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# Alpine Rendez-Vous STELLAR White paper

## Workshop 2: Methods and models of next generation technology enhanced learning

Authors:

### Workshop Organisers:

Daisy Mwanza-Simwami, Agnes Kukulska-Hulme, Gill Clough, Denise Whitelock & Rebecca Ferguson

Affiliation: The Open University, United Kingdom.

### Provocateur & Grand Challenges Co-ordinator

Mike Sharples

Affiliation: University of Nottingham, United Kingdom

Date: 27<sup>th</sup> May 2011

## 1. Introduction and motivation

The main objective of the methods and models of next generation technology enhanced learning workshop (WS2) was to explore issues connected with setting the scene for developing methodological innovations for next generation technology enhanced learning (TEL) focusing on methods and models for:-

1. Researching next generation technology enhanced learning
2. Designing next generation technology enhanced learning
3. Evaluating next generation technology enhanced learning
4. Assessing next generation technology enhanced learning

### *Rationale*

Our understanding of learning with technology is increasingly lagging behind technological advancements, such that it is no longer possible to fully understand learning with technologies without bringing together evidence from practice-based experiences and theoretical insight to inform research, design, policy and practice. Furthermore, whilst practical experiences and theoretical insights make significant contributions towards understanding learning with new technologies, the dynamic nature of learner practices and study contexts make it difficult to predict future requirements in terms of methods and models for next generation technology enhanced learning.

We therefore require formal and comprehensive methods and models of learning with technology that accommodate theory and practice whilst allowing us to anticipate methodological innovations that capture future transitions and changes in learner practices and study contexts, in order to inform research, design, policy and practice.

Workshop participants represented different communities of interest including research, design, evaluation and assessment. The overall objective was to anticipate methodological innovations in technology enhanced learning research and design over the next 5/10 years.

## *Workshop Structure*

This two-day workshop (28-29 March 2011) brought together invited participants and those responding to a call for papers. Each of the four sessions addressed one of the workshop's methodological themes and began with a plenary presentation by an invited speaker. Speakers presented a method they had used to investigate a TEL activity, and used a case study or a learning scenario involving technology to demonstrate how this had been done. In small breakout groups, participants then carried out practical activities in which they applied the method to a learning activity. Groups also commented on the method presented by the invited speaker, applied their own methods to the case study or learning scenario, recorded their experiences and commented on future methodological advancements. Each session concluded with a plenary in which participants developed grand challenges relating to current and future methodological issues associated with TEL.

## **2. Workshop description**

Workshop presentations were organised around the four methodological themes identified above. Six presentations were given by invited participants who served as workshop strand leaders for the various themes, as follows:-

### *Methods and models for researching next generation technology enhanced learning*

The research strand was led by Professor Mike Sharples of the University of Nottingham, UK. This strand used the socio-cognitive engineering (Sharples et al., 2002) method as a systematic approach to studying the theory and practice of how people learn with their current mediations of technology, culture and context. This leads to the formulation of a Task Model, for the type of learning under consideration that provides a foundation for design of the new intervention.

### *Methods and models for designing next generation technology enhanced learning*

The design strand had two leaders, namely: Professor Rose Luckin of the University of London, UK, and, Professor Gerhard Fischer of the University of Colorado at Boulder, USA. Prof. Luckin used the Ecology of Resources model (Luckin, 2010) as the underpinning for the development of a design framework that can be used to analyse existing situations, to design fresh learning activities, to design the way in which technology might best be used to support learning activities, or to design the technology itself. Prof. Fischer introduced a list of requirements to represent some initial methods for exploring the design and integration of technological artefacts in next generation technology enhanced learning.

