Learning Dashboards & Learnscapes

Erik Duval
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
erik.duval@cs.kuleuven.be

Sten Govaerts
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
sten.govaerts@cs.kuleuven.be

Joris Klerkx
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
joris.klerkx@cs.kuleuven.be

Gonzalo Parra
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
gonzalo.parra@cs.kuleuven.be

Katrien Verbert
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
katrien.verbert@cs.kuleuven.be

Jose Luis Santos
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
joseluis.santos@cs.kuleuven.be

Till Nagel
Visiting Scientist
SMART, Singapore-MIT
Interaction Design Lab, FH
Potsdam, Germany
nagel@fh-potsdam.de

Bram Vandeputte
KU Leuven
Celestijnenlaan 200 A
B3000 Leuven, Belgium
bram.vandeputte@cs.kuleuven.be

Abstract

In this paper, we briefly present our work on applications for 'learning analytics'. Our work ranges from dashboards on small mobile devices to learnscapes on large public displays. We capture and visualize traces of learning activities, in order to promote self-awareness and reflection, and to enable learners to define goals and track progress towards these goals. We identify HCI issues for this kind of applications.

Keywords

learning analytics, information visualization

ACM Classification Keywords

H.5.2. User Interfaces, K.3.1. Computer uses in Education

General Terms

Design. Human Factors.

Context

There is a growing movement to more open learning environments. For instance, Personal Learning Environments replace monolithic Learning Management Systems with user configurable sets of widgets [1]). Learning infrastructures provide generic services for
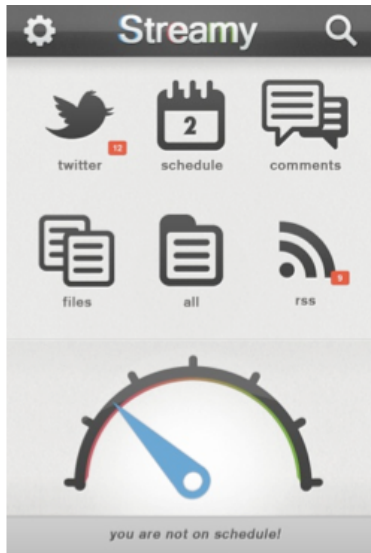
learning, for instance through registries[1], or open educational resource infrastructures [2]. However, how learners and teachers interact with these widgets, services, resources and with each other often remains unclear, both for the users involved, as well as for system components - which makes it difficult to personalize the interactions.

At the same time, there is a growing movement of quantified self in medicine [3], sports, many other fields and, indeed, learning [4]. The basic idea in many of these initiatives is to enable users to track their activities, in order to enable self-analysis, often by visualizing traces of the activities.

More specifically for our context, the field of 'learning analytics' focuses on tracking learning activities to promote self-awareness and reflection through algorithmic analysis (in educational data mining [5]) or information visualization.

Our work so far

We have designed, developed and evaluated a suite of tools for tracking learning activities and visualizing them as learning dashboards over the full gamma from mobile devices (including augmented reality eyewear) over tablet and laptop to desktop computers, up to tabletops and large public displays.

In a participatory design approach, we have carried out these developments and evaluations in projects with "real life" test beds. **Figure 1** illustrates a mobile client: the dashboard shows the number of relevant course tweets, links to other relevant information, and

Figure 1: a mobile dashboard developed by our students

a progress indicator that takes into account the time investment of the student, progress made in the course, the course schedule, etc. Such mobile clients provide exciting affordances for automatic tracking of learning activities – for instance, students can track time spent, proximity, etc. or 'check in' for a lecture in a foursquare[2] type of way.

