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People, Partnerships and Pedagogies

The "IKEA Model" for pragmatic development of a custom learning analytics dashboard

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Many educators and learning analytics practitioners find themselves in 'learning analytics limbo', with access only to simplistic one-size-fits-all vendor-driven LA dashboards, as they wait for development of possible future LA solutions that would allow customizations that genuinely cater to differences in learning design and educator skills. We present here a simple and pragmatically oriented project that allows individual educators to build and customize an LA solution 'at home' with relatively simple tools. This open-source project takes advantage of data available to an educator via the LMS, and allows them to develop and customize an educator-facing dashboard that meets their teaching and learning design needs. This small-scale solution allows local educators and practitioners to continue to build their data literacy and LA-informed teaching skills, and to contribute to ongoing institutional learning through sharing their experience with institutional LA teams.

Keywords: dashboard, open source, customization, pragmatism, LMS data

Introduction

In the past decade, learning analytics (LA) that developers hope will support teaching or learning have typically been reported via ready-made educator- or learner-facing dashboards (Jivet et al., 2017; Verbert et al., 2020). These authors also describe, however, that a range of challenges hamper effective implementation or uptake of LA dashboards. Primary among these is the reality that in order to be meaningful and useful, LA dashboards "must be highly customizable to cater to educator differences for adopting LMS tools and their overarching pedagogical intent" (Macfadyen & Dawson, 2010, p. 598).

Our institution has a small central Learning Analytics team[1] whose long-term goal is to develop infrastructure to provide meaningful learning data and LA visualizations – likely via dashboards – for learners and educators (J.L., personal communication, 2021); thus far, however, no campus-wide solution has been implemented. Available pilot LA tools are variable in stage of development, usability or reliability, and lack customizability options. Meanwhile, our institutional LMS, Canvas[2], includes an LTI tool – 'New Analytics'[3] – that offers educators some limited data and accompanying visualizations detailing aspects of learner interaction within a Canvas-hosted course site. Unfortunately, we find that the interface and visualizations are not particularly intuitive, and are often not useful for an educator seeking answers to questions about *their* course and students. Worse, they offer identical analytics and visualizations for all courses, regardless of learning design, clearly ignoring the warning by Gašević et al. (2016)11/27/2023 11:18:00 PM (and many others) that "Learning analytics should not promote one size fits all" (p. 68).

As in many educational institutions, educators and practitioners at our university find themselves in an LA limbo, waiting for development of possible future customizable LA solutions, and meanwhile presented with limited, simplistic and non-customizable options. Macfadyen (2017) has previously proposed that a pragmatic approach to LA may be most effective in contexts where an institution is struggling to establish LA solutions at scale. Rather than envisioning Grand Unified Solutions in the face of well understood institutional barriers (Macfadyen, 2022), the pragmatic approach encourages "implementation of a small-scale grassroots analytics agenda that makes use of available tools, data, and skills to tackle local challenges" (Macfadyen, 2017, p. 37).

[1] https://website.web.ca
[2] https://www.instructure.com/
[3] https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-is-New-Analytics/ta-p/73

In this paper, we describe the development and pilot implementation of a grassroots customizable LMS analytics dashboard that offers educators an approach to visualizing LMS analytics meaningful for their course. Our goal is to bridge the gap between the rather limited LA reporting made available by the current institutional LMS, and the more advanced customizable institutional solutions that we hope will eventually be implemented by our institutional LA team.

We call this pragmatic LA solution the "IKEA[4] model", because it offers individual educators with some moderate data skills the capacity to build and customize an LA solution 'at home', with relatively simple tools, to meet the LA needs of their own learning designs and pedagogical plans. This model takes advantage of available data, and give an educator the tools to control data extraction, data exploration, and further analysis.

Development & testing

Development of the IKEA LA model 'flatpack'

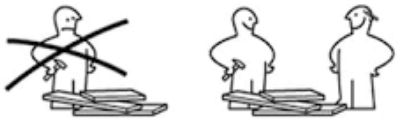

Figure 1. Standard image from an IKEA product assembly manual

Our pilot solution – the flatpack – comprises a set of Python[5] scripts for data extraction and management, a prototype learning data dashboard built using Tableau[6] data visualization software, and detailed step-by-step instructions that facilitate local project setup and maintenance.

In our IKEA model, an educator (or instructional support team member) is first guided to periodically download and store LMS-generated data reports using the Canvas New Analytics interface. (These reports include *Participation* metrics, which count learner engagement with and contributions to interactive course content such as discussion forums, assignments, or wiki pages; and *Pageview* metrics, which represent counts of views of course content, and are drawn from request log data[7]). Next, the user implements a series of Python scripts that allows them to extract and organize additional data about their Canvas-hosted course and its structure, by taking advantage of the Canvas LMS's open application programming interface (API) (the API gives access to course context data: course structure, student assignment and discussion submissions, and more[8]). Finally, a single Python script allows the user to combine downloaded learner activity report data with the API-derived course structure information, and generate an output dataset designed for import into a Tableau dashboard. All Python scripts are available in an open-source GitHub repository[9], and are designed to be run locally by the user (avoiding any concerns about distribution of learner data).

