Preface

By encouraging interaction, exploration and experimentation in environments that directly represent the domain to the learner, Exploratory Learning Environments (ELE) adhere to constructivist theories of learning that emphasize learners' control to construct their own understanding. More generally, Open-ended Learning Environments (OLEs) offer students opportunities to take part in authentic and complex problem-solving and inquiry learning activities. These environments provide learning context and a set of tools to support learners while they engage in many activities, including (i) seeking and acquiring knowledge and information, (ii) applying that information to a problem-solving context, (iii) assessing the quality of the constructed solution, (iv) evaluating and reflecting on the overall approach, and (v) assessing and enacting cognitive and metacognitive processes.

However, there are several factors that prevent appropriate learning within ELEs or OLEs. The structure of the activity sequences and the level of support by teachers, peers, technologies are crucial determinants of learning. This is particularly true in domains where knowledge is not a directly observable outcome of a situation under exploration (e.g. simulators) but is externalized by cognitive tools in the environment. There is a wealth of learning sciences literature about support for learning in exploratory environments, but developing the technology to support these still faces several impressive challenges that the community is only beginning to address.

At the same time the migration of technology from the desktop to the wider learning environment provides the opportunity to collect data about learners' interactions with a greater bandwidth of learning resources. Smart phones, tablets and technologies embedded in the fabric of the environment are now commonplace in educational settings. In parallel with these developments, there has been great progress in developing techniques to analyse learning interactions through the large amount of data that is generated by these various systems. This kind of learning analytics offers the potential for novel feedback and scaffolding to support project-based and experiential learning that involves physical computing projects and other hands-on type projects.

The papers submitted to this workshop address various aspects of the above-listed issues, which are all at the heart of the AIED community's interest.

Summarizing the papers in brief, Chase et al. and Mazziotti et al. focus mostly on the *design and evaluation of exploratory learning environments*. Chase et al. in particular describe the design of an ELE to support invention activities, inspired by a model of naturalistic teacher guidance. Mazziotti et al. present a pedagogical intervention model that selects and sequences exploratory learning activities and structured practice activities. Four papers focus more on the *tools, algorithms and approaches* behind the implementation of intelligent support in ELEs. Karkalas et al. evaluate requirements and present a prototype for learning analytics for constructionist mathematical e-books. Segedy and Biswas use coherence analysis to provide measures of the quality

of students' problem-solving processes. Silva et al. propose an automatic rating system to assess students and to sequence activities. Harpstead et al. demonstrate a method of accelerating model development for both knowledge and skills by applying a concept formation algorithm.

Lastly, two papers focus specifically on *Learning analytics for project based and experiential learning scenarios.* Luckin et al. present an analysis framework for project-based learning situations that involve the use of technology. Spikol et al. present the design of a visual-based programming language for physical computing and mobile tools to invite learners to actively document and reflect on their projects in a way that creates possibilities of intelligent support and learning analytics.

This workshop builds on the previous work from several editions of the Intelligent Support in Exploratory Environments workshop, and the Scaffolding in Open-Ended Learning Environments in AIED 2013. The format of the workshop is based on a question-oriented organisation around open problems raised by the papers accepted for the workshop. It also includes a posters and hands-on interactive session for participants to present prototypes and get or provide feedback. Our website (http://link.lkl.ac.uk/iseole15) provides more information as well as the current and previous proceedings.

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