### *Methods and models for Evaluating next generation technology enhanced learning*

The evaluation strand also had two leaders, namely: Professor Päivi Häkkinen of the University of Jyväskylä, Finland, and, Dr Giasemi Vavoula of the University of Leicester, UK. Prof. Häkkinen introduced a method that focuses particularly on evaluating (1) the level of participation and (2) the quality of collaborative knowledge construction (Häkkinen and Järvelä, 2006). Dr Vavoula introduced the M3 evaluation framework (Vavoula and Sharples, 2009) to explore issues around evaluating a mobile learning application that connects learning in the classroom with learning in museums and galleries.

### *Methods and models for assessing next generation technology enhanced learning*

This assessment strand was led by Dr Denise Whitelock of the Open University, UK. The presentation explored issues and techniques for assessing and validating technologies that are designed to assess and provide feedback about learning, which in turn should be embedded within a pedagogical framework. A supportive infrastructure known as the 4T's pyramid (Whitelock, 2010) was introduced as a way to facilitate moving forward with assessment frameworks and Web 2.0 tools.

### 3. Emerging Research Questions

Research questions that emerged from workshop discussions relate to the role of assessment and evaluation in learning, by reflecting on current innovative methods of assessment and evaluation. Questions also reflected on the potential to develop, revise or extend current methods so as to make connections with research and design approaches for technology enhanced learning.

Emerging research questions were specifically concerned with:

- How to stimulate thinking around current and future methods and models of technology enhanced learning?
- How to provide a platform for showcasing a range of methods and techniques currently used to investigate technology enhanced learning?
- How to provide support for the development of new methodological innovation?
- How to explore the various ways in which cutting edge technological innovations might interact with social structures and practices over time?
- How to understand how subsequent changes in social practices might impact on methods and models of technology enhanced learning?

### 4. Grand Challenge Problems

#### **Grand Challenge 1: Provide effective assessment of learning in an open, social TEL environment**

Our current model for the assessment of learning is primarily summative and individual, firmly bound to hierarchical education structures. This model was developed when knowledge was not abundantly available, when groups of learners were taught and examined at the same time in the same physical location, when teachers and learners were clearly differentiated and when online collaboration and publication were unknown. As new models of learning have been widely adopted, this model of assessment is no longer fit for purpose. A new model is required which takes into account the changes in learning and teaching that have taken place during the last decade.

*What problems of the European education system are addressed, and what are the long term benefits for society (100 words)*

Open, social TEL environments have made new models of learning possible. Learners now draw upon many different people and mediating artefacts, knowledge is dispersed and distributed, individuals may move rapidly between the roles of teacher and learner, and their collaborations extend across time and space. These new models of learning are ill served by a reliance on summative assessment of individuals. TEL environments also offer new resources in the form of the data they record – learners' demographics, activities,

interactions, participation and engagement – little of which is currently harnessed to support assessment. We need to develop ethical frameworks and learning analytics that will enable us to change our assessment practices to support learning in these new educational environments.

*What are the main activities to address this Grand Challenge Problem (up to 200 words)*

- Learning network analysis – assessing networks and driving the development of groups and networks that provide effective support for learners
- Learning dialogue – assessing the quality of dialogue, and using this formative assessment to guide the development of learning dialogue
- Learning behaviour analysis – assessing the activity of individuals and groups, and using this formative assessment to guide the development of skills and behaviours associated with learning
- Learning content analysis – assessing the resources available to learners, and using this information to recommend appropriate materials, groups and experts
- Summative analysis of networks, dialogue, behaviour and content that is valued by learners, teachers and society
- Development of recommendation engines that use these analytics to provide personalised recommendations that support learning and that are valued by learners, teachers and society.

*What is the timeframe for the Grand Challenge Problem (give an estimation in month or years that corresponds to the activities described in 3; up to 50 words)*

Initial work on learning analytics is currently underway, providing analysis, visualisations and recommendations that support learners and teachers and help to develop meta-cognitive skills, educational dialogue and learning. Within five years these initial explorations could be trialled, developed, validated and scaled up for widespread use.

