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Report on the Second Rendez-Vous and White Papers

Edited by
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SEVENTH FRAMEWORK PROGRAMME

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1. Executive Summary

This is the 2nd report on the non-standard conference, Alpine Rendez-Vous, that was held in March 2011 in La Clusaz, France. The event was organized as part of 'Scientific Capacity Building' in the Network of Excellence STELLAR (WP 3) and its main goals were (a) to identify and advance emerging topics, methodologies and technologies in the field of Technology-Enhanced Learning (TEL) and (b) to build a community within and beyond STELLAR.

During the event, each of eight different workshops discussed one topic related to one or more of the STELLAR Grand Challenge Themes: 'Connecting Learners', 'Contextualisation', and 'Orchestration'. The summarized results include on the one hand, Grand Challenge Problem formulations and on the other hand, explicit research questions that target the first goal of the event. This report includes the 10 to 20-pages workshop White Papers, followed by some exemplary Grand Challenge Problems and an analysis of their link to the Grand Challenge Framework. Early childhood is an exemplary area addressed by Grand Challenge Problems. In this respect, it is seen as highly important to develop an agreed-upon set of principles for designing and evaluating digital technologies. A related research question is: What is the relationship between early childhood use of technology and child development?

Furthermore, adult learning is targeted by Grand Challenge Problems (GCPs). Some GCPs, for example, address the systematic use of recommender systems to support teachers and learners to take advantage of online tools for sustained and engaged learning. One important research question is, e.g. 'How can educational, psychological and sociological indicators of a high drop-out risk, as well as measures potentially able to reduce the risk, be effectively used for the design of recommender systems for learning?'.

Another area that is highlighted in several GCPs is the assessment of new forms of learning. An important research question in this area is, e.g., 'How can we assess learning in open, social TEL environments?'. An increasing number of researchers suggest the inclusion of neuroscience perspectives and methods in TEL. One GCP is directed towards designing game-based environments that are informed by our growing understanding of the brain's reward system. A related research question is "how can neuroscience help us understand and foster engagement in learning through the use of games?'.

With respect to the second goal, (b) *community building*, a Social Networking Evaluation and analyses of the participants have been conducted. 152 researchers representing different career levels (PhD candidates, mid-career researchers, professors) and different TEL-related disciplines participated in the event, The results of the analyses identified a multitude of future collaboration possibilities for all participants and a general appreciation for the event's networking format. No significant differences were found in the evaluations from attendants with different career levels or attendants with and without a STELLAR membership.

Looking ahead, a fourth Rendez-Vous is scheduled to take place in Grenoble, France, 2013[1].

[1] Information about the upcoming Rendez-Vous is available in the STELLAR Rendez-Vous page of the STELLAR web http://www.STELLARnet.eu/programme/wp3/rendez-vous/

2. Goals of the Alpine Rendez-Vous

The goal of this third edition of the Rendez-Vous has not changed from previous editions, and consists in:

(a) Advancing Emerging Topics, Methodologies, and Technologies
The Alpine Rendez-Vous approach to address these goals is to provide a non-standard platform for a series of co-located workshops presenting and relating cutting edge research on Technology-Enhanced Learning (TEL) driven by the STELLAR Grand Challenge Themes[2], leaving enough time for networking across the boundaries of the different TEL communities.

(b) Community Building
The second main goal of the Rendez-Vous is to provide an interdisciplinary forum as a bridging action between different layers of scientific capacity early-stage, mid-career and senior researchers in Europe, to integrate the different research communities in the STELLAR Network of Excellence, and to connect with other TEL research communities in Europe.

The Alpine Rendez-Vous is intended to serve as an instrument to approach the **three WP3 objectives**, (1) Supporting the integration of researchers belonging to different research units and fostering the sharing and integration of competences, methodologies and ideas, (2) fostering the dialogue and collaboration between researchers of different levels of expertise (early-stage, mid-career and senior researchers), and (3) stimulating the participation of those researchers in European laboratories and research units that are not part of the current STELLAR network (i.e., are not members of the STELLAR consortium).
In this third edition, more effort has been put in the extraction and analysis of the emerging topics. Practically, the guidance for the workshop organisers (=authors) of the Rendez-Vous White Papers was improved to enhance the quality and readability of the output of the event. The whitepapers now also include a reflection on the multidisciplinarity and the role of the community process in TEL. In addition, the Rendez-Vous had to be aligned with the more specific Grand Challenge Themes concept that developed in the network as a consequence of the meeting of the minds. It was an explicit goal to develop a series of so called Grand Challenge Problems with related research questions

[2] For more information on the Grand Challenge Themes, see http://www.STELLARnet.eu/programme/wp1/, as well as deliverable 1.1)

3. Organisation

In the following an overview of the boards and committees of the Alpine Rendez-Vous is provided.

3.1. Committees

Three main committees contributed to the organisation of the Alpine Rendez-Vous, the Scientific Capacity Committee (SCC), the Reviewer Board, and the Local Organisation Committee (LOC).

3.1.1. Scientific Capacity Committee (SCC)

General. The main task of the Scientific Capacity Committee is to ensure the scientific quality and due diligence of the procedure in selecting proposals to be funded by STELLAR common funding with respect to the instruments within WP3: Theme Teams, Incubator Grants now Mobility Fellowships and Alpine Rendez-Vous. Regarding the Alpine Rendez-Vous, the board approved the selection of the new local organiser, supervised and evaluated the definition of the thematic scope, evaluated the call for workshop proposals, was to some extent responsible for the selection of workshops for the Alpine Rendez-Vous, and the approval of the Excellence Awards. To involve the Scientific Capacity Committee in the actions stated above, regular online and face-to-face meetings have been held. In some cases the board members voted asynchronously via email.

Composition. Ten board members have been approved by the General Assembly. They represent different disciplines, different parts of the STELLAR network (e.g. former Kaleidoscope and former ProLearn members), different universities as well as research and industry organisations, and are responsible for other STELLAR work packages that have to be co-ordinated with work package 3 activities and instruments.

For an overview of the members of the SCC responsible for the Alpine Rendez-Vous 2011 see Table 1.

Table 1: Members of the Scientific Capacity Committee and their institutions.

Members	Organisation
Nicolas Balacheff	CNRS-Université Joseph Fourier
Rosa Bottino	CNR-ITD
Daniel Burgos	Atos Origin
Pierre Dillenbourg	Ecole Polytechnique Fédérale de Lausanne
Frank Fischer	Ludwig-Maximilians-Universität München (Chair)
Francesca Pozzi[3]	CNR-ITD
Peter Scott	Open University UK
Hans Spada	Albert-Ludwigs Universität Freiburg
Marcus Specht	Open University of the Netherlands
Sue Timmis	University of Bristol

[3] Francesca Pozzi and Rosy Bottino have only one shared vote as they are working in the same team.

3.1.2. Reviewer Board

Other than the reviewer board of the Alpine Rendez-Vous 2009, not only a sub-group of the SCC but also a list of external researchers was suggested by the Local Organisation Committee and approved by the SCC to built the Reviewer Board for the selection of the Alpine Rendez-Vous workshops (for the full list of reviewers see Table 2). The task of the Reviewer Board was to evaluate the incoming workshop proposals on the basis of a review grid and suggest to the SCC a list of workshops to be included in the event (see 3.2 on selection procedure).

Table 2: Reviewer Board for the Alpine Rendez-Vous 2011.

STELLAR External:	STELLAR Internal:
• Marco Bettoni (ETH Zürich) • Monique Grandbastien (Université Nancy) • Beatrice Ligorio (University of Bari) • Kristine Lund (Centre national de la recherche scientifique) • Che Ping - Chirp (Hong Kong Institute of Education) • Carolyn P. Rose (Carnegie Mellon University) • Martin Wolpers (Fraunhofer Institute for Applied Information Technology)	• Nicolas Balacheff (CNRS) • Rosa Bottino (CNR-ITD) • Daniel Burgos (AtoS) • Pierre Dillenbourg (EPFL) • Frank Fischer (LMU) • Francesca Pozzi (CNR-ITD) • Hans Spada (UF) • Marcus Specht (OUNL)

3.1.3. Local Organisation Committee

The main task of the Local Organisation Committee (LOC) of the Alpine Rendez-Vous 2011 was to identify a proper location and to prepare and coordinate the event at the selected location. For the second STELLAR Alpine Rendez-Vous a new local organising team has been selected and approved by the Scientific Capacity Committee. Kris Lund from CNRS Lyon and her colleague Pascale Pauly formed the new local team while the LMU team (former local organiser) supported their planning. For an overview of all members of the new organising team and a distribution of tasks see Table 3.

Table 3: Organising Committee of the ARV 2011.

Institution	Members	Tasks
CNRS Lyon	Kris Lund Pascale Pauly	• Selection of conference venue • organisation of the procedures at the conference location • organisation of the Community Event • Event marketing • Registration process • Continuing financial planning • Coordination of White Paper submissions
LMU Munich	Frank Fischer Lena Hofmann Silvia Schulz	• Support of CNRS team • Coordination with SCC • financial coordination • preparation and accomplishment of evaluation • maintenance of project website

3.2. Selection Procedure (Selection of Workshops and Participants)

3.2.1. Methodology

The selection of the workshops proposed at the Alpine Rendez-Vous, and later of the participants of these workshops was conducted in a way aiming at maximizing their quality and their alignment to the STELLAR strategic objectives. Proposals were in particular evaluated according to explicit criteria and procedures and by a well informed review by well informed (external and internal) experts of the domain.

Selection of Workshops

A call for workshops proposals was launched (see Appendix 7.1), and proposals were selected.

- A **call for workshops proposals** (see appendix 7.1) was distributed (in June 2010) via the STELLAR website and several relevant mailing lists and web sites (e.g. TELEurope.eu, ICDE, APSCE bulletin board, etc.). Deadline of the call: *July 15th, 2010* (to be later extended to *August 1st, 2010*).

- **Selection of the workshop in a competitive peer-review procedure**, and based on a **set of criteria** were applied by the Reviewer Board (see 3.1.2) to determine the quality of the proposals. Notification to the authors: *last week of August, 2010*.

Criteria used to determine the quality of the proposals:

- Completeness of information on a) identification b) description abstract c) tentative budget d) plan for promotion e) plan for selecting participants.
- Relevance of the topic
- Soundness and clarity of argumentation
- Addressing at least one of the grand research challenges per workshop

More specifically a guideline for the evaluation and a rating table was distributed to the reviewers to be complete for each proposal. The evaluation table is available in the Appendix of this document (7.3.1 Workshop Proposals Evaluation Sheet.).

Reviewing of the Workshop Proposals:

Every proposal was reviewed twice, once by a STELLAR internal reviewer and once by an external reviewer (see 3.1.2). All board members made their rating on up to 4 proposals asynchronously and sent their respective rating tables to the local organising team. The integrated table was then to be discussed during an (online) flash meeting which took place on *18 August 2010* (see Appendix 7.3.2 for the flash meeting).

Selection of Workshops Participants

Each of the selected workshops launched a call for workshop contribution.

The workshop organisers were allowed to select their participants and had to report their procedures and the results of the procedures later in the White Papers (for all White Papers see Appendix 7.4). It was required to select a substantial part of the participants from outside the participating STELLAR labs. The deadline for submission was the *22nd October*

2010, and the acceptance (or rejection) letters were to be send before *November 30th, 2010*.
A webpage has been created by the local organisation team in the STELLAR web site to provide all the necessary information to the potential participants (http://www.STELLARnet.eu/programme/wp3/rendez-vous). To register for the event another webpage has been created (http://www.STELLARnet.eu/programme/wp3/rendez-vous/registration_form_participant).
Also, each workshop has been offered a group space at TELEurope.eu created by the organising team to support the exchange of content before the event.

JTEL Winter School

In addition, the WP4 Winter School with 20 participants (13 late stage PhD students, 4 tutors, 3 organisers) was organised to take place in parallel to the Alpine Rendez-Vous (for the distribution of PhD students to countries of residence see Table 4). During the week the PhD students one the one hand prepared for their defence and on the other hand tried to link their work to the Grand Challenged Framework. To enhance the connection between the two events and all participants the seminars took place at the same hotel with coordinated schedules. Furthermore, PhD students from the Winter School were for some time distributed to the 8 workshops.

Table 4: Provenance of PhD students from the JTEL Winter School.

Region / Country	Number	Comment
EU	9	Portugal: 1; Belgium: 1; Sweden: 2; Estonia: 1; Romania: 1; Uk: 1; Germany: 2
Switzerland	2	
Israel	1	
Canada	1	This PhD student was supported as being a WP4 awards winner for his best paper at the RED conference
Total	13*	

*Note: A 14th PhD students from the UK was not able to attend because of a visa problem.

3.2.2. Results of the Call for Workshops Proposal

Workshop Proposals Acceptance

15 proposals for workshops were submitted (see Table 5) of which 4 were submitted by Theme Teams. 8 proposals were accepted meaning an acceptance rate of 53%. For an exemplary result of the feedback for one workshop, see Appendix 7.3.3.

Table 5: Workshop proposals submitted.

Workshop N°	Name of proposal
1.	Networks for Learning: Institutions, new generations of learners and the impact of Web 2.0
2.	Using Digital Technologies to Orchestrate Learning: What, Where, Why & How? THEME TEAM
3.	Exploring the Fitness and Evolvability of Personal learning Environments (EFEPLE'11)
4.	Early Years and Technology: The design and evaluation of technologies to support young children's learning
5.	Awareness and Reflection in Research Communities (ARRC)
6.	Orchestrating learning in Multiple Settings with IMS LD
7.	Research 2.0: Evaluation Workshop and Hands-on tutorial
8.	Design of mobile technologies for learning in formal and informal contexts
9.	dataTEL — Data Sets for Technology Enhanced Learning THEME TEAM
10.	Multiple Perspectives on Multiple Representations (MUPEMURE) THEME TEAM
11.	Methods and Models of Next Generation Technology Enhanced Learning
12.	Neuroscience, Technology and Learning: Areas and Issues for Interdisciplinary Progress THEME TEAM
13.	Structuring online collaboration through 3 Ts: task time and teams
14.	Is mobile augmented reality resulting in a pardigm shift for learning?
15.	Leveraging Researcher Multivocality for Insights on Collaborative Learning

The 8 successful workshops selected ranked between 52 and 73 and can be found in the following section 3.3.1 Programme Overview.

All of the selected workshops were shortlisted for funding by WP3 common funds. For each workshop, 10 people had to be selected by the organiser to receive funding (including room, food, conference fee but NOT travel). The workshop organiser was funded as well and did receive funding for travel (up to 400€ within Europe and up to 800€ beyond Europe) (for more details see 5.1.2).

3.3. The Scientific Programme

3.3.1. Programme Overview

The basic structure of the Alpine Rendez-Vous 2011 has not changed from that of the event in 2009. Both events consisted of three main parts: a first series of workshops, a Community Event (see section 5.2) and a second series of workshops (for the schedule see Appendix 7.2).

The first workshop day took place on Monday, March 28th 2011, with a prior welcome and first get-together dinner organised on Sunday, March 27th. The workshop ended on Thursday, March 31st.

The first and second series of workshops followed a similar schedule, including a morning session (8.30-12.30) and an afternoon session (16.30-20.30). Every workshop had its own schedule and organisation (details provided in the respective White Papers, see Appendix 7.4). In addition, every day after the lunch break, there was a three-hour break that was mostly used for networking, recreational activities and in some cases, for prolonged workshop sessions (see Figure 1). Each day ended with dinner at the hotel restaurant, which all participants attended and used for networking.

Nevertheless there have been some changes in the event like the introduction of Provocateurs (see 3.3.3) and insights in all workshops during the community event (see section 5.2.2).

Figure 1: Participants of the EFEPLE workshop continuing a discussion on top of a mountain.

3.3.2. Workshops Accepted

The following workshops took place at the Alpine Rendez-Vous 2011 and were organised by the following scientists:

Workshop	Organiser(s)
#1 Early Years and Technology	Andrew Manches
#2 Methods and Models for next generation TEL	Daisy Mwanza-Simwami, Gill Clough, & Agnes Kukulska-Hulme

#3 Neurosciences, Technology & Learning THEME TEAM	Paul Howard-Jones, Bert de Smedt, Michela Ott,& The van Leeuwen
#4 Structuring online collaboration through 3Ts: task, time & teams	Francesca Pozzi & Donatella Persico
#5 Exploring the Fitness and Evolvability of Personal Learning Environments (EFEPLE)	Effie Law, Felix Mödritscher, & Martin Wolpers
#6 data TEL THEME TEAM	Hendrik Drachsler, Nikos Manouselis, Katrien Verbert, Riina Vuoikari, Stefanie Lindstaedt, Martin Wolpers, & Miguel-Angel Sicilia
#7 Multiple perspectives on multiple representations THEME TEAM	Armin Weinberger, Daniel Bodemer, Manu Kapur, Gaëlle Molinari, & Nikol Rummel
#8 Leveraging Researcher Multivocality for Insights on Collaborative Learning	Kris Lund, Dan Suthers, Carolyn P. Rosé, Nancy Law, Chris Teplovs, & Gregory Dyke

Workshops #1 - #4 took place in the first half of the Alpine Rendez-Vous (Mon, 28th March – Tue, 29th March 2011) and workshops #5 - #8 in the second part (Wed, 30th – Thur, 31st March 2011). For the schedule of the Alpine Rendez-Vous 2001, see Appendix 7.2.1.

All workshops can be thematically mapped onto at least one of the three Grand Challenge Themes (see Figure 2), as was requested in the call for workshops. Most workshops (5 out of 8) focus at least on 'Contextualising Learning' whereas three workshops respectively (also) focus on 'Orchestrating Learning' and 'Contextualisating Learning'.

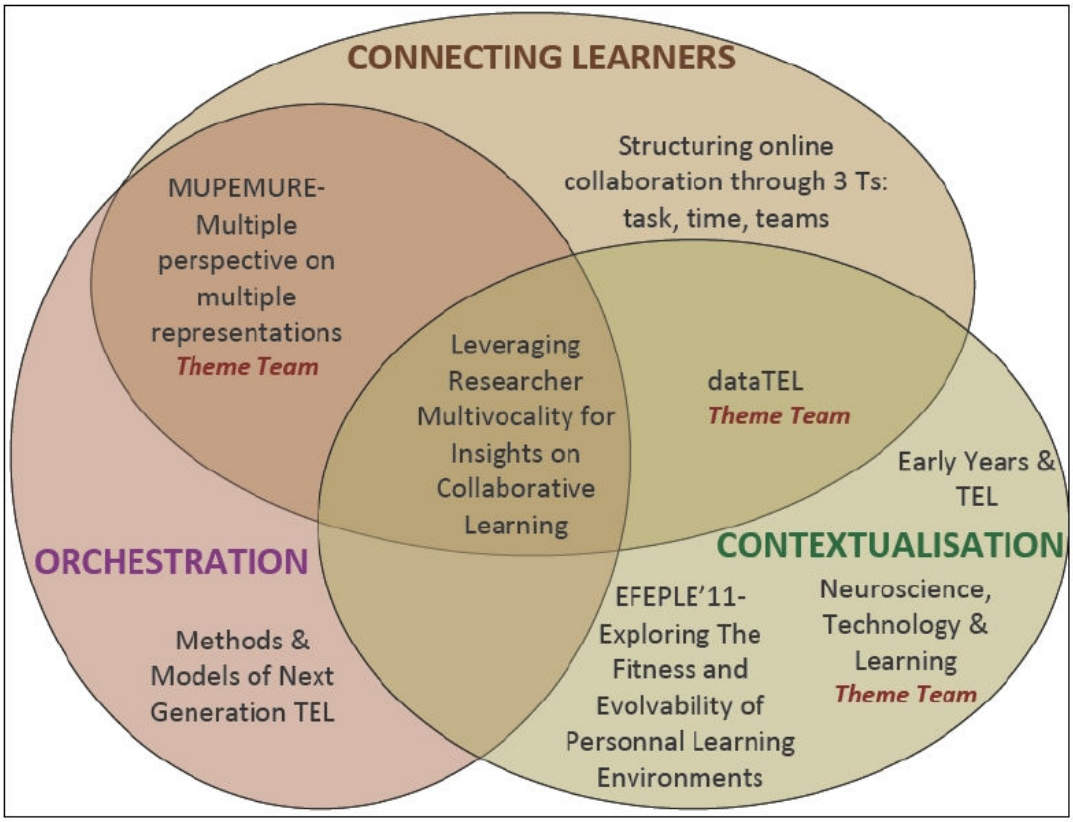


Figure 2: Allocation of workshops to the Grand Challenge Themes.

3.3.3. Provocateurs

The concept of the Provocateurs was developed to support the workshop leaders in advancing the workshop outcomes and especially in expressing its link to the STELLAR Grand Challenge Framework.
A Provocateur was assigned to attend each workshop in order to filter, collect, and provoke Grand Challenge discussion and/or arguments. The discussion should then serve as a basis for a one-pager for each workshop to further shape the Grand Challenges Framework and serve as a basis for the requested white papers.
The Provocateurs were experienced STELLAR members who were familiar with the concept of the Grand Challenge Framework, the Grand Challenge Problems and ideally had already been registered participants of a workshop (for the distribution of Provocateurs to workshops see Table 6).
In order to prepare the Provocateurs for their task, each was given the complete set of workshop papers beforehand. Also, there was an online planning session several weeks before the event and a face-to-face briefing at the beginning of the Alpine Rendez-Vous.
During the workshops, the Provocateurs 'provoked without destabilising' the workshop. The three main activities we suggested were:

1. **Inform** the workshop participants about GCPs as we see them in STELLAR
2. **Support** emergent contributions to discussions if they relate to GCPs
3. **Formulate** a Grand Challenge Problem **draft** and get feedback from the workshop participants

After the second round of workshops had ended, all Provocateurs met and presented their GCP draft to the other Provocateurs and the members of the organising team. (see Figure 3).

Figure 3: Provocateurs during their closing meeting.

Table 6: Assignment of Provocateurs to workshops.

Workshop	Provocateur
#1 Early Years and Technology	Ros Sutherland
#2 Methods and Models for next generation TEL	Mike Sharples
#3 Neurosciences, Technology & Learning	Frank Fischer
#4 Structuring online collaboration through 3Ts: task, time & teams	Marie Joubert
#5 Exploring the Fitness and Evolvability of Personal Learning Environments	Fridolin Wild
#6 data TEL	Frank Fischer
#7 Multiple perspectives on multiple representations	Nicolas Balacheff
#8 Leveraging Researcher Multivocality for Insights on Collaborative Learning	Ulrike Cress

4. Emerging Topics and Community Building

This event report consists of two main sections. Section 4.1 introduces the scientific report of the workshops, the white papers that include Grand Challenge Problems. This first section of chapter 4 is thus referring to the goal of the Alpine Rendez-Vous of identifying and advancing emerging topics, methodologies and technologies'.

Section 4.2 addresses the second goal of the Alpine Rendez-Vous, namely 'building community within and beyond STELLAR'. Here, we will first present a participation analysis, followed by Social Network Evaluation aiming to measure how networking took place within and between the following groups:

1. All participants
2. Career levels (doctoral students, mid-tier researcher and professors)
3. Research disciplines (education, psychology, computer science)
4. STELLAR members and people from outside the network

In section 4.3, the results of the STELLAR standard event evaluation are presented. The evaluation form had been developed by work package 7 for the 2nd Alpine Rendez-Vous and modified by the organising team for the 3rd Rendez-Vous.

Figure 4: A small group of participants from workshop #2 in a group work phase.

4.1. Scientific Report on the Workshops - Advances with Respect to Topics, Methodologies and Technologies (Goal 1)

Each workshop organiser was asked to produce a White Paper summarizing the findings in their respective area.[4] Those are the first step towards a publication each workshop organiser has agreed to set up. These extended contributions will be monitored by the LMU organising committee.
A common structure of this document and guidelines were provided in order to facilitate a cross analysis between the different areas covered by the workshop until 31st May 2011. For the requested structure and content for the Workshop White Papers see Table 7.

Table 7: Original instructions for the workshop organisers on the contents and the structure of the White Papers.

The length should be 3500 words, but can be more, depending on how many Grand Challenge Problems you describe.

1. **Introduction and motivation** – 400 words (describe what the goals of the workshop were, why they are important and with which structure – time schedule – you targeted them)
2. **Workshop description** – 2000 words (summarize the presentations given in the workshop and the main ideas that were brought forth, relate them to the goals of the workshop; please include all authors' names and their affiliations)
3. **Emerging Research Questions** – 300 words (describe the new research questions that emerged from the workshop)
4. **Grand Challenge Problems** – 400 words per Challenge (200 words for the formulation of the problem, 200 words for description of activities needed to solve the problem) (describe the Grand Challenge Problems that the Provocateur helped bring out in relation to workshop themes

   Please, bear in mind the structure of the Grand Challenge Problems:
   - clearly stated, short statements, contribution to long-term benefits for society
   - timely, measurable and incremental
   - be relevant within the European education system
   - potentially attract interest and funding
5. **Researchers and Communities** – 400 words (tell us why researchers in which disciplines are needed to answer the Grand Challenge Problems and Research Questions - what capacities are needed - you need psychologists because..., computer scientists because... linguists because.... etc. Also, which established communities of research are pertinent for answering the Grand Challenge Problems and Research Questions and why?)

The focus of the White Papers is on topical and methodological advances in respect to the three Grand Challenge Themes *Connecting Learners*, *Orchestration* and *Contextualisation*. A brief reminder of the Grand Challenge Themes: a) 'Connecting Learners' incorporates supporting self-directed, self-managed and self-maintained communities and create

[4] All White Papers from the Alpine Rendez-Vous 2011 are publicly available in a sustainable way in the TeLearn open archive http://www.telearn.org/ as well as in the STELLAR Open Archive ('White Paper collection').

successful new forms of collaboration, b) 'Contextualisation' covers that technologies for learning are increasingly to be designed for culturally diverse and cross- and intercultural settings. This requires the co-design of technology and pedagogy for situated learning, simulated environments and support for mobility, and c) 'Orchestration' is about the integration of technologies into processes of learning and instruction in the classroom. A specific focus might be on the role of the teacher in technology-enhanced classroom learning.[5]

The following Table 8 gives an overview of the authors of the White Papers and the Grand Challenge Problems described. All White Papers can be found in the Appendix 7.4.

Table 8: Overview of White Papers and Grand Challenge Problems from the workshops.

Workshop	Authors	Grand Challenge Problems described
#1 Early Years and TEL (Appendix 7.4.1)	Andrew Manches (University of London), Janet C Read (University of Central Lancashire), Ros Sutherland (UB)	1. Develop an agreed set of principles for designing and evaluating digital technologies for the early years that are informed by our understanding of early child development. 2. Design and evaluate technology that supports grandparents, parents and carers to focus on children's early literacy activities with their children. Such technology should take into account literacy and technology practices in the home environment. 3. Design and evaluate dynamic digital representations that allow children to express, explore, make visible, share and reflect on ideas in novel ways in areas such as math and physics. 4. Design and evaluate digital technologies that foster regulatory behavior of emotions and meta-cognition
#2 Methods and Models of Next Generation TEL (Appendix **Fehler! Verweisquelle konnte nicht gefunden werden.**)	Daisy Mwanza-Simwami, Agnes Kukulska-Hulme, Gill Clough, Denise Whitelock, Rebecca Ferguson (Open University)	1. Provide effective assessment of learning in an open, social TEL environment 2. Open Platform for Learning Design 3. Construct evaluations of TEL that allow complexities of interaction between policy, strategic school leadership, teacher and student to be negotiated successfully. 4. Make evaluation adaptive and integrated with evolving designs of learning 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 6. Create socio-technical environments in which people of all ages are inspired to learn rather than have to learn

[5] For more information on the Grand Challenge Themes, see http://www.STELLARnet.eu/programme/wp1/, as well as deliverable 1.1)

#3 Neuroscience, Technology and Learning: Areas and Issues for Interdisciplinary Progress (Appendix 7.4.3)	Paul Howard Jones (UB), Michela Ott (CNR-ITD), Teo van Leeuwen (University of Twente), Bert de Smedt (KUL)	1. Substantially improving motivation and learning of students in European schools by systematically using game-based environments informed by our emerging understanding of the brain's reward system 2. Designing TEL environments to systematically inform all European teachers on main advances in Neuroscience and possible conclusions for teaching and learning in school.
#4 Structure Online Collaboration through 3Ts: Task, Time and Teams (Appendix 7.4.4)	Francesca Pozzi, Donatella Persico (CNR-ITD), Yannis Dimitriadis (University of Valladolid), Marie Joubert (UB), Mike Tissenbaum (University of Toronto), Dimitra Tsovaltzi (Universität des Saarlandes), Christian Voigt (ZSI), Alyssa Wise (Simon Fraser University)	1. Develop and validate approaches to empowering teachers and learners to take advantage of the potential of online tools for sustained and engaged collaborative activity aimed at improving or transforming learning.
#5 Exploring the Fitness and Evolvability of Personal Learning Environments (Appendix 7.4.5)	Lai-Chong Law Effie (University of Leicester), Felix Mödritscher (Wirtschaftsuniversität Wien), Martin Wolpers (Fraunhofer FIT), Denis Gillet, Sandy El Helou, Maryam Najafian-Razavi (EPFL), Carlo Giovanella (University of Rome), Martín Memmel (DFKI GmbH), Christopher Nehaniv (University of Hertfordshire), Christian Prause (Fraunhofer FIT, Berlinghofen), José L. Santos (KUL), Behnam Taragi (Graz University of Technology)	1. The Million Practices & Million Teachers Challenge: Ad Hoc Formation of Large-scale Learning Networks 2. Fitness of Learning Environments is Plasticity with Respect to User Requirements 3. One Tutor per Child
#6 data TEL (Appendix 7.4.6)	Hendrik Drachsler (University of the Netherlands), Katrien Verbert (KUL),	1. Reduce the drop-out rate in online learning environments by 10% through applying well evaluated and tested recommender systems for learning. 2. ACTUALLY, help students and teachers in TEL to use

	Miguel-Angel Sicilia (University of Alcalá), Martin Wolpers (Fraunhofer FIT, Berlinghofen), Nikos Manouselis (Greek Research and Technology Network), Riina Vuorikari (European Schoolnet), Stefanie Lindstaedt (Know-Center).	data supported information systems. 3. Create a generic infrastructure for sharing, analyzing and reusing learning resources and learning activity logs (educational datasets) and related research findings. 4. Reduce delivery costs and create more effective learning environments by applying advanced information retrieval technologies on educational data sets.
7# Multiple Perspectives on Multiple Representations (Appendix 7.4.7)	Armin Weinberger (Universität des Saarlandes), Daniel Bodemer (Knowledge Media Research Center, Tübingen), Manu Kapur (Nanyang Technological University), Gaëlle Molinari (Fondation Formation Universitaire à distance, Sierre), Nikol Rummel (Ruhr-Universität Bochum)	1. A Semiotic Recommender System to Decide which Representation Can Fit Learning Needs at Best 2. When the Representation is Not There, How to Introduce it and Facilitate its Adoption? 3. How Can T(EL) Support Navigation Across Media and Communities?
8# Leveraging Researcher Multivocality for Insights on Collaborative Learning (Appendix 7.4.8)	Carolyn P. Rosé, Gregory Dyke (Carnegie Mellon University), Nancy Law (University of Hong Kong), Kristine Lund (Université Lyon 2), Dan Suthers (University of Hawaii), Christopher Teplovs (Copenhagen Business School).	1. Building a comprehensive framework for exchanging research data and analyses from different research teams in order to deepen the discourse, coming to a convergent interpretation and identifying further research questions.

4.2. Community Building through Participation and Networking

In this section we present analyses of participation at the Alpine Rendez-Vous 2011 (4.2.1) and how and if participants used the opportunity to network (4.2.2). Furthermore, we will present the results of the standard event evaluation in respect to the satisfaction of the participants and their estimation of the value or usefulness of the event (4.2.3).
During the event all participants were informed about the Hash tag #arv11 to allocate the tweets. Furthermore a list with all participants that attended the event has been compiled including besides name and email a picture and information on the institution. This list was send to the event's mailing list shortly after the event together with the link to the flickr photo stream[6] and received very positive reactions from the participants.

4.2.1. Information on the Participants

To give an overview of the 152 participants who attended the Alpine Rendez-Vous - of who 29% did already attend the Alpine Rendez-Vous 2009 - we present (a) their provenance, (b) their scientific background, (c) their membership in the STELLAR network, and (d) the former networks Kaleidoscope and ProLearn.

a) Number and Provenance

The Alpine Rendez-Vous 2011 has been attended by a total of 152 participants of who the majority (81%, 123 persons) come from or currently reside in Europe. The rest is composed of 18 participants (12%) from America, 9 (6%) from Asia, and respectively 1 person from Australia and Africa (for more detail on the countries of provenance see Table 9).

b) Scientific Background of Participants

The majority of the participants at the Alpine Rendez-Vous 2011 indicated that information technology, information science or education technology was their scientific discipline (48,5%), followed by education & learning sciences (29%) and psychology (14,5%). Other (not categorised) disciplines were represented with 8% and comprise connected disciplines as for example cognitive science, didactics, neuroscience, and CCI.

c) Membership in Networks

Of all participants that attended the Alpine Rendez-Vous 2011 46 (30%) work in labs that are members of the STELLAR network. 36 participants have indicated on their questionnaire to be member of the Kaleidoscope network of whom 18 (12%) are now member of STELLAR. 17 participants indicated their membership in the ProLearn network and 8 (5%) of these 17 are now members of STELLAR. 78 participants (51%) have not been in any of these networks.

