A first approach to "Learning Dashboards" in formal learning contexts

Abstract. This position paper introduces to "learning dashboards", flagged as a new breed of eLearning interfaces. Following an observation of 3 instances of these structures for regulative support, it suggests possible effects on attention to the learning experience, reflective learning and sense of personalisation. The paper concludes with the identification of research challenges associated with the mirroring of tracked data, inherent to these displays.

1   Introduction

The aim of this short paper is to provide a way to start talking about "learning dashboards". These artefacts are apprehended as reflective tools interweaving personal and contextual information about learning at hand. An argument is made that this crisscrossing between content-related and self-related dimensions, arranged within a permanent, visual and dynamic displays, is a new phenomenon in the practice of formal eLearning education. Its emergence stands at the cross-section of reflective practice, self-regulation and personalisation issues. Technically speaking, it is made possible by progress achieved in tracking and mirroring techniques

2   Cognitive orchestration

Reflection – and similar constructs like "meta-cognitive development" [1] or "learning to learn" [2] – is assumed to be an essential factor of quality learning. Its practice in schools is supposed to gradually increase learners' awareness of what helps and hampers a consistent orchestration of the various dimensions of their learning processes [3]. However, ways to initiate, train and support orchestration[1] processes and skills have not been systematically investigated. This paper holds that developing reflective behaviours could be trained by exploiting the unique tracking and visualisation facilities of electronic environments. Familiarizing learners to engage with the so-called "learning dashboards" (LDs) may cultivate awareness and coordination of the various personal and contextual dimensions of learning. On an institutional level,

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[1] The cognitive orchestration of learning has been a constant concern of research on Personal Learning Environments (PLEs). However, designing one's learning environment by establishing a network of people, artefacts and tools is quite a high-level skill [4] which differs from the engagement with and the interpretation of a learning dashboard. Hence, convergences and differences between LDs and PLEs would be worth digging.

LDs[2] might contribute to build reflective thinking skills, self-analytic habits [5], ownership of learning and alternatives to one-dimensional assessments into curriculum and classroom practice.

3   Examples of learning dashboards

In order to get acquainted with LDs and to better qualify what they are, a literature review was conducted. It aimed at gathering concrete examples of these displays. The review covered various connected domains: literature about reflection, tracking, visualization of learning traces, self-monitoring skills, adaptive systems, scrutability of learner models, etc. A dozen instances of LDs were collected, allowing to establish early converging traits and variations. To be included in the sample, the cases had to a) be well-documented (a clear picture of the display was a must-have), b) address learning in formal settings[3]. The review yielded a sample of 8[4] instances meeting these conditions[5]. Three of them are now given as concrete illustrations of LDs.

3.1   CALMsystem

Developed in the context of research on intelligent tutoring system, the CALMsystem [8] opened the learner model to students (children aged 10-11 in a science class), allowing them to inspect the representations of their current knowledge level as assessed by the system (area 1 in Fig. 1), and their self-assessment for each of the topics in the subject domain (area 2). The negotiated version also offered learners an opportunity to discuss (area 3) and develop their learner model. Both inspectable and negotiated versions were intended to promote meta-cognitive skills while improving the model's accuracy.

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[2] Other metaphors like "learning cockpits", "control towers" or "control panels" could also be used since they induce similar ideas of personal control, coordination of information, support to decision making. The word "dashboard" is probably the most obvious because there is a dashboard in every car.

[3] This requirement excluded interesting examples of Web 2.0 dashboards (the Apple dashboard for the arrangement of widgets, the dashboard provided by Google for Blogger, etc.). The inventory also left out examples in sport and (serious) games, which yet have a long tradition of dashboard usage.

[4] A first lesson of the literature review was that most of the LDs found in formal learning contexts were usually designed for instructors [6], [7]. The mirroring of tracked data seemed seldom practiced to the direct benefit of students.

[5] The examples found are subsumed under the label "Learning Dashboard". However, their authors do not use this idiom.
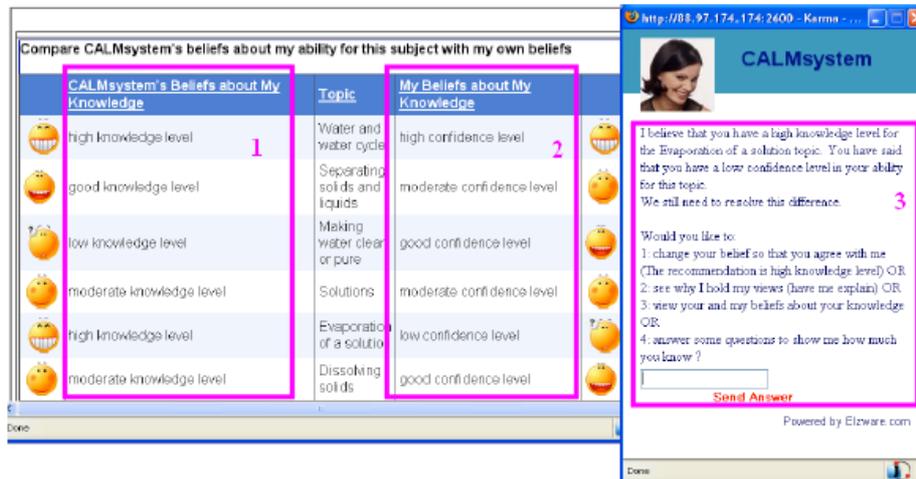
Fig. 1. Dashboard of the CALM system

