Conceptual framework for learning analytics and its feasibility in the Estonian context

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Summary

This article aims to investigate the potential of implementing learning analytics in Estonia and to provide a conceptual framework for learning analytics.

According to Greller and Drachsler (2012) the amount of data that has been published and made publicly available on the web has exploded in the last few years. They continue by saying that proliferation of interactive learning environments, learning management systems, intelligent tutoring systems, e-portfolio systems, and personal learning environments in all sectors of education produces vast amounts of tracking data. However, although these e-learning environments store user data automatically, exploitation of the data for learning and teaching is still very limited. These educational data sets offer unused opportunities for the evaluation of learning theories, learner feedback and support, early warning systems, learning technology, and the development of future learning applications. This leads us to the importance of learning analytics. One of the leading definitions of learning analytics suggests that it is „the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs" (cited by Long & Siemens, 2011, p. 34).

A multiple case study was combined with a research based design of three different learning analytics applications. Participatory design sessions and interviews were conducted with different stakeholders from the field of education. Such sessions involve potential users with whom prototypes will be validated against the real life situations in design experiments. In the context of designing and developing learning analytics applications, the researchers, such as Emin-Martínez et al. (2014) have suggested the use of participatory design in order to allow the end-users to interpret the collected data and perceive the importance of the tool.

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The following cases were selected for the development of learning analytics application:

- eDidaktikum – It has been designed to support Estonian teacher education and is used by five teacher education institutions. A community based system allows conducting formal courses in the system, as well as the creation of informal professional communities in order to share digital learning resources, to network and so on. System supports competence based teaching and learning and as an outcome, users can create their competency based digital portfolios.
- Educational cloud – The aim is to develop a digital eco-system and toolsets for managing and accessing digital resources that are produced and hosted by various content providers. The system aggregates and makes accessible meta-data related to digital learning resources, such as e-textbooks that are located in different repositories. Publishers, teachers and students can create collections of these resources and share their collections with other users.
- EMMA – Operates in two modes: as an aggregator and hosting system of courses produced by European universities; and as a system that enables learners to construct their own learning pathways using units from MOOCs as building blocks. The EMMA team is taking a deliberate multi-lingual, multi-cultural approach to learning by offering inbuilt translation and transcription services for courses hosted on the platform.

In the case of eDidaktikum, design sessions were held with three didactic lecturers who had previous experience with eDidaktikum. Visual mock-ups of learning analytic solutions were used during the sessions that focused on the feedback from students, visualising competences and scaffolding course designers and facilitators. In the case of Educational Cloud interviews with more than 30 teachers and experts from the educational field were conducted. Visual mock-ups were used during the interviews and the central focus of the learning analytics was analysing the usage and creation of materials and the feedback from the users.

In the case of EMMA empirical data was collected in two phases. Firstly, the design of the learning analytics application together with the EMMA MOOC facilitators was conducted. It was collaboratively decided what data will be collected, how it will be analysed and reflected to the participants of MOOCs. In the second phase, data was analysed that was collected with the learning analytics application. Platform was piloted by 8 MOOCs and altogether nearly 1200 users participated in the MOOCs. In the pilot phase the study focused on analysing the frequencies of the activities.

Results of the study illustrated three approaches to learning analytics in the educational systems:

Learning analytics of *Educational Cloud* focuses on analysing the usage of learning resources (see Figure 1). Different dashboards of learning analytics will be developed for teachers, school principles, repository owners and administrators. Each of the dashboards will illustrate a different aspect.

eDidaktikum has several focuses related to learning analytics. Firstly, the overview of the progress of the students will be analysed and reflected in learning analytics dashboard. Secondly, the overview of the course activities (completed tasks, accessed learning resources, discussions in forum) will be visualised to the course designer. Such overview allows the facilitator to see what might be obstacles of the course – assignments that are not passed by the students, materials that have not been accessed etc. But as the eDidaktikum enables competency based teaching and learning, it was important to get the feedback about ones' own competencies. Figure 2 illustrates the overview of competency based portfolio, where it is possible to see what competencies are evidenced and reflected and where are the possible gaps in the competency profile.

EMMA – In the pilot phase firstly the intensity of using learning resources was visualised to MOOC participants and MOOC facilitators. Participants had a chance to see what materials they have or have not accessed also with the recommendations to see some materials that other MOOC participants have seen, but they have not. Secondly, the progress of participants was visualised. Figure 3 illustrates how, based on lessons and units, a MOOC participant can see how many units and lessons he/she has passed compared with the „average student" in same MOOC. Progress was calculated on the basis of performance of assignments, accessed materials and participated discussions.

Finally, the conceptual framework of learning analytics for educational systems is provided. The following elements are important to consider:

- **Pedagogy-driven design** – learning analytics is linked to pedagogical interventions and brings the educator to the centre of the whole learning arrangement. As Greller and Drachsler (2012) mentioned,   LA must be embedded in a pedagogical approach;
- **Open distributed architecture** – In our framework we refer to open standards (in our case Experience API aka xAPI), open technological architecture (in our case open-source learning record store and dashboard solution), open algorithms;

- **Visualisations and recommendations** – learning analytics has to provide visualisations of the learning process. Graphics working as a feedback channel for the learners as well as instructors, teachers and trainers and finally also for administrators, developers and researchers (Ebner et al., 2015). Different dashboards for students, teachers/facilitators, repository owners have been provided in our framework;
- **Ethics and privacy** – Based on the work of Pardo and Siemens (2014), the following aspects are importantly related to ethics and privacy: i) transparency; ii) student control over data; iii) security and iv) accountability and assessment. In our learning analytics framework, the idea is promoted that learning analytics systems development should be based upon a „privacy by design" approach, rather than addressing privacy concerns as an unpleasant afterthought.

Keywords: Learning Analytics, xAPI, open architecture, research based design, digital learning resources, digital learning environments, massive open online course (MOOCs)