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Analytics for Learning and Becoming in Practice

Abstract: Learning Analytics sits at the intersection of the learning sciences and computational data capture and analysis. Analytics should be grounded in the existing literature with a view to data 'geology' or 'archeology' over 'mining'. This workshop explores how analytics may extend the common notion of activity trace data from *learning processes* to encompass *learning practices*, with a working distinction for discussion as (1) process: a series of related actions engaged in as part of learning activities; and (2) practice: a repertoire of processes organised around particular foci recognised within a social group. The workshop intersperses attendee presentations and demonstrations with relevant theme-based discussions.

Organizers

Golnaz Arastoopour is a graduate student in Learning Sciences in the Epistemic Games research group at the University of Wisconsin-Madison working on engineering epistemic games. Formerly an engineering student and a classroom teacher, she is currently researching how players solve and reflect on complex design problems in engineering games and simulations. Golnaz has organized workshops, tutorials, and has been involved in the development of Epistemic Network Analysis, a discourse and learning network analysis tool.

Wesley Collier is a graduate student in learning sciences in the Epistemic Games research group at the University of Wisconsin-Madison working on the Nephrotex project (an engineering epistemic game) and Epistemic Network Analysis. He is interested in how games and simulations can be assessed using discourse analysis.

Paul A. Kirschner is professor of Educational Psychology and Programme Director of the Learning and Cognition programme at the Centre for Learning Sciences and Technologies at the Open University of the Netherlands. He is past President of the International Society for the Learning Sciences, member of the Scientific Technical Council of the Foundation for University Computing Facilities (SURF WTR), associate editor of Computers in Human Behavior and chief editor of the Journal of Computer Assisted Learning.

Simon Knight is a PhD candidate in Learning Analytics at the UK Open University's Knowledge Media Institute and researches epistemic commitments in information seeking. He attended the highly competitive Learning Analytics Summer Institute and received a 'best paper' nomination for his LAK13 paper. He has reviewed including for the Journal of Learning Analytics and ICLS-2013.

Simon Buckingham Shum is a Professor of Learning Informatics and Associate Director (Technology) at the UK Open University's Knowledge Media Institute, where he leads the Hypermedia Discourse group. He was Programme Co-Chair for the 2012 Learning Analytics conference, a co-founder of the new Society for Learning Analytics Research, and is a regular invited speaker on the topic. He brings a human-centred computing perspective to the challenge of building analytics, collective intelligence and sensemaking tools.

David Williamson Shaffer is a Professor of Learning Science at the University of Wisconsin-Madison, is a Principal Investigator at the Wisconsin Center for Education Research. Shaffer is one of the developers of Epistemic Network Analysis (ENA), which uses network models to quantify and visualize the connections that students make between skills, knowledge, identity, values, and epistemology when solving complex problems.

Alyssa Friend Wise is an Associate Professor of Education at Simon Fraser University. An integral member of both learning sciences and learning analytics communities, her research focuses on developing digital environments and analytics that work together to promote learning. Dr. Wise serves on the ISLS CSCL Committee, the Executive of the Society for Learning Analytics Research, as an Associate Editor of the Journal of Learning Analytics, and was the Workshop & Tutorial Chair for LAK2013.

Theoretical Background

Bridging learning sciences and analytic techniques through learning analytics which offer the ability to track an ever increasing number of process and output variables is of great current interest. Indeed, this 'middle space' was the theme of the 2013 Learning Analytics and Knowledge conference (LAK13) (Suthers and Verbert, 2013):

> In summary, although individual research efforts may differ in their emphasis, we believe that all research in Learning Analytics should address the "middle space" by including both learning and analytic concerns and addressing the match between technique and application. Advances in learning theory and practice are welcome, provided that they are accompanied with an evaluation of how existing or new analytic technologies support such advances. Advances in analytic technologies and methods are welcome, provided that they are accompanied with an evaluation of how understanding of learning and educational practices may be advanced by such methods. (Suthers and Verbert, 2013, p.2)

The core issue is that for learning analytics to have the most effective impact they must attend to the existing research around learning, cognitive, social and epistemological factors (Knight, Buckingham Shum, & Littleton, 2014). Shaffer (2011) noted the problematic nature of the term 'data mining' suggesting we should instead refer to 'data geology'; that is, we must understand the underlying structure of the phenomenon we seek to explore with analytics prior to digging into data.

> The "interpretative flexibility" of new technologies – including analytics – is high: when we consider appropriation of technology within particular social settings we should be mindful of not falling into the trap of technological determinism (Hamilton & Feenberg, 2005). As Crook and Lewthwaite (2010) note, our expectations for technology for transformative change should be mitigated by an understanding of those technologies in wider educational systems. Moreover, we should understand that technology's influence comes about through pedagogic change – not out of technology's direct effects (Crook & Lewthwaite, 2010). (Knight, Buckingham Shum and Littleton, 2013, p. 6).

This workshop applies these middle space issues to the ICLS conference theme, marking a sharp conceptual distinction between practice and process. The workshop begins with discussion around the status of these two concepts and the ways in which they can be evidenced through the analysis of data traces:

Process – a series of related actions engaged in as part of learning activities

Practice – a repertoire of processes organised around particular foci recognised within a social group

A focus on practice reflects the growing recognition in educational thinking that students from school age upwards should be given the opportunities to engage in authentic learning challenges, wrestling with problems and engaging in practices increasingly close to the complexity they will confront when they graduate. In higher education the quality of the student experience is under intense scrutiny, as educational systems reflect at national and international levels on their fitness for purpose and value for money. The workforce now needs graduates who are not just academically excellent, but have transferable skills and competencies equipping them to rapidly learn new work practices, and demonstrate the qualities needed to thrive in complexity and uncertainty. This is serving as a driver for action research into new models focused on the wholistic design of learning, catalysing academics (Deakin Crick, 2009; Gardner, 1983; Perkins, 1993; Claxton, 2001), national networks and funding programmes (Whole Education, 2014; Hewlett Foundation, 2014). A particular focus of these initiatives is on 'deeper learning' that is more authentic in nature—to the extent that the educator may not know the 'right answer' but is learning with the students. Indeed, there may be no knowable right answer, such is the open-ended nature of truly "wicked problems" whose very definition sometimes defies consensus (Rittel, 1984). While accuracy of conceptual understanding remains as important as ever, in the absence of a knowable correct solution, it becomes increasingly important to evidence mastery of the appropriate *practices* through which one may tackle such open-ended problems.