3.2 Tell Me More

Tell Me More is a commercial language learning software based on series of multi-media and interactive exercises covering the skills involved in learning a language: reading, writing, listening, speaking, vocabulary, and grammar. The Tell Me more learning dashboard displays the lessons (area 1 in Fig. 2), the activities which compose them (area 2), the percentage of completion by lesson (area 3), the percentage of completion by learning activity (blue), the percentage of correct answers for the covered part of the activity (dark blue) (4), the activities denied to the learner (5), the not yet started activities (6), the recommended next activity (7).
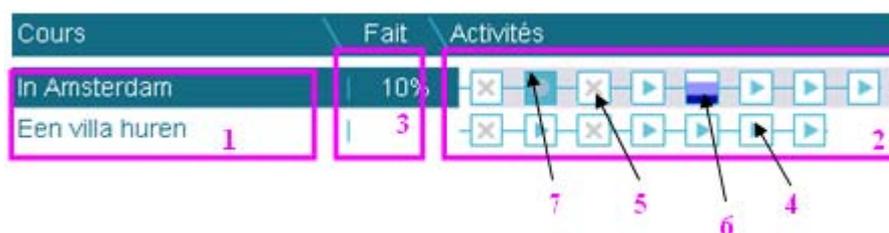

Fig. 2. The Tell Me More Dashboard

3.3 met.a.ware tool

The meta-cognitive tool met.a.ware was designed to support laypersons' Internet search [9]. Learners were requested to paste (area 2 in Fig. 3) the information found on the Internet under one of the six thematic tabs (area 1) and to simultaneously as-

sess and monitor their knowledge acquisition and comprehension via 3 meta-cognitive prompts: assess how well you have comprehended information they pasted (area 3), assess how much you currently know about the specific aspect of cholesterol (area 4), assess how much information you still need to search for regarding this theme (area 5). All ratings were attached permanently to the specific contents and could be retrieved and evolved at all times during future Internet research.
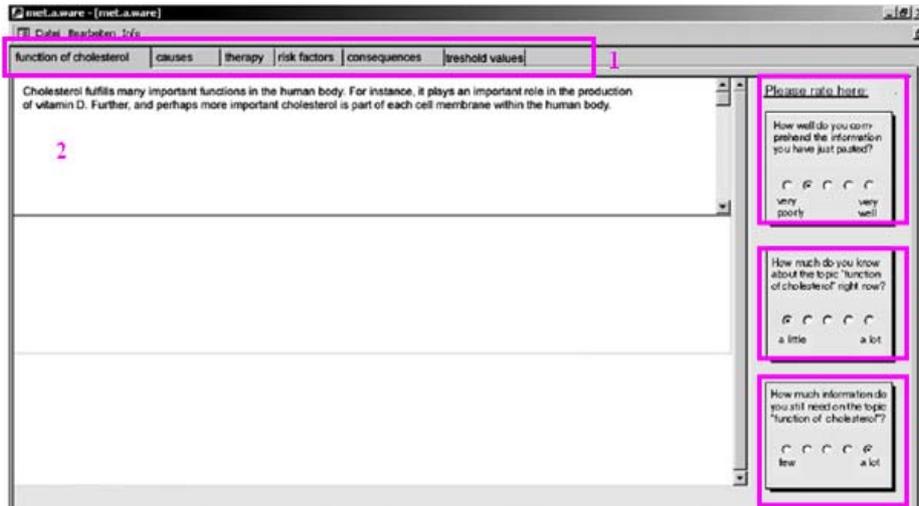
Fig. 2. Dashboard of the met.a.ware tool

4　Key features of learning dashboards

Following the review, common characteristics of learning dashboards were derived from intuitive observation and comparison. LDs:

- add an additional layer of meta-information to learning contents and tasks. This extra layer endows learners with self-appraisal and learning-related indicators [10, 11], gauges, meters, etc.;
- create this additional layer of meta-information by mirroring [12] personal tracked data (feedback by the system to the learner in the Tell Me More dashboard) and/or by recording personal information proactively provided by learners (feedback by the learner to the system in the met.a.ware dashboard);
- display this additional layer of meta-information in a one-stop place [13] from which, in return for an effort of awareness and reflection, students can keep an updated status of their situation in the course and to better control it;
- seem to be designed according to 3 principles: comprehension (following a meta-learning or sense-making ambition), condensation (following a portal orientation) and possibly combination (following a mash-up orientation);
- diversely develop the visual aspects;

- in some instances (CALMsystem's dashboard) offer an option to confront own mirrored data to some kind of yardstick;
- can be arranged at different levels of granularity: single pages (met.a.ware) or whole course (Tell Me More, CALMsystem).

