

# The Potential of Learning Analytics to Support Peer Assessment

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**ABSTRACT:** There are few studies of peer assessment in the learning analytics (LA) field. In this research the potential of LA methods to analyze peer assessment data is examined. The first study comprises an application of LA methods on a big data set coming from the use of a peer assessment tool, Peergrade. The second study analyzes the use of LA methods in order to understand how the context data, together with the Peergrade data, can provide insights into the role of peer assessment in learning and teaching.

**Keywords:** learning analytics, educational data, peer assessment, learning design, teacher inquiry

## 1. RESEARCH BACKGROUND

*Learning analytics (LA)* is a new emerging field that has the potential not only to support assessment for learning, but also to better understand learning processes. Ferguson et al. (2016) calls for aligning “analytics with assessment practices” as LA has the potential to change assessment practices and support “the holistic process of learning” (Ferguson et al., 2016, p. 37). *Peer assessment* is “a quantitative evaluation and qualitative feedback of a learner’s performance by another learner” (Patchan et al., 2017, p. 1). Peer assessment research has a long research history of 40 years, which showed that student’s feedback can be both helpful and reliable, as well as correlate high with the teacher’s grading (Patchan et al., 2017; Raes et al., 2015; Li et al., 2016). Peer assessment is especially valuable in the context of MOOCs, where the ability to provide feedback by the instructor for each learner is limited (Wahid et. al, 2016). Moreover, it is also widely used at the universities (de Alfaro & Shavlovsky, 2016).

Results from Misiejuk’s (2017) Master thesis, in which the proceedings from the International Conference on Educational Data Mining, the International Learning Analytics and Knowledge, and the ACM Conference on Learning at Scale were analyzed using a variety of scientometric techniques such as keyword analysis and citation analysis, revealed that the topic of peer assessment is still relatively underexplored in the field of Educational Data Sciences (EDS) (Misiejuk, 2017). Furthermore, the state-of-the-field review of learning analytics confirms this finding (Misiejuk & Wasson, forthcoming). Studies from the field of EDS focus mainly on the relationship between peer assessment and student performance (Jiang et al., 2014; Kulkarni et al., 2015; Sajjadi et al., 2016; Tritz et al., 2014; Ashenafi et al., 2016). The other significant research areas are the quality of the student grading (Xiong et al., 2010; Xiong & Litman, 2013; Raman & Joachims, 2015), the exploration of the peer assessment metrics such as accuracy, validity, and reliability (de Alfaro & Shavlovsky, 2016; Piech et al., 2013; Vogelsang & Ruppertz, 2015; Vozniuk et al., 2014), and technological improvement of the peer assessment (Kulkarni et al., 2014; Kolhe et al., 2016; Xing et al., 2014). Even though the definition of LA includes “the measurement, collection, analysis and reporting of data about learners and their contexts” (Buckingham Shum & Ferguson, 2012, p. 4), no studies were identified that examine not only the technical challenges of implementing learning analytics methods

but also include an in-depth analysis of the learning contexts in the field of peer assessment. This research aims to fill this gap.

## 2. RESEARCH DESCRIPTION

This section introduces the research questions and two of the studies that will be carried out.

### 2.1. Research Questions and Methodology

Three research questions were developed to guide this research project: 1) How can LA be used to better understand peer assessment learning in higher education to inform teachers and learners? 2) Which LA methods are useful on peer assessment data? How are they useful? 3) How can context data be integrated into the LA analysis?

Two methodological frameworks, which highlight aspects of LA and assessment that need be considered, will guide the development of the research design: *Learning Analytics - Principles and Constraints Framework* (LA-PCF) (Khalil & Ebner, 2015; see Figure 1) and *Assessment Analytics Framework* (AAF) (Papamitsiou & Economides, 2016; see Figure 2).



Figure 1: Learning Analytics - Principles and Constraints Framework (LA-PCF) (from Khalil & Ebner, 2015, p. 1333)



Figure 2. Assessment Analytics Framework (AAF) (from Papamitsiou & Economides, 2016, p. 125) 2

LA-PCF was developed based on previous frameworks proposed by Clow (2012), Chatti et al. (2012), and Greller & Drachsler (2012), and it comprises the LA Life Cycle that describes “proceeding steps, starting from the learning environment and ending with the appropriate intervention” and the LA Constraints that represents limitations of LA research (Khalil & Ebner, 2015, p.1327). The LA Life Cycle model is divided into four main stages: 1) Learning Environment that focuses on how data produced in learning environments can be used to benefit stakeholders; 2) Big Data that indicates the different types of data; 3) Analytics that describes various LA techniques which can be applied to analyse the data; 4) Act which has interpretation of analytics results in focus and use them to optimize LA objectives (Khalil & Ebner, 2015). The LA Constraints model represents aspects of LA implementation that should be taken into consideration, such as Privacy, Transparency, and Ownership (Khalil & Ebner, 2015). Even though the consequences of the use of LA methods, especially in the areas of student retention and assessment, can significantly influence higher education institutions, ethical and privacy issues are rarely reflected on in LA research (Drachsler et al., 2015).