To give a focus, many factors of the developing area of 'Social Learning Analytics' (SLA) (Buckingham Shum & Ferguson, 2012) focus on properties of learning which come into being through social activity. In particular SLA

relate to: discourse between learners and teachers, social network analysis, content analytics on user generated web 2.0 materials, dispositional analytics regarding the 'mindsets' learners bring, and context analytics regarding facets of learner environments. Yet, while tracking and supporting high quality instances of these facets of learning may be important, understanding *why* such processes are involved in learning or the display of knowledge requires theoretical or/and empirical understanding of the practices in which they are constituted, and which they constitute. It may, for example, be important to explore "interaction trajectories", the ways in which processes develop and interact over time, in their social, practice-oriented context (Furberg, Kluge and Ludvigsen, 2013).

Knowledge practices are, thus, fundamental to learning processes – e.g. metacognitive skills, epistemic cognition, self-regulation – and the particular subject domain practices to which we introduce our students, and the degree to which assessments value authenticity. Learning in the context of a practice is an inherently social process where knowledge is co-constructed in some specific social environment, or within some community. Analytically, such learning communities have been described as *communities of practice*—groups of people that share ways of working, thinking, and acting in the world (Lave & Wenger, 1991). In this view, designed learning environments that are modeled around such communities offer a space for novices to learn processes within the context of the practice. For example, *epistemic games* are simulations of professional workplaces where participants role-play as interns and learn to think about and solve problems in the ways that professional within that practice would solve problems (Shaffer, 2007). These simulations provide process and product data from learner interactions that are analysed through the lens of an *epistemic frame,* the ways in which members of a community make connections between domain-specific skills, knowledge, identity, values and epistemology (Rupp, Gushta, Mislevy, & Shaffer, 2010). The analysis of process data in terms of epistemic frames can reveal something about novice learning processes, such as how novices imitate and internalize the professional ways of thinking that mentors model (Nash & Shaffer, 2011), develop positive associations with the practice (Chesler, Arastoopour, D'Angelo, Bagley, & Shaffer, 2013), and develop the social identity of a practice (Arastoopour & Shaffer, 2013). In other words, designed learning environments based on knowledge practices allow for process data from activities that the community would recognise, and can be analysed in light of community practices.

The notion of practices of learning and becoming is also relevant at the *level* of analytics use. We need to design and evaluate analytics with not only a view to the processes of how they are be used, but also to how they can form part of instructors' and students' practices, thus shifting patterns of teaching and learning activity (Wise, Zhao & Hausknecht, 2013). For example, Social Learning Analytics might be productively used to foster data-assisted reflection for the support of the goal-setting, monitoring, and evaluative processes of self-regulated learning. Here again Crook & Lewthwaite's (2010) concern is key. In order for our expectations for the potential of new tools to be met, we must understand the ways in which they are embedded into educator practice, and the policies around those practices (Piety, 2013).

In sum, the goal of the workshop is to discuss these and other distinctions between process and practice and explore their implications for research and the design of analytic platforms, using participant submissions and organizer examples as useful foci of discussion.

Objectives

We anticipate that this workshop will provide a space to discuss conceptual issues around analysis of learning and becoming in practice. Short papers and demonstrations will allow for a forum to describe and discuss learning analytics used in the field; the theoretical base/learning science concepts and frameworks surrounding learning analytics; how current work uses data traces to generate evidence of processes, practices or both; and other items/themes for future discussion surrounding learning analytics.

By way of providing illustrative examples, and a potential source of discussion and papers, this workshop will be devoted to hands-on activity. The format will thus include:

1. Short introductory presentations on the emerging field of learning analytics, and practice oriented analytic techniques.

2. Discussion of conceptual issues around process and practice analytics, and their research and design implications. We anticipate this session being resourced by short presentations of accepted papers and demonstrations, followed by a combination of whole-group and break-out-group discussion. The

discussion will be shaped by participants but may be focused on the suggested paper submission topics, or particular subject practices (e.g., STEM), etc.

3. The afternoon session is devoted to hands-on demonstrations of approaches to analysis of practice. Demonstrations will be used as a focus for discussion around suitability of analytic techniques for the analysis of learning and becoming in practice alongside discussion of emergent themes from the morning sessions. Participants will be encouraged to consider the broad application of such techniques to their own research agendas. A combination of submitted and invited presentations will be used to resource this session as required. The workshop organisers have experience in and can lead discussion around, demonstrations of Epistemic Network Analysis (Shaffer & Arastoopour) the building of teacher practices around analytics (Wise), and discourse/collective intelligence mapping analytics (Buckingham Shum)

4. Plenary discussion will provide time for considering the theoretical and empirical implications of defining 'practice' for research agendas with reference to the learning sciences broadly, and to participants own research programs.

Because of the interactive nature of this workshop, we anticipate that a significant number of participants will continue discussing and exploring topics surrounding learning analytics and practice beyond the workshop. In addition, we expect participants will collaborate on future projects and tool development regarding the relationship between learning analytics, processes, and practices.

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