[6] http://www.flickr.com/photos/mcls-dtp/sets/72157626301464455/

Table 9: Countries of origin of the participants of the Alpine Rendez-Vous 2011.

	Country	Number of participants	
Europe	Austria	6	
	Belgium	5	
	Denmark	2	
	Estonia	1	
	Finland	2	
	France	6	
	Germany	23	
	Greece	4	
	Ireland	1	
	Italy	4	
	Norway	2	
	Portugal	1	
	Romania	2	
	Spain	8	
	Sweden	7	
	Switzerland	7	
	The Netherlands	10	
	UK	31	
			123
America	Canada	3	
	USA	15	
			18
Asia	China	2	
	Japan	1	
	Israel	3	
	Qatar	1	
	Singapore	1	
	South Korea	1	
			9
Australia			**1**
South Africa			**1**
		Total:	**152**

4.2.2. Evaluation of Networking

The second goal of the Alpine Rendez-Vous was to 'build community within and beyond STELLAR'. To find out how much networking has taken place and who has networked with whom Julia Eberle and Karsten Stegmann (LMU) have conducted a social network evaluation to assess the effectiveness of the Alpine Rendez-Vous regarding networking activities between the participating researchers – in general and between different subgroups of participants:
Research question 1: To what extent did the Alpine Rendez-Vous affect networking between all participants?
Research question 2: To what extent did the Alpine Rendez-Vous affect networking between participants of different career levels?
Research question 3: To what extent did the Alpine Rendez-Vous affect networking between participants from different research disciplines?
Research question 4: To what extent did the Alpine Rendez-Vous affect networking between non-STELLAR members and STELLAR members?

Method

Participants and Design

To evaluate the effectiveness of the Alpine Rendez-Vous regarding networking activities, a social network evaluation with a pre-post-design was conducted at the Alpine Rendez-Vous. At the end of each workshop and the TEL Winter School all participants were asked to fill in a questionnaire to evaluate the networking during the event. 167 questionnaires were handed out (17 persons attended two workshops during the Alpine Rendez-Vous and were asked to fill in a questionnaire for each of the workshops) and N = 156 of them were returned, resulting in a response rate of 93%.

Questionnaire and Variables

An individual questionnaire was designed for each workshop, which consisted of a list of all participants' names of the particular workshop. The participants were asked to describe their relation with each of the other participants by ticking the box that seemed most appropriate to them out of the following four possibilities:

1. 'I have collaborated[7] with this person before the ARV and have not identified (new) potential for future collaboration.'
2. 'I have collaborated with this person before the ARV and have identified (new) potential for future collaboration.'
3. 'I have not collaborated with this person before the ARV and have not identified potential for future collaboration.'
4. 'I have not collaborated with this person before the ARV and have identified potential for future collaboration.'

[7] To avoid heterogeneous understandings of the term "collaboration" the following definition was provided to the participants: 'Collaboration: Here we mean every type of personal interaction, e.g. exchange of information about interesting articles, discussions about data collection and analysis, writing of joint articles, starting of a joint project,…'

From those data, several variables were computed and used for further analysis. The two main variables were:

- The amount of a participant's newly identified potential for future collaboration with other participants of the particular workshop (answers to questions 2 and 4), reported by the participants themselves. The value was standardised by the number of possible future collaboration partners within the particular workshop/TEL Winter School to make it comparable across workshops. This is the percentage of newly identified potential for future collaboration.
- The amount of other workshop participants' reports of a particular person's identification as a new potential collaboration partner (answers to questions 2 and 4). This value was standardised by the number of persons who could have reported the person as a potential new collaboration partner.

As important predictive variables for the identification of potential collaboration partners we also computed values for the amount of prior collaboration partners (answers to question 1 and 2), one from self-reports and one from the report of other participants about a particular person.

Also data for the identification of potential for future collaboration across workshops was collected. These data, however, is not as clear and reliable as the data within workshops: Because of the large number of participants at the Alpine Rendez-Vous, it was impossible to give a complete list of all participants for indicating the identified potential collaboration partners; instead, participants were asked to write down the names of the participants outside of their workshop with whom they had identified potential for future collaboration. This led to recall-problems and unspecific indications and therefore identified potential for collaboration across workshops is likely to be underestimated.

Statistical Analyses

The data was analyzed using analyses of covariance and Bonferroni post-hoc tests where appropriate, to explore differences between different groups of participants. For each research question two analyses were performed: First, differences between the groups regarding their reports of identified potential collaboration partners were analysed and second, differences between the groups regarding how often a member of this group was named by other workshop participants as a potential future collaboration partner. The number of prior collaboration partners (from self-reports for the first analysis and from the reports of other participants for the second analysis) were included as covariates. As the eight different workshops and the TEL Winter School offered different possibilities for their participants to get in contact with each other, we also included the workshops as random factor in the analysis to control for their different influences. All statistical tests were performed on the 5% level of significance.

Network Visualization

The statistical findings will be complemented by visualizations of the social network of the Alpine Rendez-Vous participants. In these graphics each circle represents one participant and a line between two circles represents a prior/potential collaboration between two participants which was indicated in the questionnaire. A grey line means that only one of

both participants had indicated this collaboration, a black line represents a collaboration that was indicated by both participants. The size of the circles corresponds to the 'importance' of the person in the social network – the bigger the circle, the more prior and/or potential collaborations with the person with others and from others were reported in the questionnaires. More central participants who are connected to more other participants are also located closer to the centre of the network while participants with a small number of connections to other participants are located to the margins. Colours of the circles differ between each graphics and are explained below the particular graphic.
To increase clarity of the network illustrations, most graphics include only participants of one representative workshop. This is also in accordance with the method of data collection which focused on the identification of potential collaboration partners within the workshops/TEL Winter School.

Results

RQ1: Networking Between All Participants (see Figure 5)

First, we have a look at the general outcome of the Alpine Rendez-Vous regarding networking activities, before looking in detail on the different sub-groups of participants. On average, the participants of the Alpine Rendez-Vous reported to have collaborated before the event with 26% (SD=22) of the other participants of their workshop/TEL Winter School. At the end of their workshop/TEL Winter School, they reported to have identified potential for future collaboration with 56% (SD=25) of the other workshop/TEL Winter School participants. Of these, 23% (SD=20) were identifications of new potential with prior collaboration partners and 33% (SD=23) were identifications of new potential collaboration partners.

The individual assessment with respect to someone being a prior collaboration partner and whether this person could become a collaboration partner in the future is not necessarily reciprocal. Therefore it is worth to not only look at what a particular participant said, but also what the other workshop participants said about the particular participant. On average, a participant was reported as a prior collaboration partner by 26% (SD=17) of the other workshop participants. After the workshop an average participant was named as a potential partner for future collaboration by 57% (SD=20) of the other workshop participants – 23% (SD=16) named an average participant as a prior collaboration partner with whom they had identified new potential for collaboration and 34% (SD=16) named this person as a new potential future collaboration partner.

The analysis showed that the identification of a potential collaboration partner was significantly positively predicted by a person's amount of prior collaboration partners among the other workshop/TEL Winter School participants (for self-report: $F(1,146)=22.91$, $p<.01$, $\eta^2=.14$; for the report by others: $F(1,154)=92.82$, $p<.01$, $\eta^2=.38$): Participants who had more prior collaboration partners identified more potential future collaboration partners. Also the particular workshops in which someone participated had a significant influence on the identification of potential future collaboration partners (for self-report: $F(8,146)=3.34$, $p<.01$, $\eta^2=.16$; for reports by others: $F(8,154)=8.25$, $p<.01$, $\eta^2=.30$): This means, in some workshops it was easier for participants to identify new potential for collaboration than in others.

Also newly identified potentials for collaboration across workshops was measured. The number of indicated identified collaboration partners across workshops/TEL Winter School ranged between 0 and 16 with a mean of M=1.84 identified potential collaboration partners (SD=2.60).

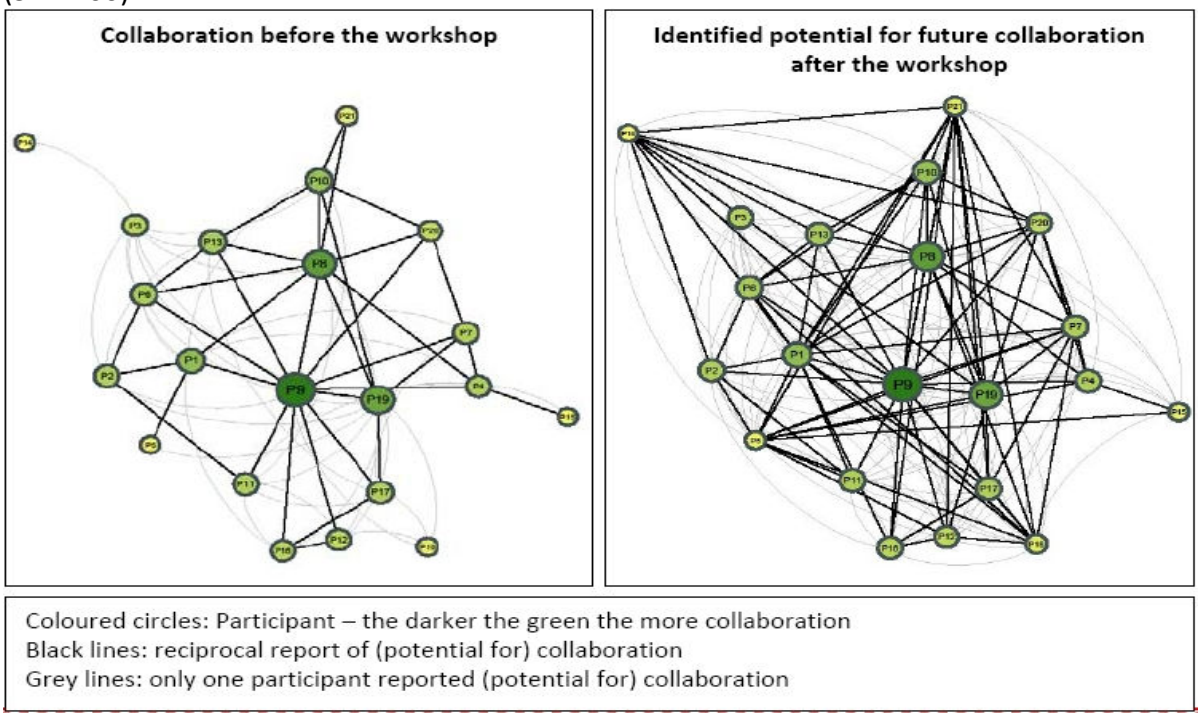


Figure 5: Collaboration between participants of an exemplary workshop.

RQ2: Networking Between Career Levels

One goal of the Alpine Rendez-Vous regarding networking was to connect researchers at different career levels. Out of all questionnaires, 41 were filled in by PhD students, 69 by mid-career researchers and 44 by full professors.

Before the Alpine Rendez-Vous, PhD students reported to have collaborated with 22% (SD=20) of the other workshop participants, mid-career researcher with 30% (SD=23) and full professors with 25% (SD=22). After their participation in the workshop the PhD students reported to have identified potential for new collaboration with 55% (SD=24) of the other workshop participants, mid-career researchers with 58% (SD=26) and professors with 53% (SD=24). An analysis of covariance was conducted to investigate the differences between the career levels regarding their identified potential for future collaboration, including prior collaboration as covariate and the workshop as random factor. The effect of the career level was small and not significant ($F(1,126)=0.55$, $p>.05$, partial $\eta^2<.01$), indicating that PhD candidates, mid-career researchers, and professors did not differ significantly in the identification of potential new collaboration partners.

Looking at who had been reported as a prior collaboration partner, a PhD student was on average chosen by 20% (SD=11), a mid-career researcher by 28% (SD=17) and a full professor by 31% (SD=19) of the other workshop participants. After their participation in the workshop a PhD student was on average chosen as a potential collaboration partner by 48% (SD=16) of the other workshop participants, a mid-career researcher by 58% (SD=22) and a professors by 63% (SD=19). To investigate the differences between the career levels regarding how often they were named as potential future collaboration partners, again an

analysis of covariance was conducted with the reports of other workshop participants of a person being a prior collaboration partner as covariate and workshop as random factor. The effect of the career level ($F(2,136)= 1.20$, $p>.05$, partial $\eta^2=.02$) was not significant. This means that PhD candidates, mid-career researchers and professors did also not differ significantly regarding their attractiveness as potential new collaboration partners for other participants.
They only differ on a descriptive level in their equality between identifying potential collaboration partners and attracting others who see them as potential collaboration partners: While the ratio between those two is equal for mid-career researchers, PhD students identified more potential collaboration partners than they could attract, while full professors attracted more participants who identified potential for collaboration with them than they identified collaboration partners themselves.

RQ3: Networking Between Research Disciplines
The second networking goal of the Alpine Rendez-Vous was to connect researchers from different disciplines. Out of all questionnaires, 43 were filled in by researchers with a background in education, 24 by psychologist, 69 by researchers with a background in information technology, and 16 by researchers with a mixed disciplinary background.
Before the Alpine Rendez-Vous the education researchers reported to have collaborated with 18% (SD=20) of the other workshop participants, psychologists with 26% (SD=21), information technology researchers with 31% (SD=SD=24), and researchers with a mixed disciplinary background with 28% (SD=20). After their participation at the workshop education researchers reported newly identified potential for collaboration with 54% (SD=28) of the other workshop participants, psychologists with 63% (SD=24), information technology researchers with 55% (SD=24), and researchers with a mixed disciplinary background with 51% (SD=22) of the other workshop participants. The differences between the different disciplines regarding the identification of potential new collaboration partners were tested using an analysis of covariance with prior collaboration as covariate and workshop as random factor. The effect of discipline was not significant ($F(3,123)=1.45$, $p>.05$, partial $\eta^2=.03$). This means that there were no significant differences between participants with a background in education, psychology, information technology and those with a mixed disciplinary background regarding the identification of potential new collaboration partners.
Looking at who had been reported as a prior collaboration partner by the other participants of the workshops, an education researcher was on average chosen by 20% (SD=16), a psychologist by 25% (SD=16), an information technology researchers by 28% (SD=17) and a researcher with a mixed disciplinary background by 36% (SD=16). After their participation in the workshops an education researcher was on average chosen as a potential collaboration partner by 53% (SD=20) of the other workshop participants, a psychologist by 60% (SD=21), an information technology researchers by 55% (SD=20), and a researcher with a mixed disciplinary background by 66% (SD=13). To investigate the differences between the disciplines regarding how often their members were named as potential future collaboration partners, another analysis of covariance was conducted with the reports of other workshop participants of a person being a prior collaboration partner as covariate and workshop as random factor. The effect of discipline ($F(3,132)= 2.95$, $p<.05$, partial $\eta^2=.06$) was significant

and of a medium size. There was a tendency that researchers with a background in information technology were less often named as potential future collaboration partners than education researchers (p=.05), psychologists (p.06), and researchers with mixed disciplinary backgrounds (p=.09).

RQ4: Networking Between STELLAR Members and Non-STELLAR Members

The third networking goal was to connect researchers within and outside of STELLAR. Out of all questionnaires, 111 were filled in by researchers who are not members of a STELLAR lab and 45 by members of a STELLAR lab.

Before the Alpine Rendez-Vous non-STELLAR members had collaborated with 23% (SD=21) of the other workshop participants and members from a STELLAR lab with 34% (SD=24). After their participation at the workshop non-STELLAR members reported newly identified potential for collaboration with 55% (SD=24) of the other workshop participants and STELLAR members with 59% (SD=28). To further investigate the differences between STELLAR members and non-STELLAR members regarding the identification of potential new collaboration partners, an analysis of covariance was conducted with prior collaboration as covariate and workshop as random factor. STELLAR membership did not have a significant effect ($F(1, 137)=0.05$, $p>.05$, partial $\eta^2<.01$), i.e., no significant difference was found between STELLAR members and non-STELLAR members regarding their identification of potential future collaboration partners.

Looking at who had been identified as a prior collaboration partner by others, a non-STELLAR member was on average chosen by 25% (SD=17) and a member of a STELLAR lab by 29% (SD=17). After their participation in the workshop a non-STELLAR member was on average chosen as a potential collaboration partner by 55% (SD=21) of the other workshop participants and a member of a STELLAR lab by 60% (SD=17). To further analyse those differences another analysis of covariance was conducted with the reports of other workshop participants of a person being a prior collaboration partner as covariate and workshop as random factor. No difference between STELLAR members and non-STELLAR members was found regarding their attractiveness as potential future collaboration partners for other participants ($F(1,147)= 0.85$, $p>.05$, partial $\eta^2=.01$) .

Conclusion

To sum up the results of the social network evaluation, it can be said that the participants of the Alpine Rendez-Vous were able to identify a substantial amount of potentially new collaboration partners within and – to a smaller extent - across workshops. They were also able to attract the attention of other participants for potential future collaboration during the event.

With respect to networking, the different career levels that were present during the Alpine Rendez-Vous (PhD students, mid-career researchers and full professors) benefited to a similar extent. The different degree to which those groups identify potential collaboration partners compared to the degree of attracting others who see them as potential collaboration partners may have several causes such as differing abilities to presents themselves among the career levels or the increasing attractiveness as collaboration partners based from lower to higher career levels. A challenge for a future Alpine Rendez-Vous could be to take these findings into account. However, in general, the Alpine Rendez-

Vous 2011 has already met the different needs of researchers in different career levels and supported them in their networking activities equally.
The networking of different disciplines was the second area of interest for the social network evaluation. Education researchers, psychologist, researchers in information technology and researchers with a mixed disciplinary background participated in the Alpine Rendez-Vous. They all benefited from their participation by identifying and attracting potential future collaboration partners during the event.
We also looked at differences between members of a STELLAR lab and those participants from institutions not related to STELLAR. STELLAR members were generally more connected to other participants before the Alpine Rendez-Vous. These differences disappeared after their participation in one of the workshops. We can thus conclude that STELLAR members and non-STELLAR members similarly benefited from their participation.
Throughout the analyses, we found that in several cases, the particular workshop a participant took part in played a role in his or her networking success. It seemed to be easier to identify potential for future collaboration or be identified as a potential collaboration partner in some of the workshops than in others. The design of the workshops might have played a role in these differences and networking potential could be considered in the design of future Alpine Rendez-Vous workshops.
Of course, this social network evaluation has some critical methodological limitations: First, we only measured the identified potential for future collaboration and not the actual new collaborations after the event. Such a measurement would have been impossible in the short time as the establishment of collaboration in research often takes a long time and is only visible after some years when joint articles have been written and published. The second methodological difficulty is the measurement of networking activities with self-reports as they are accompanied by questions of reliability. For this reason, we implemented a second, more objective instrument of measuring networking activities: During the event, participants carried an RFID-chip with them that measured with whom and for how long each participant was in speaking distance. The analysis of the data collected with this completely new network analysis method has just begun, but these measures will complement future self-reported findings.
Despite these limitations, we have an acceptable measure that gives evidence of the networking activities during the Alpine Rendez-Vous: The event was primarily a good opportunity for its participants to identify future collaborators and therefore a successful instrument to build a community among TEL researchers.

4.2.3. Results of the Standard Event Evaluation

117 of the attending participants filled in the evaluation form, which corresponds to a response rate of 77%. The participants spread over the workshops as demonstrated in Table 10 (multiple answers possible):

Table 10: Number of responses to event evaluation per workshop.

Workshop	Title	No. of participants
	JTEL Winter School	9
W1	Early Years and Technology	10
W2	Methods and Models of Next Generation TEL	11
W3	Neurosciences, Technology & Learning	9
W4	Structuring online collaboration though 3 Ts : task time & teams	15
W5	Exploring The Fitness and Evolvability of Personal Learning Environments	10
W6	dataTEL	16
W7	Multiple perspective on multiple representations	17
W8	Leveraging Researcher Multivocality for Insights on Collaborative Learning	22
Not stated		20

The complete Event Evaluation Questionnaire can be found in the Annex 7.5.

Most of the participants indicated that they learned about the Alpine Rendez-Vous 2011 through colleagues (56%) while 22% were informed by e-mail newsletters[8].

Funding. 74% of the participants were funded by the workshop and while 30% of them would have taken part in the event also without any funding, 61% of the funded participants neglected this choice. Of those who weren't funded by STELLAR and received funding from elsewhere 70% would not have taken part in case of no financial support. Only 3 participants (2.6%) attended without any funding.

Participants were asked to rate the different aspects of the Alpine Rendez-Vous on a Likert scale ranging from 1=unsatisfactory to 4=excellent (for all means, minimum, maximum and standard deviation see Table 11) respectively from 1=not useful at all to 4=very useful. Means concerning the satisfaction and usefulness with different aspects of the event and the attributed usefulness ranged between 3.19 and 3.73 with only two outliers (2.53 satisfaction for *insights into other workshops* and 2.73 for *the Community Event*) and can thus be considered indicating high overall contentment. For more information on the rating of all categories see Table 11.

In their open comments participants highlighted their appreciation of the **networking possibilities** with like-minded researchers (29 comments). The adequate format and high quality of the **workshops** and the contents was also mentioned many times (by 25 persons). The **discussions** were seen as very useful and stimulating and participants often mentioned that they gained more insight in the research field and broadened their minds (16x). The informal **setting** (13x) and the organization at place (breaks, food, etc.) (13x) were positively commented upon. Participants also liked **working in small groups** (6x) and underlined the quality of the other workshop attendants (12x). Visitors liked opera and skiing possibilities,

[8] Mailinglists named by participants that informed about the ARV 2011: ISLS, Kaleidoscope, ROLE, STELLAR, CSCL, ICLS, ICTRN, Teleurope

while the hiking during the Community Event was not liked by everyone, especially because of the cold and rainy conditions

Regarding potential improvements, the participants asked for more cooperation and exchange in between the different workshops (8x). Some would also prefer getting deeper into a theme and taking part in only 1 workshop instead of 2 (8x). This corresponds to the demand for extended event duration in general (6x). Some people (8) criticized the organization in advance of the event in terms of lack of a participants list as well as more and earlier information on schedule and (sports) equipment that would have been appreciated. The hotel facilities were seen as partly unsatisfying, especially the sizes of private and meeting rooms (5x). Another 5 persons complained about the inadequate wireless internet connection.

Table 11: Descriptive statistics for the variables in the standard event evaluation questionnaire

Evaluation Aspect						
		N	Min	Max	Mean	SD
Satisfaction with	Event administration	113	1	4	3.26	.912
	Structure of the programme	114	1	4	3.36	.816
	Venue and facilities	116	1	4	3.21	.772
	Presentations in the workshops	116	2	4	3.48	.676
	Insights into other workshops	94	1	4	2.53	1.286
	Discussions	115	2	4	3.64	.710
	Event dinner and catering	113	1	4	3.19	1.027
	Community Event	100	1	4	2.73	1.319
Usefulness of	Presentations in the workshops	102	1	4	3.59	1.342
	Discussions	102	2	4	3.62	1.330
	Group work	99	2	4	3.53	1.402
	Opportunities to network	102	2	4	3.73	1.338

5. Structure

In this section information on the procedures of the local organisation, the Community Event, and the financial aspects of the Alpine Rendez-Vous are provided.

5.1. Local Organisation

The local organisation was situated in Lyon, France at the ENS Ecole Nationale Supérieure of Lyon. The LMU team cooperated with Kristine Lund who was responsible for the local organisation and her colleague Pascale Pauly who was recruited for logistical aspects.

5.1.1. Selection and Description of the Location

The hotel choosen by the local organising team was the Best Western Alpen Roc Hotel situated in the Alpine environment of the typical Savoyard village of La Clusaz (1100/2600 meters). The village placed in the Aravis Mountain is a popular location in Haute-Savoie, next to Lake of Annecy and the city of Chamonix. The hotel was chosen because of the overall capacity to host the Alpine Rendez-Vous 2011, as well as the availability of meeting rooms in order to ensure space for all participants of the 8 workshops. Beside this the hotel also offered the possibility to use apartments and triple rooms to special "student prices" for the attendants of the JTEL Winter School.

For the Community Event (see 5.2), the Alpen Roc Hotel made available "The Village Hall" which can receive more than 300 people.

5.1.2. Participants and Finance – Some Figures

152 participants, including workshop organisers and the organising team, took part in the Alpine Rendez-Vous 2011.

87 of them were funded by STELLAR WP3, 18 were funded by WP4 (JTEL Winter School)[9], and 49 participants had other funding. Table 12 shows an overview of funded participants.

Table 12: Distribution of funding of participants not including the JTEL Winter School.

Funding	Number of participants
Participants financed by WP3 STELLAR funds	91[10]
Self financed participants	49

8 workshops were selected for the event. The number of participants in each workshop depended on demand, the selection strategy of the workshop organiser(s), and capacity of

[9] One participant was half funded by WP4 and half funded by WP3.

[10] The number consists of 87 funded participants and the 4 artists forming Kazoosbelli who presented the TEL Opera during the Community Event.

allocated workshop room. Independent of the number of participants, one organiser and a maximum of 10 participants were financed per workshop by STELLAR.

Local organizers, award winners, and actors of the TEL Opera were full board funded.

STELLAR chose to reimburse the travel of one workshop organizer per workshop based on the following conditions:

From Europe

- Train or flight by presenting the original receipt of transport ticket maximum amount 400€
- By car: from the hometown to La Clusaz, 0,30 EUR per kilometre reimbursed.

Workshop organizers travelling from outside Europe up to 800€ can be reimbursed by presenting the original receipt of transport ticket.

5.1.3. Recreation Activities

At the end of the winter season in March 2011 when the ARV took place little snow was left available at the top of the Aravis Mountain. But nevertheless several sportsmen and sportswomen carried out ski and snowboarding at the highest top of the mountain at 2257 meters in the 'Massif de l'Aiguille'.
Also proposed by the local organisers were activities such as going for a sleigh ride and a cheese dairy visitation. During the event the Hotel offered free access to the fitness area including swimming pool, sauna, steam room and a gym room.

5.2. Community Event

The Community Event was a platform for award ceremonies and an opportunity to get to know each other outside the 'working environment' of the workshops (for the full time schedule see Appendix 7.2.2). It was positioned in the middle of the week on March, 29th starting at 5pm and served as a link between the two series of workshops. Participants of the first and second workshop round joined the ceremony. Kris Lund presented the general idea of the Alpine Rendez-Vous and the 'Grand Challenges Framework'. Katherine Maillet awarded the EATEL price and Nicolas Balacheff presented the TELEARC award (see section 5.2.1) and every workshop presented insights in respect to the Grand Challenge Themes / GCP approached (see section 5.2.2). Subsequently the whole group walked to the mountain restaurant to close the evening with a typical Savoyan dinner.

5.2.1. EATEL and TELEARC Awards

The definition of the awards and the selection of the award winner have been undertaken by the two major TEL associations in Europe: the European Association of Technology-Enhanced Learning (EATEL) and the Technology Enhanced Learning European Advanced Research Consortium (TELEARC). Representatives from both associations gave a short talk during the Community Event.

TELEARC. The TELEARC award addressing PhD excellence was handed over by Nicolas Balacheff who also gave an introduction on TELEARC. Following, the awardee Yishay Mor from London Knowledge Lab (UK) and Technologies in Education Graduate Program - University of Haifa (Israel) gave a short talk on the awarded paper (see Figure 6). The rewarded work has the title **'**A Design Approach to Research in Technology Enhanced Mathematics Education'[11] (available in the TeLearn open archive[12]).

EATEL. Katherine Maillet, gave a short introduction on EATEL in her function as president of the association. She then presented the **Best Interdisciplinary Paper Award** (synergy between disciplines) winner of EATEL, Myroslava Dzikovska who unfortunately could not attend the event. She won the prize for the paper 'Content, Social, and Metacognitive Statements: An Empirical Study Comparing Human-Human and Human-Computer Tutorial Dialogue' together with her co-authors Natalie Steinhauser, Johanna Moore, Gwendolyn Campbell, Katherine Harrison, and Leanne Taylor.

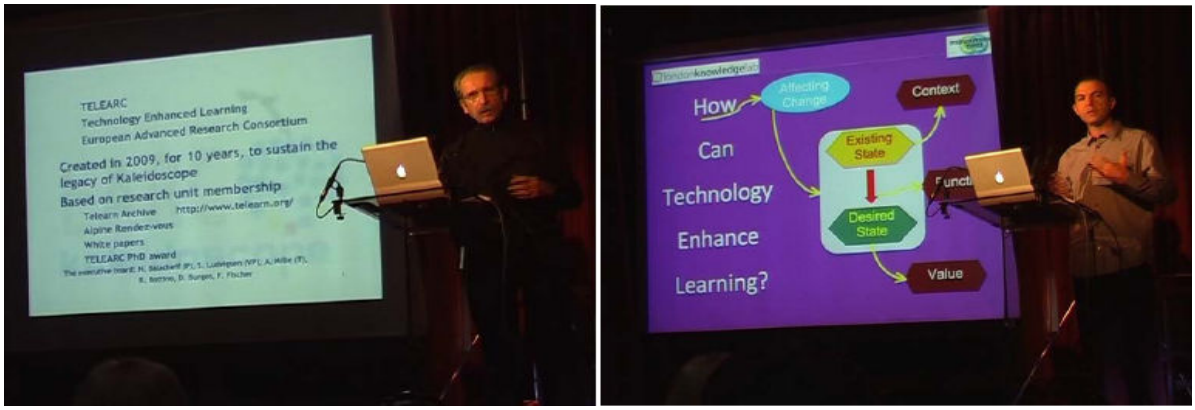


Figure 6: Nicolas Balacheff presenting the TELEARC award and award winner Yishay Mor

5.2.2. Introduction of the Workshops

In her role as local organizer Kris Lund presented an introduction to the format of the ARV 2011 as well as to the Community Event (see Figure 7). After the presentation of schedule and some organisational information the awards were handed over by TELEARC and EATEL (see 5.2.1). Following, Kris invited each workshop organizer to present their Grand Challenges/Grand Challenge Problems either in the way they had already been approached or for the workshops of the 2nd half of the week how they plan to approach them.

5.2.3. The TEL Opera

As final piece of the first part of the Community Event, Kris invited the theatre company 'Kazoosbelli'[13] to perform a humoristic 'TEL Opera' - a musical entertainment in the form of an opera summary, loosely based on the myth of Faust[14]. The artists created an opus named

[11] Link to video cast from the WP2 podcast channel in Teleurope: http://www.teleurope.eu/pg/podcasts/play?g=131776
[12] http://www.telearn.org/open-archive/browse?resource=5700
[13] For further information and to contact the theatre company: contact@kazoosbelli.com
[14] Link to video cast from the WP2 podcast channel: http://www.STELLARnet.eu/index.php/repository/podcast_player_5s/?pID=58

“The Damnation of Sauft”. For each of the 8 workshops part of the thematic content was integrated in the opera.

Figure 7: Kris Lund giving the introductory speech and a scene from the TEL Opera by Kazoosbelli

5.2.4. At the Mountain Restaurant

The community event ended at the “Telemark Café” a mountain restaurant in the Etale Mountain.

After a short ride by buses, the restaurant could be reached by foot equipped with a headlamp or by 4x4 cars. The restaurant served a typical Savoyard meal (see Figure 8). Unfortunately it was raining outside and the climbing was an adventure, but inside the mountain hut it was warm and cosy!

Figure 8: A typical Savoyan meal in the cosy mountain restaurant

6. Conclusion and Outlook

In this final section, conclusions are drawn with respect to (6.1) the scientific advances and (6.2) the community/ capacity building that occurred at the Alpine Rendez-Vous event. An Outlook (6.3) sketches the next steps with respect to the Alpine Rendez-Vous and the Grand Challenge Problems.

6.1. Scientific Conclusions: Advancing TEL Research with Respect to the Grand Challenge Themes

One of the two main goals (see section 2 Goals of the Event) of the Alpine Rendez-Vous in the context of STELLAR was to conduct workshops to advance the Grand Challenge Themes 'Connecting Learners', 'Contextualisation', and 'Orchestration' by developing Grand Challenge Problems. In this respect, the new concept of the Provocateur was a full success. All of the workshops produced Grand Challenge Problems (GCPs) that help to structure the respective research field and that may contribute to better coordinated research efforts in conjunction with education industry and policy. More than 30 'raw' GCPs were formulated in the white papers and all of them are associated with pertinent research questions. Taken together, they might be taken as a 'map of the potentials of European TEL research' for the next years.

