Learning Analytics Classroom Hacks: Examples from an Australian University

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This study discusses learning analytics solutions I implemented in three blended undergraduate units over two years. My objective was to gather data on students' engagement with content. The solutions are "hacks" because they resolved the limitations of my university's learning management system. I note how these hacks enabled me to make data-driven iterative changes to unit design/content; in addition, student surveys show an increase in satisfaction with the resources of one of the units. I also identify several issues raised as a result of my adoption of these LA solutions—useful for a general discussion of how LA solutions are conditioned by everyday practice in real settings. In addition to the limitations of some LMS, these issues include the following: the need for multiple metrics and benchmarks for a context-rich understanding of engagement and effective iteration; the difficulty of avoiding university (technical) support for small-scale LA initiatives; the importance of recognizing that ethical grey areas can appear without being anticipated (and be overlooked); the need to accept that some teachers could be ignorant of their university's broader LA initiatives and how this might relate to their own classroom-based teaching goals; and, the importance (and difficulty) of gathering LA data unobtrusively.

Keywords: learning analytics, learning management system, Blackboard, Google, higher education

1 INTRODUCTION

This paper documents my attempt to use learning analytics to answer the following question: are my undergraduate students reading my (blended) unit's online content? "Reading my content" involves, at least, clicking on content, measured with the metric "click through rate" (CTR). More specifically therefore, my question has been: "What is the CTR of my content?" I have reasoned that having this data will help me make educated decisions about changes to content and improvements to my unit.

Solving my problem would seem simple enough, as one benefit of the managerialism underpinning the high rate of adoption of learning management system (LMS) at universities (Beer et. al. 2012), is the collection of student data. Indeed, the collection and analysis of large amounts of data by university systems, such as an LMS, is the purview of learning analytics (LA). As my account demonstrates, however, there are several obstacles to accessing and analyzing learning data on a small-scale at the classroom level.

I encountered these obstacles first-hand, and in what follows I explain my attempts to work around them, developing what I call several "LA hacks." While these hacks provided me with data that gave me an idea of student engagement with my unit's content (thus enabling me to optimize the content), they also identify several issues specific to the implementation of LA solutions at the classroom level.

2 CONTEXT: BIG DATA, SMALL DATA, AND ORCHESTRATION

LA research is typically the purview of Big Data, and Big Data is defined as a "cultural, technological and scholarly phenomenon" that rests on the interplay of technology, analysis and the belief that larger data sets offer a higher form of intelligence (Boyd & Crawford, 2012, p. 663).

Typically, the focus of Big Data in LA has been on "analyzing institutional data captured by an LMS and other institutional information systems" (Campbell et. al., 2007) to track student interaction, identify behavior change and enable early identification of "at risk" students (Colvin et. al., 2015). For example, a student profile might be built from a weighted combination of demographics, online engagement data (e.g. LMS activity) combined with an assessment of aptitude (Colvin et. al., 2015).

Retention, risk and attrition are often listed first as the core areas of LA analysis (see for example Colvin et. al. 2015), but research does identify the value of LA data for understanding student engagement with content and improving curriculum design (Dawkins, 2016; Howell et. al., 2017). Involved is a focus on "small data" in LA, specifically at the classroom level. In this context of LA, it is also important to note that the person best placed to decide on relevant student engagement metrics and evaluate the data is the teacher or course designer (Macfadyen & Dawson, 2010).

It has also been noted that LA research understands how student activity and learning is complex, involving a variety of technologies across different spaces (Martinez-Maldonado, 2016). Moreover, a useful perspective on student learning is "orchestration," which recognizes that classrooms/blended-learning scenarios are variable and complex; educators need to adapt technical resources to enable students to achieve their learning goals; and, technology used in LA environments should be practical, minimalist and flexible—so as to prevent hindering the learning activities (Martinez-Maldonado, 2016).

3 LEARNING ANALYTICS AT AN AUSTRALIAN UNIVERSITY

3.1 The problem

It is accepted in the industry that CTR is a fundamental metric for understanding user engagement with content (Raso, 2016), and so it follows that the CTR of university reading content is a useful metric for understanding student engagement with content.

I encountered several problems in my attempt to measure student engagement with content, and the first was (and is) my ignorance about my university's own Big Data LA initiatives, and what (if any) initiatives could be directly applied to my research question. The perception that "the provision of information about how learning analytics is being used" is "poor or very poor" was shared by most academics in a recent survey (Rogers et. al., 2015). Not knowing where to start regarding the broader LA initiatives of my university, I instead decided to focus my attention on what was easily available to me: my university's LMS (Blackboard) and its "Course Analytics" data.

