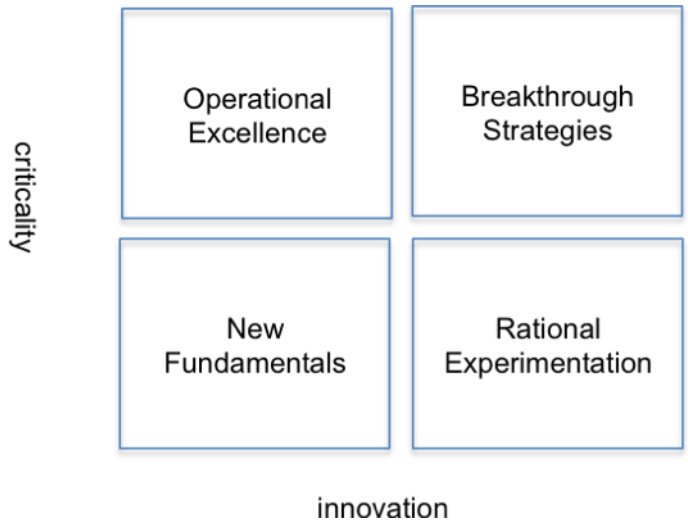

Figure 1. *Internet Value Matrix*

The Internet Value Matrix (Figure 1), a popular e-business evaluation framework developed by CISCO, is used as a basis for organizing e-learning applications into different categories, according to their criticality and degree of innovation:

- New fundamentals - technology-enabled non-critical applications and practises that are low risk and driven by cost-reduction and efficiency objectives
- Operational excellence - needs-driven learning applications and practices that are medium risk, and might involve some degree of re-engineering
- Rational experimentation - highly innovative initiatives, usually involving creation of new learning or business models, new market segments or channels
- Breakthrough strategies - high-risk initiatives, transformative applications and practices.

In this paper the question of innovation beyond the “state of the art” (the “Breakthrough strategies” box in Figure 1) in e-learning is considered, together with an attempt to identify and explore some of its defining characteristics in the context of higher education.

In discussions regarding the “criticality” of e-learning applications the needs of students, employers and other higher education stakeholder, such as governments should be taken into account:

- Students prioritize and value real-time interactions, individuality, creativity, constant stimulation, connecting and sharing. (Bean, 2010),

- Employers are increasingly interested in development of non-cognitive, personal and team-working skills. For example, e-skills UK has worked with the major IT industry employers on defining a set of personal competences and skills that are equally important to employers as technical, business and project skills (ITMB, 2006).
- Government requirements are driven by the needs of digital economies such as, development of lifelong learning networks, increasing participation, cost-efficiency, greater diversity of educational provision etc (Educause, 2010).

Case study in a 'state of the art' university environment

As a result of its pioneering work on implementation of the proprietary VLE entitled StudyNet, the University of Hertfordshire was awarded substantial CETL funding in 2004 for further development of e-learning capabilities and has since became one of the leading UK universities in implementing and evaluating different modalities of e-learning, especially those focusing on blended learning. Blended-learning is a special case of e-learning, that emphasises the importance of face-to-face contact and the underlying pedagogies in any learning design:

> "The key assumptions of blended learning design are: thoughtfully integrating face-to-face and online learning, *fundamentally rethinking* the course design to optimize student engagement" (Garisson and Vaughan, 2008).