*What are measurable progress and success indicators (up to 100 words)*

Measurable improvements in:

- Engagement with learning - supported by directed feedback
- Quality of online learning dialogue
- Engagement with online learning networks
- Retention – due to appropriate and personalised feedback
- Class management – due to development of a students-in-trouble alerting system
- Learners’ and teachers’ awareness of the value of learning analytics

*How can funding be attracted (which funding bodies could be approached, what kind of research capacity is needed; up to 100 words)*

A potential funder is ‘Next Generation Learning Challenges’: a collaborative, multi-year US grant programme aimed at dramatically increasing college readiness and completion through applied technology. Grant money is issued in multiple funding waves launched every 6-12 months. Wave 1 included a call to research learning analytics <http://nextgenlearning.org/>

Another possible funder is Google, which offers Research awards in several relevant areas, including machine learning and data mining, and educational innovation [http://research.google.com/university/relations/research\\_awards.html](http://research.google.com/university/relations/research_awards.html)

While learning analytics can be developed to run on specific VLEs, a large-scale research effort would be needed to bring together different forms of learning analytics and to make them available to learners and teachers working on different platforms.

## **Grand Challenge 2: Open Platform for Learning Design**

How do we create a platform for open, live, malleable, dynamic representation of design knowledge in TEL, supporting collaborative processes of design for learning, learning to design, and learning by design, and including the broadest community possible in these processes?

*What problems of the European education system are addressed, and what are the long term benefits for society (100 words)*

The evolution and wide access of advanced technologies offer educators and learners unprecedented opportunities to create, organise, share and access knowledge. Such technologies effect potent learning environments, yet these are constantly shifting with escalating complexity. The challenge of education is no longer about delivery of knowledge: it is about designing environments, tools and activities for learners to construct knowledge. In order for educators to effectively orchestrate learning within this landscape they need to perceive themselves, and indeed to be perceived by society, as techno-pedagogical designers. Ideally, learners should act as designers of their own learning and of their personal learning environment. A design attitude should not be pre-conditioned by technical ability: it may well be reflected in effective configuration and customisation of existing resources. Over the last few decades, the design paradigm in TEL research has achieved a growing momentum. Yet for it to attain its full desired impact, it needs to develop a common language and make this language accessible to the widest possible audience. Such a language, and the related media of interaction, should allow experts and novices to extract design knowledge from experience, articulate it in a coherent manner, connect, combine and manipulate it, and use it to resolve new challenges.

*What are the main activities to address this Grand Challenge Problem (up to 200 words)*

This language should be supported by appropriate tools and community spaces, which will streamline the process of constructing, validating and utilising design knowledge, making it open, accessible and transparent. It cannot be a uniform, centralised entity - but needs to allow for a diversity of discourse by establishing a set of open protocols and standards over which an open process of massively collaborative knowledge building can thrive.

*What are measurable progress and success indicators (up to 100 words)*

The success of such an initiative will be measured by the vibrancy of the community it engenders, the evolution of a widespread culture of learning design, and consequently the quantity and quality of open learning design artifacts.

**Grand Challenge 3: Construct evaluations of TEL that allow complexities of interaction between policy, strategic school leadership, teacher and student to be negotiated successfully.**

To improve the conditions for TEL, there is a need to constantly address the rapid increase in the up-take and use of digital technologies in European schools and how learning takes place at different levels. But understanding conditions is not enough; technologies need to be understood in their use in order to provide understandings of the learning they can enhance across institutional levels. The underpinning idea is that technologies do more than just support learning; they change how we think and act as humans and the ways we interpret and develop learning.

*What problems of the European education system are addressed, and what are the long term benefits for society (100 words)*

Research in relation to up-take and use of digital technologies for improving TEL and knowledge building in European schools seems to be neither clear nor indicating a full-scale success. Reasons can be tendencies in research to focus indicators possible to locate in every single school and a lack of intersectional research, i.e. by overlooking the interplay between organizational structure and culture. Up till now, too few studies are sufficiently information rich to provide insight and understanding of critical factors for TEL at the institutional level. New methodological approaches when evaluating and researching TEL in European schools are urgent.