My next problem was with Blackboard. This LMS does not enable instructors to accurately measure student engagement with content. Blackboard provides student "views" data on a "Content Item" or "Web Links." A Content Item is a container that holds content for a topic of a unit; for example, learning objectives; online lectures; links to readings; and preparation questions. A Web Link is a link

to a page on the internet, and Web Links can only be positioned before or after a Content Item. Data of views of a Content Item or Web Links is problematic for understanding student engagement. Views of a Content Item is only a general metric, and more ideal data would drill down and explain, for example, engagement with readings (CTR). Web Links *do* provide specific engagement data, but their positioning complicates the user-pathway, negatively impacting user engagement. A leading principle of user experience design (UX), defined as the "optimization of a product for effective and enjoyable use" (Lamprecht, 2017), is the "law of pithiness" from Gestalt psychology, which emphasizes that websites that are easy to use and achieve their objectives are clear, ordered and simple (5 psychological principles of high converting websites, n.d.). For example, this can involve less calls to action (CTA), and/or less steps in the conversion funnel—since "one naturally expects fewer users at each step" (Stokes, 2013, p. 504). In terms of measuring student engagement with content on Blackboard, even the most basic application of "pithiness" would involve positioning links, using simple HTML, in a clearly defined pathway within a Content Item. More sophisticated design might place the link beside an image, after a CTA—or even replace the link with a button.

3.2 The hacks

The first hack was my initial attempt to find a way around Blackboard's limitations (noted above) and measure student CTR of unit content in the LMS without disrupting user experience. I was aware of research that has tackled "reading compliance" and, using quizzes and surveys, has found that as little as 20 to 30 percent of students complete weekly readings (Burchfield & Sappington, 2000), but my professional experience led me to CTR as a method for understanding the problem. Also, I wanted to be able to implement the solution in several weeks of the unit so as to enable me to test the CTR of different content formats (for example, text and video and audio) and genres (for example, academic and non-academic text).

I was unsure of the technical capabilities of the LMS, so I contacted the University's Blended Learning Team (BLT) and, after some conversation, the following solution was implemented in two weeks of the unit. I inserted a hyperlink in the weekly Content Item which directed students to an HTML page outside the LMS. On this page, I inserted another hyperlink for downloading a PDF file of the reading content, with the following CTA: "Download the PDF (xMB)." Data from two metrics, page views of the HTML page (via Google Analytics) and downloads of the PDF (via server files), provided me with insights into student engagement with content that week. The data was provided by the BLT since I did not have access to either of the sources. I considered the CTR of the first link to be indicative of students' intention to read the content—in other words, engagement. Also, I was resigned to a decline in CTR between the first and second step of the process given the two-step process complicated the user pathway.

The second hack was another attempt to gather data on student engagement with content without disrupting user experience. This time I also wanted to completely minimize BLT support. Drawing further on my industry experience, this time in mass email optimization, I decided to gather data on student engagement with content by emailing course content to students and tracking the CTR of links in the email. I was aware mass email is typically only opened by a small number of subscribers relative to the number who received the email, and even less subscribers typically click on links (Email marketing benchmarks, n.d.), but I reasoned that comparing CTR to established benchmarks would nevertheless provide me a relative understanding of student engagement with content. My

university uses Blackboard to send student emails, and since I was unsure of the capabilities of Blackboard's email I needed to contact the BLT for advice. I was informed that Blackboard does not provide CTR or open rate data from its emails.

Since this was the case I decided to use a third-party email service provider (ESP) that I had some professional experience using: MailChimp. Naturally I considered whether permission was required from my university. The learning and education portfolio had flagged with me—in a separate context—the need for ethics approval for teaching experiments that involved publishing student data. Since I did not intend to publish any data from the email hack, I decided early on not to submit a formal application. I needed to contact the BLT for assistance with transferring student email addresses from the University's database to MailChimp, and at this stage I was advised that, despite the University having no policies/guidelines preventing me from using a third-party ESP, I needed to confirm that MailChimp could provide the following: adequate "support" (if students needed assistance with the emails); appropriate "data storage" of email data; and "data retention" (in case the email data needed be extracted in the future (Saliba, personal communication, July 29 2015). After contacting MailChimp and reassuring the University that MailChimp could provide all the above, it became apparent that I needed to seek permission from the Academic Registrar. I did so, and the experiment was permitted (since data gathered would be de-identified), but I was nevertheless asked to seek ethics approval for privacy and data management reasons. I contacted Human Ethics and was informed of the following conditions of the experiment: I was permitted to discuss de-identified data from the emails for internal use in the University without ethics approval; and I could publish a discussion of the experiment's methodology without ethics approval (Pangilinan, personal communication, October 9 2015).