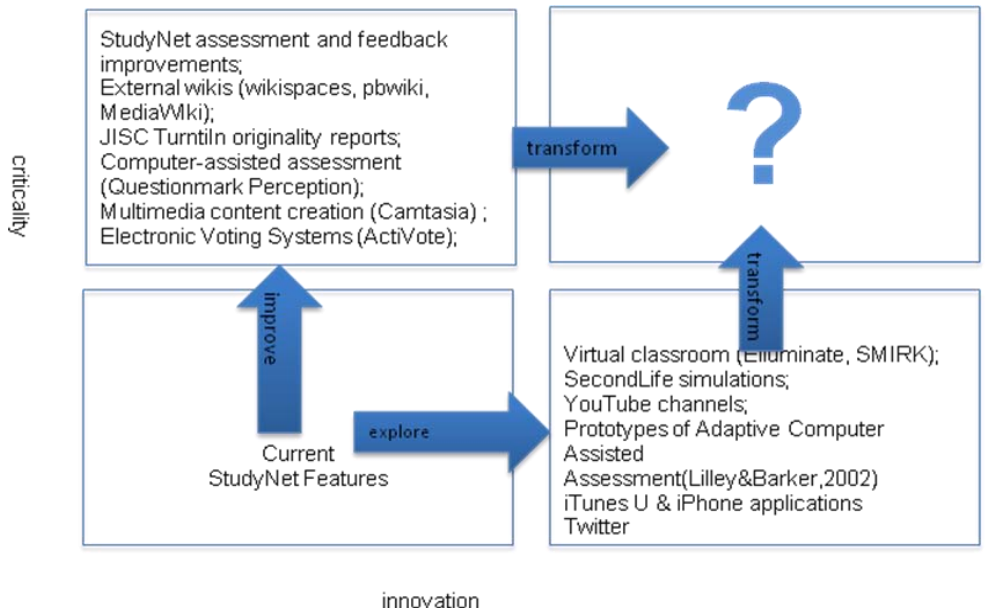

Figure 2. *UH e-learning inventory*

While most teaching staff are using standard StudyNet features in day-to-day teaching practice, an increasing number of teaching staff, estimated at 25%-30% are engaging with more innovative aspects of blended learning. Therefore, the current "inventory" of blended learning at UH includes not only the StudyNet–based applications and related practices, but also, other "informal" ways of learning that extend beyond the institutional walls (Leadbeater, 2009) and which are aiming to either *improve* existing practice ("Operational Excellence" box in Figure 1) or *explore* new blended learning opportunities ("Rational Experimentations" box in Figure 1). However, to move "beyond the state of the art", the University will need to provide students with "transformational" learning experiences, based on highly innovative learning environments. In the next section, we explore what such an environment might be.

Innovative learning models and applications

A simple lexical analysis of the recently funded EU ICT projects in the category of education and e-learning reveals as dominant themes (apart from those related to subject-specific learning applications): collaborative learning (12%) and personalized learning (10%). This finding is further supported by the analysis of students' and employers' needs discussed earlier. In the rest of this section, the specific characteristics of "transformational" innovation in each of these two areas are considered.

Learning Environments: from VLEs to PLEs

While Virtual Learning Environments (VLEs), also known as MLEs (Managed Learning Environments) or LMSs (Learning Management Systems) are a predominant model of technology-enhanced learning environments in higher education today, they tend to be institution-centric and administrative environments, "geared entirely to the management needs of the institution rather than the needs of individual learner".

To address this anomaly, current educational research focuses on the Personal Learning Environments (PLEs that provide learners with more control over their learning experience and in particular, in managing their learning resources, work in progress and learning activities.

Currently, PLEs are supported at a very basic level by standard VLEs such as Moodle, WebCT, or StudyNet, through individual portals and views but with little or no specific capabilities for personalized learning, such as: setting of learning goals, managing process of learning, communication with others in the process of learning, and connecting with other learning resources and systems.

Since the late 1990's, many PLE models and prototypes have emerged (Table 1), but despite some recent success in adoption (e.g. a recent PebblePAD conference attracted 80 delegates from 3 different continents and produced more than 25 case-studies) there still remains a lack of significant uptake by either educational institutions, or work-based learning providers.

While the slow uptake of PLEs can be contributed to the low level of investment compared to that for institutional VLEs, it can be argued that “up-to-date” PLE prototypes and models have failed to realize the initial promise of “learner-centric” and “learned-driven” experience. In particular, apart from standard Web 2.0 features for content creation, aggregation and syndication the PLEs offer little or no capabilities for flexible learning, adaptive testing, coaching, dynamic learning workflows etc.

Table 1. *PLE Examples*

PLE	Features
pebblePAD	Creation of action plans, abilities, achievements, experiences and thoughts.
PLEX	Setting and realisation of learner goals with the creation of learning opportunities and their transformation into learning activities.
Connected Learning Community PLE	Blog-centred environment, linked together and aggregating content using RSS feeds and simple HTML scripts
University of London Computing Centre Personal Learning Plans (PLPs) and e-Portfolios	Customizable Views, Reflective Journals, Networking, C.V. Builder
Manchester PLE	Social networking service with integrated concurrently-editable multi-user media spaces
Dokeos	Adaptive testing, rapid content authoring, course sequencing, coaching and interactions, individual reporting
PLEF	Aggregating, managing, tagging, commenting, and sharing of learning resources
eLearning Companion	A computer-based “conversational agent” designed to give practical support, guidance and focus to the independent learning activities of adults who currently lack the confidence or the opportunity to take part in organised learning(EU 6th Framework Companions Project, documented in Eynon, Davies and Wilks, 2009)

Semantic Web ideas provide a promising framework for realizing some of the PLE potential, especially regarding the dynamic and rapid creation of flexible, adaptive and "semantic-aware" learning environment. The full study of the role of Semantic Web in education is beyond the scope of this paper, but an obvious application is automated generation of e-learning content from the existing web corpus. According to the recent Google Squared Demo at Searchology 2009 one of the hardest computing problems today is "looking at the unstructured web and abstracting values and facts and information in a meaningful way in order to present it to users, building out some of these ... in an automated way." Tools such as *text2onto* (Montoyo *et al*., 2005) are supporting automatic extraction of the "meaning" (in a form of an "ontology") from an arbitrary text domain. While it can be argued that a mental abstraction of a knowledge domain forms a significant part of the cognitive process, automatically generated knowledge domain models, such as ontologies, can aid the learning journey by providing a "seed" for "active conceptualization" as well as a "trigger" for a "learning conversation" (Cubric & Tripathi, 2009).

