Grand Challenges in Technology-Enhanced Learning: A Dialog Started in Villard de Lans

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Abstract This book is the result of the Alpine Rendez-Vous 2013—a scientific event for European researchers in the field of technology-enhanced learning (TEL). The objective is to continue stimulating collaboration among TEL researchers and to move toward uniting the interdisciplinary TEL field. Event participants describe 12 socio-technical Grand Challenge Problems (GCPs) related to learning and to the educational system covering a wide range of topics. They focus on the improvement of learning and teaching in classrooms by technological means, the development of innovative TEL environments, updating the perspectives of TEL stakeholders, and the improvement of TEL research practices. Experts with backgrounds in either research, practice, or policy making comment on the 12 GCPs.

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This is already the second book on Grand Challenge Problems (GCPs) in Technology-Enhanced Learning (TEL). Just like the first, this second book is also an outcome of an Alpine Rendez-Vous—a scientific event for mainly European TEL researchers that has been held biannually in the Alpine region since 2007. The objective of the Alpine Rendez-Vous has been to stimulate exchange and collaboration among TEL researchers and to move toward uniting the interdisciplinary field of TEL by building a bona fide European TEL research community. This second book is the outcome of the Alpine Rendez-Vous 2013 which brought together 156 researchers with backgrounds in psychology, information technology, education, computer science, learning sciences, and other fields from Europe and beyond. During the Alpine Rendez-Vous 2013, researchers participated in at least one of the ten two-day workshops about specific TEL questions that were held in two parallel groups. However, while isolated in a hotel in the small French village of Villard de Lans, the researchers also used the time to look beyond their own research interests and discussed questions of TEL across workshops.

As the European TEL research community is still young and TEL research is diverse and scattered over several disciplines, the Alpine Rendez-Vous events are an important tool for community building and strategizing for future research directions. Therefore, we think it is important to make sure that the results of this event are accessible to those who are interested in TEL but who did not participate in the 2013 event. We have in mind not only TEL researchers but also other stakeholders who could benefit from TEL research.

Continuing the tradition started at the previous Alpine Rendez-Vous in 2011, we asked all workshops to come up with a short paper that describes what the participants see as the most important GCP for current TEL research. GCPs in TEL go beyond mere research projects and "are fundamental socio-technical problems whose solution will lead to breakthroughs that improve learning and educational systems and bring long-term benefits to society" (Zirn et al. 2014, p. 1). A GCP needs to be achievable in incremental steps that come with measurable outputs along the way of a mid-term agenda. GCPs can usually only be tackled in interdisciplinary collaborative efforts of researchers, practitioners, policy makers, and other stakeholders.

Each workshop undertook the task of developing a GCP in its own way, either by discussing among all participants or by giving the responsibility to a smaller group of the participants who took over the task. As a helping hand, each workshop had a *provocateur*[1] who was familiar with the idea of a GCP and his or her role was to support the development of the workshop's own GCP. Each workshop came up with a GCP, some even with two, resulting in 12 GCPs that are reported in this book.

The 12 GCPs 0 topics in TEL. Several GCPs attempt to **improve learning and teaching in classrooms by technological means**: In GCP 3, Pedaste and

[1]French for "challenger".

colleagues identify the challenge of empowering science teachers to use technology to scaffold inquiry learning. They suggest developing a platform-independent virtual teaching assistant with expertise on theories of learning and teaching and the capability to use learning analytics for adaptive scaffolding. In GCP 4, Cuendet and Tormay address the problem of sub-optimal teaching especially by novice teachers in the classroom. Their suggested solution is technology-supported visual feedback to teachers on emotional states and on attention distribution in their classroom. In GCP 11, Wasson, Hanson, and Mor focus on the challenge for teachers to make meaningful use of the increasing amount of student data available through ICT-based learning. They argue for the development of new measurement and analysis tools, accompanied by respective teacher training. In GCP 12, Molenaar and Wise point out that currently, teachers need to sacrifice a lot of potential teaching time for testing students and at the same time lack robust means of testing. They propose to assess student learning through continuous collection and interpretation of temporal performance data produced during learning processes.

Another set of GCPs focuses on (**further**) **development of innovative TEL environments**: In GCP 2, Chanel and colleagues draw our attention to emotion regulation as a social skill that is specifically important in social media. The authors suggest supporting the development of emotional skills with adaptive technologies to increase emotion awareness in collaborative learning environments. In GCP 6, Dehler Zufferey and Schneider formulate the challenge to bridge the gap between school-based and work-based learning contexts in vocational training to foster apprentices' identity building and integration into relevant communities of practice. They advocate for developing technological means to support apprentices and other stakeholders in bridging between the different learning locations in collaborative efforts among all stakeholders. In GCP 7, Mödritscher, Luengo, Law, Hoppe, and Stegmann discuss the challenge in response to the massification of university education by high-quality massive open online courses (MOOCs) that avoid drop-outs and support personalized learning experiences. The authors suggest developing tools based on learning analytics to support teachers and learners in MOOCs.