Some of the GCPs are aimed at tapping into the potential of the advances of highly dynamic research fields to address cross-sectional problems in educational systems. For example, neuroscience can inform our existing knowledge on games and the brain's reward system to improve the design of learning environments that boost learners' motivation. Some other GCPs arose from eminent societal concerns such as the increasing exposure of very young children to technology and resulted in a plan to develop guidelines with research-based principles for how to engage young children with digital technologies.

Some of the GCPs also suggest tackling educational problems that are worsened through TEL such as high drop-out rates in online courses. It was suggested, for example, that recommender systems which draw on large amounts of learning process data and that are embedded in a collaborative environment could potentially reduce drop-out rates.

Several GCPs take the mass use of technology as their starting point and develop visions of a substantially improved educational system in Europe through TEL. An example is the 'million teachers, million practices' GCP, where many teachers share their successful teaching practices and thereby support one another in finding TEL examples appropriate for their classroom or specific learning environment. Another example is the vision of one technology-based tutor per child, building on firm empirical evidence that one-to-one tutoring is among the most effective forms of teaching (but hard to implement without technology).

TEL provides a substantial opportunity (and necessity) to change our assessment and evaluation practices. As TEL increasingly contributes to the blurring of lines between formal and informal education, it demands new ways to assess competencies facilitated in online

and blended TEL environments. In addition, digital technologies are seen as having a very high potential for enabling new forms of assessment and evaluation, for example through automated analysis of learning process data using text classification technologies. In this respect, a cross-sectional issue emphasised in several GCPs is that of data sharing to support the development of new methods of analysis.

6.2. Conclusions on Community Building, Networking, Capacity Building and Organisation of the Event

The second goal of the Alpine Rendez-Vous was community building on different levels as, for example, between participants from different disciplines and career levels.

As was the case with the first STELLAR Alpine Rendez-Vous, the majority of the event's participants were not in the STELLAR network. 20% even travelled from outside of Europe, which led to a wide variety of researchers meeting at the event. The network analyses revealed that the initial advantage of coming from a STELLAR lab with respect to being connected to other participants vanished during the workshops and resulted in an equal distribution of identified future collaboration opportunities for members and non-members of the STELLAR consortium.

Generally, there was a substantial increase in foreseen future collaborations during and, most probably, through the event. This was not surprising, and deeper analyses revealed that for researchers of different career levels (PhD, Mid Career, Full Professors), the Alpine Rendez-Vous 2011 provided equally high-levels of networking opportunities. The same holds true for researchers with different disciplinary backgrounds: Participants from educational technology, computer science, psychology and other areas indicated similar levels of newly planned collaborations. There are also a substantial amount of foreseen new interdisciplinary collaborations which meet the need for interdisciplinary teams and approaches that are emphasized in most of the White Papers.

Beside the very promising results from the network evaluation and high ratings of the usefulness of networking opportunities (3.73 on scale with a maximum of 4, N=102), there were still requests for more networking opportunities between the different workshops. Measures to support the connection between all attendants of the Alpine Rendez-Vous 2011 after the event (like the dissemination of a link to a flickr photo stream[15]) have received positive feedback. Following a request by several participants, a participant mailing list was put together by the organising team, including pictures and information on institutions for everyone who attended the event.

[15] http://www.flickr.com/photos/mcls-dtp/sets/72157626301464455/

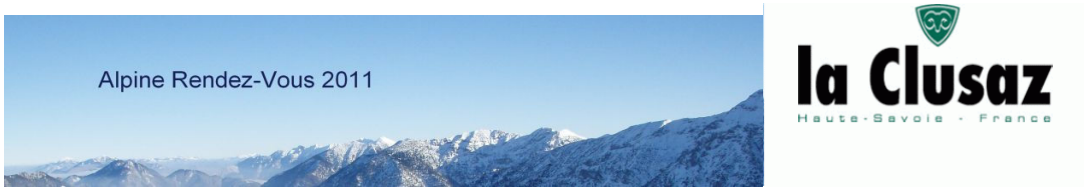
6.3. Outlook

The Grand Challenge Problems are an important starting point for future developments. Selected stakeholders from education, academia, industry and policy are currently invited to comment on a sub-set of GCPs with the goal to start a dialogue and identify areas that are prioritised by several of the stakeholders. The result will be published in a book.

A second positive prospect is that the Alpine Rendez-Vous has a future. The next event will be organised by the MeTAH Team (Modèles et Technologies pour l'Apprentissage Humain), Laboratoire d'Informatique de Grenoble in March 2013. The two main scientific societies, EA-TEL and TELEARC provide resources to organise some of the workshops.

7. Appendix

7.1. Appendix 1: Call for Workshop Proposals Alpine Rendez-Vous 2011



Alpine Rendez-vous Call for Workshop Proposals – new deadline August 1st, 2010

What is the Alpine Rendez-vous?

The Alpine Rendez-Vous (ARV) is supported by the STELLAR Network of Excellence (www.STELLARnet.eu) and aims at building a Technology Enhanced Learning (TEL) researcher capacity on a European level. You do not have to be a STELLAR member to respond to this call.
The ARV is an atypical, informal gathering, lasting three and a half days. The two previous ARVs were held in Villars (Switzerland) in 2007 and Garmisch-Partenkirchen (Germany) in 2009. The ARV is not a standard conference, but a set of independent workshops located at the same time in the same hotel. Four workshops run in parallel during the first part of the week and four during the second part. It's called "Rendez-Vous" because shared events are organized in the middle of the week (Tuesday evening) and because we set up breaks and meals in a way that promotes informal encounters between participants from the different workshops. Finally, it is called "Alpine" because it gathers scientists in the Alps, away from their workplace routines, in a place where snow is used as “social facilitator."

The international Reviewer Board of the Alpine Rendez-Vous gathers together members of the TEL community from all over the world and in particular European researchers who were active participants of the former Networks of Excellence Kaleidoscope and Prolearn. The Reviewer Board includes both members of the present Network of Excellence STELLAR as well as researchers outside of the network. The goal of STELLAR is to continue the community building process
initiated by Kaleidoscope and Prolearn. The ARV is also supported by the executive bodies of TELEARC and EATEL, the associations stemming from the two former networks of excellence.

Important dates

Workshop proposals (see below for requirements) should be sent by August 1st, 2010 to Kristine Lund and Pascale Pauly at ARV2011@ens-lyon.fr

Authors of accepted workshop proposals will be notified by the last week in August, 2010.

Workshop calls for participants should go out at the latest by September 15th.

Potential participants should apply at the latest by October 1st.

Workshop leaders will notify chosen participants and inform the Reviewer Board of their organization by October 15th.

The ARV 2011 will be held March 27th to March 31st, 2011

Where?

The third biennial ARV will take place in the French Alps in the *Massif des Arravis* at a beautiful ski resort called *La Clusaz (hotel Alpen Roc)*:
http://www.laclusaz.com/hiverwinter10/index.php?lang=_uk .

There will be some free time in the afternoons for TEL community building during winter activities.

What should the workshop proposal include?

Submissions, preferably in PDF format, should include the following items:

1. Identification
    - Contact information of the workshop proposer including: name, affiliation, address, email, phone, fax and homepage URL (these last two optional);
    - Workshop title;
    - Expected number of participants

2. Description Abstract (2 pages)
    - Brief description of the workshop explaining the topic and the goals (especially as it relates to one or more of the grand challenges – see below);
    - Brief description of the general structure of the workshop, e.g., whether it will include paper presentations, whether a call-for-papers will be issued or whether it will be invitation-only;
    - A clear publishing strategy needs to be described: whether the contributions to the workshop will be published in a book, a special issue for a journal, etc. Please indicate the targeted journal(s) or book publisher;
    - Brief statement how this workshop will contribute to the integration of different TEL research communities in Europe and beyond;

3. Let us know if you could have any funding for your proposed workshop coming from another instrument within STELLAR or from any sources outside STELLAR (EU project, etc.).
    - Note, that there is a limited number of additional slots for workshops related to the topic but funded by other grants. If you are interested in organizing such an externally funded workshop, please send a description of your plan.

1. Plan for promoting the workshop and disseminating results (Website etc.)

5. Plan for selecting workshop participants
    - One main goal of the Alpine Rendez-Vous is to bring together the different scientific communities doing research on Technology-Enhanced Learning.

What are the criteria for choosing workshops?

Between 6 and 8 workshops will be chosen by the Reviewer Board and the extent to which the workshop proposer responds to the five points above will be evaluated. Each workshop proposal will be sent to three reviewers (one internal to STELLAR and two external). A workshop would typically include 20 participants. About half of them should be members of labs that belong to STELLAR and will hence have their own funding to come. The second half should come from outside STELLAR (this is a requirement). The participation of 10 of these external participants (2 or 3 nights + food) will be covered by the budget of the Alpine Rendez-Vous (10 people per workshop regardless of workshop size), but they must cover their own travel expenses. Workshop size can vary, depending on room distribution (5 rooms of 21m2 each, 1 room of 110 m2, 1 room of 70 m2, 1 room of 35 m2).

Workshops should encourage information sharing and discussion amongst groups of participants, rather than mere presentation of information by the organizers and presenters.

In 2011, the JTEL Winterschool will be organized together with the ARV. The Winterschool is a high-level PhD school for the field of TEL in which interdisciplinary PhD candidates come together and present and discuss their advanced thesis work. Reflection will be carried out on thesis topics in relation to ARV workshops and the grand challenges of STELLAR (see below). The selected PhD candidates will be supported by STELLAR grants. Please direct any questions to Marcus.Specht@ou.nl.

Workshops are required to make progress towards issues within at least one of the three ”Grand Challenges” in TEL research, shaped by STELLAR as:

1) Connecting Learners

On the Web, we can see that self-directed, self-managed and self-maintained communities create successful new forms of collaboration. A wide range of tools is used by these communities for knowledge sharing and building, communication, collaboration and networking. Knowledge sharing and building is facilitated by open and closed forums, Wiki pages and personal or shared blogs. Multimedia material is shared using popular tools such as FlickR and YouTube.
Communication takes place using forums, annotation, tagging, chat rooms, instant messaging and video conferences. Collaboration is facilitated by shared media repositories, version management systems and collaborative text editing systems such as Google Docs. Networking portals, such as FaceBook and LinkedIn, allow professionals to find, contact and keep in touch with like-minded. In a Web 2.0 world new communities bring together self-directed, self-managed and self- maintained users and, thereby, create successful new forms of collaboration. These new communities are open to all learners at any point in their life of learning. Within successful communities, inherent incentive mechanisms to motivate and encourage participation exist. The heart of learning and knowledge consists of people. Replacing the current centralized, static technology-push models with new interactive models that reflect the continuous, social nature of learning requires a radical shift from a focus on knowing what to a focus on knowing how and knowing who. Within this theme key research questions are: What are the characteristics of a network for learning? What are key enabling and success factors for learner networks? What impact could web 2.0 technologies have on learning in educational institutions? What impact could web 2.0 technologies have on learning outside educational institutions? …. [excerpt from STELLAR-STELLAR-Del. 1.1]

2) Orchestrating Learners

The development of digital technologies, their interfaces and association with communication technology, has opened up the possibility of accessing a large diversity of learning tools and all kinds of resources, as well as new infrastructures to support interactions and communications among learners and teachers or trainers -- or in more general terms, among learners and knowledgeable others. This evolution is supported by the emergence of theoretical frameworks which provide new means to understand learning and to design more efficient and more relevant environments to support it. Situated cognition and situated learning theories, collaborative learning, exploratory learning as well as mobile learning theories are stimulating new approaches to learning, pedagogy, didactics and assessment. The multiplicity of the resources, the multiplicity of the devices, the multiplicity of the agents (co-learners, teachers or trainers, artificial or human agents) contributing to a learning process is the modern mark of TEL. Its practical impact is the requirement for more and new collaborative competence for using, generating and exchanging knowledge in a peer-to-peer manner and participating in communities of learning. To face the emergence of this richer and more complex than ever world of learning resources, the new challenge is to find methods and principles, as well as concepts and tools, to engineer learning situations and/or learning environments. Within this theme key research questions include: What is the role of the teacher/more knowledgeable other in orchestrating learning and how does this relate to collaboration and the knowledge of students? What is the role of assessment and evaluation in learning and how can technology play a role? From the point of view of the learner what is the relationship between higher-order skills and learning of a particular knowledge domain and what is the role of technology in this respect? How can we identify the current learning trajectory or a person? Would it be beneficial to make them aware of trajectory switches? …. [excerpt from STELLAR-Del. 1.1]

3) Contextualizing virtual learning environments and instrumentalising learning contexts

As learning has become an integrative part of our life, and as it takes place in different learner communities, so the tools, resources and systems that are used need to be contextualized. The learning context is the "setting", in a broad sense, in which the learning occurs (see discussion page). It is continually created by people in interaction with others, with physical and digital objects, with their surroundings and with everyday tools. Complementarily, the interplay between formal and informal learning in formal and informal contexts has to be instrumentalized through the use of physical artifacts, mobile devices and the configuration of physical and virtual space, in order to create learning opportunities beyond the traditional institutional boundaries. Technologies for learning must be designed for culturally mediated settings, which include the co-design of technology and pedagogy for situated learning, simulated environments and support for mobility.

Traditional classroom learning is founded on an illusion of context stability, by setting up a fixed location with common resources, a single teacher, and an agreed curriculum, which allows a semblance of common ground. But if these are removed, a fundamental challenge is how to form islands of temporarily stable context to enable meaning making from the flow of everyday activity. Within this theme key research questions include: How can new forms of technology-enhanced learning enable novel experiences for learners and for development of human competences and capabilities? How can the mobility of the learner in distributed and multi environment learning settings be supported, to include the transition between a) real and virtual contexts b) informal and formal learning contexts? Which standards are needed to achieve interoperability and reusability of learning resources in this

field? How can we harmonize the existing learning standards? … [excerpt from STELLAR-Del. 1.1]

What else do we ask of workshop organizers?

After the event, workshop organizers will be responsible for writing or editing a White Paper (8 pages) briefly summarizing the event and how it contributed to one of the Grand Challenges of STELLAR. Wherever applicable, the workshop contributions should be published in a journal special issue or book. Workshop organizers should create and maintain a group on teleurope.eu to communicate their topics with stakeholders. The White Paper could include an outline of the special issue or book proposal. The White Paper will be due May 20th, 2011 and instructions for writing it will be communicated at a later date.

We look forward to your Alpine Rendez-Vous 2011 workshop proposals!

7.2. Appendix 2: Programme of the Alpine Rendez-Vous 2011

7.2.1. Time Schedule of the Alpine Rendez-Vous 2011 including the JTEL Winter School

<table>
<tr><td></td><td>Sunday, March 27</td><td>Monday, March 28</td><td>Tuesday, March 29</td><td>Wednesday, March 30</td><td>Thursday, March 31</td></tr>
<tr><td>7:00 - 8:15</td><td></td><td colspan="4">Breakfast</td></tr>
<tr><td>8:30 - 12:15</td><td>Arrival for first half of the week</td><td>Workshops 1, 2, 3, 4,
+ JTEL Winter School
(including coffee break)</td><td>Workshops 1, 2, 3, 4,
+ JTEL Winter School</td><td>Workshops 5, 6, 7, 8
+ JTEL Winter School
(including coffee break)</td><td>Workshops 5, 6, 7, 8
+ JTEL Winter School</td></tr>
<tr><td>12:15 - 12:30</td><td></td><td colspan="4">React (with post-its) to workshop leaders' + JTEL paper boards on the GC (prepared beforehand and put in a common room)</td></tr>
<tr><td>12:30 - 13:30</td><td></td><td>Lunch</td><td>Lunch</td><td>Lunch</td><td>Lunch</td></tr>
<tr><td>13:30
15:00</td><td rowspan="5">Arriving
JTEL
Winter School</td><td rowspan="2">Spare time: snow activities available</td><td>Spare time: snow activities available
15:30</td><td rowspan="2">Spare time: snow activities available</td><td>Workshops 5, 6, 7, 8 + JTEL</td></tr>
<tr><td></td><td>Workshops 1, 2, 3, 4 + JTEL Winter School (including coffee break)
17:00</td><td>15:00</td></tr>
<tr><td>16:30
17:00</td><td rowspan="6">Workshops 1, 2, 3, 4
+ JTEL Winter School
(including coffee break)</td><td rowspan="6">Workshops 5, 6, 7, 8
+ JTEL Winter School
(including coffee break)</td><td rowspan="7">End</td></tr>
<tr><td>17:00 - 17:15</td><td>STELLAR community event introduction and attribution of “Stakeholder award”</td></tr>
<tr><td>17:15 - 17:30</td><td></td><td>TELEARC award winner presentation</td></tr>
<tr><td>17:30 - 17:45</td><td></td><td>EATEL award winner presentation</td></tr>
<tr><td>17:45 - 19:05</td><td rowspan="2"></td><td rowspan="2">Each workshop (10 minutes each) presents their Grand Challenges</td><td>WS 1 - 8</td></tr>
<tr><td>19:05 - 19:15</td><td>JTEL</td></tr>
<tr><td>19:15 - 19:30</td><td></td><td></td><td colspan="2">Short break & preparation for Opera</td></tr>
<tr><td>19:30 - 20:15</td><td></td><td></td><td colspan="2">TEL Opera</td><td></td></tr>
<tr><td>20:30 - 21:00</td><td rowspan="2">Dinner at the hotel</td><td rowspan="2">Dinner at the hotel</td><td>Travel to the mountain restaurant</td><td rowspan="2">Dinner at the hotel</td><td></td></tr>
<tr><td>21:00 - 21:30</td><td>Dinner in the mountain restaurant</td><td></td></tr>
</table>

7.2.2. Time Schedule for the Community Event on Tuesday, 29th March 2011

<table>
<tr><td>17:00</td><td colspan="2">STELLAR Community Event introduction and presentation of the Alpine Rendez-Vous concept by Kris Lund</td></tr>
<tr><td>17:15
–
17:30</td><td colspan="2">TELEARC award winner presentation by Nicolas Balacheff
Talk by Yishay Mor</td></tr>
<tr><td>17:30
–
17:45</td><td colspan="2">EATEL award winner presentation by Katherine Maillet</td></tr>
<tr><td rowspan="2">17:45
–
19:15</td><td rowspan="2">Each workshop presents their Grand Challenges
(10 minutes each)</td><td>WS 1
WS 2
WS 3
WS 4
WS 5
WS 6
WS 7
WS 8</td></tr>
<tr><td>JTEL Winter School</td></tr>
<tr><td>19:15
–
19:30</td><td colspan="2">Short break & preparation for Opera</td></tr>
<tr><td>19:30
–
20:15</td><td colspan="2">TEL Opera by Kazoosbelli ‘The Damnation of Sauft’</td></tr>
<tr><td>20:30
–
21:00</td><td colspan="2">Travel to the mountain restaurant with buses followed by hiking</td></tr>
<tr><td>21:00
– 0:00</td><td colspan="2">Dinner in the mountain restaurant</td></tr>
</table>

7.3. Appendix 3: Workshop Proposals Evaluation

7.3.1. Workshop Proposals Evaluation Sheet.

Workshop evaluation table			
Brief description			
Workshop Leader name			
Title of Workshop			
Expected number of participants			
In what ways does the workshop address one or more of the following STELLAR Grand Challenges (GC)? **See the call for a description of the challenges.			
1. Connecting learners (**CL**)			
2. Contextualisation (**C**)			
3. Orchestration (**O**)			
Give points to represent the quality of the proposal for each box below (3 is best)			
1, 2 or 3	C1 weight: 3	What is your opinion on the quality/impact of their approach towards the GC? Please give reasons	
1, 2 or 3	C 2	Do they define success indicators for making progress towards 1, 2 or 3? If so, what are they?	
1, 2 or 3	C 3	Is the workshop structure adequate?	
1, 2 or 3	C 4	Do they plan to choose participants representing both the different TEL communities as well as researchers at different times in their careers?	
1, 2 or 3	C 5	Do they have an adequate publishing strategy for workshop output?	
1, 2 or 3	C 6	Do they sufficiently plan to promote the workshop and disseminate results?	
1, 2 or 3	C 7	In which ways does the workshop contribute to integrating TEL communities?	
1, 2 or 3	C 8	How are PhD students integrated into the workshop?	
1, 2, 3, 4 or 5	C 9 weight: 2	Rate this workshop where 1 is lowest and 5 highest	

7.3.2. Reviewer Meeting

The reviewers' (online) flash meeting on 18th August 2010 to finalize the selection of workshops.

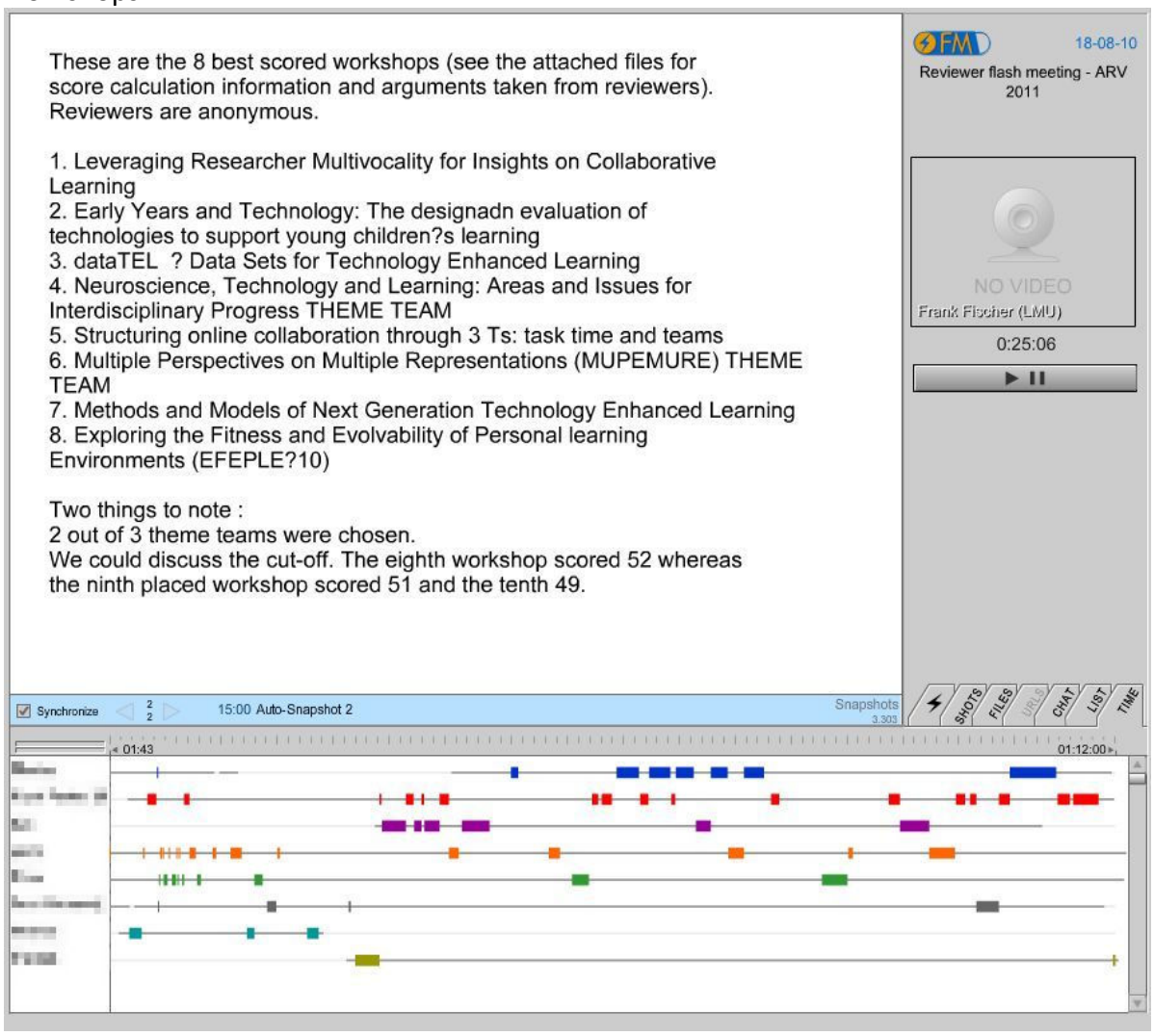


Figure 9: Screenshot of the reviewers (online) flash meeting.

Note: The reviewers have been intentionally blurred to protect the confidentiality of the review process.

7.3.3. Exemplary Result of the Evaluation

Example of the evaluation sheet of one workshop proposal

Note: Only the "first in class" evaluation sheet is provided in order to preserve the confidentiality of the review. A consolidated version of the evaluation sheet was produced after the reviewers' online meeting.

Grand Challenges	**Criteria**	**Ratings**	
Leveraging Researcher Multivocality for Insights on Collaborative Learning		STELLAR	external
STELLAR/ **CL:** e.g. Face-to-face computer-mediated corpus on learning fractions **C:** Corpus in an informal or workplace situation planned **O:** e.g. analysing interaction in data corpora to improve learning **Quality:** The analysis of different corpora of CSCL with different viewpoints and methodologies is demanding but fruitful. The group has already demonstrated the competence to collaborate effectively. **EXTERNAL/** **CL:** The main goal of this workshop is to understand learners interaction and their interaction with tools and teachers by multi-perspective analysis. The comparison of different analysis on the same corpora will enhance the global understanding of how learners are connected to each other and to tools. **C:** this challenge is mainly address by looking at the interplay between formal and informal learning **O:** This is considered as a consequence of the first Challenge. The multi-perspective approach will support an understanding of the effect of a particular orchestration analyzed and how it could be improved. **Quality:** All the three challenges are considered and discussed coherently with the aims of the workshop.	C1 (x3)	3	3
	C2	2	3
	C3	3	3
	C4	3	2
	C5	2	3
	C6	3	3
	C7	3	3
	C8	2	1
	C9 (x2)	4.5	5
		Total score: 73	

CL= Connecting Learners
C= Contextualization
O= Orchestration

7.4. Appendix 4: Workshop White Papers

7.4.1. Workshop #1: Early Years and TEL

Organizer: Andrew Manches (Institute of Education (IOE), University of London)
Authors: Andrew Manches (Institute of Education (IOE), University of London), Janet C Read (Child Computer Interaction, University of Central Lancashire), Rosamund Sutherland (Graduate School of Education, Queen's University, Belfast)

7.4.1.1. Introduction and Motivation

This workshop was proposed by Andrew Manches, (London Knowledge Lab) and organised with Janet C Read (University of Central Lancashire) and Ros Sutherland (University of Bristol). The workshop was funded by STELLAR. Invitations to the workshop were open and communicated through a range of national and international mailing lists. Applications for the workshop were made through 400 word abstracts, which were reviewed for quality and relevance to the workshop aims. 13 abstracts were accepted, although two individuals were unable to attend. In total there were 15 participants, with 11 presenting work. The workshop took place over the first 2 days of the STELLAR Alpine Rendez-Vous 2011.

This White Paper summarises the conclusions of the workshop. In this first section, the motivation and background is described. The second section then gives a short summary of the presentations and the emerging themes from discussions. Section three lists some of the key questions raised by participants, which were used to structure discussions of the Grand Challenges. The Grand Challenges were an important focus of the workshop, where the aim was to identify key research questions emerging from discussions that could inform future work. These Grand Challenges are presented in section five, and section six proposes the researchers and communities who might be involved in addressing these challenges.

Whilst technologies such as pen and paper have a long history in supporting young children's learning, digital technology is comparatively novel, and the role it plays relatively less well understood. Designing technology to support younger children is arguably an emotive area. We are more protective of younger children and whilst we could reason that older children need to accustom themselves with technology for employment, the same rationale is not as convincing for younger children. In other words, if digital technology does not support the younger child's development, why should we present children with such devices?

The design of materials to support young children's learning has a long history, although the aim of supporting children's developing concepts might be traced to pioneers such as Froebel who generated his kindergarten 'gifts' for ideas such as number (Froebel, 1909). Digital technologies, however, offer a qualitative leap in what materials can be developed; children may continue to love storybooks but now it is possible for these to sound out words, bring images to life, and be designed to respond to children's interactions. This information is not constrained to the physical artefact but can be sent, shared and recorded remotely. What is not clear is how these affordances of digital technology affect young children's development.

Whilst the possibilities offered by digital technology for supporting young children are exciting, it is important to be cautious. Various concerns have been raised, for example: does

providing more independent interactivity impact children's typical social interactions? Does including certain digital effects affect children's propensity to imagine what other 'effects' could be possible? Do emulating physical activities in a virtual world discourage physical activity?

It is possible to continue speculating on the possible negative outcomes of digital technologies but these concerns often lack any empirical support. The key point is that we need to carefully consider how novel technologies reshape children's learning experiences – both in terms of the opportunities they bring and in terms of the possible limitations. This need motivated this workshop on evaluating the role of Digital Technologies for Children in the Early Years.

In addressing the issues summarised above, the arching aim of the workshop was to explore through debate the role of digital technologies for children in the early years. The more specific goals were:

1. Share good practice of research innovations and case studies.
2. Engage in debate and discussion of critical issues surrounding technologies for the early years both currently and in the future.
3. Develop a framework for evaluating early learning technologies through discussion and group activities with commercial products.

The first workshop aim – to share good practice in this field – was addressed by engaging with the high quality work being carried out by the workshop participants. In total, eleven presentations were given as well as other opportunities to discuss work. The backgrounds of the workshop's participants varied substantially. As a result, it was possible to share the different approaches, as well as terminologies used, of researching this area.

Participants demonstrated a willingness from the start to engage in debate, which often raised emotive issues, around the role (if any) technology should play in supporting young children. These debates were structured in sessions around specific themes such as the importance of context or the needs of young children. As such, the second workshop aim was achieved. Debates also reflected differences in how we might 'value' different aspects of children's development - a critical issue when discussing how we might 'evaluate' the role technology has to play. It was clear through discussions that such evaluation had to take account of the specific context in which young children interact with different technologies as well as how any particular digital properties may shape these interactions.

The final sessions of the workshop aimed to draw participants' ideas together and identify key themes in this area. Developing this window on the role of technology in young children's lives addressed the third workshop aim, although it was agreed that the goal of creating an evaluative framework was too ambitious. Indeed, the challenge of addressing the third workshop aim informed the Workshop Grand Challenge. In order to develop a framework for evaluating learning technologies for this age group it is necessary to establish a more coherent and comprehensive understanding of how materials shape children's development, and the implications for digital designs.

7.4.1.2. Workshop Description

13 abstracts were accepted for the workshop. As two invitees were not able to attend, a total of 11 presentations were given.

The names of participant and organizers are presented in Table 1 along with the titles of abstracts.

Table 1: List of Participants WS #1.

No	Name	Organisation	Country	Role	Abstract title
1.	Andrew Manches	U of Nottingham	UK	Organizer / Participant	The effect of Novel forms of Interaction on Learning in the Early Years
2.	Arjette Karemaker	U of Oxford	UK	Co-organizer / Participant	Assessing the effectiveness of a whole-word multimedia reading intervention designed to support development of early literacy skills
3.	Audrey Mazur Palandre	U of Lyon	France	Participant	___
4.	Christine Michel	U of Lyon	France	Participant	___
5.	Christine Wang	U of Buffalo	USA	Participant	Exploring Young children's Epistemic Reasoning in Computer-Supported Collaborative Science Inquiry
6.	Evi Mansor	U of Manchester	UK	Participant	Preschool Children's Fantasy Play in an Interactive Tabletop Environment
7.	Inge Molenaar	U of Amsterdam	Netherlands	Participant	Developing Metacognitive Skills of Young Children with Interactive Agents
8.	Janet Read	U of Central Lancashire	UK	Co-organiser / Participant	___
9.	Javier Marco	U of Zaragoza	Spain	Participant	Using digital manipulatives in preschool education
10.	Kaska Porayska-Pomsta	Institute of Education	UK	Participant	Echoes: Enhancing child-computer interaction with AI
11.	Kristine Lund	U of Lyon	France	Participant	CogniK: adapting technology to children's learning profiles
12.	Ros Sutherland	U of Bristol	UK	Co-organiser	___
13.	Ruth Dower	Isaacs, UK	UK	Participant	Dream Catcher - using digital technology to connect children's learning
14.	Sarah Eagle	U of Bristol	UK	Participant	Children, adults and designed artefacts: what

					insights can older traditions and existing artefacts offer to designers of new technologies for young children?
15.	Tilde Bekker	U of Eindhoven	Netherlands	Participant	Practicing social skills with open-ended play objects
16.	Diana Yifan Xu	University of Central Lancashire	UK	Not able to attend	Children's Physical Play and Early Year Learning
17.	Michael Evans	Virginia Tech	USA	Not able to attend	Supporting PreK Learners Co-Construction in Informal Geometric Reasoning: An Evidence-Based Design Approach to Virtual Manipulatives

The 11 presentations were grouped into three broad areas:

- *Physical and virtual materials*
- *Social interaction*
- *Meta-cognition*

These headings are used below to summarise the research areas presented in the workshop.