On laptop and desktop environments, we have developed numerous trackers for learning activities (leveraging existing tools like wakoopa[3], rescuetime[4] and the rabbit Eclipse plugin[5]). We made these data available in visualizations that rely on OpenSocial widgets [6], so that learners and teachers can compose their own dashboard.
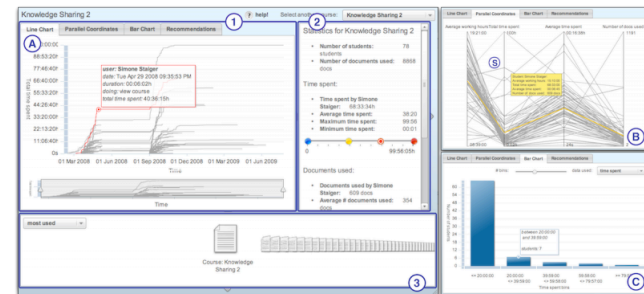

Figure 2: the Student Activity Monitor (SAM)

As illustrated by **Figure 2**, we have also developed a standalone application [7] that provides rich statistics

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[1] http://www.learningregistry.org/

[2] https://foursquare.com/

[3] http://wakoopa.com/

[4] https://www.rescuetime.com/

[5] http://code.google.com/p/rabbit-eclipse/

in the form of line charts, parallel coordinates and bar charts, as well as recommendations for relevant documents.

Finally, we are also designing what we call learnscapes for tabletops and large public displays. Most of our efforts so far in this area have focused on providing rich learning environments for small groups of learners– see for instance **Figure 3** [8].

For all of our work, we typically follow a user centered rapid prototyping approach, where we first rely on paper prototypes to gather initial feedback on early ideas and then develop gradually more functional digital prototypes in rapid iteration cycles. We then deploy more advanced implementations in realistic test beds with tens to hundreds of learners.

Issues

We briefly discuss some of the most important research issues below and would suggest that these might be good candidates for further discussion at the workshop.

What are relevant learner actions? Maybe some mouse clicks or physical interactions are not related to the learning activity (for instance: quick email or chat interrupt, or leaving the room to get a coffee), but then again, maybe they are and it is often difficult to figure out what activity is relevant at which point in time.

How can we capture learner actions? We often rely on trackers for laptop or desktop interactions, social media for learner interactions (through twitter hash tags or blog comments, for instance) and on physical sensors for mobile devices. However, capturing all relevant

Figure 3: Tangible geo-visualization in Venice Unfolding

actions in an open environment in a scalable way is challenging.

How can we evaluate the usability, usefulness and learning impact of dashboards and learnscapes? Whereas usability is relatively easy to evaluate (and we have done many such evaluations of our tools), usefulness, for instance in the form of learning impact, is much harder to evaluate, as this requires longer-term and larger-scale evaluations.

How can we enable goal setting and connect it with the visualizations, so as to close the feedback loop and enable learners and teachers to react to what they observe and then track the effect of their reactions? We are experimenting with playful gamification approaches, that present their own challenges [3], for instance around trivialization and control.

How can we leverage attention metadata for recommending and mining? We model learner actions as 'attention metadata' [9]. The focus of our dashboard work is on visualizing these data for self-awareness and reflection. Alternative approaches to achieve the same goal include *'educational data mining'* to identify relevant patterns [5] and *educational recommenders* that can suggest resources, activities and people [10].

How can we exploit novel opportunities in mobile devices for supporting *communication and collaboration* between learners and with teachers, which is especially relevant in a Computer Supported Collaborative Learning (CSCL) setting, the more so as these devices can capture context information.

How can we design physical spaces that promote learning rather than hinder it, especially in the case of tabletops and large public displays, where the impact of the physical environment on the user experience is sometimes higher and, vice versa, the devices have a higher impact on the physical setting [11].

What kind of data and service infrastructure can best support the applications we envision? Of particular relevance here is a linked open data approach that can integrate well with the Web infrastructure [12] and that can support an open analytics infrastructure [13].

How can we enhance and exploit facilities for seamless transition from mobile over tablet and laptop to desktop, tabletop and large public displays. Issues here include coherence, synchronization, screen sharing, device shifting, complementarity and simultaneity (see http://precious-forever.com/).

There are obvious issues around privacy and control – yet, as public attitudes and technical affordances evolve [14], it is unclear how we can strike a good balance in this area.

Conclusion
Maybe most important is the question in what respect learning is different from activities like sports, play, tracking for health and lifelogging in general – and how that impacts on the way we design, implement and evaluate learning dashboards and learnscapes. We believe that we are just beginning to explore the opportunities in this area and that a deeper understanding of the issues involved can help us to be more effective and efficient in pursuing the opportunities.

Acknowledgements

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