Eventually, I built two optimized and responsive emails myself (by modifying MailChimp's templates) with embedded links to the readings. Students were not prompted to expect the special emails. The first email was sent twice, on a Friday and Tuesday, and this was based on the recommended send times suggested by MailChimp (Insights from MailChimp's send time optimization strategy, 2014). Since the Friday send received a higher engagement, the second email was only sent on a Friday. After each send I used data from the ESP's campaign report to analyze open rate and CTR of links to unit content. Furthermore, I optimized content placement in the third send based on CTR data from the first and second sends: I placed the content I considered most important in the position that previously had the highest CTR.

I also designed a third LA hack, again to understand student engagement with content. This time I was interested in an LA solution I could completely implement and manage myself, multiple times throughout the unit. I wanted to completely avoid BLT support and having to seek permission from University stakeholders. This meant that a key requirement was for the hack to be an "off-the-shelf" solution that I could embed myself in the HTML of a Content Item in the LMS. And like the other hacks, I did not want to implement technologies that would disrupt the students' reading pathways on the LMS.

I devised the following solution. I used the weekly topic content to design an online activity—for example, a series of short-answer questions that asked students to apply a concept from the readings. I created these activities using Forms on Google Drive and embedded them within the Content Item and strategically placed on a user pathway. And, I asked students to identify

themselves and their class day and time in a separate field of the form. I reasoned that permission from the University was not required since I did not intend to publish any of the data gathered in the forms (there would be no data identification issue), and since access to the Google Forms was only through the University's password-protected LMS (there was no privacy issue).

I asked students to complete the activities before attending class. I planned to use the students' answers to evaluate their understanding of the reading and before-class preparation; but also, it would be clear when there was no response in the forms who had not attempted the reading at all. I could have implemented a similar activity using a "Discussion Board" in Blackboard, but I choose to use Google because I could position the Forms anywhere in the Content Item. In addition, I could see a summary of responses at a glance with Google's analytics dashboard.

I implemented the third hack three times during the thirteen-week unit. I analyzed the response-rate for each activity relative to the following: the week of the topic (i.e. was it early in the unit, in the middle, at the end; and, was it before an assessment, after an assessment, or in the intra-session break?); the number and complexity of online lectures and readings; the activity's position relative to other content in the Content Item; and finally, in terms of the number and complexity of the questions themselves.

3.3 Results/Discussion

On the one hand, I can argue that the hacks were successful. This is because they each provided me with LA data I could not otherwise have obtained. Moreover, evidence that demonstrates the value of solutions designed to track student engagement with content is an increase in student satisfaction in feedback surveys from 2016 (n=58). In the units reviewed, I implemented several "analytics hacks," including the third initiative noted above (Google Forms). In one of the surveys, all questions in the survey show an increase in student satisfaction since 2015, but of most significance is the marked improvement in scores for "Learning design" (3.5 [2015] vs. 4.4 [2016]) and "Learning resources" (3.3 [2015] vs. 4.2 [2016]).

On the other hand, evaluating the hacks is more complex and warrants further discussion. What were the critical issues and lessons learned from the adoption of these LA solutions at the classroom level? Orchestration is a useful perspective for unpacking this complexity. Orchestration understands that student activity and learning involves multiple stakeholders and a variety of technologies distributed across different spaces. In addition, an orchestration perspective emphasizes that LA technologies should be practical, minimalist and flexible (Dillenbourg, 2013 in Martinez-Maldonado, 2016); and, an orchestration framework involves a notion of iteration; for example, consider the "four stage iterative process": teachers access data; assess data; develop insights from data; and, introduce new insights (Verbert, 2013 in Martinez-Maldonado, 2016, p. 71).

The perspective of orchestration reveals the limitations of some insights offered by the hacks. Each hack was implemented in isolation in a week of a unit (or in different units). As noted in previous LA research, student learning typically involves a variety of tools across a variety of spaces. To better attend to the way students learn, data gathered from a combination of sources could more accurately describe student engagement with content. This said, future research might implement all hacks simultaneously in one week. Of course, using multiple metrics to measure engagement is

best practice in website optimization (Patel, 2016), and while this approach is noted here to emphasize what more comprehensive LA solutions could involve, it also needs to be said that a teacher's workload may not allow for such a detailed, multi-faceted approach in a single week of a unit—and this was certainly the case for me.

Another issue raised by the hacks is the complexity of stakeholder involvement. First, BLT assistance was necessary for the first two hacks, despite my concerted effort to design and implement them myself. This suggests that technical support may be unavoidable for teachers interested in implementing LA solutions, and this may be for the simple reason that university BLTs have exclusive access to data sources. The level of technical support needed can impact on the viability of the LA solutions, and in the case of the first hack I decided not to repeat the hack in other units precisely because the technical support needed added a significant layer of complexity. Second, my dialogue with university stakeholders proved there was some uncertainty about the permissions required for the email hack. Perhaps this "uncertainty" justifies my concern that university approval processes could have a chilling effect on future small-scale LA experiments—noted as crucial for driving innovation in today's technological teaching space (Office for Learning and Teaching, 2015, p. 38).