Some GCPs even go beyond classical research-related challenges. These GCPs focus on **decision and policy makers as well as practitioners, and other stakeholders** involved in the design of the educational system and the technology that increasingly surrounds us and propose to **update their perspectives** in a way that it is in accordance with the current scientific state of the art: In GCP 1, Giovanella, Martens, and Zualkernan focus on how learning can co-evolve with the rapidly advanced concepts of smart cities. They suggest combining functionalist views on optimizing the consumption of primary resources with more bottom-up perspectives of communities and the individual within a community. In GCP 5, Schneider and Dehler Zufferey identify the transformation of the currently outdated vocational education systems in Europe into systems that are more adequate for an information and communication society as a grand challenge. They suggest focusing especially on collaboration among all stakeholders in the re-design

of new vocational education systems and extensive teacher training to implement the new view on vocational training. In GCP 9, Beetham, Perrotta, and Holley draw our attention to the problem that TEL may lead to educational inequalities. The authors suggest developing models for TEL stakeholders to identify and adequately respond to causes of inequalities.

A fourth set of GCPs specifically targets the **improvement of TEL research practices**: In GCP 8, Mödritscher, Luengo, Law, Hoppe, and Stegmann point out that the use of Learning Analytics on a certain group of learners does not often respect ethical requirements (e.g., learners are not always aware that their behavior is analyzed). In spite of this, they suggest widening the use of Learning Analytics from only focused on learners to also include the analysis of teacher behavior in order to engage both parties in interactive processes beneficial for learning and to support responsible use of Learning Analytics. This implies that ethical requirements be more generally understood and applied across stakeholders. In GCP 10, Dirckinck-Holmfeld and colleagues focus on the challenge to foster systematic and applicable TEL research across the many small and medium sized European research labs. Their suggested solution is the development of an agile and productive knowledge infrastructure for networking among the TEL research labs.

For the second part of the book, we asked experienced TEL researchers (Mike Sharples and Nicolas Balacheff), expert practitioners (Mikko Ripatti and Peter Schwertschlager, both principals of secondary schools, the first in Finland and the second in Germany), and a proficient policy maker (Lieve van den Brande), to comment on the 12 GCPs and share from their perspective what trends they see in the GCPs, how they think pushing these GCPs forward can be beneficial, and what they think is still missing. Across the different perspectives, the experts agree that there is currently a big gap between reality in schools and the outside world regarding the use and importance of technology and this gap needs to be closed. While each expert clustered the topics covered in the GCPs in their own way, several of them identified a trend of looking at big data in the form of learning analytics in the GCPs which brings new opportunities to teaching and learning but also comes with new dangers that must not be overlooked. Another trend that was identified by several commentators was the disappearance of the borders between formal and informal learning and a push toward more personalized learning experiences. This kind of learning is often much more self-regulated than traditional learning forms and especially the practitioners emphasize that it is highly demanding for learners and the preparation for self-regulated learning is a GCP on its own as well as the preparation of teachers for innovative ways of teaching, based on TEL.

The experts stress that the current situation in schools regarding laws of data protection and especially equipment is far from ready for implementing TEL and this is not sufficiently addressed by the GCPs. In addition, the danger that one may think TEL can eventually replace teachers instead of empowering them with technology is something to be reckoned with. In general, the experts express critically that although all GCPs attempt to be learner-centered, many of them put technology in the foreground and learning processes and the real needs of learners follow.

This situation emphasizes the need for more collaboration among the different disciplines in TEL research as well as the need for collaboration with stakeholders outside of research, with practitioners and policy makers given the possibility to influence the current TEL situation.

Despite these critical remarks, the interesting collection of GCPs reflects to some extent that the community building among European TEL researchers is progressing. Only half of the developed GCPs deal with classical TEL research-related questions, i.e., the improvement and development of learning environments. The second half, however, focuses on the one hand on internal community challenges that need to be tackled and to an even greater extent on the transfer of internal community knowledge to those people who need to take the next steps to implement the research findings so that society can benefit from TEL researchers' efforts. This last aspect can especially be interpreted as a sign that the TEL research community has left the phase in which the individual members need to understand how to benefit from collaborative efforts in the community. The TEL community seems to have progressed to a productive performing phase by starting to tackle the problems that are important for the whole scientific community. The 12 diverse GCPs have the potential to stimulate new collaborative projects within and beyond the TEL research community. Furthermore, the increased awareness of TEL researchers of the different perspectives and needs among TEL stakeholders raises the chances for successful collaboration that takes these needs into account and will eventually lead to a growth in the practical impact of TEL research. These developments give hope that TEL research will continue to attract funding by the EU and national funding agencies.

In a multidisciplinary field as dynamic as TEL, new technologies and new ideas are co-evolving very quickly. Dialog is the mechanism to establish and maintain flexible linking between researchers of different disciplines. This book is intended to continue and broaden a multidisciplinary dialog that has begun at the Alpine Rendez-Vous in Villard de Lans.

Reference

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