AAF (Papamitsiou & Economides, 2016) was developed to consolidate learning and assessment research with learning analytics, and consists of four main parts: 1) input that describes the input parameters used for the analytics; 2) process that includes the ways in which data is analyzed and interpreted; 3) output that shows what is the analytics outcome and for which stakeholder should it be available; and 4) feedback that describes not only the feedback given to the final user, but also the feedback iterative process. The concept of context comes from the learning sciences and is an important part of the AAF (Papamitsiou & Economides, 2016). It provides additional information about “the situation of an entity (eg, person, place or object)”, which is especially important in the real-life application of the assessment analytics (Papamitsiou & Economides, 2016, p. 125).

## **2.2. Peergrade Tool**

In this research a peergrading tool developed at the Technical University of Denmark, Peergrade, will be used in various courses to implement peer assessment.

Peergrade is “a free online platform to facilitate peer feedback sessions with students”<sup>1</sup> (Peergrade, n.d.). It can be integrated with the most popular LMS platforms such as Moodle and Canvas. The platform not only enables giving feedback to the other students, but also creates a feedback loop, in which the feedback is evaluated by the person who was assessed. The agreement between the graders is calculated, so that the teacher can intervene in the case of a high discrepancies between the grades. There is also data on how much time students spent on giving feedback. Many kinds of files can be uploaded for grading including PDFs, videos, etc. The assignments can be weighted and it is possible to give feedback anonymously.

## **2.3. Study 1: Big Data Analysis**

Peergrade is a partner with Centre for the Science of Learning & Technology (SLATE) at the University of Bergen. The anonymised data from the Peergrade tool has been made available for a retrospective analysis in the SLATE’s big data infrastructure. The up to date data set consists of data from hundreds educational institutions that use Peergrade.

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<sup>1</sup> Free for the Basic and a pricing model for additional features.

The analysis of this big data set focuses on the usefulness of various LA methods on the peer assessment data for helping with the understanding of learning processes. The focus of this study is both learning-centric analytics as well as learner-centric analytics, so not just student behaviour, but also the content and produced learning artefacts will be examined (Stein, 2012). Different LA methods are used to analyse different aspects of learning, such as a predictive analysis of the student performance based on the peer assessment data, and a natural language processing analysis of the content of the students' feedback. Since there is little context data available for the analysis, the results from this analysis will be exploratory in nature and will inform the research in Study 2.

## **2.4. Study 2: Context Data Integration**

Study 2 focuses on peer assessment in higher education, especially the use of LA in order to understand how the context data from the setting in which the tool is used, together with the Peergrade data, can provide insights into the role of peer assessment in learning and teaching<sup>2</sup>. In focus are aspects such as learning design (e.g., Peergrade assignments), the way students are trained in giving feedback, how peer assessment is introduced, the quality of the peer feedback and how it changes over time. The goal is to look beyond just the Peergrade data (informed by what is learned in Study 1), and to include contextual data such as focus interviews, videos, etc., as well as to analyze the perception and usefulness of the visualizations presented to the teacher and the learner.

Kristiania University College (HK) collaborates with SLATE in a project using Peergrade. As the collaboration is planned for the next couple of years, there is a possibility to study changes in the learning design and thus perform an iterative process, where based on the LA results interventions are undertaken, analytics are improved, and the cycle is repeated on a new group of students (Clow, 2012). In the fall 2017 semester four HK courses in a variety of discipline are using the Peergrade tool and data generated will be used in the Study 2.

## **2.5. Current Status of the Research**

Two extensive literature reviews on LA have been previously carried out (Misiejuk, 2017; Misiejuk & Wasson, forthcoming). These will be extended with a in-depth revision focused on learning design, teacher inquiry, and peer assessment.

The data is available for the Study 1 in SLATE's big data infrastructure. The exploratory analysis on the big data set has begun with cleaning the data and exploring the database structure. Preliminary natural language processing analysis and simple descriptive analytics have been carried out to map out the kinds of questions that can be answered with this dataset (e.g., sentiment analysis, temporal analysis). The next steps are to crystalize the research questions and methods to address them.

The first courses using Peergrade at the HK are ongoing during fall 2017 semester. Data sets for these courses have been made available. Since Study 2 is part of a larger project, the design of my study will be further developed, and in particular the relationship of LA, learning design, and teacher inquiry.

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<sup>2</sup> This study is currently being designed and will most likely be part of a larger protect that will be looking at the relationship between learning analytics, learning design, and teacher inquiry (Mor et al., 2015; Wasson et al., 2016). For this reason the study description is general.

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