5 Effects of learning dashboards

Based on the shared traits outlined hereunder, it does not seem extravagant at this stage to consider LDs as a distinct family of artefacts for learning. This section speculates about the properly cognitive and instructional effects of these affordances.

5.1 Learning dashboards and meta-learning

Although LDs look quite different across learning situations, they all organize a criss-crossing between the externally imposed context of the learning assignment and the internal context of the individual committed to it. LDs blend the content and the self. They include menus but are more than menus. They are menus + me. This entanglement between formal and personal dimensions, between learning and meta-learning [14], is obtained either through mirroring (the display of personal tracked data), or through externalization (the request made to learners to make an aspect of their learning process visible). In both cases, the relationship between the learning task and the agents becomes somehow personal and tangible in the LDs. Besides the monitoring support, LDs stimulate awareness of own learning experience [15], help to realize what learning is made of and contribute to the development of instructional meta-cognitive knowledge [16]. Such an increased attention to learning behaviours can be a precondition to "learning to learn".

5.2 Learning dashboards and personalisation

The position is taken here that the mesh of cognitive and meta-cognitive landscapes, materialised in LDs, should be explored as a specific way to personalise learning [17]. The personalisation would occur throughout the development of an inner sense of personal accountability and control of the learning material, fed by the presentation to individuals of their learning traces, deliberately produced or not. This rationale possibly offers a counterpoint to the traditional adaptive-systems approach to personalisation which proceeds by automatically individualising the learning path. In contrast, the type of personalisation conveyed by learning dashboards relates to the appropriation by a learner of externally imposed values and standards, which remains a typical attribute of formal education. By providing traces, histories and factual indications of the processes fostering the internalisation of these underlying values, learning dashboards would not only work as regulative supports helping for performance achievement but would also act as a vector of ownership. This way to "personalise" would not necessarily require any individualisation of the learning material but tools supporting the building and the updating of a mental model [18] of the learning situation and of one's own position within it.

5.3 Learning dashboards and reflection

Another striking feature of LDs is that they can be interpreted, from a pedagogical viewpoint, as combinations of reflection amplifiers[6]. Whereas the promotion of reflection is often associated with post-practice methods of experience recapture [20] through portfolios or learning diaries [21] or with the use of dialogue and collaborative activities as levers of thinking [22], LDs enact as reflection amplifiers nested in the study material and offered to individuals during solo studying. By collating contextual and personal information about the task at hand, they provide learners structured opportunities to examine and evaluate their own work, to reflect and appreciate one's position within the learning process, to facilitate the cognitive coordination of information about learning [23].

6 Further work

Whilst some early qualifications of LDs could be achieved in the exploratory work, most assumptions developed in this position paper lack empirical evaluation. Many questions were threw up in need of further investigation: what is the value of mirroring personal information for instruction? what kind of information is relevant to be visualised in LDs and how? What kind of LDs would be built by teachers? Which components of these LDs would be perceived as useful by the learners ? How would they appropriate their learning traces once mirrored to them?

   Some plausible effects of LDs on feeling of personalisation, awareness and consistence of the learning experience, sense of control and ownership, enhanced regulation, quantity and quality of reflection, relatedness (sense of acceptance) to the learning assignment, evolution of the perceived locus of control, level of meta-learning activity, performance were pinpointed but must be disentangled. A critical question touches upon the kind of reasoning expected from a dashboard-supported reflection. While learning dashboards' monitoring and regulation functions seem to fit in with a traditional view of the self-as-performer, the exposure of learning processes that they operate and their potential for sense-making could also put them in the service of the self-as-learner.

   In order to further investigate these questions and to collect empirical evidence about the feasibility and the effectiveness of the approach to personalisation outlined here, additional studies are planned. They will use a prototype of LD (purple frame in Fig. 3) coupled to the Open Educational Resources course "Seks in the theory of evolution" [24].

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[6] An identification of reflection amplifiers available in LDs was performed according to an inventory of reflective techniques [19]. It exhibited that the dashboard of the CALMsystem offered a combination of reflection amplifiers called "Indicators of understanding", "Self-efficacy judgment", "Compare with yardstick" and "Pausing to reflect". The Dashboard of the Tell Me More language platform merged the reflection amplifiers "Room for choice" and "Growing mastery visualization". Met.a.ware federated the reflection amplifiers "Writing on the reading", "Indicators of understanding", "Self-efficacy judgment" and "Eliciting intentions before a task".

The learning dashboard, developed on the eLearning platform Liferay, will mirror basic and easily accessible analytics (time spent on the course or on specific pages, number of page views, number of messages posted in the forum, number of annotations taken) related to clear-cut learning task.

Fig. 3. The experimental course will revolve around a content <u>AND</u> a learning dashboard

6.1 Conclusion

This paper holds that learning dashboards are a new phenomenon in eLearning. By mirroring/recording interaction footprints, these structures for regulative support can quickly show something of an active and personal relation of an individual learner to digital instruction. It is put forward that making visible [25] learners' personal interaction history with a learning task is able to support attention to, reflection on and personalisation of learning.

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