International Workshop on Technology-Enhanced and Evidence-Based Education and Learning

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ABSTRACT: The multi-disciplinary research approach of Learning Analytics (LA) has provided methods to understand learning logs collected during various teaching-learning activities and potentially enrich such experiences. This workshop aims to explore the frontiers of how technology can help to extract evidence of effective teaching-learning practices by applying the knowledge base of LA and developing novel techniques. It focuses on discussions on realizing a technology-enhanced evidence-based education and learning (TEEL) systems. We invite research articles conceptualizing foundations, methodologies and utility of TEEL systems. Further, we plan to have a focus group activity to validate an initial technical proposal of Learning Evidence Analytics Framework (LEAF) and draw a research road-map of log data-driven evidence-based education system.

Keywords: Technology-enhanced Evidence-based Education and Learning, TEEL, Learning Evidence Analytics Framework, LEAF

1 BACKGROUND

1.1 Motivation for the workshop

The purpose of Learning Analytics (LA) is "understanding and optimizing learning and the environments in which it occurs." (Siemens, G., & Long, P. 2011). There has been workshops and tutorials in previous LAK conferences discussing about various methods, policies and data-crunching techniques to achieve the purpose. The concept of Evidence-Based Practices (EBP) has its root in medicine and coined by doctors at McMaster University in Hamilton, Ontario in early 1990s (Kvernbekk T., 2017). According to Kvernbekk (2017), EBP involves the use of the best available evidence to bring about desirable outcomes, or conversely, to prevent undesirable outcomes. Davies, P. (1999) reviews the concept of EBP in education. Literature takes various theoretical perspective such as Research-based education (Hargreaves, 1996), Literature-based education (Hammersley, 1997), Context-sensitive practice (Greenhalgh and Worrall, 1997). What is missing is any research agenda of how technology can support the process involving educational big data and the relevant discussions regarding issues in the current age of data-driven education.

In the Learning Analytics community, SOLAR, the term evidence has recently come up in the context of a workshop in 2018's Learning Analytics Conference (LAK 18) regarding evidence-based institutional LA policy (Tsai Y.S., Gašević D., Scheffel, M., 2018; sheilaproject.eu) and in LAK 17 in work presented by Ferguson & Clow (2017) where they introduce Learning Analytics Community Exchange (LACE) project's Evidence Hub. The Evidence Hub (http://evidence.laceproject.eu/) followed the evidence-based medicine paradigm to synthesize published LA literature and meta-

analyze four propositions about learning analytics: whether they support learning, support teaching, are deployed widely, and are used ethically. But neither of the works look at technological affordances required to extract evidence of learning from logged data and make it available for the practitioners to adopt in their own context. This workshop is on technology-enhanced evidence-based education and learning (TEEL) system. It aims to bring together researchers, practitioners and policy makers to discuss ways of conceptualizing evidence of learning success in different technology-enhanced learning contexts.

1.2 Contribution to research and alignment to LAK 2019

This workshop initiates a discussion on foundations, methodologies and utility of TEEL systems to extend the existing knowledge of learning analytics. It explores how to utilize existing LA infrastructures to capture teaching-learning practices, evaluate its effectiveness and recommend good practices back to the community of teachers. We ideate to refine our initial proposal on Learning Evidence Analytics Framework (LEAF), a framework that can be used for integrating an evidence-based education system in practice (see Fig1. below).