7.4.1.2.1. Physical and Virtual Materials

Technology offers new ways to present and manipulate information. Materials can be designed with particular audio or visual effects to help children build ideas, for example in Maths and English at School. The main form of interaction has been through the mouse and keyboard, however, there has been a growth in more direct interfaces: including interactive tablets or tables and more advanced designs integrating technology inside of physical objects. In order to understand the benefits of these new materials research has attempted to compare interaction with traditional materials to identify benefits and limitations.

Arjette presented work looking at the effect of technology on reading development by comparing commercially available software with traditional books balanced for content. The carefully designed comparison studies not only demonstrated a benefit of the software but helped identify possible causal factors: such as the highlighting of words which they were being sounded out, and the potential for children to independently select words to hear that they could not read.

Andrew presented work looking at the possible benefits of physical interaction in learning. This research is important in understanding the cognitive effects of moving interaction to devices such as the mouse, and helps evaluate the potential of novel technologies such as tangibles where physical objects are augmented by technology. Andrew presented work highlighted the range of actions and strategies generated when young children manipulated objects in a maths tasks and how these were constrained when using virtual materials using a mouse.

Javier also examined the potential of augmented physical objects with technology through studies using sets of physical toys linked to digital information on a tabletop computer. As well as showing the appeal of the materials, the research showed the potential for these designs to reinforce explorative and collaborative behaviours through sharing, turn taking and role-playing.

Evi examined the effect of using virtual technologies on young children's fantasy play – a key part of their development. Three evaluation studies were conducted on a multi-touch table and after addressing certain design issues demonstrated the potential to create virtual environments to support fantasy play.

7.4.1.2.2. Social Interaction

Traditional materials (such as balls or books) have played a key role in mediating collaborative activities between children or between children and adults. Digital technologies can shape these interactions. Digital effects can respond to children's actions that can open up new forms of discourse, although there are concerns about how the interactive nature of technology might impact children's interaction with others.

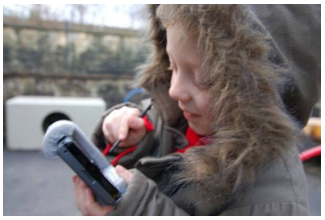
Sarah looked at how digital toys shape interactions between children and their families. In her presentation, Sarah focused on interactive devices such as story books and demonstrated how the designers choice of activities can shape communication – often focusing on the 'right way' to solve the problems presented rather than build on children's more imaginative and personal discourse. This research provides a valuable lens with which to consider how technology might be designed to foster this important aspect of interaction.

Tilde presented research looking at how augmented objects may foster novel types of social interaction between children. Tilde discussed two designs: ColoFlare and Moveable Sound using lights and sounds respectively to engage children. The designs are simple, providing space for children to discuss and negotiate their own games and activities around these materials.

Kasksa presented work from a project: Echoes, which examines the increasing potential for technology to play a role as an equal social partner for children. The project builds upon recent developments in how technology can sense information (e.g. gestures / expressions) and respond (using Artificial Intelligence). For children with social difficulties (e.g. children with autism), these forms of technology may help provide a safe and secure way to empower children by developing social skills.

7.4.1.2.3. Meta-Cognition

Becoming more aware of our own experiences and learning is a key aspect of cognitive development, although this is traditionally considered challenging for younger children. Digital technology presents new opportunities for children by providing simple ways them to record and revisit their experiences using different media and to feedback information about their own learning.



Ruth presented work from a prototype research project DreamCatcher where children used technologies to record things

important to them to share with home and school. Although the aim was to see how the technology could foster links between home and early school settings, it was interesting to hear how children were given the opportunity through the technology to record and then voice their personal experiences.

Inge presented work from her PhD where she developed a dynamic scaffolding system to support students (8-12 yrs) self-regulation while they learn in computer based learning environments using Avatars. It was demonstrated that technology can support meta-cognitive skills – where interaction between students amplified the effect of digital scaffolds and when the scaffolds were presented in the form of questions. Inge raised questions in the workshop about the potential for this form of technology to support younger learners.

Kris presented work from three projects she is involved with through her doctoral students. Two of her students are working on a commercial project: Cognik, that Kris co-founded, that provides education gaming activities for children adapted around their cognitive competencies. One area of research is looking at the impact of different forms of interaction (mouse versus touch) whilst another examined the content of the games according to cognitive profiles. This ambitious project highlighted the potential, and some of the challenges, of designing effective learning environments that monitor and adapt to children's cognitive abilities.

Workshop Themes: Understanding the role of technology in learning is complex, and perhaps more so for young children where there is less emphasis on more formal educational objectives and more on developing certain emotional, social as well as cognitive skills. Young children are quickly changing how they interpret the world around them. They also face a major transition in learning environment – from home to school – where the learning they bring has large effects on their later achievements. It is therefore important to understand how technology shapes young children's experiences and development – whether digitally augmenting materials has a positive effect.

In this regard, one approach to understanding the role of digital technologies is to look at the new 'affordances' and discuss what benefits these bring. The difficulty with this approach is the benefits or 'effectiveness' of these different properties will ultimately depend upon a range of factors. These factors are complex, involving an intricate mix of social, cultural factors as well as child's own cognitive and emotional characteristics. Although this is the case in evaluating any form of technology with different age learners, this may be particularly pertinent to younger children where such factors are constantly reshaping as the child and their context change at a significant pace. Young children's choice of device and activities is also much more determined by the practices of others, be they parents, grandparents, carers or teachers.

Another approach therefore is to try and understand the factors that mediate the role of technologies and use this understanding to predict how different digital designs may shape children's interactions and the ideas that may subsequently develop. This approach gained support in the workshop, where a key aim was to explore the factors influencing the effect

of technology and to develop a lens with which to discuss, and ultimately evaluate, the design of technologies in this area.

During discussions, certain themes were recurrent. This section attempts to describe these under several headings. These themes are not considered comprehensive but rather those considered more salient in the workshop. The particular affordances of digital technology are not discussed as a separate theme but rather are integral to each theme. In other words, each theme is intended to act as a window with which to consider how particular digital properties may shape children's interactions and ultimately the ideas they develop.

7.4.1.2.4. Continuously Redeveloping Tools

Technology will be used and interpreted in often-unpredictable ways depending on the cultural context in which they are used. Consequently, good design practice should attempt to follow this process and evolve the designs if the intention is to foster certain (learning) interactions. This may be more easily achieved when the technology is software, where interactions can often be tracked and updated relatively easily. In contrast, physical technologies may require a greater level of investment in studying use and developing novel designs from this information. The ability to create and update / change online materials may also reflect the proliferation of simpler resources with less investment in development. This possibility may generalize to the growth of applications on novel devices e.g. iPad.

Implications for Early Years

This issue may be particularly relevant to children in the Early Years where physical designs are more prevalent. It may also be more challenging to obtain 'user' information given the developing communication skills of younger children. Furthermore, there is arguably a greater responsibility felt in the Early Years of considering what is 'good' for children: to limit access to frivolous games designed with minimal consideration of children's needs.

7.4.1.2.5. Structure of Activity

Activities can range between those that are more structured or intentional, and those that are more exploratory, unstructured and unintended. Although the latter is often presented as providing more creative opportunities, this may not always be the case: structure may help children consider new ideas. It is important, however, to consider how technology may shape the type of activity. Certain virtual environments need to constrain the range of interactions in order to provide children with feedback, although developments mean more open exploration may be possible. Novel forms of Interaction (e.g. tangibles, commercial systems such as the 'Wii') are also providing ways for children to interact in less structured ways with technology – adapting and interpreting digital effects in different ways. By opening up ways to interact with technology, these devices are not only more accessible but may help 'hide' the technology and help children focus on activity.

Implications for Early Years

This issue may be particularly relevant to children in the Early Years where an emphasis is on fostering exploration and creativity. Developments in technology may offer more possibilities in terms of the structure of the activity by being more adaptive to children's interactions. The development of novel forms of interaction may be particularly important by making designs more accessible and easier for children to adapt to different contexts and activities.

7.4.1.2.6. Interaction with Others

Technology can engage children independently by providing feedback to their actions. Alternatively, the technology can act as a tool to foster interaction with others, for example by using sounds to support joint attention, or allow communication over distance. When technology is designed as a social partner for children, it possible to control certain aspects such as who initiates interaction, how predictable responses are, or the emotional level of response. Although the complexity of human interaction has yet to be achieved, it may be possible to use these features in a way that makes the computer more than a poor human replacement.

Implications for Early Years

This issue may be particularly relevant to children in the Early Years because there is great emphasis on developing children's social skills and concerns that independent activity with technology cannot provide the form of interaction needed. Younger children need to develop particular skills, such as attention and listening, and it is interesting to consider how technology may be able to target these early competencies.

7.4.1.2.7. Motivation

Digital Technology can be designed to capture children's attention. Whilst engagement may be short lived for some novel designs, the effect of technologies such as gaming demonstrates the potential to sustain motivation. The aim of tapping into gaming as a way to engage learners is being addressed although generally for older children.

Implications for Early Years

For younger learners there is arguably a greater feeling of responsibility over children's choice of activities, and questions about whether we should necessarily try to motivate more prolonged use of particular technologies. Young learners also differ in how technologies are provided for them rather than actively choose their own materials and how they may be more curious to try what is presented. Younger children may also differ in what digital effects capture attention, such as the use of colour or audio.

7.4.1.2.8. Meta-learning

Technology has changed the way information is authored, presented and shared. There are increasingly more opportunities for children to author information and create their own digital artifacts. This may offer new opportunities to change how children perceive information and develop their understanding of knowledge generation.

By providing ways to mediate and record interactions digital technologies may provide novel opportunities for children to plan and reflect on their own learning. Technology may also provide a way for children to become aware of their own emotions in a safe and more predictable environment.

Implications for Early Years

Aspects of meta-cognition have been considered a great challenge for young children. However, authoring of information is arguably becoming more accessible for this younger group, and media such as images or audio recording may help children recollect and communicate their own learning and feelings. By providing a way for children to generate and share information, digital technologies also raise the possibility of empowering younger

children in terms of their understanding of how information is shared more widely and knowledge is generated.

Summary: In this report, we have identified five themes that were recurrent in discussion about the role of technology to support learning in the Early Years: Continuously redeveloping tools, Structured Activity, Interaction with others, Motivation and Meta learning. These themes are not necessarily areas where technology offers the most potential but rather represent important areas to consider when trying to understand the role of technology in young children's lives. The themes highlight the importance of considering the particular needs of younger children.

That said, these themes often do indicate areas where new technologies present exciting opportunities to support young children. However, it is necessary to examine these possibilities and avoid unwarranted claims. The effect of technologies will depend upon a complex range of factors, from the context in which they are used to the particular design. In this regard, the themes identified in the workshop emerged as important points to consider when evaluating the role of technology in young children's learning.

7.4.1.3. Emerging Research Questions

In the final sessions of the workshop, participants were asked to raise certain questions surrounding the role of technology for children in the Early Years. These questions then formed the basis with which to identify more overarching questions for the Grand Challenges – presented in the final section. Rather than filter these question, they are listed below, removing cases of repetition.

- How do children interpret the culture of technology?
- How can technology enhance parent / child interaction?
- What are the appropriate research questions in this area?
- Do young child want to develop their own games?
- How does theory underpinning research influence what you see in 'empirical studies'?
- How do we decide and define the key cognitive skills for this age group?
- Can novel forms of interaction provide resources that allow more open-ended exploration for young children?
- How do certain digital effects shape interactions between children?
- How do different design features motivate children's interest and also that of adults who buy these technologies?
- How long do these motivational effects last?
- How can new forms of recording (cameras etc) change children's understanding of knowledge generation?
- How do we define the age groups for Early Years? Do we include children under three?
- Does neuroscience have any important messages to inform the design of technologies in the Early Years?
- How do we avoid imposing the 'right' way to do things when designing technologies or interacting with children around technologies?
- Can we differentiate between effects with and effects of when evaluating

technologies for learning?

- How open should activities with technologies be?
- Is it possible for technology to replace a human teacher or guide?
- How can we take account of parent / carers' expertise when designing technology for children?
- What role does technology play in fostering self-regulatory behaviour?
- Can we successfully measure learning in this age group?
- Are there too many variables to consider when trying to understand the effect of a particular technology?
- What is the 'goal' of children's interactions?
- How do digital technologies play into ecology of learning?
- Should we design for surprise in these technologies?
- Where is the pedagogic heart of the 'technological design' discussion - how can we build on the child development thinking that is so embedded already into early learning environments?
- Would a child from one national community have the same experience with a technology as a child from another?
- Can technology open up opportunities for role-play?
- Can technology give children opportunities to explore and respect other cultures?

7.4.1.4. Grand Challenge Problems

Supported by the workshop Provocateur, Ros Sutherland, several grand challenges were identified during the two-day workshop. The workshop identified four grand challenges in total, although the first can be considered the main, over-arching challenge. The subsequent three reflect areas of focus within this main challenge.

7.4.1.4.1. Grand Challenge Problem 1

Develop an agreed set of principles for designing and evaluating digital technologies for the early years that are informed by our understanding of early child development.

The proliferation of digital technologies in homes and early school settings emphasizes the need to understand their impact on young children's development. This understanding needs to inform guidelines on evaluating and designing novel technologies. These guidelines are needed by a range of stakeholders: by parents to inform purchase decisions and value their role in children's interactions with these technologies; by teachers to evaluate designs for learning and know how best to integrate devices into class; by policy makers to inform wider decisions; by designers to inform product development, and by researchers to help illuminate the most pressing questions in this field.

What is missing from current guidelines is a more thorough understanding of how certain digital designs shape children's social and physical interactions. Understanding how novel technologies affect young children's lives requires greater consideration of the role played by traditional technologies such as blocks or books in a range of interactions, in different settings, with a range of actors - from peers and teachers to parents and grandparents. Whilst existing work (e.g. NEAEYC16 2011 draft position statement) addresses this area,

[16] National Association for the Education of Young Children http://www.naeyc.org/positionstatements/technology

reference is often made to 'developmentally appropriate' use of technology without clarification of what this entails.

Addressing this grand challenge therefore requires the generation of specific guidelines adapted to different user groups. These guidelines should be comprehensive but digestible. They should be accurate and easy to comprehend. They should be practical without making unwarranted claims.

7.4.1.4.2. Grand Challenge Problem 2

Design and evaluate technology that supports grandparents, parents and carers to focus on children's early literacy activities with their children. Such technology should take into account literacy and technology practices in the home environment.

Many technologies to support children's literacy focus on practising specific skills such as phonetics or word recognition, and often do not recognise the important social factors that engage children and bring meaning to reading as an activity. One challenge therefore is to examine ways to design digital technology to foster productive interaction around reading. As stated in the challenge, designing such technology requires a good understanding of literacy practices in the home. Addressing this challenge would require using this understanding to develop a prototype design that could be evaluated by examining the effect on interaction, shaped by the technology.

7.4.1.4.3. Grand Challenge Problem 3

Design and evaluate dynamic digital representations that allow children to express, explore, make visible, share and reflect on ideas in novel ways in areas such as maths and physics.

New forms of digital representation provide novel ways for children to explore information and develop meaning. In domains such as Maths and Physics, this may be particularly beneficially by drawing children's attention to certain aspects of the materials. For example, focusing on numerical patterns or processes such as forces or electricity. In order to build these representations, it is necessary to not only have a solid understanding of the domain but also develop representations that draw children's attention to ideas in these domains.

For younger children, new forms of interaction provide new ways to manipulate, explore, and share digital representations. Tangibles for example allow children to manipulate physical objects augmented with digital technology. These new forms of technology have generated lots of commercial and research interest in their potential to support young children's learning, however, more research is needed to understanding the effect of these novel materials on young children's learning. This need would be addressed by this challenge by designing and evaluating novel forms of representation to allow children to explore ideas in domains such as Maths and Physics.

7.4.1.4.4. Grand Challenge Problem 4

Design and evaluate digital technologies that foster regulatory behaviour of emotions and meta-cognition

It was highlighted in the workshop that digital technologies have lowered the threshold in terms of how easily young children can record and reflect upon their own interactions and experiences. Devices such as cameras or sensors can help record aspects of children's interactions in ways not previously possible. This opens up novel ways for children to reflect

upon their own learning and behaviour, which if designed appropriately, can be used to help develop children's regulation of their own behaviour and learning.

Developments in artificial intelligence also presents ways in which technology can be designed as an equal social partner with which children are able to explore and have feedback on their social interactions. By designing digital partners, children may have novel opportunities to explore the consequences of their behaviour in a safe and secure environment.

7.4.1.5. Researchers and Communities

For the first grand challenge, the initial emphasis will be on gathering the knowledge and thoughts from experts on child development, e.g. psychologists, as well as those with an understanding of how technology can shape interactions with technology. However, in order to develop guidelines, it is essential to work with different stakeholders including designers, educationists, policy makers and parents. For the other three grand challenges, there is a need to draw together teams of research in psychology and education with computer scientists. These teams need to collaborate in an iterative design process.

The grand challenges refer to a wide range of learning domains, including children's physical, social, cognitive and emotional aspects. Common to all these, however, is the focus on early child development. As discussed in the workshop themes, there is strong reason to believe that there are significant differences for this younger age group, which will affect the design and use of different technologies. It is important therefore to draw together different communities researching in this age group – including those who have not focused on technology - and to integrate the different approaches taken to examine the role of technologies. (e.g. Antle, 2007; Clements & Sarama, 2003; Druin, 2009; Eagle, Manches, O'Malley, Plowman, & Sutherland, 2008; Luckin, Connolly, Plowman, & Airey, 2003; Members, 2008; Plowman & Stephen, 2005). It will also be important to draw upon existing work on designing and evaluating technologies for and with children (e.g. Druin, 2010; Markopoulos, Read, & MacFarlane, 2008).

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7.4.2. Workshop #2: Methods and Models of Next Generation Technology-Enhanced Learning

Authors and Organizers: Daisy Mwanza-Simwami, Agnes Kukulska-Hulme, Gill Clough, Denise Whitelock, Rebecca Ferguson (Institute of Educational Technology, Open University)
Provocateur: Mike Sharples (Learning Sciences Research Institute, University of Nottingham)

7.4.2.1. Introduction and Motivation

The main objective of the Methods and models of next generation technology workshop 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:
a) Researching next generation technology enhanced learning
b) Designing next generation technology enhanced learning
c) Evaluating next generation technology enhanced learning
d) Assessing next generation technology enhanced learning (e-assessment)

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. 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.

This **workshop is directly related to the TEL grand challenge of 'Orchestrating Learners'** by setting the scene for developing methodological innovations for next generation technology enhanced learning. Within this challenge, the workshop will examine questions relating to the role of assessment and evaluation in learning, by reflecting on current innovative

methods of assessment and evaluation, exploring the potential to develop, revise or extend these methods, and making connections with research and design for learning.

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.

7.4.2.2. 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:

a) 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.

b) 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.

c) 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.

d) 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.

7.4.2.3. 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?

7.4.2.4. Grand Challenge Problems

7.4.2.4.1. 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

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, multiyear US grant programme aimed at dramatically increasing college readiness and completion through applied technology. Grant money is issued in multiple funding waves launched

every 612 months. Wave 1 included a call to research learning analytics[17].
Another possible funder is Google, which offers Research awards in several relevant areas, including machine learning and data mining, and educational innovation[18].
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.

7.4.2.4.2. 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 preconditioned 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

[17] http://nextgenlearning.org
[18] http://research.google.com/university/relations/research_awards.html

engenders, the evolution of a widespread culture of learning design, and consequently the quantity and quality of open learning design artifacts.

7.4.2.4.3. 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 uptake 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 uptake 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 multilevel focus taking into account the motivators for various stakeholders in the European school system. The use of multilevel 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 multilevel 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 multilevel 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.

7.4.2.4.4. 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 shortterm cognitive gains into mediumto longerterm 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 organizational structures, and further into their global impacts on the policies and politics of education as well as 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

7.4.2.4.5. 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

7.4.2.4.6. 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 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

7.4.2.5. 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.

7.4.2.6. Conclusions

Grand Challenges developed in this workshop focus on: effective formative assessment in new types of learning environments (including TEL environments that should be designed o 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 adaptible and flexible, yet provide solid guidance for next generation designs.

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7.4.3. Workshop #3 Neuroscience, Technology and Learning: Areas and Issues for Interdisciplinary Progress

Authors and Organizers: Paul Howard Jones (Graduate School of Education, University of Bristol), Michela Ott (Istituto Tecnologie Didattiche, Consiglio Nazionale Ricerche (CNR)), Teo van Leeuwen (University of Twente), Bert de Smedt (Katholieke University of Leuven, (K.U.Leuven))

7.4.3.1. Introduction and Motivation

This workshop was originally proposed by the STELLAR theme team NTEL (Neuroscience and Technology Enhanced Education). The NTEL theme team comprised Paul Howard-Jones (University of Bristol, coordinating), Bert de Smedt (Katholieke Universiteit Leuven, Belgium), Michela Ott (CNRNational Research Council, Italy) and Theo van Leeuwen (Twente University, Netherlands).
From May 2010 to May 2011, NTEL was funded by STELLAR to explore the issues and opportunities that may be generated by combining what we know about the brain with the affordances of modern learning technology.

This workshop aimed to bring together TEL researchers and specialists in neuroscience to:

To identify areas of understanding where technology enhanced learning may benefit from neuroscience and
To discuss how interdisciplinary research capacity in this area can be developed.

The workshop was by invitation-only, with priority given to active researchers in the TEL field who expressed interest in using findings from neuroscience to inform their research. Additionally, workshop attendance was appropriately balanced to provide sufficient expert opinion from neuroscience, psychology and education.

Programme:

Monday March 28th

8.30 - 9.00 Introduction to the workshop and from participants
10.30 -11.00 Coffee
10.30 -11.15 Key note presentation (Dan Schwartz)
11.15 -12.15 Converging Areas I: Presentations by NTEL team
12.30 - 1.30 Lunch
13.30 - 16.30 *Snow activities*
16.30 – 18.00 Converging Areas II: Circulation/discussion of participants' research questions
Small group discussion on
Question 1: "Where will neuroscience meet TEL research?"
18.00–18.30 Coffee Break
18.30–19.15 Small group discussion on:
Question 2: "What are the barriers to progress?"
19.15- 20.00 Discussion groups report back on each question
Plenary Discussion

Tuesday March 29th

8.30 - 9.00 Summing up some of the issues/barriers etc
9.00 -10.30 Presentations by NTEL team on a "Levels of Analysis" approach
10.30 -11.00 Coffee break
11.00 -12.15 Small group discussion on:
Q3: "How can we develop interdisciplinary research capacity in this area?"
Discussion groups report back on question; Plenary Discussion
12.30 - 1.30 Lunch
13.30 - 15.30 *Snow activities*
15.30 - 16.00 Theme Team sum up some key opportunities identified
16.00 - 17.00 Where do we from here?
Mutual interests, common goals, collaboration between participants

7.4.3.2. Workshop Description

As can be seen from the programme above, the structure of workshop avoided an emphasis on individual presentation, in order to maximise opportunities for interdisciplinary dialogue between members of the diverse communities of neuroscience and TEL. In order to support discussion, a detailed 10,000 word review was circulated 3 weeks prior to the meeting that

had been prepared by the NTEL theme team. This review reported on recent neuroscience findings that might be considered relevant to research within TEL. This document, together with additional reviews by members of the NTEL theme team on literacy and numeracy, was also posted on the NTEL web-site (www.neuro-tel.net). Additionaly, a presentation was provided by Prof Dan Schwartz on his personal U.S. perspective on possibilities in this emergent area, and 2 individual presentations were provided by Paul Howard-Jones (University of Bristol) and Theo van Leeuwen (Twente University, Netherlands) that summarised the discussion document and allowed for clarification of its concepts.

In this way, the workshop was able to focus on generating a set of key issues to overcome, and a set of opportunities for progress that took the form of new grand challenges for STELLAR.

Participants were:

Dan Schwartz	Stanford, US
Anja Ischebeck	University of Graz, Austria
Tamara van Gog	Erasmus University of Rotterdam, Netherlands
Elisabeth Friedrich	University of Graz, Austria
Niklas Ravaja	Helsinki University, Finland
Theo van Leeuwen	Twente University, Netherlands
Di Levine	BECTA, UK
Carlo Perrotta	Futurelab, UK
Riccardo Berta	University of Genoa, Italy
Tony Fisher	University of Nottingham, UK
Diana Laurillard	London Knowledge Lab,UK
Paul Howard-Jones	Bristol University, UK
Michela Ott	CNR- National Research Council, Italy
Frank Fischer	LMU Munich, Germany
Charles Fadel	CISCO, U.S.
Pierre Dillenbourg	EPFL, Switzerland

Examples of where the workshop identified neuroscience with relevance to TEL
Neuroscience is shedding light on a range of developmental disorders and neuroscientists themselves have already been actively involved in developing technology-based educational interventions that seek to apply some of this emerging knowledge. Technology may help provide adaptive training for a range of disorders. Butterworth and Laurillard have highlighted several attractions of applying our emerging knowledge of dyscalculia in educational digital technology [1]. They point out that digital implementation can be practice-oriented (providing easily-accessed and unsupervised repeated practice), can be age-independent, needs-oriented (e.g. providing alternative input/output modes for learner also suffering from slight dyspraxia or reading difficulties), meaningful (e.g. they can link the physical to the abstract in ways not possible in the physical world, such as when a learner 'zooms into' a 1–10 number line to discover decimal numbers) and they can offer private,

unthreatening interaction and feedback in an endlessly patient fashion. These potential advantages of integrating our scientific understanding with technology are relevant in attempts to remediate a broader range of developmental disorders. Although claims about the general effectiveness of commercial programmes must be carefully scrutinised[2], neuroimaging can also provide insights in cases where successful results are reported. For example, a dyslexia intervention using commercially available language training software reported partial remediation and improved reading, with ameliorated disrupted function in brain regions associated with phonological processing and additional compensatory activation in other regions[3]. When the cognitive and neural data converges in this way, we can be more confident in the underlying theoretical models and the effectiveness of the intervention.

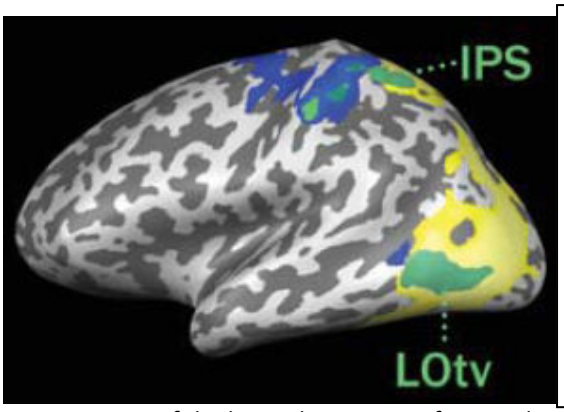
Historically, neuroscientists have focused more upon abnormal than normal development and this helps explain why the first examples of neuroscience in TEL have been aimed at ameliorating developmental disorders. However, understanding from neuroscience has increasingly wider implications for TEL, with relevance to a range of mainstream TEL concepts. Although a preference for a particular learning style does not appear helpful in educational terms, we have seen (in Box 3) how some types of digital **personalization** can influence emotional engagement. Neuroscientific techniques may also provide insights into **individual differences** on a range of factors that can inform how technology might be tailored to suit particular types of learner. These factors may include ability, but also gender and age. One study has highlighted gender differences in how individuals respond to video games[4], which have been cited as an informative and engaging context that educators may wish to understand learn from[5]. In another example, the type of feedback which is optimal for our brain to learn appears dependent upon our maturity. Here, in a study of a computer-based rule search and application task, brain imaging data suggested a qualitative difference in how children and adults use performance feedback, with a transition around 11-13 years old towards an increased influence of negative feedback on performance adjustment[6]. Understanding how our ability to self-regulate develops through to adulthood may also provide insights and reasonable expectations (rather than constraints) about the **self-regulated learning** of children at different ages. Recent research shows how a range of factors that are critical to successful self-regulated learning (processing speed, voluntary response suppression, and working memory) mature across different age groups[7], and this development is linked to an understanding of structural changes that occur in the brain until early adulthood[8].

However, perhaps of greater value is the ability of technology to adapt dynamically to the changing needs of the learner, based on an automatic assessment of their responses. Indeed, the potential of combining TEL and neuroscience in **adaptive educational systems** has been highlighted in the UK as an area of research deserving future investment. An example of where scientific research has been integrated with an adaptive educational system is “Graphogame” - a non-commercial system developed at the University of Jyväskylä (Finland) which introduces the association of graphemes and phonemes to young children according to the frequency and consistency of a grapheme in a given language[9]. In this game, online algorithms analyze a child’s performance and rewrite the lesson plans “on the fly” depending on which specific confusions the learner shows[10]. The difficulty of the content is also adjusted so that the challenge matches the learner’s ability. Using fMRI and EEG

together (allowing both good spatial and temporal resolution in measurements), it has been shown that the practise with the game could initiate print-sensitive activation in a critical component of the mature reading network located in the left occipitotemporal cortex, termed the "visual word-form system"[11]. Knowing that this occipito-temporal print sensitivity is established during the earliest phase of reading acquisition in childhood, suggests that a crucial part of the later reading network first adopts a role in mapping print and sound. Such results provide insight into how the software succeeds in supporting literacy, how/when it should be implemented and how neuroscience can be used to inform TEL design. McCandliss[10], reflecting on this and other studies, suggests "Given that adaptive educational computer programs are being developed in tandem with imaging studies of how such innovations drive changes in brain activity, new possibilities may emerge for educational and neuroscience research efforts to inform one another in increasingly rapid cycles."

It has been known for some time that illustrating text can enhance memory [12], with pictures of objects appearing more memorable than their names. This effect has provided an important justification for the type of **multimodality** that can be provided by technology. Such approaches might be further informed by evidence that additional brain activity is produced by multimodal stimulus over and above that produced by experiencing each mode separately[13]. In this study, participants were scanned while exposed to auditory and visual characteristics of tools (hair-dryer, hammer etc) and the additional activities related to simultaneous exposure to both types of sensory cue were associated with making links between visual and auditory features. This automatic recruitment of additional processing might suggest we should necessarily observe improved memory for multimodally presented stimuli. However, this is not always the case. Simply presenting cues in two modes does not guarantee improved long-term memory (although it can decrease the load on working memory). The effectiveness of multimodal presentation as a memory/learning strategy appears to rely on whether it encourages in-depth processing of the type related to educational objectives [14]. Andreano et al. recently studied the effects of increasing the immersive nature of a virtual reality environment, with the hypothesis that this should increase activity in regions associated with learning [15]. This study showed that adding auditory cues to a virtual reality environment (comparing unimodal with multimodal) increases activation in the hippocampus, a region strongly associated with memory formation and having no sensory function, thus supporting the notion that multimodality is an important aspect of virtual reality that can support learning. The educational use of **tangibles** may also be informed by fresh understanding from neuroscience. For example, topics involving shape have been principally taught through the medium of vision, but there is increasing evidence for shape information being easily transferable between vision and haptics. A recent imaging study suggests that the relationship between audio and visual processes, which may be considered complimentary in their differences, may not resemble the relationship between haptic and visual processes, which may be considered more similar. Indeed, object recognition by touch and vision activate several overlapping and closely-related brain regions (see Fig. 1). In this study, the researchers observed "enhanced effectiveness", in neural terms, of combining haptic and visual stimulus[16]. That is, the

multisensory gain with a combination stimulus was greater when its unisensory components were themselves associated with greater neural activity.



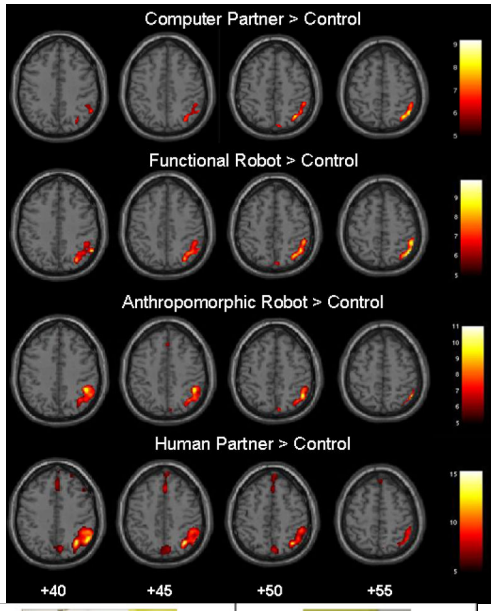
Regions of the brain that activate for visual and haptic object recognition overlap. Tangibles both types of information about shapes and these appear to enhance each other's neural effectiveness
YELLOW = activation due to visual object recognition
BLUE = activation due to haptic object recognition
GREEN = overlapping activation regions

Fig. 1: Regions of the brain that activate for visual and haptic object recognition overlap.