The IKEA Model 'flatpack' also includes a pre-designed but customizable interactive Tableau dashboard into which users can integrate the dataset they have generated (see Fig. 2 for an example page of the dashboard). Tableau data visualization and analysis software is freely available to educators and students, and allows users to interchange and update datasets, if data structure remains the same. We developed the dashboard prototype as online educators who are familiar with LMS analytics and the related LA literature and who are able to articulate the 'kinds of data and visualization' that may be valuable to educators. The dashboard allows an educator to view learner activity across multiple dimensions, including time, content, or course structure. Interactive features allow filtering and viewing of an individual student's activity in comparison with peers. Table 1 offers examples of optional elements of the prototype dashboard, and the kinds of pedagogical or learning design questions each may assist with. Analytics of this kind can allow monitoring of whole group and individual progress, guiding educator engagement and presence; they may flag absent or struggling students, suggesting where educators might usefully support or intervene; or they may offer on-the-fly feedback and retrospective insights into learner activity and engagement that can guide revisions of learning design. (A review of all possible applications of LMS analytics and related research is beyond the scope of this paper, but Sclater (2017) offers a valuable overview). Educators may choose to modify, remove or add elements to the basic dashboard to allow exploration of LA more relevant to their pedagogical goals, or to remove elements that are not relevant to the design of their course.

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[4] https://www.ikea.com/
[5] https://www.python.org/
[6] https://www.tableau.com/
[7] https://community.canvaslms.com/t5/New-Analytics-Users/Analytics-Page-Views-and-Participations/ta-p/262828
[8] https://canvas.instructure.com/doc/api/
[9] https://github.com/saud-learning-services/course-details

Table 1: Examples of elements of the IKEA model LA dashboard

Dashboard elements	Pedagogical relevance
Whole class progress and engagement	
• Chart: Whole-group participations and pageviews per course module • Chart: Pageviews over time • Chart: Participations and pageviews by day of the week • Table: Course discussion participation per topic	• Are students progressing through materials 'on time'/as expected/desired? • Is course activity engagement sustained over time? • Are some course topics attracting more interest than others? Are some course topics being avoided? • Is the group more active on some days than others? What are the implications for course timelines and deadlines? • Are some course discussions attracting more engagement than others? How could discussions be redesigned to promoted greater peer engagement?
Individual learner progress and engagement	
• Chart: Individual student participation and pageviews over time • Charts & tables: Comparison of individual student assignment completion and grade achievement with peers/average	• Which students are not engaging? • Are individual students showing sustained participation? Are individual students showing reduced engagement over time? • Which students are performing comparatively poorly?
Learner grade achievement	
• Charts: Assignment score distributions • Chart: Correlation of student running % grade with pageviews and participations	• Are some assessments more challenging for the group than others? • Does the evidence suggest that greater use of course resources leads to greater success (as measured by grade achievement)?
Engagement with selected course resources	
• Charts & tables: Individual and group usage of course resources - files, datasets, images • Charts & tables: 'Course item activity' (and % of students who access them) • Chart: Usage of selected individual resources over time	• Which course resources are students accessing most? Least? • Are resources considered 'essential' or 'required' being heavily used? Visited by all learners? • Which course pages, assignments, or tools are visited most frequently? Least frequently? • Are learners using resources at relevant and appropriate times in the course timeline?

Test implementation of the dashboard with a teaching team

As recently as 2020, Kaliisa *et al.* noted that "little attention has been given to how teachers perceive and use the insights generated from LA data and visualizations" (p.34), in spite of the growing body of research demonstrating that LA can offer insights into teaching strategies and learning design. Recognizing this gap, and drawing on (Prieto-Alvarez et al., 2018) emphasis on the importance of co-design of learning analytics tools with stakeholders, we piloted our dashboard with a test group of educators leading a multi-institution graduate training course. We assisted them in preparing data, and helped them import their Canvas LMS activity data into the dashboard template. Subsequently, we engaged in multiple rounds of questions, feedback and modification with the instructional team, to develop a dashboard they felt comfortable using and that revealed learner and design insights specific to their course design. Initial consultation revealed areas of difficulty in basic interpretation of data visualizations, and guided some revisions. Later customization refined dashboard relevance – for example, because this course does not make use of graded assignments or final grades, elements showing analysis of grade data were removed. On the other hand, educator interest in learner usage of video and PDF files prompted us to add filters allowed more careful focus on individual use of these materials.