Human Ethics, of course, is a necessary stakeholder. Ethics in LA is an important area of research and there is not scope in the current study to engage with this issue in detail. The complexity added by approval processes, such as ethics, to small-scale LA projects needs to be noted; but also, discussion of ethics approval processes raises another issue relevant here: ethics grey areas in research and the question of when ethics approval is necessary. The third hack illustrates one such grey area. I reasoned that ethics approval was not necessary for my implementation of Google Forms in several weeks of the unit, but I realize now that future iterations of this hack should consider the (potential) privacy implications regarding students' sharing of information on a collaborative Google Form, as well as (potential) data-retention issues specific to Google Drive. This hack identifies how ethical grey areas can appear without being anticipated—and can easily be overlooked—in rapidly advancing technological teaching spaces.

The teacher is another crucial stakeholder in LA orchestration, and my role in the above hacks identifies several important issues. The biggest issue was my ignorance about the LA initiatives operating at my university and their potential relevance for my own teaching practice. Related is my competency, and confidence, with LA technologies—and teachers' concerns with the technical knowledge required for LA solutions has been noted in previous research (Rogers et. al., 2015). In my case, I have some basic expertise from previous professional work that has helped me design and implement the hacks noted above, and recognize their limitations. But this may be a level of technical expertise missing for many teaching academics at university.

In terms of orchestration's emphasis on practical, minimalist and flexible technology, the hacks were successful in so far as they were easily embedded *within* the Content Items. But did these hacks enable a positive user experience? It needs to be acknowledged that in terms of the first hack, any positive effect for user experience of embedding the link in the Content Item was probably cancelled by the two-step solution implemented. In addition, this hack required that content was PDF format, which limits the resources that can be used and has been noted in industry research as a disliked format since users would rather not download content (Nielsen, 2001). In addition, the second hack was hampered by characteristically low open rates and CTR of mass email (Email marketing

benchmarks, n.d.), and the third hack was another example of a two-step process where students were taken out of the LMS. In sum, I acknowledge how important it is to implement "minimalist" LA solutions that do not disrupt the user experience, but these examples demonstrate how difficult this can be to achieve.

In terms of iteration in orchestration, minimal changes were made to content because of the hacks, making the usefulness of the hacks limited. One reason iteration was limited is the lack of benchmark data against which to measure engagement. While email benchmark data exists for open rate and CTR (Email marketing benchmarks, n.d.), I am unaware of benchmark data for CTR in an LMS, or engagement in an online activity using Google Forms. As a result, the optimization noted above was largely guesswork. Another reason iteration was limited is a direct result of the design of university units themselves. In an ideal scenario, a teacher would change content based on engagement data; but it is typically the case that course content is decided months in advance, approved by directors of academic programs, and is unable to be changed "on the fly." In any case, it is unreasonable to notify students about changes to content less than a week in advance, which also makes last minute changes based on CTR data unrealistic. It is clear, therefore, that the iterative adoption of LA solutions can be difficult to effectively achieve in a university classroom context.

Finally, a critique of the hacks reveals the importance in classroom-based adoption of LA technologies of understanding the context of data (Boyd & Crawford, 2012). It needs to be noted that CTR is not necessarily reflective of reading since many internet users, students included, click—and even share—content without reading it. Also, CTR can vary according to a user's opinion of where the link is taking them, as well as the wording of the link text, and the placement of the text. Put simply, each of these factors constitute the context of the data and need to be considered and accounted for when designing and evaluating LA solutions.

4 CONCLUSIONS

This study documents my implementation of LA classroom "hacks," designed to provide me with data (student engagement with content) I could not obtain from my LMS. I reasoned that accessing this data could help me better understand student engagement and improve the design and content of my units.

The hacks themselves illustrate a range of ways engagement data can be gathered—using free, "off-the-shelf" third-party technologies. Importantly too, the processes involved in designing and implementing the hacks identify key issues in the orchestration of LA solutions at the classroom level. Most salient are: the need for multiple metrics and benchmarks for a context-rich understanding of engagement and effective iteration; the difficulty of avoiding university (technical) support for small-scale LA initiatives; the importance of recognizing that ethical grey areas can appear without being anticipated, and be overlooked; the need to accept that some teachers could be ignorant of their university's broader LA initiatives and how this might relate to their own classroom-based teaching goals; and, the importance (and difficulty) of gathering LA data unobtrusively.

There are clearly issues involved in the adoption of LA and orchestration solutions at the classroom level and these need to be resolved, but we should nevertheless bear in mind the opportunities

afforded by the internet and its data traces, for us (teachers) to roll up our sleeves and cobble together another perspective on our students.

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