Advances in fMRI techniques are now allowing the neural substrates of social processes to be imaged. This is providing insights into the subtleties of how we engage with others in simple co-operative tasks, which can contribute to our understanding of **collaborative learning**. A recent study identified the right pSTS as a key region for both social interaction and joint attention. By considering activations of this region in this and other studies[17,18], the authors suggest that full joint attention requires more than just simultaneously gazing at the same object. Instead, two people must deliberately coordinate attention on the object, usually with the expectation that the object will be rewarding (for cooperative exchanges) and/or relevant (for communicative exchanging), and it is this behaviour that activates the pSTS. In other research, it has been found that several aspects of social interaction that may support collaborative learning, such as interactional synchrony, anticipation of other's actions and co-regulation of turn-taking, are associated with neural synchronisation between collaborators' brains as measured by EEG[19]. Brain research has also helped establish a better understanding of how trust between potential collaborators develops through reciprocity[20,21] and insights into such trust differs from that engendered through institutions[22].

Understanding how our brain responds to other humans can also shed light on our response to **artificial agents** (tutors, competitors, collaborators), which may form an increasingly important part of the new learning technologies. New learning technologies that embody key elements of individual human tutoring while avoiding its extraordinary financial cost are likely to exploit what we understand about human processes of imitation, shared attention and empathy[23]. When we 'communicate' with non-human technology we may recruit brain regions usually involved with communicating with each other, particularly if this technology appears moderately human-like. A question tackled in a recent fMRI study was how human-like an artificial agent needs to be before we start attributing human intentions to them, i.e. a theory of mind. Although we have already seen that visual appearance is not a prerequisite (see Box 3) using networks usually associated with biological action, it does seem that visual appearance can play an important role. In a recent fMRI study, participants were asked to play a game against different type of opponent who, unbeknown to them, were all playing randomly[24]. Brain regions associated with theory of mind were activated in order of

increasing human-like features (computer<functional robot<anthropomorphic robot<human). This suggests that cosmetic attempts to make technology more human-like may seriously influence our tendency to attribute human intentions and engage with it (Fig. 2).



Interaction Partner				
Condition	Computer Partner (CP)	Functional Robot (FR)	Anthropomorphic Robot (AR)	Human Partner (HP)
Humanlikeness	no human shape; no perceivable button pressing	no human shape; button pressing with artificial hands	humanlike shape; button pressing with humanlike hands	human shape; button pressing with human hands

Fig. 2 Regions associated with 'theory of mind' grow more active as the appearance of a technological opponent becomes more human-like, even when it is clearly not human (Krach et al 2008).

Through technology, we are now able to experience **mobile, ubiquitous and pervasive learning**, but biological contexts play an important role in understanding why such 24/7 experiences appear to be effective or not. Sleep plays an important role in memory, so when we learn influences how well we learn, with better recall following a period asleep than after the same period awake. Since technology now makes it easier for us search out, learn, communicate and apply knowledge all day and all night, this access can impact negatively on our sleep. For example, hormonal developmental influences produce a phase delay in the circadian timing mechanism of teenagers, but the use of mobile technology has also been shown to contribute to their sleep loss [25]. A recent study in the U.S., a recent study showed the average teenager indulging in around 4 activities involving technology after 9.00 pm, spending over an hour on each [26]. When we sleep after learning, the hippocampus in our brain rapidly integrates this information within distributed regions of the cortex[27]. Successive sleep-dependent reactivation of this hippocampal–cortical network leads to progressive strengthening of connections across the cortex, which over time, allowing these memories to become independent of the hippocampus and gradually integrated with other, pre-existing cortical memories. Therefore, not only does sleep support our recall of these memories but it also supports our ability to make links between these memories and older ones, which is important for our creative functioning. So, when access to technology impacts

on our sleep habits, it can be detrimental to both our learning and our creativity. Moreover, activities involving close bright screens are able to delay the brain's production of the hormone melatonin and so interrupt sleep-cycles in ways that a TV screen does not[28,29].

Evidence that our learning has biological substrates is sometimes mistakenly used to support theories of biologically determined outcomes. Yet a core concept of modern neuroscience is the brain's plasticity. Our educational experience influences the connectivity, function and structure of our brains. Even in old age, the brain remains plastic[30,31] and use of cognitive training by the elderly has been shown to improve and protect cognitive function. These successful attempts at **technology enhanced lifelong learning** include research that has focused on sufferers of Alzheimer's, who have used training derived directly from our understanding of how different regions of the brain are affected at the various stages of the disease (AD). This study showed maintenance of cognitive function for sufferers with severe symptoms compared with controls, and improvements in related behaviours (anxiety, depression, apathy, sleep disturbances) for those with mild to moderate symptoms (Yuanguas 2006). Many of the training programmes tested have been technology-based and it has been pointed out that technology offers particular advantages in these applications Faucounau(2010) et al.
Computer-based cognitive training (so called "brain training") amongst the healthy has chiefly been found to improve performance on the training itself, rather than transferring to everyday application[32]. Once very important exception, however, is the training of working memory, which is a major constraint on our ability to learn new concepts. When young adults undertook a 19-day computer-based training program that focused on developing working memory for 30 minutes a day, it was found that not only their working memory, but also their fluid intelligence improved (i.e. their ability to solve problems in new situations). A convincing range of such results (including associated neural changes – see Fig 3) have led scientists to conclude that working memory can be trained[33], and changes to prefrontal activations associated with working memory have been identified[34]. This bodes well for those wishing to develop more effective "brain training" games – but so far the commercial response to these exciting developments has been slow.

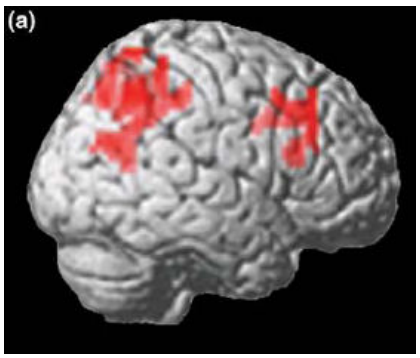


Fig 3 Increases in frontal and parietal regions after WM training (Olesen et al. 2004)

7.4.3.2.1. Interdisciplinary Discussions

It was noted that links existed between a range of concepts in TEL and neuroscience. The diagram below highlights some of these (fig. 4)

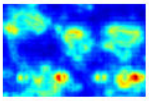
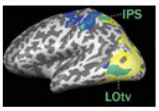
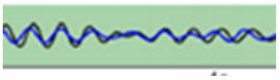
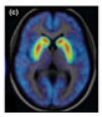
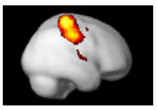
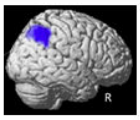
TEL	Neuroscience	
Screen design	Visual salience	
Tangibles	Visual/haptic processing	
Collaboration	Neural syncronisation	
Cognitive training	Tuning dopaminergic transmission	
Artificial agency	Mirror neurons	
Creative idea sharing	Automaticity suppression	

Fig. 4 Some potential links between concepts in neuroscience and TEL. The table is intended to highlight where interdisciplinary discussion might be fruitful in interrelating concepts, and is not intended to imply equivalence or any simple correspondence of ideas.

Discussions identified a number of barriers to progress that would need tackling in efforts to integrate understanding from neuroscience into TEL research, arising from differences in:

- language, terms and concepts in the two fields
- professional aims (neuroscience is interested in determining new fundamental facts about neural processes, TEL seeks to generate practical demonstrations of benefit)
- methods and epistemology, and the types of validity that are sought
- research contexts (i.e. moving from controllable lab experiments to more ecologically valid but complex and less controllable “real world” scenarios)

7.4.3.3. Emerging Research Questions

In response to the discussion document, some participants had already noted a number of areas where neuroscience and TEL might inform each other, and they demonstrated these in the following (potential) research questions:

Charles Fadel

- How might neuroscience help refute "learning styles" and other techniques for accelerated learning – or help confirm them?

Tamara van Gog

- Would mirror neurons really play a role in learning from video-based or animation-based modeling examples in which tasks involving human movement are demonstrated to learners (which we hypothesized in a 2009, Educational Psychology Review article, might be a potential explanation for the fact that many animations about mechanical or natural phenomena are NOT more effective than a series of static pictures, while those involving human movement are)
- Self-regulated learning: Adults are quite effective at monitoring their learning under certain instructional conditions; the findings regarding young children are mixed, an interesting question in my opinion would be whether this process relies on the same neural mechanisms in children and adults and how it develops?

And two more general questions:

- Cognitive load measurement: EEG seems very promising, but what about fMRI for example?
- I often get the impression that many people in the TEL community believe that technology makes kids effective multitaskers (doing homework with the television on while chatting on Facebook and following tweets), even though studies in cognitive psychology show that when it comes to learning, this is not effective at all; potentially, neuroscience research on attention and memory could make an important contribution (and one that might be more convincing for some) in this area as well

Tony Fisher

- How might neuroscience inform our pedagogical and technological choices when we look to exploit ICT tools, social networks etc as part of learning and teaching?
- How does neuroscience help us to understand and foster attention, engagement and flow in learning?
- What can we usefully say in ITE and teacher CPD about the intersection of TEL and findings from neuroscience?

Niklas Ravaj

- How do emotion- and cognition-related psychophysiological responses predict learning during a learning game?

Diane Levine

- Can technology help us to learn what to remember?
- What can the neuroscientific evidence on 'rewards' tell us about the ways in which young people develop relationships with others online?
- Is there a difference between cultural and biological evolution? And how much do culturally learned thinking skills explain human creativity in a globalised TEL context?
- What sorts of metaphors are good for helping children and young people understand what we know about how brains work? And how can they use those working models to keep safe and happy online?

- To what extent are we able to remember old solutions or strategies whilst generating new ones while using new technologies?

Lisa Friedrich

- What games are suitable to be combined with neurophysiological measurements (e.g. can be modified to send appropriate trigger for EEG analyses)?
- What approaches are there/ should be made for adaptive educational systems (e.g. what kind of measurements (EEG, ECG, skin conductance,...), criteria/threshold for adaptation, which games, impact/consequences/improvement)

Further discussion was focused on developing further Grand Challenge Problems, as a means of demonstrating how opportunities at the confluence of neuroscience and TEL might arise.

7.4.3.4. Grand Challenge Problems

7.4.3.4.1 Grand Challenge Problem 1

Substantially improving motivation and learning of students in European schools by systematically using game-based environments informed by our emerging understanding of the brain's reward system

Activities necessary:

- Basic research on understanding how the brains reward system responds to different types of feedback – and how that influences learning
- Use the neuro-computational algorithm, implement them into the game software to maximise engagement
- Design-experimentation on improving an exemplary game; including varying the content
- Bridging studies that study the game in the laboratory but also in the classroom with teachers included in this process.
- Scaling studies
- Involve industry, technologists, educators, neuroscientists to explore the interdisciplinary processes to build future research capacity

A Time frame of 4 years would be necessary for this project. Measurable outcomes could be:

- improved engagement and achievement amongst targeted students

The generation of neuro-computational algorithms accurately predicting behaviour in a variety of game contexts, with their neural correlates

7.4.3.4.2 Grand Challenge Problem 2

Designing TEL environments to systematically inform all European teachers on main advances in Neuroscience and possible conclusions for teaching and learning in school.

Activities necessary

- Define a curriculum with respect to concepts, methods, and findings of neuroscience with respect to learning and instruction (including the definition of a process to revise the curriculum in the light of advances in research). We need a working group comprising educ. researchers, practicing teachers, teacher educators, and neuroscience researchers.

- Develop and evaluate a platform for bi-directional exchange (collecting and urging relevant areas of investigation – target group being neuroscientists ad educational researcher – neuroscience in a nutshell /minimum level of knowledge not to fall under the influence of neuromyths / strong method focus. Need for a technical team in addition.
- Support the systematic implementation (including finding ways to engage the different groups, evaluation of these TEL environments; tap into funding; use ECER network; ministries of education.
- Empirical research: studies on scientific reasoning; change of perspective of use of rewards, interest, motivation.

This Grand Challenge could be later generalised to include parents and policy makers as target groups. A suitable timeframe would be 2-3 years in order to meet the following measurable success criteria:

- vibrant community;
- development of research agendas;
- change in (neuro)scientific reasoning of teachers
- scale of participation(5000 teachers)

7.4.3.4.5. Researchers and Communities

Clearly, such projects as outlined above would require interdisciplinary teams for their successful promulgation:

Educational experts - able to identify content and participants, to help problematize research questions, guide issues of ecological validity, participate in evaluations

Cognitive neuroscientists – able to provide existing neural concepts and help theorize their application

Psychologists – able to provide existing psychological concepts linking brain and learning behaviour, able to provide essential data specifying participants

TEL experts (including commercial software providers) – able to theorise learner-technology interaction, help devise and construct prototypes and support exploitation of outcomes.

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7.4.4. Workshop #4 Structuring Online Collaboration through 3Ts: Task, Time and Teams

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Organizers: Francesca Pozzi, Donatella Persico

7.4.4.1. Introduction and Motivation

The workshop entitled "Structuring online collaboration through *3Ts*: Task, Time and Teams" took place during the first part of the ARV 2011, from March 28th to March 29th in La Clusaz. It was organized by Pozzi F. and Persico D., both from CNR-ITD (Institute for Educational Technology, National Council for Research - Italy).

The workshop intended to bring together researchers who had been working on the general issue of "structuring online collaboration" with different approaches, be they collaboration techniques, strategies, scripts, content schemes, or any other type of structuring technique.

The need for this workshop had emerged from the current intense debate in the literature around how it is possible to support students' online collaboration. As a matter of fact, such debate has been focusing on whether, to what extent and under what circumstances structuring the interactions among students enhances the effectiveness of collaborative processes (Demetriadis et al., 2009). While some studies support the claim that an excess of freedom in the way collaborative tasks are proposed may fail to engage all team members in productive interactions (Hewitt, 2005; Bell 2004; Liu & Tsai, 2008; Demetriadis et al., 2009), others maintain that there is a danger in over-scripting collaborative learning activities (Dillenbourg, 2002). They claim that too much guidance, due to an excess of task structuring, may hinder learners' creativity, flexibility and ability to self-regulate, thereby jeopardizing the co-construction of knowledge and ultimately causing a loss of effectiveness of the learning process.

Kanuka & Anderson (1999) discuss some frequently used techniques for fostering the collaborative learning processes. These techniques include procedures and behaviours to be enacted by students in order to carry out a given task during a learning activity. Collaborative strategies and techniques, which are usually selected by the instructional designer and managed by the tutor during the educational experience, allow the organization and scaffolding of activities (that is, they structure them), in order to help students collaborate effectively and thereby reach the learning objectives. Examples of these strategies are: Discussion, Jigsaw, Role Play, Case Study, Peer Review, Pyramid, etc. The CSCL literature is full of case studies where one or more techniques have been adopted (Pozzi & Persico, 2011).

Other researchers (Dillenbourg & Hong, 2008; Dillenbourg & Jerman, 2007; Kollar, Fischer & Hesse, 2006; Weinberger et al., 2004) have oriented the issue of providing a structure to online collaboration towards the definition and use of "scripts", that is, a set of direct

instructions (often provided through interaction prompts) guiding learners in the online activity.
Finally, another research thread has been explored (Ertl, Kopp & Mandl, 2007) that focuses on the concept of "content schemes" implemented by tools to scaffold the structure of the output of a collaborative learning process. Overall, collaborative strategies, techniques, collaboration scripts and content schemes are all complementary ways to support students while they carry out a collaborative learning activity: they can be combined with one another and at different levels in order to improve both the design and the execution of the collaborative learning process.
Building on such debate and more broadly, on the literature in the CSCL field, the workshop organizers identified and proposed to adopt 3 Ts, namely ***Task***, ***Team(s)*** and ***Time***, as the main dimensions along which one may look at the structure of an online learning activity. The idea behind the workshop was to look at the 3 Ts as ***unifying common backbones*** around which to build a joint discussion even among people who have traditionally oriented their research efforts towards different design approaches.
To sum up, the main goals of the workshop were:

- To bring together researchers who have tackled the problem of sustaining collaboration in CSCL activities with different structuring approaches
- To share a common framework to analyze these approaches and to critically engage with the usefulness of this framework
- To identify research questions that deserve attention and that can profit from an international research approach/ team
- If possible, to plan concrete actions (i.e. "cross-experiments") to investigate them.

The main idea behind the overall organization around which the workshop was conceived was to make it as much interactive as possible and to share roles and responsibilities among the participants in order to actively involve all of them in each phase of the workshop.
As a consequence of this, the workshop took the form of a blended event, composed of a preliminary virtual session and a main face-to-face session at the ARV.
In particular, before the ARV in February and March 2011, a virtual activity was proposed by using a TELeurope Group. Through this facility, the workshop participants shared their abstracts and were asked to introduce themselves. Then, an activity was proposed to them aimed to promote reflection around the workshop theme. Such an activity included completing an online questionnaire in which participants were asked to test the 3 Ts model by describing a collaborative learning activity they had delivered/proposed in their experience. The questionnaire aimed to help them become familiar with the 3Ts, as well as to test its usability in the various research contexts of the participants. In addition, the participants were asked to provide an initial feedback to the model. The feedback was then used by the organizers as a starting point for the discussion during the face-to-face sessions.
The face-to-face part of the workshop (subdivided in 4 main phases) was articulated as an alternation of presentations and working groups. More specifically, the workshop was organized as follows:

virtual session	• Each participant was required to share the abstract submitted to the workshop organizers and to introduce him/herself

TELeurope group	• Each participant was asked to fill in an initial questionnaire (developed by the workshop organizers) aimed at capturing participants' preliminary concepts and ideas about how the 3Ts affect collaboration structuring
F2F first half-day	• Welcome and opening of the workshop by the organizers • Short introduction of all participants • Presentation by the workshop organizers of a re-elaboration of participants' inputs (provided online) in the light of the 3Ts • First round of participants' presentations • Questions and answers
F2F second half-day	• First session of group work • Second round of participants' presentations • Questions and answers
F2F third half-day	• Second session of group work • Presentations of the results of the working groups
F2F fourth half-day	• General discussion and definition of next steps and of future research directions • End of session and workshop.

7.4.4.2. Workshop Description

Overall, there were 11 presentations (subdivided into three sessions) and 6 working groups (subdivided into other two sessions). In the following, both the presentation and group work sessions are described. In particular, section 2.1 briefly syntheses all the presentations; section 2.2 reports on the group work sessions and on the main results achieved by the groups.
Lastly, section 2.3 summarizes the main outcomes of the workshop and illustrates the main ideas brought forth by the workshop participants.

7.4.4.2.1. Report of the Presentation Sessions

The workshop was introduced by Francesca Pozzi, who explained the main ideas behind the workshop, its goals, schedule and the expected outcomes [Pozzi F. (*Istituto Tecnologie Didattiche, CNR, Italy*) – "Introduction to the workshop"].
Afterwards, Marie Joubert, who was the workshop Provocateur appointed by STELLAR, briefly illustrated the Network of Excellence and provided an explanation of the Grand Challenges, which were to serve as a framework for the workshop [Joubert M. (*University of Bristol, UK*) - "The STELLAR Network of Excellence"].
Then, Francesca Pozzi took the floor again and summarized the main inputs derived from the analysis of the online questionnaire filled out by the participants prior to the workshop. The results of this were taken and further elaborated by Donatella Persico who, in the presentation that followed, explained the 3Ts model and described the main principles behind it [Persico D. (*Istituto Tecnologie Didattiche, CNR, Italy*) – "Structuring online collaboration through 3Ts: Task, Time and Teams"].

This introductory session was followed by the first session of presentations given by the participants. This was chaired by Armin Weinberger (*Saarland University, Germany*) and elaborated 4 interventions: Yannis Dimitriadis presented concepts of learning and

assessment design patterns and showed how, in principle, these can be both described in terms of the 3Ts. In addition, Yannis Dimitriadis explained a number of aspects of the model that could be improved in his view. In particular, he pointed out that the model doesn't encompass technology or resources (documents, tool, etc.) as main dimensions along which to describe an online collaborative activity. He then claimed that given their current formulation, the 3Ts don't grasp the relationships between activities [Dimitriadis Y., Villasclaras E. (*University of Valladolid, Spain*) - "Pattern-oriented orchestration of learning and assessment activities in CSCL classrooms"].

His intervention was followed by that of Nicolaos Avouris, whose contribution focused on the use of tablets in collaborative learning activities in classrooms and on the issue of how to assess activities of this kind in particular. He reflected on whether and how the 3Ts, which originated in 'pure' CSCL contexts, could serve to describe the structure of collaborative activities in face-to-face learning environments [Chounta I.A, Avouris N. (*University of Patras, Greece*) - "A case study: Tablet computers in orchestrated, collaborative activities"].

Afterwards, Dan Suthers elaborated on the concept of 'representational guidance' and claimed that shared representations may support the collaborative learning process at different levels (negotiation potentials, referential resource, reflector of subjectivity, etc.). He claimed that different representations may have different impacts in terms of expressiveness, salience, prompting [Suthers D. (*University of Hawai'i, HI*) – "Unstructured 'Structuring' with Representational Affordances"].

The last presenter in this session, Sue Timmis, discussed the interactions that occurred within groups of students, who, while required to carry out a collaborative research project within a formal course, were also encouraged to interact freely in their choice of informal environments. This was done to support affect and sustainable forms of collaboration. She suggested that a fourth T, namely Tool, would enrich the 3Ts model because the use of informal communication tools makes collaboration sustainable and supports motivation and affect. At the end of her presentation, Sue Timmis put forward the following research problem: "Need strategies for empowering students to sustain their own supportive and collaborative endeavors, alongside more scaffolded approaches" and formulated a number of research questions related to the impact of friendship on collaboration, how to encourage sustainable collaboration, the role of the teacher in collaboration, etc. [Timmis S. (*University of Bristol, UK*) - "Longitudinal instant messaging conversations amongst undergraduates: From orchestration to sustainability and empowerment"].

The second presentation session, chaired by Yannis Dimitriadis (*University of Valladolid, Spain*) comprised another 4 talks. Christian Voigt mainly reflected on two issues: the former concerned the difficulty of assessing effective collaboration and, taking inspiration from Minsky, 1994, he proposed referring to the concept of 'negative knowledge'. He argued that rather than saying what 'should happen' during a collaborative learning activity (prescriptive design knowledge), Time, Task and Team should indicate what 'shouldn't happen' (negative design knowledge). Talking next about implementing design knowledge, he came to his second issue, i.e. how technology can enhance reflection. To tackle this issue, he showed some useful ways of visualizing the flow of discourse [C. Voigt (*Centre for Social Innovation, Austria*) and Peter Kraker (*Know-Center, Austria*) - "Empowerment as reflection on structures"].

Alyssa Wise started her contribution by providing feedback on the 3Ts model, which she suggested she was rather comfortable with, even if she would encourage the inclusion of a fourth T, namely the Tool. She then focused on the Time component and reflected on the relationships between this and the other components of the model in online discussion forums. First, she pointed out some key temporal concepts for asynchronous online discussions (freedom and time management, concurrency, periodicity & salience of time, persistence & continuity of interaction, resituating & memory decay). Using concrete examples, she then discussed the fact that often, the kind of Task or the roles within the Team may affect the Timeliness of students' contributions and thus the overall quality of the process [Wise A. (*Simon Fraser University, Canada*) -"As Time Goes By: Using Task and Team Design to Support Conversation Flow in Asynchronous Discussions"].

In the presentation that followed, Nikol Rummel focused on online collaboration carried out by dyads working through audio and video conferencing. After discussing some examples, she reflected on two concepts of 'scripted collaboration' (where the focus is on structuring students' collaborative activities/interactions) and 'productive failure' (where the focus is on delaying content related support). She then provided some feedback to the 3 Ts model, mainly by pointing out that Task and Team should be better differentiated and that Timing may be interpreted as 'timing of the support', as well as 'timing as part of the scripting'. She then presented a framework (developed by herself and a group of colleagues) describing the main dimensions for supporting collaboration. She raised the question of how it would be possible to map this framework onto the 3 Ts model [Rummel N. (*Ruhr-Universität Bochum, Germany*), Diziol D. (*University Freiburg, Germany*), Westermann K. (*Ruhr-Universität Bochum, Germany*) – "How to design support for CSCL: Of Models, Scripts, Adaptive Support and Productive Failure"].

The last intervention was by Miky Ronen, who pointed out the importance of the Teacher in online collaborative learning activities, suggesting that this was not sufficiently recognized in the 3T model. He presented CeLS, an approach and environment for the design and enactment of structured collaborative activities. Miky Ronen discussed the approach behind CeLS and reflected on how it could be used to design and control the 3Ts. During her speech, she put forth the notion of collaborative 'TECHNOGOGY', whose role is "to promote and expand the educational potential of new technologies through sound pedagogical exploitation"[19]. This notion was later on discussed by all the participants [Ronen M, Kohen-Vacs D. (*Holon Institute of Technology, Israel*) - "Controlling the 3T's with CeLS for practice and research"].

Each presentation was followed by a time slot dedicated to questions and answers. During these slots, some important ideas were raised and discussed. Since many of them were then further discussed within the group work sessions, they are reported in the following section of the paper.

7.4.4.2.2. Report of the Group Work Sessions

The first of the group work sessions encompassed 3 working groups that were organized and led by the two workshop organizers and one participant. The second session encompassed another 3 groups, this time organized and led by 3 volunteer participants.

[19] Quotation from http://www.technogogy.org.uk/

The group discussions of the first session all aimed to discuss and receive feedback on the 3 Ts model. The three groups were asked to carry out the same task, i.e. to elaborate a small set of research questions deemed relevant around the 3Ts and to identify possible plans to address these questions.
Each group chose a rapporteur in charge of taking notes during the discussion and then reporting the main ideas emerged to the rest of the workshop participants within the final plenary session.
In the following, the notes produced by the 3 rapporteurs are provided.

Right-hand side group

Participants: Francesca Pozzi, Yannis Dimitriadis, Anastasios Karakostas, Sue Timmis, Maria Perifanou, Bernhard Ertl
Coordinator: Francesca Pozzi
Rapporteur: Yannis Dimitriadis.

The work in groups took place after the introduction of the workshop and the associated 3T model, as well as the first session of presentations. It focused on a deeper analysis of the 3T model and it was characterized by several diverging positions on the main elements to be included in the model.
The following items were discussed chronologically:

- The distinction between **collaboration and cooperation**, as reported in the literature.
- There were several asser**tions stating that Task is mu**ch more important than the other two Ts (Time and Teams), although it is cl**ear** that the other Ts are still necessary and important.
- With respect to **Teams**, a classification into "individuals, pairs, small group, big groups" was proposed. It was noted that particular group structures seem to encourage particular types of interactions.
- One of the major issues dealt with the **objective of the 3T** model, which could be used to organize, optimize, describe, understand, etc. Depending on this objective, the model could be appropriately assessed. The same holds with the **actors that are involved in the 3T model**, i.e. instructional designer, teacher, researcher, tutor, learner, etc. The combination of actors and objectives could be used to assess the validity of the model more systematically.
- With respect to **Time**, there was some discussion on its role and whether it should be controlled or not. The elements of deadlines, milestones, and the need for synchronization or description of phases could be essential for this dimension.
- An important aspect (of the discussion) concerns the **quality of collaboration** and its characteristics. On the one hand, the learning objectives in a knowledge domain or with respect to collaboration skills could be considered. On the other hand, the efficiency of the process could be taken into account. Should the process be adapted and personalized and what is the unit of analysis? Globally, a model of the quality of collaboration, such as the one proposed by N. Avouris could be useful. Having a model of the quality of collaboration and the way to assess it might also be useful for the analysis of the 3T model and it could also help in enhancing the model.

- With respect to the model, an **analysis of the usefulness and robustness** of each dimension should be undertaken. Is simplicity the major characteristic to be achieved? Also, it will be necessary to "**include" the tensions** on structuring that were discussed thoroughly throughout the workshop.
- The **role of Tools/Technology** was also discussed. The majority of participants consider Tools to be elements that help the realization of the learning tasks. However, for Yannis and Anastasios at least, technology could also be used to support the design process, or the evaluation, i.e. before or after the learning process. The affordances of the technological tools should be taken clearly into account.
- Some discussion was carried out on the importance of considering the **role of learners and learning** more; besides teachers/designers, etc; who structure the collaboration process. Also, it was concluded that the distinction of formal and informal settings should be considered.
- The **personal and emotional aspects** should be taken into account, either on an individual level or in a group level through the social interactions. There is insufficient research on these aspects and they should be included in the model.
- With respect to **concrete actions**, the following were considered:
    - Provide immediate feedback on the model through its analysis.
    - Understand how the tensions regarding structuring are described in the model.
    - Include and consider the tools for design, enactment and evaluation.
    - Formulate the most appropriate research questions and consider whether they are new or persistent through time.
    - The quest for the "best" structure that meets all tensions is still an open issue.
    - The influences between dimensions should be studied in all levels, e.g. what happens when one dimension changes?

Left-hand side group

Participants: Eloy Fernandez, Dan Kohen-Vacs, Donatella Persico, Miki Ronen, Dimitra Tsovaltzi, Armin Weinberger, Mike Tissenbaum
Coordinator: Donatella Persico
Rapporteur: Mike Tissenbaum.

The work from the left-hand side began with the central notion that we, as researchers, cannot be everywhere – that is to say, we cannot be there to watch all the instances of a particular design or technology's implementation. How then do we encourage and support teachers to use these techniques, especially over time? The following is a summary of the main ideas and points that were raised:

- One of the main points that arose from our discussions was the need to find ways to encourage teachers to **employ collaboration strategies in their daily practices**.
- In addition to the notion of collaboration, two other main themes were prominent throughout our discussions: **technological affordances** and **scripting.**
- In our discussions, collaboration focused mainly on collaboration among teachers. In particular, we talked about how, in relation to encouraging teachers to adopt and

continue using particular educational designs over time, a community of teachers could be established who would support both novices and experts alike in using these designs.
    - In connection to this, we put forth the notion of **teacher scripts**, which are similar to student scripts in that they scaffold novices in the adoption and integration of particular activities until they feel confident enough to use them on their own.
    - From this we developed our group's central question: How do we support teachers in designing, sharing, and enacting these kinds of curriculum/activity – what kinds of scripts can be provided for educators, and how can these scripts be faded to give the teacher ownership of the curriculum?
- Supporting the above notion was the role that technology played in the successful implementation of these designs. In particular, we asked how technology could provide teachers with **dynamic representations and aggregations of student;** work that could not be done with traditional (non-digital) means, and how can this information help teachers **adapt their scripting** of the 3Ts in **real-time** to address student needs?
- We also noted that it isn't enough to simply provide *all* the collectable student information. It is also important to ask what information is required by the teacher to make decisions for the particular activity at hand.
- Furthermore, we discussed the issue of how **culture** affects the successful implementation of a particular curricular design – we noted that the same design might be enacted quite differently, and with very different results, depending on where and with whom it was employed.
- In an attempt to better understand this issue, we asked ourselves: How do external (given scripts) and internal (culturally shared) scripts interact in the execution of the curriculum?
- Finally, we discussed the role of student agency and motivation in the activities. We noted that over time, much like with the teacher, it is important to give the student a **sense of ownership** in the learning activity, and as such asked two questions:
- How can these curricular designs provide students with the ability to construct (externalize) their own scripts within the context of the learning activity?
- How does the ownership of the scripts affect student motivation?
- **Measurement** was also a key part of our discussions. We developed three measurements to determine the success of our designs in regards to the questions posted above:
- **Sustainability of the curriculum:** Is the teacher employing the curriculum over time?
    - This would assessed with periodical check-ins with the teachers to improve both adoption and retention of the designs.
- **Re-application of scripts:** Students' ability to describe and (re)-apply the scripts developed during the curriculum.
    - Done either through post-tests or observing students in other settings outside of the intervention.
- **Collaborative Practices**: Does the self-construction of scripts result in good collaborative practice?
        - In an attempt to tie teacher support to student motivation we also asked:
    - Which forms of teacher support result in more self-regulation by the students?

Window-side group

Participants: Nikolaus Avouris, Peter Kraker, Pantelis Papadopoulos, Nikol Rummel, Dan Suthers, Christian Voigt, Alyssa Wise
Coordinator: Christian Voigt
Rapporteur: Alyssa Wise

The discussion began with the question "why do we structure online collaboration?" and quickly moved to the notions of self-sustaining collaborative practices and learner agency, how to support these via structuring and how to assess when they have been achieved. The following is a summary of the main ideas and points that were raised:

- One of the driving purposes of structuring online collaboration is to make effective collaborative practices a natural part of learner interactions. In other words, to create a **self-sustaining system**.
- What might the progression towards such a system look like? There are multiple trajectories towards productive collaboration. One scheme of **incremental development** is:
    - **Exploration**: Learners focus on understanding the structuring resource as a tool.
    - **Reliance**: Learners use the tool as a means of focusing on the domain problem (can vary in fluency).
    - **Appropriation**: Learners "own" the resource, possibly using it in ways not designed for or anticipated.
    - **Internalization**: Learners internalize the functional support of the structuring device, so they no longer need the external artifact that embodied that structuring.
    - **Carry-On**: Learners "own" the structuring device by continuing to use it beyond the mandated setting (next project, next class, life in general).
- How can the creation of such a system be supported?
    - By using the "**endemic"** tools and practices of a domain (ones that are authentic rather than contrived).
    - It is critical that learners can **see the value** in using the structuring devices if they are to continue using them on their own.
    - There needs to be a balance between providing too much or too little structure to let learners develop agency but also support them in the process; and this **balance of how much structure is just enough will change over time** (structuring fades as learners appropriate/internalize).
- The idea of ownership and sustainability led to a discussion of learner agency and the following question: Rather than seeing structuring and agency as two opposing forces in online collaboration, how can structuring be used to enable agency? What factors in structuring could be varied to affect this?
    - Is structuring provided on an **opt-in or opt-out** (only when need identified vs. faded over time) basis?
    - **Who has the control** of how much structuring is provided (Teacher, students, peers, shared or distributed control)?

