

Learning Analytics Dashboard Research Has Neglected Diversity, Equity and Inclusion

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ABSTRACT

Learning analytic dashboards (LADs) have become more prevalent in higher education to help students, faculty, and staff make data-informed decisions. Despite extensive research on the design and usability of LADs, few studies have examined them in relation to issues of diversity, equity, and inclusion. We conducted a critical literature review to address three research questions: How does LAD research contribute to improving diversity, equity, and inclusion? How might LADs contribute to maintaining or exacerbating inequitable outcomes? And what future opportunities exist in this research space? Our review showed little use of LADs to address or improve issues of diversity, equity, and inclusion in the literature thus far. We argue that excluding these issues from LAD research is not an isolated oversight and it risks reinforcing existing inequities within the higher education system. We argue that LADs can be designed, researched, and deployed intentionally to advance equitable outcomes and help dismantle inequities in education. We highlight opportunities for future LAD research to address issues of diversity, equity, and inclusion.

Author Keywords

Learning Analytic Dashboards; Diversity; Equity; Inclusion; Literature Review

CCS Concepts

•**Applied computing** → Learning management systems; **Education**; •**Human-centered computing** → **Visualization design and evaluation methods**;

INTRODUCTION

Learning analytic dashboards (LADs) are visualization systems that display indicators of student learning processes across many curricular and co-curricular contexts [23]. Dashboards are increasingly used by various stakeholders in higher education, including for students to monitor their progress in classes [7], faculty to monitor student learning and get feedback on their teaching practices [8], advisors to aid in

student decision-making [13], and university administrators to manage and support students, instructors, and staff [11]. Most LADs are designed to scale across students, courses, and organizational units, which has facilitated their deployment across universities to reach growing numbers of students and instructors [19, 2]. In particular, providers of major learning management systems (LMS), such as Blackboard and Canvas, have added dashboards as a novel feature available to students and instructors [14, 15, 5, 6]. Given the pervasive use of these LMS, with over 100 million Blackboard users [4] and over 30 million Canvas users [16] in colleges worldwide, this product change alone likely exposed millions of students and instructors to LADs. While these academic environments continue to grapple with inequities, the sudden widespread availability of LADs raises critical questions about how LADs are designed and used.

With LADS quickly advancing as the status quo, incorporating new features like predictive analytics, and aiming to help those who make data-informed decisions, like students and faculty, make sense of available data. This is an opportune time to examine the state of LAD research, especially in light of recent calls to address issues of social inequity in learning analytics [9, 24]. We conducted a critical literature review to understand how to improve diversity, equity, and inclusion through LAD research and to highlight opportunities for future work in this area. This critical literature review will add depth to the LAD literature by addressing the following research questions:

RQ1. How does LAD research contribute to improving diversity, equity, and inclusion?

RQ2. How might LADs contribute to maintaining or exacerbating inequitable outcomes?

RQ3. What are the future opportunities to improve diversity, equity, and inclusion in Learning Analytic Dashboard research?

METHOD

Following Paré and colleagues' [20] definition of a critical review, we sought to "reveal weaknesses, contradictions, controversies, or inconsistencies" (p. 189) and "to highlight problems, discrepancies or areas in which the existing knowledge about a topic is untrustworthy" (p. 189). Unlike systematic and comprehensive reviews, a critical review uses a sample of papers instead of attempting to review all literature in an area. We approached this review from a critical constructionist

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Table 1. Number of the articles considered in this critical literature review by publication venue.

Publication Venue	# of Articles	Publication Venue	# of Articles
Computers & Education	4	Educational Technology and Society	1
International Conference on Learning Analytics & Knowledge	4	Higher Education	1
Assessment & Evaluation in Higher Education	3	Innovations in Education and Teaching International	1
CHI Conference on Human Factors in Computing Systems	3	International Conference on Information and Communication Technology (ICICT)	1
IEEE Transactions on Learning Technologies	3	International Conference on Learning and Collaboration Technologies	1
Journal of Learning Analytics	3	International Journal of Emerging Technologies in Learning (iJET)	1
British Journal of Educational Technology	2	Journal of Computing in Higher Education	1
Computers in Human Behavior	2	Journal of Educational Technology Systems	1
Learning @ Scale	2	Journal of Research in Innovative Teaching & Learning	1
Technology, Knowledge and Learning	2	Teaching in Higher Education	1
Asia Pacific Education Review	1	The Internet and Higher Education	1

epistemology, wherein we searched for alternative ways of knowing and expose unrepresentative assumptions that have been embedded into knowledge [17].