Another enabler for the future PLEs is the increasing proliferation of open educational resources (e.g. OER Commons , MIT OpenCourseWare, WikiEducator , Merlot etc) , founded on the principles of Gideon Burton's "Open Scholar", the one who makes their intellectual projects and processes digitally visible, invites and encourages criticism, creates new type of education, uses and contributes to open educational resources (quoted in Anderson, 2009).

The challenge is to extend the PLE with the tools for easy search and navigation of open resources, as they remain hard to find and are not always easy to deploy.

"Personalization" also appears as a dominant theme in recently funded JISC projects on the "Transforming Curriculum Design and Delivery through technology" program, one of the biggest programs under the JISC e-Learning theme. The majority of awarded projects are developing ideas around the "personalized curriculum" topic, such as,

- "Tagging" of curriculum with competences to assist learners in choosing electives (Manchester Metropolitan University)
- Individual curriculum creation where learners will be able to select provision suitable to their needs, construct award and negotiate assessment, with structured support from a personal coach (Leeds Metropolitan University);
- Co-ordinated tools and services which will use learner based timeline scenarios to assist staff to reflect upon and formalise innovative adjustments to the curriculum (University of Ulster).

The innovative PLEs will therefore need to integrate features for creation and management of personalized curricula.

Learning Interactions: from collaborative to net-centric learning

There is plenty of evidence that collaborative learning has been and remains one of the major topics in educational research in the last twenty years. Although there are many definitions of collaborative learning, they all emphasize that collaborative learning takes place within a group and as a result of group interactions, where knowledge is created as it is shared. Some authors, including Panitz (1996) further distinguish between "collaborative" and "cooperative" learning, stating that "collaboration is a philosophy of interaction and personal lifestyle whereas cooperation is a structure of interaction designed to facilitate the accomplishment of an end product or goal." So, for example a group of students discussing a lecture is an example of collaborative learning, but not of cooperative learning. An example of cooperative learning would be a group of students working together to create a web page.

The latest Educause Horizon report (Johnson *et al*., 2010) in their influential and methodologically sound trend predictions, includes collaborative learning as one of the four major topics in 2010, suggesting that schools "have created a climate in which students, their peers, and their teachers are all working towards the same goals" and that "the emergence of a raft of new (and often free) tools has made collaboration easier than at any other point in history." In addition to the "collaborative-cooperative" divide, Terry Anderson's "taxonomy of many" (Anderson, 2009) distinguishes further between group, network and collectives as basic formations for quality e-learning. While groups are the principal formation for collaborative and cooperative blended learning, networks and collectives are emerging formations for "net-centric" e-learning. All three formations are based on different metaphors, they exhibit different attributes, and are supported by different tools (Table 2). The participatory motivation in the latter two is founded less on the need to "socialize" and more on the ideas of "social capital" and altruism.

Table 2 *Taxonomy of Many (Anderson, 2009)*

	Metaphor	Attributes	Tools	Participatory motivation
Group	virtual classroom, VLE	structure, pacing, leadership, sense of privacy, time-limited, blended	discussion forums, wikis, wiggio	recognition, relevance, socializing
Network	virtual Wenger's 'community of practice', Web 2.0	fluid membership, emergent norms, activity ebbs and flows, rarely f2f, little expectation of reciprocity, transparency	google wave, digg, facebook, wePapers, courseHero, elgg, ning, voicethread	altruism, raising own reputation and social capital
Collectives	emerging net-centric applications	leaving traces on the net, aggregate the information and extract knowledge, wisdom of the crowd idea	Slashdot, Omgili	altruism, raising own reputation and social capital

These ideas are very much in the foundation of Jenkins concept of "participatory culture" (Jenkins *et al*., 2006), a culture that shifts the focus "from one of individual expression to community involvement" and comes in four different forms:

- Affiliations, formal and informal memberships in online communities that are centered around various forms of media, such as MySpace, Facebook, message boards, game clans etc.
- Expressions, production of new creative forms, such as digital sampling, skinning, video making, fan fiction writing, zines, mash-ups etc
- Collaborative problem-solving, working together in teams, formal and informal, to complete tasks and develop new knowledge (such as through Wikipedia, alternative reality gaming, spoiling, theorem proving in mathematics etc)
- Circulations, contents that are shaping the flow of media (e.g. podcasting, blogging).