    - **How long** should structure be provided (need to first experience success)?
    - Other questions can be derived from an examination of specific collaborative scenarios (see notes from the follow-on session).
- It is important to take into account the **context of learners today and the technological milieu** in which they operate; for many, the notion of agency in online interactions is implicit. As designers we need to take what students do as a starting place and respect the ecology of current tools.
- There is a need for **long-term studies** to examine these questions; short experiments won't do.

As has already been mentioned, the groups of the latter session had different aims and tasks: Each of them was organized by one of the workshop participants who has chosen the focus of the activity. One group (right-hand side) was organized by S. Timmis and aimed to analyse some interactions occurring among students within an informal online environment within one of her courses (see the short synthesis of Timmis' presentation). The idea behind this activity was to reflect on the relationship between the 3 Ts and learning in informal settings.
Another group (left-hand side), organized by M. Ronen, aimed to present myCeLS (an online environment to design online collaborative activities). The idea behind this was to reflect on how CeLS may support the design and control of the 3 Ts (see the short synthesis of Ronen's presentation).
The third group (window side) was launched and coordinated by A. Wise and was around the notion of Time and how this is affected by the other components of the model (see the short synthesis of Wise's presentation).
The following is a summary of the notes provided by the 3 rapporteurs:

Right-hand side group

Participants: Francesca Pozzi, Anastasios Karakostas, Sue Timmis, Maria Perifanou, Bernhard Ertl, Dimitra Tsovaltzi
Coordinator: Sue Timmis
Rapporteur: Dimitra Tsovaltzi and Francesca Pozzi

In the beginning, the discussion was oriented towards informal learning. Then, the group agreed that the examples provided by Sue can be considered examples of 'informal communication' (rather than informal learning) that can be used to support both formal and informal learning. The discussion led the group to formulate the following questions:

- What is the relation between informal and formal communication and learning? How can we leverage the advantages of informal communication to advance formal learning?

Another issue raised by Sue and then discussed by the group was related to the sustainability of collaboration, which can be influenced by elements such as trust, cohesion, affect, etc. This led the group to elaborate another small set of questions:

- What is the role and contribution of emotional support to the sustainability of the groups/collaboration as one of the main possible contributions of CSCL (tool affordances, e.g time extension)?

- What is the role of structure to foster emotional engagement and common learning interests/goals as the preconditions of sustainability? How do these mediate learning outcomes?
- How can we effectively research affect?

Left-hand side group

Participants: Dan Kohen-Vacs, Donatella Persico, Miki Ronen, Mike Tissenbaum
Coordinator: Miki Ronen
Rapporteur: Mike Tissenbaum.

The work from the left-hand side group continued primarily from the work developed from the previous session. In this session, we spent time looking at Ronen's project, discussing what kinds of insights it provided and what questions arose in relation to similar technology-based learning platforms in general.

- Looking at myCeLS – the environment developed by Dan and Miki – we highlighted several interesting affordances of the technology that would be important for other similar platforms:
- An easy-to-use **authoring environment** that is also **flexible**, so that teachers do not need high-level programming experience to use it, configure, and author their own curriculums with it.
- Feature such as "drag & drop" and other GUI features were mentioned as being highly "teacher friendly".
- The ability to integrate the platform with other technologies was also noted as being an important feature – from grade systems, to content creation systems (such as Google Docs).
- A central feature that came up in our discussion was the need to make the environment **social**.
- How can the environment give access to the collective experiences and expertise of the wider community of teachers, students, developers, and researchers by others?
- How can such an environment provide these different stakeholders with information about the activities taking place within the environment?
    - Who is online? Who has accessed specific areas? What are their individual contributions?
- We also noted the need to construct different **levels** of "**social structures**", including classes, groups, sub-groups, and individuals within the learning environment to allow for different types of interactions depending on the learning goals of a particular activity.
- Ultimately, we noted that **Technology Solutions** are out there but how do you promote the practice of technology use for wider dissemination?
    - It's not just getting the technology in the teachers' hands but encouraging (and working with them) to use it over time.
- What supports (teacher training, etc.) and scripts can best result in teacher adoption of new pedagogical technologies?

- Furthermore, given the many different pedagogical technology designs out there, what are the **affordances** and **opportunities** presented by the different technology platforms?
    - What different teachers' needs are addressed by each of these platforms?
    - And since there is no panacea (nor should there be) platform – what **concessions** are made by each platform to address particular needs?
- We also asked in what ways the **community** of teachers are supported by the technology?
    - To what extent does this kind of system allow for the sharing of experiences and resources among teachers?
- We closed with a rather broad idea of our own Grand Challenge problem:
- Developing an **Ontology (or Taxonomy) of Collaborative Activities**
    - We would like to further think about and potentially develop an understanding of the different configurations of collaborative activities that work well in consort, result in powerful and effective learning outcomes and support particular pedagogical aim. What what technologies are most effective in their implementation?

Window-side group

Participants: Yannis Dimitriadis, Nikolaus Avouris, Peter Kraker, Pantelis Papadopoulos, Christian Voigt, Alyssa Wise
Coordinator: Alyssa Wise
Rapporteur: Christian Voigt

Realising the wide range of possible directions to progress starting from the discussion of the previous day, the group decided to focus on the temporal dimension of the 3T framework. The following notes capture the questions addressed and points of view presented during the group discussion. Roughly, the session can be split into a first, common ground creating phase (points 1 & 2) in which general issues were discussed and a second, more applied discussion that followed a 'pyramid structures' example (Note: A pyramid structures the transfer of learning outcomes, combining the outcomes from various small groups).

- **Should models go for simplicity or coverage?**
    - Continuing the debate on whether 3Ts were enough or whether a 4th or 5th should be added, a more general question about the nature of instructional guidelines and models was raised: Should models go for simplicity or coverage?
    - It was perceived that simple models had an important advantage in being useful and inspiring to a wider range of teachers ...
    - Complex models were deemed less usable as they often required a steep learning curve.
- **What is the audience?**
    - Next, we discussed whether the 3T model would be more useful for specific user groups (e.g. Designers, Teachers, Researchers).

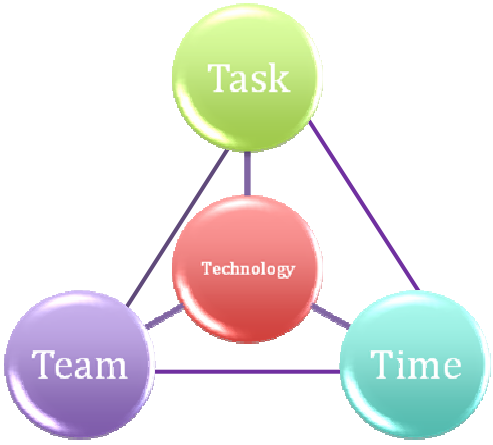
    - Although the framework was perceived to favour designers of learning processes, it was suggested that one framework should be able to cater to all three audiences. However, in light of the previous comment, a more simple version should be for users and a more complex one for researchers.
- **Are we aware of new tools and tasks emerging out of the provided initial question?**
    - To avoid the group spending too much time with high level speculations, there was a call to look for more applied scenarios of using the 3T Framework. According to the initial idea discussed in the previous session, groups are more likely to be self-sustained if they can use the tools and structures that are "endemic" to their community. Hence, rather than prescribing what structures to use, we first asked: Where and how do we consider the emergence of tools over time?
    - Are we aware of new tools emerging out of tasks as well as new tasks, that are discovered while exploring the tools?
    - Eventually, the 3 Ts framework was perceived as a helpful structure for looking at existing teaching strategies to shed light on the role of learner agency.
- **Can we go to an example?**
    - The previous point was then contextualised, taking the 'Pyramid structure' as an example.
    - We quickly came to the conclusion that the emergence of new tools requires a different level of observation. Whereas the 3T framework supports a macro view on learning process, the emergence of new tools etc. is likely to be discovered by looking at micro-level interactions.
- **Pyramid structures demonstrate how much power teachers have over the learning process?**
    - It was then argued that providing structure is also a matter of exercising control over what's happening in the classrooms. Control is often a precondition for getting comparable results in formal education. Hence, drawing agency into the picture would also require us to reconsider ways of evaluating learning outcomes.
    - The challenge here would be to use structures in ways that wouldn't stifle learners' creativity / agency because learners could feel that they had to comply with a given template for the task.
- **Recap, how many abstract support means do we need?**
    - We compared the 3T framework with other approaches we knew, such as alternative models or design patterns. However, the aim was not to endorse or refute the 3Ts framework, but to use it to discuss ways of enabling agencies.

7.4.4.2.3. Report of the Final Plenary Discussion: Main Outcomes of the Workshop

During the final plenary session, the results of the group work sessions were reported. Then, an overall discussion took place from which the main ideas brought forth by the workshop participants and the main outcomes of the workshop were drawn.

One of the main outcomes of the workshop concerns the feedback received by the workshop organizers on the 3Ts model. As we saw from the previous sections, the feedback was provided in different moments of the workshop and at different levels, but it is possible to summarize them as follows:

- Generally speaking, the 3Ts model was appreciated by all the participants for its immediateness and flexibility;
- All the participants agreed that the Tool (or Technology) component should be added as a fourth T of the model. The Teacher, who certainly plays a crucial role within the process, can be considered part of the Team component;
- According to the workshop participants, further attention should be devoted to the relationships among the Ts and the way they influence one another;
- The following representation was suggested to capture the main dimensions of the model and their connections:



- Overall, the 3Ts are considered a good vehicle for studying some of the main underlying tensions of the field. However, the model should be adapted to particular objectives (to design, to describe, to assess, etc.) and to the users involved (instructional designer, teacher, tutor, student, …). This calls for further research and testing. Further joint work on the model is being considered and may lead to common scientific publications by sub-groups of the workshop participants in the future.

The model proved to be very effective in stimulating discussion among the workshop participants, who, even if initially oriented towards different structuring approaches, focused on the following, common issues during the workshop:

- The notion of 'agency' should not be seen in opposition to structuring. Rather, the question should be: How can structuring be used to enable agency? The discussion surrounding this issue is ongoing among some of the workshop participants. It is likely that a sub-group of them will carry out some joint work on it.

- The attention towards a 'sustainable collaboration' that should be achieved via a fading structure (i.e. the collaborative mechanisms are internalized by students until they do not need the structuring scaffold anymore).
- The importance of the affective and emotional sphere within the collaboration learning process.
- The importance of providing structure to teachers as well, so to encourage and help them to use technology appropriately.

7.4.4.3. Emerging Research Questions

During the group activities, long-term research questions emerged that go beyond the scope of a two-day workshop. Many of these questions are ongoing 'concerns' for which there are no definite answers. Most of them have already been addressed but more work is needed.

The 3 Ts were considered a good means of addressing these questions. We asked:

1. How and how much should the 3Ts (or 4Ts) model be developed in further detail in order to serve the purpose of helping instructional designers, teachers and students in their tasks?

    a) Should the possible Tasks be exemplified/listed?

    b) Should the possible group structures be described (including different levels of them) and investigated individually?

    c) How should the influence of timing be studied? Should a taxonomy of tools be built?

2. How do teachers manage the tension between structured activities and the need for fostering student agency? How do they, or could they, manage to maintain the balance particularly as it shifts over time?

3. How can we support individual students and student communities in achieving effective collaboration while recognizing the importance of their own agency in this process? How do we assess the effectiveness of collaboration?

4. How could learners and learning communities be helped in getting ownership in their collaborative learning process? Should they be monitored or facilitated in exploring/relying/appropriating/Internalizing/carrying-on with the use of structuring techniques? To what extent should they be in control of the amount of structure they are provided with? How could collaborative learning activities be designed and orchestrated to promote the learners' and learning communities' sense of ownership? What is the role of structuring techniques in exploring/relying/appropriating/internalizing/carrying-on activities? How do learners and teachers respond to varying levels of monitoring and control provided by the structures which determine the activities within collaborative learning processes?

5. How do personal/emotional aspects integrate/meddle with the 3Ts/4Ts framework? Can we leverage the advantages of informal communication to advance

formal learning? How can emotional support sustain collaboration? How could the 3Ts/4Ts framework be adapted to take into account the personal/emotional aspects of learning and collaboration?

6. Are there cultural differences that should be taken into account while using the 3T framework with students/learners? How do cultural differences influence the way learners collaborate within given structures framed by the 3T model?

7. To what extent is the 3Ts (or 4Ts) framework compliant with conceptual and technological tools currently used to design and manage CSCL processes? What features are needed for a tool to lend itself to be used in conjunction with the 3Ts (or 4Ts) framework?

7.4.4.4. Grand Challenge Problems

At the end of the workshop, a problem based on the workshop discussions and outcomes was tentatively elaborated by the workshop Provocateur and organizers. Again, this should be considered as prototypical and would require further refinements.

The formulated umbrella problem was abstracted from the various workshop assumptions and the research questions that emerged. This is stated in the following.

Problem Formulation
Although online collaboration between learners has the potential of contributing to learning, it is generally recognized that teachers and learners do not fully appropriate its potential. Many innovations in this area have been developed and used in a variety of situations, but online collaboration is not often sustained and learners frequently engage in collaborative activities only to the extent that is required by the task or activity they are given. Take up is lower than hoped for. At the same time, there is evidence that many learners use social networking tools in their everyday lives. Thus, this research area explores the ways in which formal education can draw on the power of social networking in order to optimise online collaborative activity for learning.

The European education system values collaboration between learners. However, face-to-face collaboration limits learners to collaborating when they are co-located and collaborating only with other people within the location. Online collaboration has the potential to connect learners any time and any place, and to connect them with people they do not already know. However, it seems that teachers frequently need support in organising and structuring online collaborative activities for learning.

The Grand Challenge problem is ***to develop and validate approaches to empowering teachers and learners to take advantage of the potential of online tools for sustained and engaged collaborative activity aimed at improving or transforming learning***.

Addressing this challenge would benefit society by a) developing the collaborative skills of learners and b) exposing learners to a wider range of perspectives.

Main Activities Needed to Attraction
Possible European funding sources include the European Research Council or organizations such as Marie Curie. A concerted effort would also be made to encourage funding from

respective National Research Councils. Exemplary bodies in the UK include the Economic Research Council. There are also funding possibilities from different stakeholders such as the Department for Education.

7.4.4.5. Researchers and Communities

As already mentioned, In order to tackle the GC Problem, i.e. to (develop and) validate a framework able to describe the way an online collaborative learning process is structured, it is necessary to gather a community of people (not only researchers, but also designers, tutors, teachers, etc.) who traditionally use different structuring approaches, and plan (cross) experiments to verify the framework's validity.
The well-established CSCL research community could certainly be a pertinent arena for this, but teachers' communities and general practitioners in this field, including learners, could also be involved in the validation process.

More specifically, Educational technology researchers are needed to better design and define the research questions, plan the research experiments, and draw conclusions from the data collected. Psychologists can contribute to these tasks and are also needed for their competence in self-regulated learning and the affective component of learning. Technology could contribute by developing ad hoc software components of the learning environments. It also provides authoring and learning-progress monitoring tools for teachers. Linguists and statistic experts would be useful for elaborating on new ways to analyse the interactions among the members of a learning community based on content analysis of messages and statistical investigation of the results. It is envisaged that all of these competences should join the same research team and work in close contact. Learners should also be involved not only as Guinea pigs of the studies but in the process of helping researchers reflect on the possible interpretations of study results.

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7.4.5. Workshop #5 Exploring the Fitness and Evolvability of Personal Learning Environments (EFEPLE'11)

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Organizers: Lai-Chong Law Effie, Felix Mödritscher, Martin Wolpers, Denis Gillet
Provocateur: Fridolin Wild (Knowledge Media Institute (KMi), The Open University)

7.4.5.1. Introduction and Motivation

7.4.5.1.1. Motivation

In the recent decade a plethora of interactive software tools, be they open source or proprietary, have emerged and perished in the realm of technology-enhanced learning (TEL). Concomitantly, there have also been surge and demise of contents, social networks, and activities associated with the use of these TEL tools. It is intriguing to understand what factors contribute to their rises and falls, and how. While controversies on the viability of making an analogy between the evolution of natural and artificial objects prevail, it is deemed worthwhile to explore its potential for analysing the changes in TEL and charting the future.

In accordance with evolutionary theory, the fitness of an environment or tool can be defined with respect to its purpose and depends on the 'genes' from former generations. In context of TEL, these genes can be understood as features of existing tools and functionality being reused from software libraries or developed over multiple lifecycles thus leading to new generations of software artefacts. Personal learning environments (PLEs) aggregate these functionalities to enable learners to connect to peers and shared artefacts along their learning activities. Consequently, the success of a PLE can be measured by its uptake and usage within different communities of practice, its perceived effectiveness and efficiency in supporting the attainment of learning goals, its application beyond pre-defined purposes, its distribution and outreach beyond single communities, and its evolution to new PLE generations through active developers. Moreover, data mining of so-called variables of evolvability (e.g., perceived pragmatic/learning and hedonic/fun value) will enable the derivation of specific guidelines for designing and developing PLEs. Such empirically grounded guidelines, supplementary to those for generic IT applications, are currently lacking and much desired.

Overall, the main aim of the workshop is to explore the fitness and evolvability of PLEs in order to identify and understand characteristics and mechanisms for successfully evolving PLEs.

7.4.5.1.2. Related Work

In principle, for a software system to be sustainable, it needs to be able to adapt to the changing requirements [1] in terms of use contexts, user goals, organizational cultures and technological opportunities. Specifically, in the field of TEL, there has been a shift from the pioneer work on designing and implementing full-featured, organisation-driven learning management systems (LMSs) to the emerging trend of developing specialised tools, which then can be assembled by users to extend/create personal learning environments (PLEs, Attwell, 2007) [2]. Not least due to the Internet, users have access to a seemingly innumerable amount of content and software tools, which are useful and partially even necessary to achieve the learning goals driven by the demands of job tasks, higher, and further education, or even private activities.

In the context of PLEs, the selection of tools is at the discretion of individual users, their organisations and the communities of practice (CoP) where users engage in a variety of collaborative activities. It is observed that some software tools, after being used for a few typical tasks by a few people only, unexpectedly spread out within a CoP widely as well as wildly through good practice sharing, convincing peers of the benefits of these tools for particular lifelong learning activities. In a very short period of time such tools can become as must-have infrastructure for collaborative work (e.g. various Google services). These tools and the environments built on them are not only intensively used but are also modified and sustained by active developer communities. On the other hand, some tools are endangered to be rejected by end-users and to die out after a few successful cases of application, even though they have undergone several iterations of redesign. Apparently, these observations manifest the notions of descent with modification, heritable variation and selection, sensitivity to changing environmental or contextual requirements, and "control of and types of variability" (Nehaniv, 2003 [3]; Wernick et al. 2004 [4]) that characterize Darwinian evolution. In the context of PLEs, it is relevant to understand the processes leading to successful tool uses, create respective models and learn how to control respective processes to increase the efficiency and effectiveness of modern individual learning environments.

The assumption that changes in PLEs can be modelled by Darwinism underpins this proposed workshop, which aims to explore several pertinent issues:

Nahaniv et al [5] (2006) define the notion of evolvability as "the capacity to vary robustly and adaptively over time or generations in digital and natural systems". This definition leads to a basic question: **What is evolvable?** Is it a matter of the complexity of a system that is quantifiable such as lines of codes, number of modules? Or is it more a matter of quality-in-use manifests in terms of user experience [6] (i.e. a non-functional requirement)? Another key question: **Why does a system evolve?** It can be instigated by changes in a system's environment, user requirements, usage, implementation methodologies and technologies. Answers to these what and why questions can shed some light onto the question **How to effectively and reliably evolve a system** (Ciraci & van den Broek, 2006; footnote 3)? Addressing these questions in the context of PLEs instigated stimulating discussions.

Fitness for survival is a widely known but poorly understood concept of Darwinian evolution. Paradoxically, the idea of heritable variation and selection is necessary but not sufficient to explain inherent phenotypic expression of fitness (Nehaniv et al. 2006; footnote 5). It hinges

on the rigidity (or flexibility) of the genotype-phenotype mappings. The main difficulties lie in drawing analogies between biological concepts and artificial artifacts (e.g. What constitutes an “individual”, a “species”, or “interbreeding”). Insights can be gained from the notion of fit-for-purpose in the field of HCI (e.g. Wong et al., 2005) [7] and the fitness model of nodes in the science of (social) networks (Barabasi, 2002) [8]. Nonetheless, it remains an open question on how to define and measure the fitness of PLE tools.

7.4.5.2. Workshop Description

There were 10 presentations, including a keynote speech. In addition, plenary discussions on specific topics were held. Section 2.1 reports the main ideas addressed by individual presentations. Section 2.2 highlights the ideas explored by the workshop participants.

7.4.5.2.1. Report on Presentations

The presentations were started by the keynote speech by Prof. Chrystopher Nehaniv, University of Hertfordshire, UK. After the discussion on the keynote speech, the subsequent presentations were given in the following order: presentation by Benham Taraghi, Carlo Giovanella, Felix Moedritscher, Martin Memmel, Sandy El Helou, Jose L. Santos, Fridolin Wild, Christian Prause, and Maryam Najafian-Razavi.

7.4.5.2.2. Report on Plenary Discussions

The plenary discussions following the presentations was oriented towards 4 topical themes: a) Contextual Issues, b) Teachers as Target Groups, c) Invisible PLE, and d)Predictive Modelling.

7.4.5.3. Emerging Research Questions

Find a way to prove to the teacher that relying on a specific technology will help them be more effective

- The million practices & million teacher challenge: ad hoc formation of large scale learning networks: Reach a certain level of scale in variability and build capacity for variablity of practices of technology use in learning and teaching.
- This includes the sharing of context information such as attention meta data, interoperability, practice capturing and sharing facilities such as scripts or learning designs or activity streams.
- This is not about showing that a certain template is used by a million people, but that 1 million people have differing practices in technology support - adapted to their needs.
- Ad hoc formation of large scale learning networks.

*Fitness of learning environments is **plasticity** with respect to user requirements:*

- Variation: Adaptation or mutation: construction set widget-based PLE, coding according to changing user requirements, mash-ups
- Speed of change
- Evidence that a trajectory is followed that a system has been adapted: evidence of plasticity
- Knowledge management for teachers

- Dissolving of communities of practices: problem solved, community dissolved

Invisible PLE

- Low entry barriers
- Flexibility with respect to pedagogical and andragogical approaches
- fitness of widgets: create an open market for widgets; then we can use the market mechanisms; show that there are widgets from each of the European countries; differing learning contexts (school, university, lll) and stakeholders (providers, learners, teachers, educational institutions)

7.4.5.4. Grand Challenge Problems

7.4.5.4.1. Grand Challenge Problem 1

The Million Practices & Million Teachers Challenge: Ad Hoc Formation of Large-scale Learning Networks

In the educational area, technology is considered an enabler for successful and collaborative activities supporting learners with the increasing complexity and dynamics observable in all knowledge domains and leading to meaningful outcomes. Although being fostered by various European research programmes, a shift in funding strategies can be identified. Instead of pushing technologies for organizational driven teaching and learning more attention is paid to learner-centric approaches fostering competences beyond professional ones, i.e. digital literacy and social competencies, in order to prepare and strengthen individuals for acting in digital ecosystems. Amongst others, EU projects like ARISTOTELE, GRAPPLE, IMREAL, MATURE, METAFORA, ROLE, and TERENCE indicate the importance on transcompetences, personalized learning experiences, collaboration and reflection. Other research, for instance the projects 80DAYS, ALICE, COSPACIAL, GALA, ITEC, or V-CITY, focus on interactivity of content, educational games, or learner characteristics beyond domain-specific knowledge.

By understanding a learner as an actor in a learning ecology, TEL research has started to capture and anaylse the interactions of a learner with her environments which can be characterised as (ad-hoc) networks of actors, artefacts, tools, activities, and communities. In the beginning strongly motivated by being a counterpart to managed learning technology, streams like personal learning environments (PLEs) have emerged over the last few years with the aim to empower learners to design their own environments and to connect to learner networks to collaborate on shared artefacts and goal achievements (Wild et al., 2008; Van Harmelen, 2008). EU projects like ROLE, ITEC, or LTfLL have been investigating into PLE technologies and approaches.

From a more technical perspective, app and widget technology is being developed and applied for learning in many different settings and for different purposes, as reported by projects like ROLE or ITEC. The overall goal here is about reaching a certain level of variability in using technology for learning. On the other hand, interoperability has being investigated on different levels and in various EU projects, such as ICOPER or ROLE, as well as in various R&D communities, like CSCW, SCORM, IMS etc. Basically these standardisation movements aim at making learning objects, learning designs, or educational scripts accessible for others in order to foster sharing and reusability of educational resources.

In fact, one grand challenge in the European Educational Area deals with reaching a certain level of scale in variability, e.g. flexibility of learning technologies, and building capacity for sharing and consuming practices of technology use in learning and teaching. Variability and the capacity for variability is a precondition for a flexibly changing learning environments. Therefore and to assist evolution of teaching with technology, the grand challenge aims at providing facilities so that a million different (individual) practices describing differing technology arrangements (e.g. a widget space in a PLE) are shared. It is not an explicit goal to show that a certain practice is used by a million people but that a million people have differing, individual needs and practices in technology support.

Grand challenge 1 includes several necessary achievements:

- *Practice capturing and sharing formalisms* such as scripts, learning designs, or activity streams
- *Facilities to capture context information* such as attention meta-data
- Means for *interoperability*
- Understanding, building, and sustaining *networks of teachers*, including ad-hoc formation and dissolution of such cliques
- Large *tool repositories* such as widget- and app-stores

Building capacity for variability includes:

- Supporting change in pedagogical approaches, shifting the focus from instructional theories and course-based teaching to *environment design capabilities and outcome-oriented learning.*
- Finding ways to evidence to the teacher that *relying on a specific technology* will help them be *more effective.*
- Since a constantly changing tools portfolio brings along the danger of environments disappearing, teachers have to be supported in meeting this with resilience. This may include *inexpensive benchmarking methods for assessing effectiveness or efficiency gains* that can be achieved with certain practices of technology use.

The degree of variability can be studied and measured. There has to be a significantly large number of differences, which can be assured by investigating provenance (contributions from all EU countries), position in lifelong learning (school, university, continuing professional development or work place learning), stakeholders (teachers, learners, providers, institutions, policy-makers), heterogeneity in practice (activities supported, different flows for the same aim) and tools (arrangements of widgets, combinations of web apps). The ‘million people, million practices’ benchmark could be seen as a ‘hard’ target, whereas evidencing a sufficent level of variability could be let up to the applicants in the challenge.

7.4.5.4.2. Grand Challenge Problem 2

Fitness of Learning Environments is Plasticity with Respect to User Requirements

Plasticity of learning environments is their ability to flexibly adapt (or be adapted) to changing requirements. Learning environments are complex ecosystems. Creating plasticity

refers to increased mass individualisation of practices and accompanying technology support. This involves:

- Supporting digital literacy of the teachers.
- Technolology as an amplifier.
- Increasing the speed of change.
- Identifying means to evidence that a trajectory is followed that a system has been adapted: providing means to evidence plasticity.
- Knowledge management for teachers
- Understanding and facilitating the ad hoc formation and dissolution of communities of practices: problem solved, community dissolved.
- Environments of scale.
- Investigating mutation, variability, and fitness of learning environments.
- Building developer – user communities (coding on demand, mash-ups and end-user development, improved human-computer interaction).
- Providing means for quick.
- Flexibility with respect to pedagogical and andragogical approaches
- Low entry barriers

This could be measured via an open market: when e.g. an open market for widgets and educational practices exists (widgets that are embedded in individual practices that are shared), the market decides which ones are best.

7.4.5.4.3. Grand Challenge Problem 3

One Tutor per Child

Human tutors can be assisted by technology to help learners become more competent and meet the demands of our knowledge-driven society. An individual tutor for every child in Europe (and beyond) is a desideratum that so far cannot be reached. With the help of predictive models and learning analytics, this area could be significantly strengthened. Combining agents and human tutors to provide high quality tutoring to every child can be achieved.

This involves the research of:

- Predictive models: Predicting performance based on traces.
- Testing of predictive models in competitions / evaluation forums. Such evaluation competitions are available in other fields: e.g. search engines are evaluated in yearly cycles (with varying focus points) in TREC and CLEF. Evaluations can be done along two lines: accuracy vs. satisfaction.
- Learning analytics: graphical user interfaces that foster quick understanding of performance supported by aesthetic displays; streaming feedback provides real-time support in analysis .
- Open requirements elicitation: implicit requirement modelling, helpdesk monitoring, implementation competitions in the bartering platforms for software development.
- Developing shared methodologies for evaluating effectiveness gains of teachers and learners.
- Pedagogically sound user interfaces.
- Research of digital identity, privacy, and trust.

A set of traces (with objective, human assessed performance scores) can be provided to evaluate the predictive models / learning analytics against. A test set (with non-disclosed human performance scores) can be retained to be used in the a competition.

7.4.5.5. Researchers and Communities

To tackle the three aforementioned Grand Challenges (GC), a broad spectrum of expertise is required. It is crucial to involve researchers from a variety of fields, including biology, mathematics, statistics, computer science, engineering, education, sociology, marketing and management, psychology, and anthropology. The orchestration of contributions from such an interdisciplinary and multidisciplinary team is a mega-challenge per se. Boundary objects [9] such as design artefacts need to be established to facilitate scientific discourses among them. It is deemed indispensable given that individual fields adopt different values, assumptions, and metaphors.

A team with such diverse expertise is typical of the field human-computer interaction (HCI). Members of the HCI community can roughly be classified as academics and practitioners. Another dichotomous categorisation is researchers and designers, although there are numerous sub-categories under these broad terms. Specifically, in addressing the GC1 above, communities of teachers are a must. Concomitantly, learners, policy makers and administrators with which teachers frequently interact will definitely be involved. For GC2, software engineers, interaction designers, and evolutionists/biologists are key players. For GC3, specialists in education technology, statistical modelling, and evaluation methodologies are essential.

Furthermore, it is necessary to construct as well as validate theoretical frameworks with representative target groups, be they teachers, learners, developers, designers and researchers. Mixed method approaches involving different stakeholders, techniques, tools and resources are required to triangulate complex findings. Besides, longer-term studies capturing required data over time are recommended. With the use of Web2.0 applications, multi-source data can be gathered, analysed and reviewed collaboratively to generate richer insights into the issues of interest.

7.4.5.6. Concluding Remarks

Evolutionary or Darwinist theories are inherently controversial; applying them to explain and predict the trajectory of the development of Personal Learning Environments (PLE) is particularly challenging. PLE is still at its infancy stage, and a consensual definition is still lacking. Amongst others, the task of defining fitness models for predicting the rise and demise of specific widgets (which are commonly seen as the building blocks of PLE) and a specific configuration of PLE per se is daunting. The workshop is seen as the first step in moving in the direction, though there are still many steps to be taken to achieve this seemingly insurmountable task. The initial step is seen as a successful conception of intriguing ideas. Future work includes organizing a series of related workshops/seminars that involve participants with diverse backgrounds. Project proposals addressing emergent topics are seen as a promising way to explore them in depth over a relatively long period of time. In the meantime, several meetings amongst the workshop participants have been held to explore these possibilities.

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7.4.6. Workshop #6 dataTEL - Datasets for Technology-Enhanced Learning

Authors and Organizers: Hendrik Drachsler (University of the Netherlands), Katrien Verbert (Katholieche University of Leuven (K.U. Leuven)), Miguel-Angel Sicilia (University of Alcalá), Martin Wolpers (Fraunhofer Institute for Applied Information Technology, Fraunhofer FIT, Berlinghofen), Nikos Manouselis (Greek Research and Technology Network), Riina Vuorikari (European Schoolnet (EUN)), Stefanie Lindstaedt (Know-Center, Know-Center Graz).
Provocateur: Frank Fischer (Faculty of Education and Educational Psychology, University of Munich, (LMU))

7.4.6.1. Introduction and Motivation

This workshop was originally proposed by the STELLAR Theme Team dataTEL in cooperation with the MAVSEL project. The dataTEL Theme Team consists of RiinaVuorikari, Stefanie Lindstaedt, Katrien Verbert, Nikos Manouselies, Martin Wolpers and Hendrik Drachsler. The MAVSEL project was represented by Miguel-Angel Sicilia.
The workshop was motivated by the issue that very less educational datasets are publicly available in TEL, so that the outcomes of different TEL adaptive applications and recommender systems that support personalised learning are hardly comparable. In other domains like in e-commerce it is a common practise to use different datasets as benchmarks

to evaluate recommender systems algorithms to make the results comparable (MovieLens, Book-Crossing, EachMovie dataset).