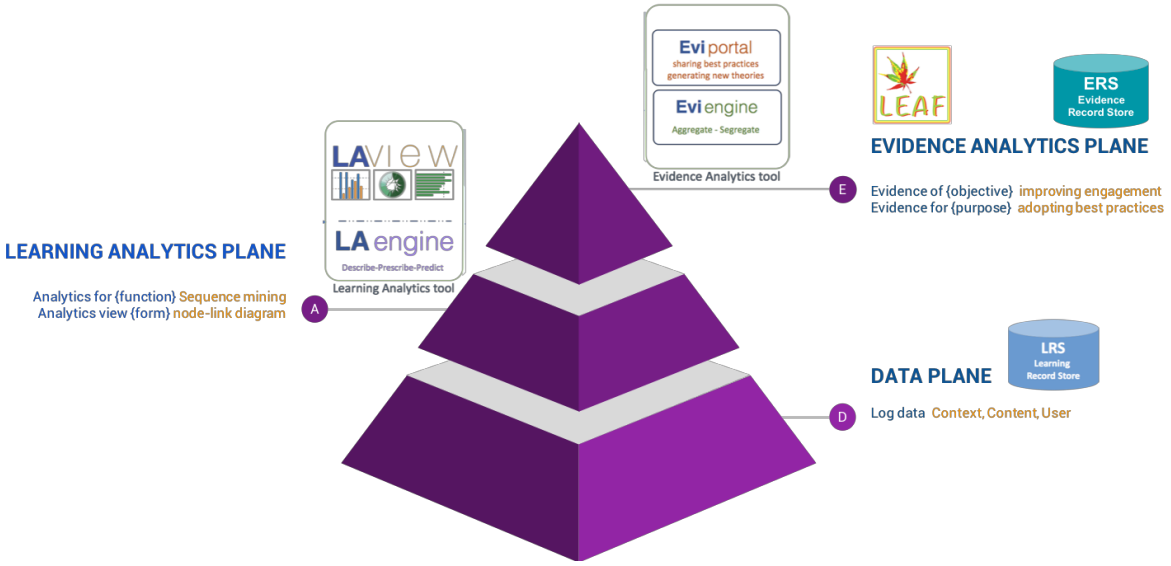

Figure 1: Planes of Analytics

The special theme of LAK2019 is on **Ways in which learning analytics can be used to promote inclusion and success**. Our workshop attempts to provide an operational perspective by discussing the technological infrastructure and methodologies to support extraction of evidence of learner success and developing a framework which connects researchers, educators, and policy-makers by sharing evidences amongst them.

2 WORKSHOP OBJECTIVES

2.1 Research Agenda and Outreach

With the open call for paper we aim to gather researchers and practitioners to present research findings in the workshop. The indicative research topics (not limited to) are listed below:

- Foundations for Technology-Enhanced & Evidence-Based Education & Learning
    - Technology Design Framework, Architecture and Platform
    - Evidence Data format in evidence record store
- Methodologies for Technology-Enhanced & Evidence-Based Education & Learning
    - Extraction of evidence from educational and learning log data
    - Meta-analysis of log data-driven evidences
    - Similarity measures of log data-driven evidence
    - Evaluation of evidences
- Utilizing Technology-Enhanced & Evidence-Based Education & Learning
    - Technological support for adoption of evidences in practice
    - Context-aware recommendation of evidence
    - Case studies of current instantiations
    - Privacy and Ethical issues

We created a website (https://sites.google.com/view/teel-workshop) where we shall list the activity outcomes from the workshop and maintain a hashtag #TEEL19 for outreach on the social media.

3 ACCEPTED PAPERS FOR DISCUSSION IN WORKSHOP

There were 9 accepted articles for discussion in this workshop. Authors of these articles were from 6 different countries.

Two of the articles present analysis of technology implementation focusing on teachers. In *Learning Analytics Dashboard Widgets to Author Teaching-Learning Cases for Evidence-based Education,* Majumdar et.al. (2019) components of LAViEW, a learning dashboard to assist authoring of teaching-learning cases (TLC) by practitioners is described. The TLCs would enable to capture problems identified in a specific context, its indicators in terms of dashboard visualizations, solution and results. Authors propose it as the unit of analysis for evidence-based teaching and learning. In *Behind the Scenes: Designing a Learning Analytics Platform for Higher Education*, Chounta et.al. (2019) reports findings from stakeholder studies during development phase of a LA platform. Their LA platform is targeted for higher education academic institutions in Estonia and this study focus on the teachers' perspective.

Three articles propose models related to learner's artifact evaluation or log analysis to extract evidence. In *Quantitative Evaluation of Concept Maps: An Evidence-Based Approach,* Kadam et.al. (2019) propose automated evaluation algorithm of student submitted concept map

assignment. In *Modelling students' effort using behavioral data*, Moissa et.al. (2019) use interaction and eye gaze data to model student's effort. In *LASAT: Learning Activity Sequence Analysis Tool,* Mishra et.al. (2019) present a case-study of utility of various sequence analysis algorithms which assist in extracting and interpreting students' learning behaviors extracted as frequent patterns (sequence of activities) from their activity traces logged in computer-based learning environments. These algorithms, developed in Institute for Software Integrated Systems, Vanderbilt University, are packaged in a toolkit with the aim to make it accessible to wider community of researchers and practitioners.

Three articles focus on the context of MOOCs. In *Automated MOOC/SPOC Learning Design Verification based on Instructional Design Theories*, Lei et.al. (2019) propose a mechanism that can quickly visualize the courseware with faulty or at-risk designs that may cause obstacles for learners, which allows just-in-time revisions. In *Using Log Data to Evaluate MOOC Engagement and Inform Instructional Design,* Chai et.al. (2019) discusses a framework of MOOC engagement composed of learning-interface, learner-content and learner-community interactions. They illustrate how to utilize the framework with log data from 10 MOOC courses offered by Hong Kong University. In *CLEAR: Cohort-Level Evidence Analysis and Reflection Process as a methodology to assist MOOC Providers and Adopters for effective teaching-learning using MOOCs,* Warriem and Balaji (2019) discuss a case study of National Programme on Technology Enhanced Learning (NPTEL), a national MOOC initiative from India. They focus on the issue of persistent engagement of learners in MOOCs and propose a process flow that will assist the MOOC providers as well as institutions signed up with NPTEL to utilize the evidences available from previous offerings of courses and take meaningful actions on it.

Finally, in *Extracting Self-Direction Strategies and Representing Practices in GOAL System,* Li et.al (2019) provides an instance of building a framework for tracking self-directed actions of learners and illustrates how to utilize it for extracting evidence of best practices and self-reflection. The work is in the context of the GOAL system, where learners use their automatically collected self-data regarding learning and physical activities, to foster various self-direction skills.

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