INNOVATIONS TO DESIGN PERSONALIZED LEARNING ENVIRONMENTS FOR STEM EDUCATION OF THE FUTURE?

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Abstract

Emerge of new technologies such as mobile devices, social media, gamification and learning analytics using big data have opened up solutions to meet the increased demand of personalized learning in the 21st century European classroom (Fitzgerald et al., 2013). Yet many challenges remain, particularly in topics of science, technology, engineering and mathematics (STEM) (Bybee, 2010). Students are unmotivated to head for STEM careers where professionals are increasingly needed (Harackiewicz et al., 2012). Future learning environments should be able to support personalized, tailored solutions for all students (Santos et al., 2014). Costs and risks of early school leavers are a global societal challenge, in which the emerge of new learning technologies, could have a direct impact upon. Technology-supported PLEs have been developed over the last few decades to increase students’ motivation and support individual learning paths suitable for each student’s learning styles (Felder & Spurlin, 2005) and preferences. Fast developing technologies propose a challenge also for teachers who lack both the time and the competences (Clements & Pawlowski, 2012) to make use of these technologies.

In this research we first investigated the PLE state-of-the-art through literature review. We then tackled the question of what should the future’s personal learning environments for STEM be like. Through a pre-commercial procurement (PCP) method we prepared PCP based on the literature review, as well as invitation to tender for which 11 complete PLE service offers were received. Those offers were then the evaluated and analyzed for the technical and pedagogical functionalities with a panel of teachers from four countries in Europe (Finland, Sweden, Germany and Spain) as well as three specifically chosen external experts (technical, pedagogical and STEM). 65-point criteria rising from the literature review was used for this.

The analysis of the evaluation panel show that the state-of-the-art in PLEs is still far behind of more commercial fields such as retail industry or social media solutions. Smart use of learning analytics can solve many of these challenges. Users expect the system to read their minds and guide them to the support they need, whether it is learning style tailored content, or smart solutions for peer support within their own classrooms. Teachers should be able to evaluate entire classrooms of students within one dashboard. The current state-of-the-art in PLEs unfortunately uses very little of the possibilities learning analytics could provide: Often the systems tend to only measure user behavior instead of actual learning.

Our findings also show that users should be involved early into the PLE design process and testing should be conducted in real classrooms. Overall the dialogue between demand and supply side throughout the development is the key to the PCP’s success. The contribution of this study is a trend guideline for PLE stakeholders, which could be specifically be used in designing improved learning solutions. This work has been conducted in within European Union co-funded IMAILE project.

Keywords: Personal learning environment, Learning analytics, pre-commercial procurement, STEM Education, Innovation.