So far, no universally valid knowledge exists in TEL on algorithm that can be successfully applied in a certain learning setting to personalise learning. Having a collection of datasets could be a first major step towards a theory of personalisation within TEL that can be based on empirical experiments with verifiable and valid results.

Therefore, the main objective of the dataTEL workshop was to explore suitable datasets forTEL with a specific focus on recommender and adaptive information systems that can take advantage of these datasets. In this context, new challenges emerge like unclear legal protection rights and privacy issues, suitable policies and formats to share data, required preprocessing procedures and rules to create sharable datasets, common evaluation criteria for recommender systems in TEL and how a dataset driven future in TEL could look like. The workshop aimed to bring together TEL researchers, data scientists, and privacy and legal protection experts to:

- identify the most pressing topics on educational datasets
- come-up with achievable objectives to overcome the current issues on educational
- datasets and potential data applications

The relevant topic of the workshop were:

- publicly available datasets for educational systems
- dealing with legal protection rights towards datasets on a European level
- privacy preservation for educational datasets
- methods of effective anonymisation of educational datasets
- management and pre-processing procedures for educational datasets
- future scenarios for educational datasets
- impact of educational datasets for learners and teachers
- mash-ups based on educational datasets
- recommender approaches that are based on educational data
- evaluation methodologies and metrics for educational recommender systems

7.4.6.2. Workshop Description

The participants were invited to submit original unpublished research as papers (4-8 pages) to the workshop. Demonstrations and Hands-on sessions were explicitly encouraged. All submitted papers have been peer-reviewed by two members of the program committee. Based on the contributions of the participants the organisers identified 4 most pressing topics of the workshop and clustered the workshop contributions accordingly.
The most pressing topics were:

- Evaluation of recommender systems in TEL
- Data supported learning examples
- Datasets from learning object repositories and web content
- Privacy and data protection for educational datasets

Next to the contributions of the participants, the organisers invited two keynote speakers from related research fields to share their view on the dataTEL topics. The keynote speakers were *Shlomo Berkovsky* (AUS) and *John Stamper (USA)*.

Shlomo Berkovsky

Shlomo Berkovsky is a Senior Research Scientist and Research Team Leader at the TLI project (CSIRO – Commonwealth Scientific and Industrial Research Organisation, Tasmanian ICT Centre). His current research project aims to provide individual users and their families with a personalized dietary and health information to help them to maintain a healthier lifestyle. His research interests include user modelling and personalisation of information. In particular, he is interested in recommender systems, collaborative and content-based filtering, mediation of user models, ubiquitous user modelling, context-aware personalisation, personalised content generation, and use of machine learning and data mining techniques in user modelling and personalisation.

On the 1st day Shlomo gave a keynote about: *Setting Up a Data Contest*

Research contests have attracted attention in many areas, mainly due to their potential to boost research on a specific problem. Contests also facilitate a fair and objective evaluation means, as all the participants share the same data and task. His talk focused on the details of organising a research contest. Initially, he gave an overview about several past contests: KDD Cup competition series, Netflix prize competition, and CAMRa challenge on context-aware recommendations. Then, he presented some of the essential components of a successful data contest: selection of appropriate tasks, data processing and preparation, publicity and attraction of participants, and the logistics of carrying out the contest. Finally, Shlomo showed the implications and constraints for a data competition in TEL on predicting the performance of students with intelligent tutoring systems.

John Stamper

John Stamper is the Technical Director of the Pittsburgh Science of Learning Center DataShop. He is also a member of the research faculty at the Human-Computer Interaction Institute at Carnegie Mellon University. His primary areas of research include Educational Data Mining and Intelligent Tutoring Systems. John received his PhD in Information Technology from the University of North Carolina at Charlotte, holds an MBA from the University of Cincinnati, and a BS in Systems Analysis from Miami University. Prior to returning to academia, John spent over ten years in the software industry. John is a Microsoft Certified Systems Engineer (MCSE) and a Microsoft Certified Database Administrator (MCDBA). John was the co-chair of the 2010 KDD Cup Competition, titled "Educational Data Mining Challenge," which centred on improving assessment of student learning via data mining.

On the second day John gave a keynote about: *DataShop: An Educational Data Mining Platform for the Learning Science Community*. In his talk he discussed the vision of creating a true platform for conducting educational data mining research. The talk focused on DataShop, part of the Pittsburgh Science of LearningCenter, which is an open data repository and set of associated visualization and analysis tools. DataShop has data from thousands of students deriving from interactions with on-line course materials and intelligent tutoring systems. The data is fine-grained, with student actions recorded roughly every 20 seconds, and it is longitudinal, spanning semester or yearlong courses. As of February 2011, over 245 datasets are stored including over 51 million student actions which equates to over 150,000

student hours of data. Most student actions are “coded” meaning they are not only graded as correct or incorrect, but are categorized in terms of the hypothesized competencies or knowledge components needed to perform that action. John focused his talk to workshop related key issues like the developing of an open data repository, security, privacy, and data diversity. Based on the 4 pressing topics and the two keynote speakers we created the following workshop programme.

7.4.6.2.1. Programme and Workshop Participants

8:30	Organisers	Hendrik Drachsler, (Open University of theNetherlands, NL	Welcome, Introduction
8:50	Keynote	Shlomo Berkovsky, (Tasmanian ICT Centre, AU)	Setting Up a Research Contest for TEL
Topic 1: Evaluation of TEL recommender systems			
9:30	Presenter 1	Katrien Verbert, (K.U.Leuven, BE)	Evaluating CollaborativeFiltering Algorithms on TELData Sets
10:00	Presenter 2	Peter Kraker, (KnowCenter, AT)	Personalized Services supporting Work-Integrated Learning: An Evaluation of applicable Recommendation Mechanisms for open accessible Datasets
10:30	Coffee break		
11:00	Presenter 3	Catherine Mulwa, (Trinity College Dublin,IE)	A Recommender Framework for End User Experience InAdaptive Technology-Enhanced Learning Systems
11:30	Organisers	All	Discussion of topic 1
12:15	Post-its session	ARV2011 Activities	
12:30	Lunch		
13:30	Snow activities		
Topic 2: Data supported learning			
16:30	Presenter 4	Raquel Crespo-García, (University Carlos III of Madrid, ES)	Peeking into the black box: visualizing student activities
17:00	Presenter 5	Maren Scheffel, (Fraunhofer Institute for Applied InformationTechnology, DE)	From Keyword Extraction ToKey Action Extraction
17:30	Coffee beak		
18:00	Presenter 6	Rory Sie,(Open University of theNetherlands, NL)	Why should I connect and to whom should I connect? Recommendation of Knowledgeable Peers in a Co-authorship Network to Foster Innovation

18:30	Presenter 7	Felix Mödritscher, (Vienna University of Economics and Business, AT)	On reconstructing and analyzing personal learning environments of scientific artifacts
19:00	Organisers	All	Discussion of topic 2
19:45	End of day 1		

7.4.6.2.2. Second Workshop Day

8:30	Organisers	Hendrik Drachsler, (Open University of the Netherlands, NL)	Introduction day 2
8:45	Keynote	John Stamper, (Pittsburgh Science of Learning Center DataShop, USA)	The PSLC DataShop: A Data Repository for theTEL community
Topic 3: Datasets from learning object repositories and web content			
9:30	Presenter 8	Joris Klerkx, (K.U.Leuven, BE)	Contextual Open EducationalResources for Future Recommender Scenarios
10:00	Presenter 9	Miguel-Angel Sicilia,(University of Alcalá, ES)	Recommenders inside learning object repositories: requirements for meaningful datasets
10:30	Coffee break		
Topic 4: Privacy and data protection for educational datasets			
10:45	Presenter 10	Eelco Herder, L3S Hannover, DE	Experiences in Building the Public Web History Repository
11:15	Presenter 11	Seda Gurses, (K.U.Leuven, BE)	Privacy issues and data protection in Technology Enhanced Learning
11:45	Organisers	All	Discussion of topic 3 and 4
12:15	Post-its session	ARV 2011 activities	
12:30	Lunch		
13:30	Organisers	Hendrik Drachsler, (Open University of theNetherlands, NL) Peter Kraker, (KnowCenter, AT)	Wrap up round: What are the low-hanging fruits? Writing down the Grand challenges. Reflection around supported by Research 2.0 tools from STELLAR.
15:00	End of the workshop		

7.4.6.3. Emerging Research Questions

The workshop focused as much as possible on group discussions and group work rather than individual presentations. Before the actual workshop the participants were asked to submit

their extended abstracts to the dataTEL group space at TELeurope.org and prepare the questions and statements for the workshop.
Every participant had 15 minutes to present the main message of his/her research followed by 15 minutes questions and discussions. At the end of each topic session we had an overall discussion that took into account the latest presentations. We finalised every topic session with a speed statement round, where each participant were asked to write down his/her main challenges and ideas in one sentence. Afterwards we collected these statements and clustered those according to the 4 main topics. In that way we collected a couple of emerging research questions during the workshop for each topic:

1. Topic: Evaluation of recommender systems in TEL

- Does a common data format for evaluation also require a common format for TEL recommender systems?
- Learning is a collaborative process, how can we translate that into evaluation measures for TEL recommender systems?
- Do we have to converge to a common evaluation framework or should we diverge to a wide range of (accepted) evaluation methods to choose from?
- We need metrics that can be applied to every standardized dataset!

2. Topic: Data supported learning examples

- How can we get richer representations of the social context in learning?
- How important are visualisations to reflect and learn from a dataset?
- Can teachers or students deal with data visualisations to reflect their learning process?
- Which new competences require data supported learning?
- How can we integrate the context of learning into the support systems?

3. Topic: Datasets from Learning Object Repositories and Web content

- Based on the experiences with SCORM and IMS-LD that should have created a European Learning Object market, will a common dataset format really lead to more datasets in TEL?
- How can we create datasets that capture real-life learner data?
- How can we overcome the lack of data sharing opportunities?
- Do we need a dataset format or rather well documented datasets? or both?
- How can we deal with the diversity of data from various TEL systems? What are appropriate levels of granularity?
- We need to create a representative association that requests datasets from the big players in LMS (e.g., Moodle, Blackboard) and learning object repositories (e.g., MERLOT, OERCommons).

4. Topic: Privacy and data protection for dataTEL

- Does dataTEL require an ethical discussion on privacy, data protection and surveillance?
- We are able to develop a new generation of support tools when we are allowed to track the context and behaviour of learners. How can we deal with privacy issues in a practical way?

- Data driven research will make unveil information visible that will challenge the way we learn, teach and conducting research.

At the second day of the workshop we focused on the description of dataTEL Grand Challenges emerging out of the 4 pressing topics and the research questions. Therefore, we split the workshop into 4 smaller groups that developed a Grand Challenge for every pressing topic.

7.4.6.4. Grand Challenge Problems

7.4.6.4.1. Grand Challenge Problem 1/ Topic 1

Reduce the drop-out rate in online learning environments by 10% through applying well evaluated and tested recommender systems for learning.

What problems of the European education system are addressed, and what are the long term benefits for society?

A challenging problem for educational institutes and lifelong learning in general are the high drop-out rates esp. in online and distance education settings. The isolation and confusion of students may cause them to withdraw from their studies. These groups of students are called 'drop-outs'. The research on TEL recommender systems can contribute to decrease the dropout rate by disseminating its research outcomes for the development of different support systems for teachers and students to offer relevant information at the right time. Regarding the drop-out problem it is thinkable to develop a drop-out analyzer that informs the tutor of a (Moodle) course which learners are likely to drop-out. This could be done by training a certain recommender technology on the drop-out patterns of previous (Moodle) courses. The trained analyzer could be applied on follow-up (Moodle) courses and mark students in a list that show similar drop-out patterns. The tutor of the course could then make an intervention and contact those students personally to offer additional support for their studies.

What are the main activities to address this Grand Challenge Problem?

- Customize existing recommendation algorithms for learning.
- Employ recommender systems in real-life scenarios.
- Develop suitable evaluation criteria for different kind of recommender systems.

What is the timeframe for the Grand Challenge Problem?

First implantations recommender systems are already available and can be implemented within a year (Manouselis et al. 2011; Manouselis et al., 2010). More challenging is the evaluation of the recommender systems that will take up to 2 – 3 years. For the further development of such systems publicly available educational datasets are needed to evaluate and compare different recommendation approaches to gain a solid body of knowledge (5-8 years).

What are measurable progress and success indicators?

Measurable progress and success indicators are depending on the applied type of recommender system (curriculum recommender system, drop-out analyzer etc.) (Drachsler, Hummel, Koper, 2009). For the this Grand Challenge a significant decrease of the drop-out rate within an educational institution would be an promising measure to value the impact of such a system. A challenging issue will be to isolate the effect of decreasing drop-out rates

only to the recommender system as most educational institutes permanently improve their educational services.

How can funding be attracted?
Next to European and national funding such a research project could be funded by single Universities (Innovation funds) and LMS providers like Blackboard or IMC AG. Next to the commercial providers recommender projects can be initiated as open source project in the Moodle or SAKAI community for instance.

7.4.6.4.2. Grand Challenge Problem 2/ Topic 2

ACTUALLY, help students and teachers in TEL to use data supported information systems.

What problems of the European education system are addressed, and what are the long term benefits for society?
In order to make data supported information systems an effective tool for educational practice, various limitations and hurdles in technology, privacy and education need to be addressed. It is important to realise that data supported tools work with computational results that are not easy to understand and need to be presented in an easy way (e.g., by visualizations) to address the daily practice of the educational stakeholders. It is crucial to interpret the presented outcomes in a correct manner to take the right follow-up activities that can lead to improved learning. Therefore, the interpretation of educational data and its related tools requires new competences to deal with the outcomes (statistical knowledge, critical thinking, privacy awareness and ethical competences).

What are the main activities to address this Grand Challenge Problem?

- Developing new data driven tools that are easy to understand.
- Make new real time data tools available as test applications.
- Identify suitable algorithms and map them to certain datasets and learning purposes.
- Integrate statistical, critical thinking, privacy awareness and ethical competences into the teacher education programs.

What is the timeframe for the Grand Challenge Problem?
The development of the data tools has already started, on every conference new data driven tools are presented (Zhang & Almeroth, 2010). Systems like Mendley and open access journals show us already the future of academic work. The training of the new competences for teachers and students in the primary and secondary education level will take more time (5 to 10 years) with having many different levels in the EU partner countries.

What are measurable progress and success indicators?

- An increased effectiveness, efficiency or satisfaction of the learning process
- Courses at educational providers that train competences to handle data products
- An increasing amount of data mashup systems for different educational stakeholders (students, teachers, parents and educational providers)

How can funding be attracted?
For the competence training the Lifelong Learning Programme of the EU is suitable. The development of the new data driven tools can be funded by FP7 and national calls.

7.4.6.4.3. Grand Challenge 3 / Topic 3:

Create a generic infrastructure for sharing, analyzing and reusing learning resources and learning activity logs (educational datasets) and related research findings.

What problems of the European education system are addressed, and what are the long term benefits for society?

The increased application of LMS, e-portfolio systems, and PLEs in schools and higher education institutions produces large amounts of educational data. But, although these elearning environments store educational data automatically, exploitation of this data for learning and teaching is still very limited. These educational datasets offer an unused opportunity for the evaluation of learning theories, student support, learning technology, and the development of future learning applications. Furthermore, educational datasets can be supportive to advance research on TEL towards a basic theory for TEL (Verbert et al. 2011) by offering the recorded and observed behavior of the stakeholders (students, teachers, parents, lifelong learners, educational institutes) in different learning settings (formal – informal learning). In that way, the educational datasets extend the methodological and empirical approaches to analyze TEL that is dominated by design-based research approaches, simulations, and field studies (Gray, 2009).

What are the main activities to address this Grand Challenge Problem?

- Data ownership and access rights are challenging because the LMS and PLE systems are collecting educational data and the current assumption is that this data belongs to them. However, who exactly holds the ownership of the data created by the students and what can be done with it is still unresolved.
- Data policies (licences) that regulate how different users can use, share, and reference certain datasets. Until now there are very limited data policies available in educational institutes. It could be considered to apply the Creative Commons licensing rights as a standard way to grant permissions to datasets.
- Common dataset formats like from the CEN PT Social data group (https://sites.google.com/site/camschema/home) and a standardised documentation of datasets so that others can make proper use of it.
- Methods to anonymise and pre-process data according to privacy and legal protection rights.

What is the timeframe for the Grand Challenge Problem?

Anything between 5 and to 8 years. For learning resources there are already standards like LOM and Dublin Core. For learning activities it's more complicated (apart from very generic formats such as XML – which does not guarantee that data can be reused).

What are measurable progress and success indicators?

- An increasing amount of publicly available datasets and research articles that are based on shared datasets
- The availability of data or privacy policies at educational providers
- More data-driven tools at educational providers
- A common dataset format

How can funding be attracted?

Funding can be attracted from governmental funding bodies like FP7, national funding, or funding by companies like Microsoft, Google, or IBM.

7.4.6.4.4. Grand Challenge Problem 4

Reduce delivery costs and create more effective learning environments by applying advanced information retrieval technologies on educational data sets.

Europe's education systems suffer from decreasing amount of teachers and the request to increase the amount of high-educated students in a short time period. As a consequence there is less time available for the individual support of students, thus the teaching quality decreases. On the other hand, the education systems are increasingly based on electronic systems like LMS and e-portfolios. With the increase in available educational data, the application of information retrieval technologies becomes valuable to create new services for the educational stakeholders (students, parents, teachers, and educational institutes). The combination of educational data and information retrieval techniques also known as Learning Analytics (LA) will become a powerful means in educational practice and student guidance (Johnson et al., 2011). LA promises the educational field to reduce delivery costs, create more effective learning environments and experiences, accelerate competence development, and increase collaboration between students and teachers.
But LA also have barriers and limitations among these are issues of privacy and data protection that need to be addressed by policy guidelines. Additional, challenges arise with respect to data surveillance[20] (social sorting, cumulative disadvantages) and its ethical implications.

What are the main activities to address this Grand Challenge Problem?

- In order to discuss and improve the above-mentioned situation a new vocabulary needs to be accomplished in order to discuss privacy, data protection and surveillance issues. For instance, what are better terms to express concepts like ownership and access control, when in digital systems replication and distribution is so easy that the concepts have no traction.
- Research is needed on how existing privacy and transparency solutions can be integrated in dataTEL practice. Further, research is desirable on how state of the art security solutions can be used to secure large educational datasets.
- There is a need for data awareness education for society. Such an educational program should not be limited to teaching individuals when to reveal or conceal their data, but also to increase their awareness with respect to large datasets, surveillance practices, and related problems.
- User and stakeholder studies (case studies) are necessary to understand the complex requirements with respect to privacy, data protection, surveillance in dataTEL.

[20] Data surveillance refers to the process which individualizes each member of the population (or a group), and permits the observation and recording of each individual's activities, then collates these individual observations across the population. From these conglomerated observations, statistical norms are produced relating to any of a multitude of characteristics. These norms are then applied back to the subjected individuals, who are categorized and perhaps acted upon, either with gratification or punishment, according to their relation to the produced norm. (Phillips, Privacy Policy and PETs, 2004)

- The issues around privacy, data protection, and surveillance need to be addressed from the beginning of the research and not as an add-on. Methodologies and guidelines that support this vision need to be developed to support privacy and ethical practices.
- There needs to be research on how to bridge between dataTEL researchers and ethical boards with respect to advances in technologies and research and the related privacy, data protection, and surveillance concerns that arise with them.
- Policies have to be defined to avoid unethical data mining research.

What is the timeframe for the Grand Challenge Problem?
The first four activities can be addressed in a time frame from 2 to 3 years because they mainly require the application or translation of existing examples or solution from other domains to the educational field. The activities 5 to 7 will require a longer timeframe (3-5 years) as they can only be developed out of the experiences with the activities 1 to 4.

What are measurable progress and success indicators?
Measureable progress and success indicators are an increasing amount of ethical boards in LA units at educational organisations. The integration of privacy and data protection statements in research projects as well as between educational providers and the students. The integration of data and privacy competence in job profiles at the educational providers.

How can funding be attracted?
Funding for these challenges could be attracted from EU FP7 projects and the Lifelong Learning Programmes (Erasmus, Leonardo or Comenius).

7.4.6.5. Researchers and Communities

In the last 3 to 6 years a couple of new research communities emerged around the dataTEL topics like Educational Data Mining, Recommender Systems in TEL, and Learning Analytics. These research communities are interdisciplinary and populated partly from Psychology Science, Educational Science, Computer Science, Data Science, Ethical science and Jurisprudence.
For the Grand Challenge Problems 1 and 3 an interdisciplinary team should consist of computer scientists, educational experts and lawyers. Before any development can take place lawyers are needed to create suitable privacy and data sharing agreements that secure individual data on the one side and enable research to use the data on the other side. In a next step the educational experts can cooperate with the computer scientists to develop the systems required by the Grand Challenge Problems 1 and 3.

For Grand Challenge Problem 2 an interdisciplinary team out of educational experts, policy makers and data scientists is needed to define the new competences required to understand the outcomes of dataTEL tools and create a training program for educational stakeholders esp. teachers.
In order to address Grand Challenge Problem 4 it is essential to work with educational scientists, policy makers, lawyers and computer scientists together. Furthermore, an European association or a Special Interest Group is needed that moderates the public

discussion on ethics and privacy in TEL and offers guidelines for the work and use of educational data and related data tools.

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7.4.7. Workshop #7 MUPEMURE – Multiple Perspectives on Multiple Representations

Authors and Organizers: Armin Weinberger (Bildungstechnologie und Wissensmanagement , Universität des Saarlandes), Daniel Bodemer (Knowledge Media Research Center, Tübingen), Manu Kapur (National Institute of Education, Nanyang Technological University), Gaëlle Molinari (Fondation Formation Universitaire à distance, Sierre), Nikol Rummel (Institut für Erziehungswissenschaft, Ruhr-Universität Bochum)

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7.4.7.1. Introduction and Motivation

Our understanding of STEM (science, technology, engineering, and mathematics) topics such as statistics, photosynthesis, the water cycle, etc. is strongly evoked and guided by how these topics are graphically or textually represented in text books or online environments. Sharing multiple perspectives on multiple representations (MUPEMURE) can affect the course and type of learners' reasoning by disambiguating discourse, fostering self-explanation and elaboration, and by strengthening a shared task focus. Latest educational technology for creating, modifying, and sharing representations in TEL (Technology-Enhanced Learning) scenarios needs to be combined with dedicated instructional approaches such as group awareness and scripting approaches as well as artificial intelligence to investigate the following research questions:

- How can we conceptualize knowledge being distributed in multiple (external and internal) presentations and agents across technology-enhanced learning landscapes?
- How do learners coordinate multiple representations and converge (or diverge) upon shared, canonical representations?
- How can learners be facilitated to actively share, process, and acquire multiple perspectives on multiple representations of STEM topics in TEL environments?

A large body of research has been concerned with learners' difficulties to detect and avoid misconceptions and to construct relations between multiple representations for building coherent mental representations of STEM topics. Moreover, much research has been invested in the questions of how to choose the optimal representation of knowledge to optimize cognitive load and how to design multiple representations for learning purposes. MUPEMURE builds on this work and takes it further by asking how learners can be facilitated to actively create and modify multiple representations and acquire multiple perspectives on science topics through specific, collaborative knowledge building activities.

This new perspective on representations is addressing current online scenarios of knowledge construction, e.g., in social networking sites, where learners can create, upload, and discuss pictures and videos.

With the 1st MUPEMURE workshop at the Alpine Rendez-Vous in La Clusaz, 2011, we aimed to bring together the scientific communities of Multimedia Learning (MML) Research and research on Computer-Supported Collaborative Learning (CSCL) and identify the overlap of these research fields in which MUPEMURE research can be allocated (see Fig. 1).

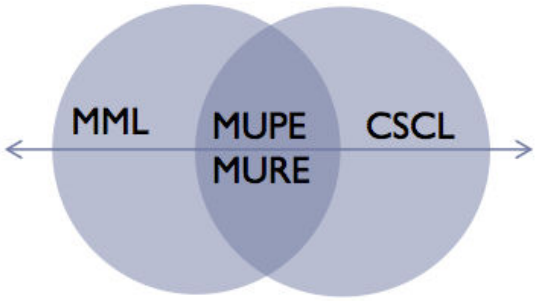

Fig. 1. MUPEMURE in the overlap of MML and CSCL research

To do so we have invited two renowned experts in the field of Multimedia Research who have dealt with the collaborative use of representations before, Shaaron Ainsworth and Mireille Bétrancourt for keynote talks. Moreover, we have funded PhD students to position themselves with respect to MUPEMURE, present their emerging work, and create new MUPEMURE research ideas.

7.4.7.2. Workshop Description

The workshop covered a number of activities involving keynotes, representing and categorizing the research of the participants as well as breakout groups to better identify and address the emerging field of MUPEMURE (see Tab. 1).

Tab. 1. The MUPEMURE workshop program

March 30
08.30 Welcome
08.45 Representing research (graphically): Individual sketches of own research
09.45 Presenting research: Fire hose presentations of participants' projects (max. 5 min. each)
11.45 Categorizing research: Positioning and discussion of the contributions
12.15 React
16.30 Keynote: Shaaron Ainsworth Understanding Multi-representational Learning: Where are we, where do we want to be and how should we get there?
17.30 Creating research: Break-out groups for converging on joint MUPEMURE studies
19.30 Discussing research: Plenary session
March 31
08.30 Keynote: Mireille Bétrancourt When collaboration fosters learning with animated and static graphics… and conversely
09.30 Towards a MUPEMURE model: Thematic clusters
10:45 Identifying emerging issues in the field of MUPEMURE: Plenary discussion
11.30 Résumé
12.15 React
13.30 Outlook: MUPEMURE practitioner workshop and symposium at CSCL 2011; and potential future activities

7.4.7.2.1. Keynotes

Two keynotes have been given; one by Shaaron Ainsworth titled "Understanding Multi-Representational Learning: Where are we? Where do we want to be? How should we get there?" and one by Mireille Bétrancourt titled "When collaboration fosters learning with animated and static graphics and conversely".

Shaaron Ainsworth' talk laid some foundation on where research on multiple representations is at and discussed what is over- and what is under-investigated in this field. The research on multiple representations has under-emphasized how its results are supposed to impact the classroom and over-emphasized how representations should be designed. Future research should rather focus on how to support learners in making meaning from and translating between multiple representations as well as to encourage learners to create and construct their own representations.

Mireille Bétrancourt's keynote similarly discussed how research on designing the most appropriate representations is limited and demonstrated a study on how representations are being comprehended in a collaborative learning arrangement. Her research indicates that collaborative learning with multiple representations can be starting point for harvesting the full potential of multiple representations as well as collaboration for learning when learners use some additional support tailored to collaborative learning arrangements, e.g., recapitulative snepshots, and tools, e.g., providing learners with full control over playing and pausing an animation.

7.4.7.2.2. Participants' Research

Introducing a series of fire hose presentations, members of the *JTEL winter school* indicated among other things how augmented reality is a new paradigm emerging in Technology-Enhanced Learning and how research on multiple representations needed to be applied in it.
Krista DeLeeuw investigated the underlying cognitive processes of individual and collaborative learning with multiple external representations. Her research indicates that collaborative learners process representations more actively than individual learners.
Daniel Bodemer next presented a complex CSCL environment in which learners needed to translate between and actively integrate multiple given representations and were made aware about the state of integration of the learning partners, which lead to better individual learning gains.
Julia Eberle and Gerhard Fischer introduced the concept of meta-design for formal and informal learning, i.e. allowing participants in run-time to change the design of an environment for creating multiple (truly unforeseeable) representations. The evolving multi-representation scenarios fundamentally differ in respect of the type of community (community of interest versus community of practice), the boundary objects, and the internal and external scripts involved supporting reflection in or reflection on action.
Anniken Furberg, Anders Kluge, and Sten Ludvigsen investigated how groups are sharing representations and how this is connected to a trajectory of interactions and developing representations. They found that students first reconstruct the information given by teachers and then create hypotheses in a computer-supported inquiry environment.
Hannie Gijlers, Alieke van Dijk and Armin Weinberger presented studies of tablet-supported collaborative drawing in elementary school combining collaboration scripts and awareness tools to highlight and guide learners to resolve cognitive divergences. Their results show that those instructional approaches substantially facilitated processes and outcomes of learning about science phenomena.
Manu Kapur introduced his concept of productive failure: Opportunities of students to "mess around" with the task are pivotal to arriving at more systematic views and approaches.
Anders Kluge and Ingeborg Krange presented the MIRACLE project (Mixed Reality Interactions across Contexts of Learning). Bridging virtual and real spaces as well as school, the web, and the museum, learners can manipulate interactive models concerning energy production and consumption.
Natasa Lackovic laid out how she uses pictorial representations of abstract concepts to shape real classroom discussion. She aims to investigate the relation between multiple representations and different types of discussion these representations mediate.

Inge Molenaar investigated pedagogical agents facilitating meta-cognition. Her results indicate that the interaction between the group members amplifies the effect of scaffolds, especially those in form of questions.
Gaëlle Molinari demonstrated how peers mutually model each other's knowledge with concept maps in CSCL. She orchestrated individual and collaborative learning phases and varied similar and complementary knowledge resources to facilitate transactivity, i.e. the extent to which learners operate on each other's reasoning.
Jochen Rick presented his work with tabletops for learning mathematics, DigiTile, with which elementary students can link multiple representations of mathematics. This work shows how learners can benefit from directly manipulation multiple representations.
Sascha Schanze showed with his work "what words cannot express", how self-constructed representations, e.g., drawings, concept maps, work sheets, in CSCL for the chemistry class can promote progressive reflection. Schanze stresses the potential of self-constructed representations for revision through peer interaction. Drawings seem to partly meet learners' problems to translate between different representations.
Mike Tissenbaum, Michelle Lui, and Jim Slotta investigated how learners construct personally meaningful artifacts with computer support inside and outside the classroom. Their notion of the smart classroom allows teachers to understand and alter the flow of class activities with computer-supported scripts.
Dimitra Tsovaltzi investigated how externalization of (erroneous) internal representations in CSCL could be facilitated with error-awareness prompts, to foster construction of canonical knowledge in turn.
Katharina Westermann and Nikol Rummel follow up on Kapur's productive failure work and complement it with some guidance in form of motivational prompts (e.g. "keep going") or cognitive prompts (e.g. "maybe your solution does not always work, here you have a counterexample"). Small groups of learners use Tablet-PCs to construct multiple representations such as tables, graphs, and formulas to foster mathematical literacy.

7.4.7.2.3. Breakout Groups

To further integrate the various studies placed within MUPEMURE, groups were formed that consisted of participants covering different areas of the field of MUPEMURE, i.e. approaching MUPEMURE rather from a MML or rather from a CSCL research perspective (see Fig. 1). All participants positioned themselves and each other on this schematic representation of MML-MUPEMURE-CSCL research and heterogeneous dyads were identified ahead of the workshop.
These dyads focused on enhancing transfer with and across multiple representations (Anniken & Katharina), supporting sharing whilst creating solutions in formal and informal learning (Anders & Mike), bringing communities of multiple disciplines together with boundary objects (Gerhard, Julia, & Natasa), how to manipulate representations to support learning (Inge & Jochen), what representations to choose and how to sequence them (Krista and Sascha), how to foster representational competency (Gaëlle, Mireille, & Shaaron), and how to build on heterogeneities in the classroom and supporting learners working with erroneous examples at the right time (Dimitra & Hannie).

7.4.7.2.4. Towards a MUPEMURE Model

One central goal of the workshop was to advance a model of MUPEMURE.

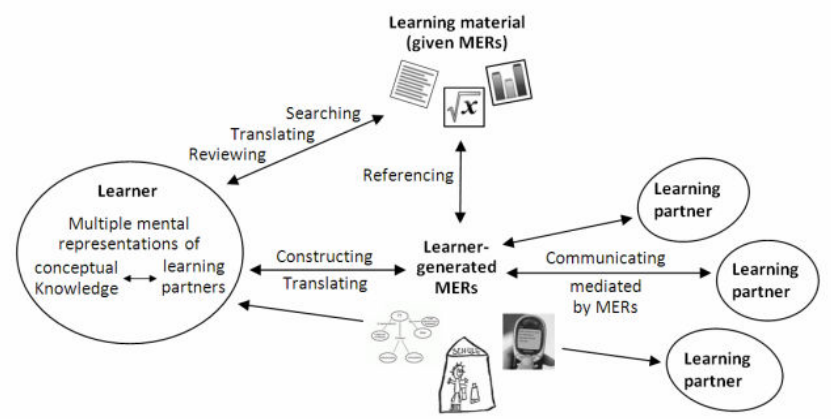

Fig. 2. Model of MUPEMURE.