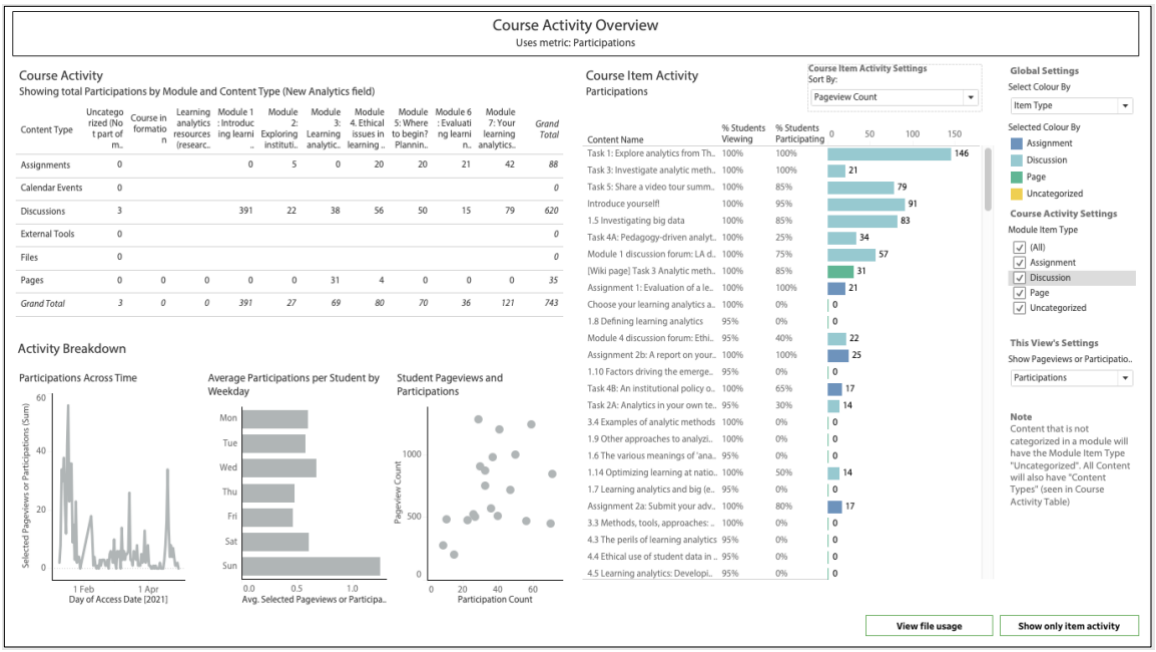

Figure 1. The Course Activity Overview page of the IKEA model Tableau dashboard[10]

Discussion, conclusions and future directions

Institutional LA solutions may offer advantages of scale and technical complexity, but many educators have no access to these, with institutional implementation beholden to the goals and timelines of third-party vendors, or barriers created by the many challenges of institutional LA implementation. We have successfully developed and piloted a DIY system for extracting pedagogically meaningful LMS activity data and visualizing this data in a customizable educator-facing dashboard. This small-scale solution allows local practitioners and educators to continue to contribute to the ever-important learning analytics feedback loop "while we wait". Field testing in different learning design contexts is ongoing.

Working with data is an inescapable requirement for LA development projects. We recognize there may be challenges for some educators if they are not familiar with GitHub, Python or Tableau. Moreover, educator data literacy has long been recognized as a barrier to effective use of educational data (Macfadyen et al., 2014). In this proof-of-concept project, we used the Python programming language because it is regarded as beginner-friendly and is free and open source, and we used Tableau because it is free for educators, powerful, relatively user friendly, and many free learning resources are available. Future development may include improved instructions for those who are intimidated by the technical and analytic task. But we note that local collaborations with data analysts can allow fruitful in-house skill-sharing in the processes of extracting data and customizing dashboards. Our project also does not solve the problem of "black boxing" of LA (Selwyn, 2019), and still depends on data developed and distributed by a third-party vendor (Canvas). However, all transformations of the original data are outlined in the project source code. The open-source nature of this project not only allows the tools to be used freely by other practitioners and educators, but also provides a transparent view of the data transformations.

The field of learning analytics has flourished since the first SoLAR conference in 2011, leading to *some* development and institutional adoption of LA solutions, but also increased recognition of the challenges of implementation at scale. Continuing grassroots, open-source approaches to LA such as development and use of dashboards such as this one can be shared with institutional LA teams to inform development or purchase of future scaled solutions. In this context, use of a tool like Tableau allows rapid prototyping of visualizations and dashboards, keeping the focus on data use for decision-making about teaching and learning, and improvements to the student experience, rather than on the technical complexity of dashboard design.

[10] http://tiny.cc/IKEAmodel

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