*What are the main activities to address this Grand Challenge Problem (up to 200 words)*

These approaches need to include a multi-level focus taking into account the motivators for various stakeholders in the European school system. The use of multi-level methodologies will have the possibilities to produce evaluations and research results that allow each set of school stakeholders to feel that their stake is being addressed. With motivation differing between stakeholders it is necessary to develop research on TEL in participatory designs assuring that stakeholders have joint interests and agreement. Otherwise, we end up with an effective methodology for evaluating an initiative that the stakeholders do not buy into. The development of a multi-level methodology approach will produce new insight regarding TEL and the use of digital technologies in schooling and education, how technologies are constructed and how knowledge develops in the course of use across levels. Constructing evaluations using multi-level approaches allows complexities of interaction between policy, strategic school leadership, teacher and student to be negotiated successfully and will have the potential to answer how technologies can be understood in their use in order to understand the learning they can enhance in and between institutional levels in European schools.

*What is the timeframe for the Grand Challenge Problem (give an estimation in month or years that corresponds to the activities described in 3, up to 50 words)*

Evaluations covering institutional complexities and practices in school will take time to produce. They need to rest on rich data sets within each level and in relation to the other levels. Estimated time in order to produce results of great impact and relevance for European schools is 42 months.

*What are measurable progress and success indicators (up to 100 words)*

To measure progress and success will require a longitudinal approach. Indicators that can be used include:

- Increased acceptance among stakeholders of looking at intersectional practices in the planning and evaluation of TEL in schools.
- The development of a body of research comprising a rich set of data providing insight and understanding of critical factors for the use of digital technologies across institutional levels.
- New and innovative methods to develop knowledge on TEL and digital technologies are increasingly reported in scientific journals.
- The relevance of research results is validated by teachers and pupils through surveys and case studies.

*How can funding be attracted (which funding bodies could be approached, what kind of research capacity is needed; up to 100 words)*

Providing research capacities in the form of new innovative methods for researching TEL will have to rely on partnerships including participants that display variation and difference as well as similarities, answering to a design that include different forms of uniqueness. This can be fruitfully developed through partnerships founded in already existing networks. Developing the future research capacities for Europe in this regard would be a responsibility of the European Commission, preferably within the research frameworks and by dissemination through the programs for education and training and lifelong learning.

#### **Grand Challenge 4: Make evaluation adaptive and integrated with evolving designs of learning**

As TEL interventions move away from supporting existing learning activities and practices towards disrupting them and/or enabling radically new ones, evaluation approaches need to change accordingly.

By removing pre-specified design objectives we also remove traditional benchmarks against which we evaluate, such as measures of cognitive learning; while at the same time we render evaluation ever so essential in the quest to understand radically new, disruptive TEL practices. We urgently need a re-conceptualisation of evaluation as an integral and integrated aspect of the development process that weaves in with evolving designs of learning.

*What are measurable progress and success indicators (up to 100 words)*

More specifically new evaluation approaches need to:

- Evaluate emergent learning in and across formal and informal contexts, as well as the transformation of those contexts effected by the TEL intervention;
- Acknowledge that “not all that can be measured counts, and not all that counts can be measured” – look beyond short-term cognitive gains into medium- to longer-term attitudinal, psychomotor, affective, motivational, emotional and behavioural gains;
- Look beyond the local impacts of TEL interventions (what this learner learns at this specific moment in time), to their ‘local’ impacts on the surrounding organisational



- structures, and further on into their global impacts on the policies and politics of education as well as the formation of social identities;
- See through technology trends and fashions into learners' expectations and how these map onto their actual learning experiences;
  - Educate learners in the ethical appropriation of TEL;
  - Make explicit references to their temporal framework;
  - Be seamlessly built into the TEL intervention and evolve with it

**Grand Challenge 5: Develop an evidence-based assessment system for cognitive, affective and psychomotor learning including free-text entry providing learners with timely feedback at the right moment that leads finally to society-wide assessment literacy and a changed perception of assessment**

This grand challenge formulated by participants of the assessment strand of the workshop is looking at a time perspective of about 10 – 15 years. The grand challenge is based on the aim of breaking current limitations in terms of the learning domains, the attention to summative assessment in current educational practices and last but not least the limitation to focus on traditional question-formats (e.g. multiple choice). The final aim is to change the perception of assessment from a judging instrument to a support mechanism for learning.