Starting from a representation highlighting given and self-constructed representations being produced and processed by the individual as well as shared among peers (Fig. 2), missing dimensions were identified, such as computers and tools for representing something, learners' prerequisites (e.g. representational competencies) or the teacher's role in the way multiple representations are selected and/or in the orchestration of learning activities with multiple representations.

In two larger breakout groups as well as in the plenum, the MUPEMURE model was discussed:

Bringing MML and CSCL together addresses how a group can coordinate itself by external representations taking into account the particular characteristics and capabilities of CSCL. External representations then are needed to externalize and eventually converge on a shared understanding. In this regard, CSCL is fundamentally building on and being scaffolded by various external representations. Externalizing representations that can be interpreted by computers can then create situations, in which computers can be programmed to provide some basic responses and advanced tools dealing with learners' representations.

Moreover, representations and collaboration may have some reciprocal effects. Specific representations may foster specific interactions and vice versa, some forms of collaboration may lend themselves to specific external representations.

Representations can have a strong influence of learners' understanding, especially when they are regarded as being correct and representing canonical knowledge. In CSCL research, the notion of productive failure emerged showing that non-canonical representations may pose far greater learning opportunities under specific circumstances than representations, which are known to be correct. Being able to trace the development of representations may therefore be a smart way to tweak learners' understanding and epistemological beliefs.

7.4.7.3. Emerging Research Questions

In addition to our motivating questions (see p. 2 of this Whitepaper), the following questions emerged in the plenary discussions on advancing the MUPEMURE model:

How can the temporal dimension of phenomena be represented?

In this respect, snepshots, narrations, video etc. can help and needed to be carefully combined to arrive at a good fit between representing a whole process and being data-economical.

How do we represent collaboration?
Do we start from the individual learners to the group arguments (from MML to CSCL): → external representation → triggers an internal representation → shared and combined between learners that may lead to higher levels.
Or from the group to individual learners' arguments (from CSCL to MML): → representing individual learners' → knowledge construction in the collaborative moment → does not reside in the individual head → it is an ontological problem with where knowledge resides → but the knowledge creation that happens in the collaboration.
Starting with the MML hypotheses (see e.g. Schnotz), (H1) external representations → facilitate the construction of more elaborate internal representations →improve the quality of collaboration → results in higher levels of learning outcomes OR (H2) different external representations → lead to different internal representations → result in different patterns of collaboration and learning outcomes.
If we start with the CSCL hypothesis: external representations → facilitate the visualization of differences and also potential gaps between learners' knowledge → improve collective cognitive convergence → may result in higher levels of learning outcomes.

Which process drives the other, is collaboration driving representations or do representations drive collaboration?
Two parts of the cycle → chicken egg problem → collaboration ⇔ representation → where do you come from → What do you want to foreground? The researcher should make the decision depending on his/her background.

Summing up, starting at the social or at the individual level is an ontological debate; the position of technology depends on its function; the driver to connect CSCL and MER is the construct of externalization; which construct is leading depends on our position as a researcher and our research question.

7.4.7.4. Grand Challenge Problems

Many technical novelties allow for new cultural practices of dealing with knowledge and representations. Learners are frequently online with mobile devices; they share their reality with friends taking and uploading photos and videos into social networks wherever they go. New (mobile) hardware with multi-touch surfaces, such as iPads or tabletops, allow for the direct manipulation of representations. One of the fundamental challenges for society and education will be to foster an active, smart and responsible use of these knowledge-at-your-fingertips-devices rather than a media consuming only attitude. The learning opportunities have drastically increased. Learners may use formal and informal learning opportunities online, e.g., learn by free lessons shared on YouTube, and be confronted with views and representations diverging from their face-to-face education. Formerly individual learning scenarios, like reading a book, may become a collaborative experience with the use of eBooks. To exploit the benefits and reduce the barriers peer learning entails, instructional approaches need to be translated and created anew for TEL scenarios, such as scripting collaboration or making learners aware. To benefit from MUPEMURE, it may be pivotal to

design for smart ways of data reduction to foster comprehension, i.e. to avoid "data obesity". This means to be intrusive at the right time right person in the right way.
The following Grand Challenge Problems have been posed and elaborated by the Provocateur of the workshop, Nicolas Balacheff:

7.4.7.4.1 Grand Challenge Problem 1

A Semiotic Recommender System to Decide which Representation Can Fit Learning Needs at Best

Technology offers a large range of possibilities to represent learning objects and content, either in texts, hypertexts, drawings, animations and films. All these representations present advantages and limits which are rarely presented precisely to teachers who have to choose material for their teaching next day. This choice is very complex because of the large number of aspects to take into account: nature of the content to be taught, variety of the available resources (computers, digital tablets, smartphones, phones, pocket calculators, paper & pencil), constraints on the communication (on site, at a distance, with or without shared visualizations), learners' competence and needs. A great scenario would be for the teacher to describe the content and the constraints, and then get advice about the representations which would fit at best the learning needs. Further development would be to express these needs and get the resources which on the net fit at best the requirements.

What problems of the European education system are addressed, and what are the long term benefits for society?

This GCP is not specific to European education systems, it is of an international relevance. Then, the problem is related to the "data deluge" and the difficulty of finding the proper resources within the Internet. The long term benefit is the enhancement of the professional activity of the teachers and a more efficient exploitation of the learning potential of the internet. With learners able to express their needs, one may expect such a system to provide responses to a question by selecting the most adapted representation. This technology may not only impact learning but also the use of the internet within an informal learning context.

What are the main activities to address this Grand Challenge Problem?

From the scientific perspective this challenge calls for a high level collaboration of computer scientists, with researchers having a specific expertise in semantic, learning science, semiotic and epistemology. The main activity should be a project (STREPS type) with a consortium gathering the said competence and as a key production a prototype of such a tool in a well-defined and not too complex domain (esp. a domain in which the issue of representation is not completely open from the learning science and semiotic perspective).
Additionally, related research projects could be designed to explore the following complementary features:

- Indicators to recognize the right moment/time to provide non-intrusive feedback/scaffolding to learners
- Indicators on when, how, and what kind structuring the learning process should be provided in a personalized way
- Criteria for choosing the effective order of representation type (self-constructed created vs. pre-constructed given) depending on the expected processing and conceptual understanding of the learner

What is the timeframe for the Grand Challenge Problem?

A 3-years STREP

What are measurable progress and success indicators?
To be able to run a demonstrator in a non-trivial knowledge domain would be a good indication of success, together with an acceptable argumentation on its potential generality.

How can funding be attracted?
This idea could attract funding from the knowledge industry and Ministries of Education of EU member states. Such a problem can be the origin of successful European projects (STREP size).

7.4.7.4.2 Grand Challenge Problem 2

When the Representation is Not There, How to Introduce it and Facilitate its Adoption?
One of the challenges of teaching is to find a way to meaningfully introduce new representations when the hypothesis is that learners do not have this representation or any premises. This challenge is common to all disciplines in various forms, but it is of a special importance in the case of science where representations are more often than not rigorously codified in semiotic registers and are used for computational purposes. A badly introduced representation can be the source of misconceptions, and also of exclusion of learners from the learning community since adopting a representation is not only a cognitive but also a social process.
Hence the problem of the introduction must be rooted in a two dimensional space: epistemological – understanding the role of the representation in the building and the use of a piece of knowledge – and sociological – understanding the communication dimension of the representation and its contribution to the construction of a community. Situations of communication associated to problem-solving situations are likely to provide the best context to facilitate the emergence, the sharing and the use of representations. This designates CSCL as the TEL research area in which tools and models could be found to take up this challenge.
This grand challenge problem is tightly related to the connecting learner and contextualizing learning STELLAR Grand Challenges.

What problems of the European education system are addressed, and what are the long term benefits for society?
This GCP problem is not specific to European education systems, it as of an international relevance. It raises many issues, among which the following which are of interest for formal and informal education:

- For a given piece of knowledge, what would be the communication and problem-solving characteristics of a situation allowing the emergence of a relevant and efficient shared representation?
- In the case of formal education, what are the constraints so that the emergent representation is either compliant to the one socially shared, or stands at a distance which allows the teacher to bridge the gap without “forcing” learners?
- In the case of informal learning, which hints would help to construct representations through processes allowing to manage the tensions between the variety of the individual needs and backgrounds and the construction of the community sharing meaning and knowledge.

What are the main activities to address this Grand Challenge Problem?
From a scientific perspective this challenge calls for a high level input from semiology and epistemology in tight relationship with educational research and engineering. It requires from computer scientists a better understanding of the interaction between knowledge representation, interface and their actual implementation. HCI requires epistemological characteristics, either reified or emergent, of the interface and its system of interactions to be revisited to produce models taking into account the "meaning" dimension and not only the functional dimension in computational terms ("meaning beyond affordance" may be the slogan).
The main activity should be a project (STREPS type) with a consortium gathering the said competence and a network of classroom or on-the-field learning communities to implement and evaluate the specifications of the situations. The content domain must be well-defined and not too complex (esp. a domain in which the issue of representation is not completely open from the learning science and semiotic perspective).

What is the timeframe for the Grand Challenge Problem?
This GCP can be associated to long term basic research on meaning, learning and representation, and shorter term research project directly related to the current technology searching for its enhancement possibly targeting first domain specific research projects where educational problems are well identified.
A 3-years STREP would set a standard timeframe for the building of a first demonstrator.

What are measurable progress and success indicators?
The explicit and precise description of the scenario for a successful learning situation fulfilling the mentioned properties and a consensus of the research community would be a first evidence of success. Then, an indicator would be the level of dissemination and the activity of a community of teachers adopting these scenarios and engaging in discussions to understand and revise-improve them. Eventually, the adoption of the specification of scenarios to enhance CSCL environment making use of content specific representations will be a relevant criterion.

How can funding be attracted?
A progress on this issue will have an impact beyond education, on the design of advanced HCI principle of design for environments which will provide services but also evolve with the user understanding of its functioning and its functionalities. This may be of interest for the knowledge industry and fit well in the EC agenda.

7.4.7.4.3 Grand Challenge Problem 3

How Can T(EL) Support Navigation Across Media and Communities?
Navigating across text-based material is now a familiar practice on the Internet supported either by metadata retrieving or full text explorations of the documents. Even, some techniques (e.g. LSA) allow an exploration beyond the identification of common words, deriving commonalities in content from the recognition of lexical context (e.g. "I drove to Munich", is conjectured to have a close semantic relation to "I took my car to Munich" thanks to a statistical knowledge of the co-occurrence of "driving" and "car" in texts). The last decade has developed the possibility to navigate among multimedia material; the complexity of the technology is of another order, because if it is a common idea that a picture is better than a thousand words, when one come to formalize the semantic of

images or video, it appears to be much more complicated than for texts. Though, it happens that in learning contexts graphical representations and images are considered as extremely important tools to facilitate sense making or communicating knowledge. This is actually the core reason why working on multiple representations is so important, even critical for the development of efficient learning, teaching and training strategies. Then, a TEL research challenge is to provide the technology and understand the practices which will allow navigating among these representations taking into account learning requirements

What problems of the European education system are addressed, and what are the long term benefits for society?
This GCP problem is not specific to European education systems, it as of an international relevance.
The navigation trail among the representations provides access to a learner representation profile (e.g. better learning curve with certain representations) and to clusters of learners sharing preferences (type of representation, type of treatments). Profile and clusters can be used to optimize group making in the design of CSCL scripts, or networking learners and teachers in a more efficient way so as to facilitate learning. A prerequisite is to specify a learning grammar for each type of representation.

What are the main activities to address this Grand Challenge Problem?
This complex GCP might benefit from a series of seed projects on issues like: identifying the semantic proximity of representations of different types for a given content; identifying the productive differences between representations so that building on them can facilitate meaning making; defining a "measure" of the epistemic complexity of a representation; defining a "measure" of the cognitive complexity of a representation; specifying inter-representations manipulation in support of learning. This could last a period of 2 years, then be followed by a 3-years STREP-like project to integrate these results and propose a navigation toolkit to be used in other applications.

What is the timeframe for the Grand Challenge Problem?
This is a mid-term research problem.

What are measurable progress and success indicators?
Production of quantitative indicators of distance and likeliness of representations, benchmarking of these on a shared bank of learning representations, level of adoption of the toolkit by other projects.

How can funding be attracted?
Representation grammars will provide a ground for tools necessary to navigate efficiently and relevantly the Internet in search of resources. Including tangible representations (objects), this challenge will be in line with the foreseen web3.0 and hence of interest beyond the TEL research area. It can attract interest from researchers in semiology, computer-science, education and providers of Internet services.

7.4.7.5. Researchers and Communities

The communities involved in MML and CSCL research mainly consist of education and psychology researchers, but clearly also move beyond those disciplines. The concept of the

Learning Sciences is indeed multi- and interdisciplinary. Some disciplines have been mentioned above; obviously, some more disciplines need to be involved:
Education is needed to design instruction, such as CSCL scripts or awareness tools, and to develop measurements of relevant processes and outcomes. Psychologists are needed to build this research on existing, sound methods and theories of cognition and motivation. Computer scientists are needed to co-develop new tools to create and share representations. Designers and artists are needed to contribute an understanding of aesthetics and historical backgrounds of representations.

7.4.8. Workshop #8 Leveraging Researcher Multivocality for Insights on Collaborative Learning

Authors and Organizers: Carolyn Penstein Rosé, Gregory Dyke (Carnegie Mellon University), Nancy Law (Faculty of Education,University of Hong Kong), Kristine Lund (ICAR Research Laboratory, Université Lyon 2), Dan Suthers (Department of Information and Computer Sciences, University of Hawaii), Christopher Teplovs (Copenhagen Business School, Copenhagen Business School).
Provocateur: Ulrike Cress (Knowledge Media Research Center (KRMC), Institut fur Wissensmedien).

7.4.8.1. Introduction and Motivation

This workshop targets researchers in the Learning Sciences, Computer Supported Collaborative Learning (CSCL) and Technology Enhanced Learning (TEL) communities who are interested in how human interaction leads to learning. Such researchers come from many different disciplines (psychology, linguistics, cognitive science, computer science, didactics, etc.) and thus employ diverse methods in pursuing their specific research goals as well as hold diverse theoretical assumptions in relation to these goals. Many of us are interested in the richness that an interdisciplinary approach to studying learning in human interaction can provide, but in order to profit from this, we must find a systematic way of leveraging our diversity to further our understanding in spite of potential incommensurable differences that may occur across traditions. Recognizing this diversity as a necessary multivocality has led our group to reflect upon ways in which such multivocality can be productive for the communities involved. In particular our objective is to make progress towards better understanding the role of human interaction in learning, an understanding that should transcend disciplinary boundaries. This workshop proposes a systematic method for promoting fresh dialogue between the relevant research traditions with the objective of making new claims about learning.

This workshop proposal continues the trajectory of a series of prior workshops. At ICLS 2008 (“A Common Framework for CSCL Interaction Analysis”), we explored dimensions along which analytic efforts can be characterized and attempted to identify a common framework that would enable comparison of analyses and building shared analytic tools. Confronted with the multivocality that makes such unification difficult, we shifted our focus at CSCL 2009 (“Common Objects for Productive Multivocality in Analysis”) to identifying the basis for dialogue between different traditions. One major conclusion was that multiple analyses of

shared data sets provide a promising basis for discussion, these data sets constituting "boundary objects" (rather than "common objects") that make discourse possible. At the Alpine Rendez-vous 2009 ("Pinpointing Pivotal Moments in Collaboration"), we followed up on this conclusion by having researchers from different theoretical and methodological traditions analyze the same data sets. The analyses were focused on the identification of "pivotal moments" in collaboration. Different conceptions of pivotal moments were identified, but in all cases they provided good starting points for further analysis of how learning arises from interaction. At ICLS 2010 ("Productive Multivocality in the Analysis of Collaborative Learning"), we expanded the corpora on which researchers from different theoretical and methodological traditions performed their analyses and we proposed an initial structure for a book focused on the multiple analyses of shared data, arising from our different gatherings. The objective of this new workshop proposal "Leveraging Researcher Multivocality for Insights on Collaborative Learning" is twofold. First, we will discuss how the multiple analyses carried out on each paradigmatic corpus we chose from previous workshops contributed to specific new insights on collaborative learning. Secondly, we will build dialogue between complementary researcher views that can be introduced into the book.

7.4.8.2. Workshop Description

The workshop was structured as a working meeting towards forming a consensus view of what the story will be in the book, which will be the final product of our workshop series. As in our earlier workshops, the structure of this workshop was organized around datasets. The book will include multiple analyses of 5 different datasets: Hajime's fractions dataset, Wen Li's Group Scribbles Electricity dataset, Carolyn's 9th Grade Biology dataset, Nobuko's Knowledge Forum dataset, and Keith's Chemistry dataset. The workshop gave more time to all but the Chemistry dataset since the majority of researchers working on the Chemistry portion of the book were not able to participate in the ARV. However, this dataset was given some consideration in all but the initial session so that its message would figure into the integrated story that will be presented in the book. A draft version of the book was available to all workshop participants ahead of time in order to facilitate rapid progress during the workshop itself.

Wednesday Session 1 Within-Dataset Multivocality Discussions

The goal of the initial session of the workshop was to welcome the participants, to introduce the book in its draft form, and then to divide into two parallel sessions, each focusing on two datasets. In those sessions, there was time to discuss the dataset as a whole and each draft analysis. Discussion focused on issues raised in the analysis, especially places where discrepancies between analyses came up in the drafts or presentations, or where participants who were not authors raised questions or objections. Not surprisingly, because our participants represent a broad spectrum of methodological and theoretical perspectives, there were challenges raised, especially relating to how analyses were set up, since many assumptions are made in this process that relate back to that range of perspectives. For example, in Parallel session 2, questions related to the setup of the Goggins social network evaluation in terms of parameter settings were raised based on the Stahl ethnographic style analysis. Questions were also raised relating to the selection of the datasets themselves –

especially with regard to whether it is beneficial to highlight what can be learned from what went wrong in the data, or whether it is more beneficial as a contribution to the CSCL community to focus on places where knowledge building was more ideal. The decision was eventually to place value both on the ideal examples of knowledge building as well as ones where things go wrong (as a reality check for the community, especially for young researchers with idealistic views of how to change the world with technology, and also as an illustration of how a multivocal approach to iterative, data-driven design and development is valuable as well as a multivocal analysis of data from more mature systems and interventions).

Time		
08:30-08:45	Opening Remarks and Introductions (Carolyn, Ulrike, and Greg)	
08:45-09:15	Overview of Book (Carolyn, Kris, Dan)	
09:15-12:15	Parallel Corpus Break Outs	
	Parallel Session 1	Parallel Session 2
09:15-09:25	Hajime Fractions Corpus Presentation (Hajime)	Bio Corpus Presentation and Analysis(Carolyn)
09:25-09:35	Analyst 1 (Stephan)	Analyst 1 (Ulrike & Joachim)
09:35-09:45	Analyst 2 (Ming)	Analyst 2 (Gerry)
09:45-09:55	Fractions Meta-Discussant (Kris)	Analyst 3 (Sean)
09:55-10:05		Bio Meta-Discussant (Cindy)
10:05-10:20	Coffee Break	
10:20-10:30	Group Scribbles Corpus Presentation (Dan)	Knowledge Forum Corpus Presentation (Nobuko)
10:30-10:40	Analyst 1 (Heisawn)	Analyst 1 (Chris)
10:40-10:50	Analyst 2 (Richard)	Analyst 2 (Nancy)
10:50-11:00	Analyst 3 (Kris)	Analyst 3 (Ming)
11:00-11:10	Group Scribbles Meta-Discussant (Dan)	Knowledge Forum Discussant (Nobuko)
11:10-11:25	Compare notions of pivotal moments (Kris)	Compare notions of pivotal moments (Carolyn)
11:25-11:40	Discuss roles of representations/ visualizations (Dan)	Discuss roles of representations/ visualizations (Chris)
11:40-12:15	Discussion of insights into Multivocality and Grand Challenges/ prepare afternoon presentation (Kris)	Discussion of insights into Multivocality and Grand Challenges/ prepare afternoon presentation (Carolyn)
12:15-16:30	Lunch and Free Time	

Wednesday Session 2 Multivocality Within and Across Datasets

In Session 2, the discussions from session 1 were summarized and reported back to the whole group since each parallel session was attended by only half of the workshop participants. In addition to reporting back, this session gave opportunity for the whole group to begin its consensus building process. What emerged from this session was deeper questions about the nature of multivocality itself. One realization was that despite the controversies that did come up, we found that we were more on the same page than we anticipated, even across apparently very different theoretical and methodological camps. We questioned whether we should have reached further out to include researchers more

different from ourselves, or whether the experience of the workshop series had brought about a mind meld in such a way that the differences we started with had been lessened over time. Questions were raised about whether very different perspectives were really as incommensurate as we initially believed. We began to see that some of us choose methodologies for pragmatic reasons rather than deeply philosophical ones, and in that case, the mind meld is more natural.

16:30-16:45	Hajime Fractions Report (Kris)
16:45-17:00	Productive multivocality discussion (Kris)
17:00-17:15	Group Scribbles Report (Dan)
17:15-17:30	Productive multivocality discussion (Dan)
17:30-17:45	Bio Dataset Report (Cindy)
17:45-18:00	Productive multivocality discussion (Cindy)
18:00-18:15	coffee break
18:15-18:30	Knowledge Forum Report (Nobuko)
18:30-18:45	productive multivocality discussion (Nobuko)
18:45-19:00	Chemistry Dataset Report (Carolyn)
19:00-19:15	Productive multivocality discussion (Carolyn)
19:15-19:45	Full group discussion and summary of multivocality lessons (Kris)
19:45-19:55	Discussion about Grand Challenges (Ulrike)
19:55-20:15	Planning for day 2 (Kris)

Thursday Session 1 Methodological Insights and Book Theme

Session 3 was a whole group working session divided into two parts. In the first part, we set aside one table for each of the 5 datasets, where the discussant for that dataset sat. All other participants divided up into traveling cohorts who visited each table in a round-robin/speed-dating style. In each of the rounds, the traveling cohort group at each table provided feedback based on the discussion from the day before about the current analyses under discussion for that dataset. These notes were collected and integrated by the discussant and then reported back to the whole group. These sets of notes will be used by those discussants in their writing of the discussion chapters for the book. These summaries also fed into the next phase of the group work, which was an affinity diagramming activity designed to identify issues that were not adequately discussed so far for the book as a whole. What came out of this discussion is that we need some high level, cross-cutting chapters that discuss the concept of pivotal moments and multivocality, a best practices methodology chapter for researchers just getting in to a multivocal style approach, and a lessons learned chapter that recaps what we take away from the experience of this workshop series. We also chose to delete two planned chapters that seemed less important than the chapters that emerged from the affinity diagramming discussion. One of those was a tools chapter that has been “rebirthed” in the form of a chapter about representations for data analysis and how these are embodied in analysis technology. As a wrap-up, the editors of the book worked out a plan with deadlines for moving forward to the final preparation of the book, which we plan to submit to a publisher in fall of 2011.

08:30-08:40	Opening remarks on today's work (Carolyn)
08:40-09:30	Feedback to discussants, "Speed dating" style (one discussant per table)

09:30-09:35	Discussants prepare response
09:35-10:00	Discussants report back (Carolyn, Cindy, Nobuko, Dan, Kris)
10:00-10:15	Coffee break
10:20-10:40	Affinity Diagramming Part 1: Participants write thematic comments on sticky notes
10:40-11:20	Affinity Diagramming Part 2: Participants put up notes round robin style
11:20-11:30	Affinity Diagramming Part 3: Identification of Themes (Nancy, Chris, and Carolyn)
11:30-12:00	Group Discussion (Carolyn)
12:00-12:30	Wrap-up discussion of themes and STELLAR Grand Challenges (Carolyn)
12:30-13:30	Lunch

Thursday Session 2 Final Book Planning and Commitments
13:30-15:00 Closing Discussion (Dan)

7.4.8.3. Emerging Research Questions

Summarizing what came out of the discussions we realized several things during this workshop, which eventually became themes presented in the Symposium we presented at CSCL 2011. One was that through multivocal analysis, some things that we expect to look different based on our initial understandings can turn out to be much more similar than we had thought, while on the other hand, things that we assume are similar based on a high level understanding of operationalizations can turn out to be quite different in important ways when we examine them up close in the same dataset. In both cases, a multivocal analysis is valuable in that it challenges researchers to reconsider their assumptions, to sharpen their operationalizations, and to catch mistakes. After years of working together through our workshop series, and noticing how natural and easy it is now to communicate about our variety of analyses, we began to wonder if we learned to be too polite and accepting, or if perhaps our analyses seemed more compatible because we weren't digging deeply enough into the details. Beyond the issues discussed above, some additional questions that came out include the following:

What is the role of statistical methods in multivocal analysis? It's obvious what role it plays in quantitative approaches – but within our repertoire of datasets, we included one where complex statistical techniques were applied to a dataset that quantitative researchers would have considered too small for such techniques. In the spirit of multivocality, should we accommodate such an approach? If we do, are we relaxing our commitment to rigor? Do we then open up our community to a lower standard in terms of accumulation of ratified knowledge? Also, at the heart of qualitative research approaches is the idea that it takes human judgment and contextual understanding to identify those interesting interactions worthy of an up close investigation. Can we use statistical techniques to identify those instances that are unusual? Are these techniques really capable of identifying the ones that don't fit the statistical distribution for the right reasons or in a theoretically interesting way? Are those instances that are important for theory building at least a subset of those instances that can be identified this way?

Questions related to falsifiability also came up with respect to the idea of a pivotal moment. In the fractions dataset, different analysts agreed on some pivotal moments and disagreed on others. What does this mean about the nature of the construct? Should all analysts

agree? Is the multivocality then for the purpose of triangulation? If discrepancies are tolerated, does that mean we are not using multivocality for triangulation? Does it mean that the construct of pivotality cannot be falsified? Is it then just a tool for facilitating discussion rather than an indicator of something that has external validity?

7.4.8.4. Grand Challenge Problems

Building a comprehensive framework for exchanging research data and analyses from different research teams in order to deepen the discourse, coming to a convergent interpretation and identifying further research questions.

What problems of the European education system are addressed, and what are the long term benefits for society?

In TEL and CSCL different research groups focus on different aspects of collaborative learning. Some do small case studies, others have larger samples that allow for longitudinal studies or quasi-experimental designs. The teams focus on different teaching methods (scripting; co-operative learning; knowledge building), gather different kinds of data for their research (text data; video data, log files, performance tests) and apply different methods (interaction analysis; pre-post test designs; multi-level methods).

In order to make use of this variety of research data across the different research groups these relevant data sets should be shared and made accessible. The data sets and related analyses could serve as boundary objects and stimulate fruitful discussion across the different research approaches. This would not just show the multivocality in CSCL research, but could also serve as a means for converging evidence about the potentials and effectiveness of TEL and CSCL. This allows not just an overview about the effectiveness of CSCL in teaching and learning for researchers and the scientific community, but also for stakeholders and practitioners.

Furthermore, sharing of datasets and analyses would ensure that results be easier to validate and replicate, facilitating peer-review and leading to more generalisable results to be shared with stakeholders and practitioners.

What are the main activities to address this Grand Challenge Problem?

Development of a *technical infrastructure* for supporting open data.

Development of a *framework* for data sharing. This framework consists of recommendations for technical formats, ethic standards and metadata. It describes the needed preparation of data and the documentation of analyses and results.

Development of a framework of how to exchange results (both the analyses as replicably performed and their interpretation) and “lessons learned” among researchers, practitioners and stakeholders.

Build a supportive structure for a dialogical interpretation of the data in order to make the community and stakeholders aware what results converge among the different data sets and different interpretations and in order to identify open questions.

Implementation and formative evaluation of this infrastructure.

What is the timeframe for the Grand Challenge Problem?

About 3 years are needed in order to develop and implement the infrastructure and achieve a critical mass of relevant data. Existing infrastructures such as PSLC Datashop[21] (Koedinger et al., 2010), MULCE[22] (Reffay & Betbeder, 2009), CAViCoLa (Harrer et al., 2007), and Tatiana[23] (Dyke, Lund & Girardot, 2009) might potentially be improved upon, adapted or adopted to lessen this timeframe.

What are measurable progress and success indicators?

- Development of an infrastructure (not just a database, but also communication opportunities, meetings, events etc.)
- Number of shared data sets and different kinds of analyses on each of them
- Involvement of representative groups
- Quality of the stimulated discourse

How can funding be attracted?

Some core EU-research teams which also integrate research teams from North America and Asia should be funded (by a Network of Excellence or an Integrated Project) which develop the infrastructure, share own data and take the responsibility to make the infrastructure sustainable.

Many funding agencies (e.g. NSF) are increasingly requesting projects to submit a data management plan which describes how data will be persistently warehoused. A platform and infrastructure for sharing could synergistically be funded with such a goal.

One of the challenges – experienced by all existing projects – lies in infrastructure sustainability beyond the funding period.

7.4.8.5. Researchers and Communities

In short, our Grand Challenge is building a comprehensive framework for exchanging research data and analyses from different research teams in order to deepen the discourse, coming to a convergent interpretation and identifying further research questions in the spirit of multivocality. Multivocality requires a multi-disciplinary community to make it work. First, we need the different orientations brought by different fields to challenge one another. We need psychologists who study the connection between discussion behaviour and cognitive processes to challenge ethnographic researchers who focus on group cognition, and vice versa. We need computer scientists who build computational models of discourse to allow interaction analysts to dig into their data so that they can grapple together with the tensions between overly simplistic generalizations represented by statistical distributions and overly complex contextualized representations that arise from a qualitative approach. We need a community where multivocal collaborations are happening in order to ensure that any infrastructure we build will have the proper affordances for facilitating and not hindering that process.

From a practical standpoint, in order to move forward in a sustainable way we also need the involvement of multiple fields. We need computer scientists to build and maintain the infrastructure for storing and analysing data, but they can't do it effectively without a close

[21] http://pslcdatashop.org/
[22] http://mulce.org/
[23] http://code.google.com/p/tatiana/

partnership with the researchers who will use those tools. Some of the technology we need is still under development, such as the technology to pre-process interaction data in order to prepare it for visualization, sequence analysis, etc. While strides towards developing and improving this technology have been made in the CSCL community as well as in the language technologies community, more work is needed to make this technology more effective. That effort itself is interdisciplinary, involving experts in linguistics, sociology, philosophy, and machine learning. We need experts in visualization to help us design representations that people can interpret. But we need interaction analysts involved in that process to ensure that the impressions conveyed by the visualizations have face validity.

In order to make this vision a reality, we also need some non-research staff with the skills to make things happen in a professional way, including people with marketing expertise, people who have experience developing financial models that work at an international level, people who know how to build and maintain databases that run properly and keep data safe, and people who can offer technical support.

References

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7.5. Appendix 5: Event Evaluation Questionnaire

Event Evaluation of the Alpine Rendez-Vous 2011

Please, provide your feedback on the Alpine Rendez-Vous. It will help us in planning our future activities. Please, tick the appropriate box or circle the appropriate number and make comments for our attention.

1. How did you learn about the Alpine Rendez-Vous 2011?
(more than one answer possible)

I already attended the 1st STELLAR ARV 2009	I received the call via a mailing list*	A colleague asked me to join	I am member of the STELLAR NOE
☐	☐	☐	☐

*Please, specify the mailing list here: _____

2. On the basis of which funding do you attend the Alpine Rendez-Vous?

Funding				No funding
I am funded by the workshop		I receive funding from elsewhere		I do not receive funding
but would have participated anyway	and otherwise could not have attended	but would have participated anyway	and otherwise could not have attended	
☐	☐	☐	☐	☐

3. Your satisfaction.

	Unsatisfactory ..... Excellent			
The event administration was	1	2	3	4
The structure of the programme was	1	2	3	4
The venue and facilities were	1	2	3	4
The presentations in the workshops were	1	2	3	4
The paper board presentations were	1	2	3	4
The discussions were	1	2	3	4
The event dinner and catering were	1	2	3	4
The Community Event was	1	2	3	4

Specific comments on the workshops and events you participated in:

1

4. The usefulness of the Alpine Rendez-Vous to you.

	Not useful at all ..... Very useful			
The presentations in the workshops were	1	2	3	4
The paper board presentations were	1	2	3	4
The discussions were	1	2	3	4
The group work was	1	2	3	4
The opportunities to network were	1	2	3	4

Any comment(s) for our attention:

5. Overall assessment.

Please, describe the strengths of the Alpine Rendez-Vous and specific contributions or activities you enjoyed:

Please, indicate how the event could have been improved:

In your opinion, what is the most important Grand Challenge in the field of TEL?

Please, indicate the workshop(s) you participated in:
1.
2.

Thank you for the completion of this evaluation form!