Collaborative sensemaking in learning analytics

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Collaborative Sensemaking in Learning Analytics

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Abstract

Learning Analytics (LA) is a new educational tool aimed at improving learning processes and outcomes via the analysis of, and feedback regarding, student trace data. Implementation has often involved visualizations for sensemaking. However, these visualizations are complicated by their wide range of audiences – from governmental, down to individual pupils. Furthermore, the needs and abilities of these various stakeholders are important to consider, with different users requiring different context data; from school level demographic data, to teachers understanding something of the personal lives' of students. This data will often be considered in collaborative, computer-mediated physical and sociocultural contexts. CSCW has engaged with visualization researchers; LA is a new area which should be of interest to these researchers, particularly given the starkness with which LA highlights issues of user roles, task needs, and data ethics. This paper highlights some of these needs in the context of the growing interest in collaborative visualization.

Author Keywords

Learning analytics; visualization; dashboard; education; educational assessment

ACM Classification Keywords

K.3.1 [**Computers and Education**]: Computer Uses in Education – *collaborative learning.*

General Terms

Design; Human Factors; Measurement; Theory

Learning Analytics

Educational Data Mining (EDM) has typically been conducted by businesses, and universities – organizations used to dealing with analytics. EDM is typically considered 'pedagogically neutral' in contrast to Learning Analytics, which is inspired by pedagogic theories associated with Vygotsky and Wenger [5]. LA is a growing field with potential for large impacts in education. However, for it to have impact in classrooms and 'lecture' theatres (virtual or otherwise) teachers, lecturers, and students as 'end users' must be able to access, and understand the data at their disposal. While some work [6] has explored the technological challenges of unifying LA data from various sources, for various targets into a shared visualization, current research tends not to focus on the pedagogic, collaborative, sense-making process within which visualizations would be used.

[Learning] Analytics

While EDM has – at least in some cases – aimed at collecting metrics for clear prediction models (for example, of drop outs), LA in contrast collects data for developing learning processes. This LA may in part be about personalization of learning through analytics, but it is also about engaging learners and educators in a sensemaking process around the data. The parallel in analytics generally is the difference between metrics – hit counters, navigation paths, conversion rates – on the one hand, and analytics which support participation of stakeholders and community building on the other.

Collaborative Analytics and Sensemaking

Sensemaking around this data is important; alone, data offers 'metrics' of success – attendance, quiz scores, forum posts made – but exploring the sensemaking process offers opportunity to understand how learners, and educators, identify the value of learning through data, and the best ways to support this.

"F*or learners and teachers alike, it can be extremely useful to have a visual overview of their activities and how they relate to those of their peers or other actors in the learning experience. In fact, such visualizations can also be quite useful for other stakeholders, like for instance system administrators*" [2:13].

However, the same author raises the issue that "many visualizations look good – and some are actually beautiful. But how we can connect visualization not only with meaning or truth, but with taking actions?" [2:11]. In a review of the area of collaborative visualization, Isenberg et al., [4] highlight the intersection of visualization, and CSCW approaches in this area. In particular, they suggest that CSCW is important in this area because it contributes to understanding of:

- Users and tasks, and the relationships between user roles and task definitions
- The cognition related to visualisation: "One of the main differentiating factors from the wider field of CSCW research is that the focus of collaborative visualization is often not the creation of a 'product' (e.g., a photo layout or a text document) but an

increased understanding or insight into a dataset, a consensus, or the ability to make informed decisions" [4:320].

- The process of interaction with data, and creation of visual representations,
- The evaluation of collaborative visualisations, and the group's new insights – both in their own right (evaluating the insights) and with respect to evaluating the group and group process.

The process of *evaluation* of visualizations holds special interest for LA. Understanding how officials, managers, teachers, parents and pupils make sense of data is important, and holds potential at all levels of accountability, and in the classroom, for LA for assessment *for* learning (formative assessment) as contrasted with assessment *of* learning (summative assessment). Conceptualizing this evaluation stage holds benefits for:

1. Understanding the new insights that have been gained, how they might be used, and how they may be visualised
2. Understanding how to best support those groups to make such insights in effective group processes.

Sensemaking for Education
This need for common knowledge is particularly pertinent in the classroom context, where teachers may seek to explore LA data with their students. This context is particularly interesting for sensemaking research, because of the stark nature of the novice-expert relation [1], where both parties hope to build common ground yet the teacher also has an evaluative role both with respect to the student's understanding of the analytics, and with respect to the implications of the data for that student.

In addition, there is an ethical imperative which is particularly highlighted by educational contexts – that it is important when collecting data, that those on whom the data is based, and for whom the data has implications, should understand those implications and the data's context of use. Sensemaking can therefore be considered as occurring not only on the data itself, but also on the context of that data – including the analysis which is conducted on it. Here, sensemaking is considered in the context of data, the purposes for which the data is gathered, and the means to translate purposes between the levels of analysis.

An additional complication is added here, in that collaboration may occur over multiple actors, in multiple places – physically, and in terms of organizational hierarchy – and over time, alongside large changes in context of use (different school grades/key stages, and disciplines for example), and contexts of *users* (socio-psychological development, for example), in addition to a variety of complex mediating factors ranging from the personal (illness, holidays, family crisis, etc.) to other contextual factors from the weather to the political climate at the time. These – and similar – factors may well play a part in a variety of analytics based settings. However, given the educational purposes for which LA are employed though, they are particularly pertinent and important to consider.

Conclusions
Collaborative visualization is an area of growing interest, and one which CSCW can contribute to.

Educational contexts will benefit from this increased attention. However, both education, and the wider community, may gain from an exploration of the specific needs of education in collaborative visualization because of the ways in which highly relevant context is brought to bear – the tasks, roles, novice-expert relations, and hierarchical purposes for which LA are employed are of interest.

This is also a particularly salient area for the consideration that:

"T*he adoption of information visualization technologies by lay users – as opposed to the traditional information visualization audience of scientists and analysts – has important implications for visualization research, design and development. Since we cannot expect each of these lay users to design their own visualizations, we have to provide them tools that make it easy to create and deploy visualizations of their datasets*." [3:92]

This paper has offered some considerations for interdisciplinary educational CSCW work on collaborative visualization, an area which we suggest should be further probed to the benefit of those working on collaborative visualization in general, and particularly those in education.

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