*What are the main activities to address this Grand Challenge Problem (up to 200 words)*

The grand challenge can be addressed by wide-scale development, evaluation and implementation of new formative assessment scenarios including the development and evaluation of technologies that make for example intensive use of text- and data mining or natural language processing approaches. A special European challenge in this regard is to develop tools and methods that can cover a wide range of European languages.

*What are measurable progress and success indicators (up to 100 words)*

Success can be measured if we can prove that learners recognize the value of formative assessment for their own learning. Some effects that can be measured include:

- Increased motivation during the assessment situation
- Changed role of assessment from a process learners have to do to a process learners want to do
- Decreased drop-out rates in distance learning institutions/programs
- Second-order effects on summative assessment

**Grand Challenge 6: Create socio-technical environments in which people of all ages are inspired to learn rather than have to learn**

The widespread penetration of high-speed Internet, wifi, fast mobile data networks combined with the fact that most people in OCED countries have a data compatible mobile phones if not smart phones and personal computers provides new opportunities for personally driven education. Meanwhile, in the emerging economies many people have access to mobile phones and GSM coverage offers new avenues for learning and communication. Yet, with all these technologies available to people of all ages there is a lack of tools to inspire people to learn. Although digitally based computer games, social

networks for sharing rich media, and collaborative knowledge and news have a vast audience participation, and they can be seen to provide a foundation for allowing people to construct personally meaningful artefacts, they tend to provide markets for consumption only (e.g. App and market stores). The grand challenge is to create socio-technical tools that allow people to construct, create, and aggregate information like texts, websites, videos, audio, images together with their own created content.

*What are the main activities to address this Grand Challenge Problem (up to 200 words)*

Currently, off the shelf software for mobile devices is available to provide different types of data capture combined with the widespread use of social media services that provide tools for customizing data (APIs). The challenge can be addressed from the design perspective or working across different stakeholders to harness these different software services into personally meaningful environments for learners.

*What are measurable progress and success indicators (up to 100 words)*

The aim is to give learners enough control to become active in the process of pursuing personally meaningful goals as well as providing enough support for their activity to result in the construction of useful knowledge and artefacts. The success of the challenge can be measured by market adoption of the tools coupled with experience of the learners and the quality of the learning materials produced and more importantly shared.

## **5. Researchers and Communities**

Success in addressing the Grand Challenges will depend on collaboration between experts in learning, assessment, evaluation, design and research; on fluid access to advanced expertise from technical development communities and computer scientists; and on considerable engagement on the part of education managers, educators, teachers and students. There is also a clear role for change agents and communities supporting professional development and educational transformation, to address necessary changes in attitudes, perceptions, behaviours and practices.

## **Conclusion**

Grand Challenges developed in this workshop focus on: effective formative assessment in new types of learning environments (including TEL environments that should be designed to inspire learning); enabling sharing of design knowledge; and changing conceptions of evaluation to take account of complexity and evolving learning designs.

The challenges arise from technological advancements, new models of learning and assessment, availability of open, social learning environments, opportunities to share knowledge across disciplines, and a growing awareness that local interventions and evaluations are not as effective as those that are integrated with broader learning processes and structures and address problems at multiple levels.

Technology enhanced learning in education settings spills over into everyday life, disrupting established practices but also inspiring the design of more potent learning environments. Methods and models developed through the grand challenges need to be adaptable and flexible, yet provide solid guidance for next generation designs.

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