Conclusions

In summary, the "breakthrough" and "beyond the state of art" e-learning applications, tools and techniques (Figure 3) will need to support high degree of individualization and collaboration and either encompass or interact with personalized learning environments that will in addition to recording, sequencing, aggregation and syndication of learning resources also:

- Monitor, guide and coach individual learning experience
- Generate learning resources from arbitrary web corpus
- Support the learner in acquiring the digital and media literacy skills through different forms of "participatory culture"
- Incorporate visual as well as textual data analysis (Johnson et al. 2010)
- Provide tools for interacting with networks and collectives of learners
- Motivate, maintain interest, enthusiasms, enable "playful creation" (Ebersbach *et al*., 2005) and sustain the net presence
- Enable seamless access and creation of open learning resources and
- Be founded on sound learning theories and aligned with the learning and teaching practice.

The future e-learning environments will move away from the institutional VLEs to net-centric, "informal" learning spaces, that will increasingly use the "wisdom of the crowd" and be supported by open content and semantic-aware applications.

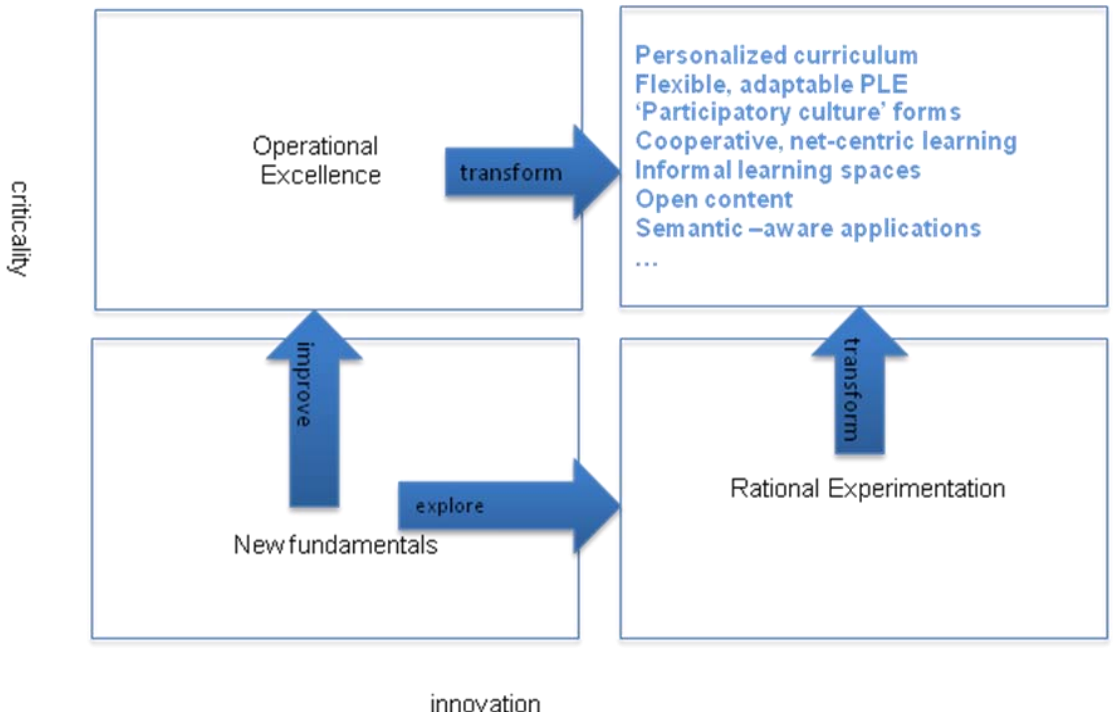

Figure 3. *Breakthrough e-learning strategies*

The challenges facing students, educators and higher education institutions related to the new "breakthrough" e-learning applications are numerous.

In order for personalized learning and teaching to take place, the data about individual learners will need to be collected and mined for trends, predictions and subsequent coaching and guidance. This will inevitably raise questions of privacy, confidentiality and ownership of the data.

The authors of the Educause Horizon report (Johnson, *et al.*, 2010) continue to emphasize the critical challenge of providing training in digital literacy skills and techniques to all disciplines including the teacher education programs. Jenkins *et al.*, (2006) confirm the importance of these skills and furthermore, see them as the main enabler of the new "participatory culture". Amongst those "21st century media skills" are: problem solving through play, discovery and improvisation through adoption of alternative identities, meaningful sampling and remixing of diverse media content, interpretation and construction of simulations, multitasking, distributed cognition, collective intelligence, transmedia navigation, networking and negotiation.

A further challenge is not only to develop the new media literacy skills, but also to maintain interest and enthusiasm and sustain the net presence and net capital of learners who are often "not deeply digitally engaged" (Anderson, 2009). Carefully selected PLE tools could play critical role in this transformation process.

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