Given that we set out to understand how LADs were being used in higher education to improve student learning outcomes, we initially chose the following inclusion criteria for articles in our review: dashboards (a) with a student component (includes both student and non-student facing LADs) that are (b) used in higher education (within and outside of the classroom) and (c) used empirical research methods. We used Google Scholar to find literature, starting with a search for "higher education dashboard." To validate this search phrase, we reviewed the abstracts of the first five papers to see if the papers matched our inclusion criteria. This confirmed that our search terms were appropriate. Next, we recorded the metadata (title, journal, year, etc.) for the first 20 papers returned by the search to make the papers retrievable for later reading. One by one, we read the abstracts and sorted the papers into three folders: Criteria Match, Literature Review, and Non-Criteria Match. Papers matching the inclusion criteria were sorted into the Criteria Match folder. Existing Literature reviews of LADs were placed into the Literature Review folder. All remaining papers were assigned to the Non-Criteria Match folder.

We skimmed each Criteria Match paper, taking notes on the purpose of the study and how the paper did or did not address diversity, equity, and inclusion issues. We also performed a backward citation search by keeping a running list of papers cited in the review papers which appeared to be potential matches for our inclusion criteria. The existing literature reviews were skimmed for a backward citation search also. Using the new list of papers, we once again recorded the citations of the papers and sorted them into the appropriate folders. To ensure saturation of the sample papers, we conducted a forward citation search on the papers in the Literature Review and Criteria Match folders. This forward citation search was conducted by searching Google Scholar with the title of the

paper and reviewing the "Cited by" papers. Unlike the previous steps where each paper was returned and sorted, we read the abstracts of each potential new paper and only kept the papers that were a criteria match.

Lastly, to further ensure a saturated sample, we searched for the keyword "dashboard" in the conference proceedings of *Learning at Scale* and *Learning Analytics and Knowledge* and all issues of the *Journal of Learning Analytics*. These three publication venues were chosen for this final pass because they publish LAD research and represent our targeted audience. After all searches had been completed, we arrived at a final sample of 40 papers. Table 1 displays the publication outlets for the papers included in this review.

FINDINGS AND DISCUSSION

Current LAD Research for Diversity, Equity, and Inclusion
 Researchers have made substantial efforts toward advancing our understanding of how to develop LADs in higher education. We see an opportunity to build upon this body of knowledge and to use LADs to strategically improve diversity, equity, and inclusion in higher education. When we posed RQ1, we hoped to find and report on LAD research that focused on improving diversity, equity, and inclusion. However, only one paper in our sample addresses these issues in the design of their dashboards. Foster and Siddle [10] initially considered the use of demographic data, but then removed this information after discussions with their university community raised concerns that these indicators could stereotype students. While critically examining demographics can foster additional concerns, if researchers do not pursue opportunities for deeper investigation we risk allowing existing inequities to proliferate unfettered. By beginning to tackle these challenging issues, researchers can model how to embed meaningful use of racial data into dashboards. For instance, Aguilar and colleagues [1] studied a summer bridge program with a high proportion of underrepresented minorities, but they missed an opportunity to examine or discuss how race could have been embedded

into their dashboard. At a time when institutions are grappling with how to identify and reduce systematic inequities on their campuses, it is a blemish on this particular research community that we are not taking up the call to study how to design dashboards that can advance this goal.

Taking advantage of the current momentum to advance social justice, we encourage more LAD research to focus on this important topic or at least critically engage with the implications of LADs for diversity, equity, and inclusion. We recommend that researchers interested in creating dashboards that center the experiences of historically marginalized students refer to the Equity Scoreboard project [12, 3]. The project "combines a theoretical framework with practical strategies to initiate institutional change that will lead to equitable outcomes for students of color" [25] and at the end of the process a dashboard is created to show context-specific metrics for long-term evaluation of initiatives. While this project concentrates on macro-level institutional data, these practices can be adapted to applications using course-level granular data too.

Maintaining Systemic Inequities in LAD Research

In order to answer RQ2, we need to understand how LAD research can be leveraged to improve diversity, equity, and inclusion in higher education. In recent years, a common institutional strategy to address social inequity has been to create Diversity, Equity, and Inclusion initiatives [21]. The offices that house them are often siloed and advance a narrative that diversity, equity, and inclusion work is only done by individuals working on initiatives created in these offices. This problem is further complicated by the never ending cycle of research to practice. This cycle has been broken down into three contexts: Production, Communication, and Use of research [18]. The gap between those that conduct research and those that enact the research into practice has led to maintaining and exacerbating inequities in higher education.

LAD research is special in that much of the research conducted interweaves multiple contexts, uniquely placing the research team in a position to affect not only the research design, but also their use of tools in educational contexts. Insofar as diversity, equity, and inclusion initiatives should be carried out across all dimensions of educational practices and research, and not siloed to diversity, equity, and inclusion offices, it is our hope that researchers will critically examine their research to understand how their research practices create and maintain inequities.

Future Work for Diversity, Equity, and Inclusion LADs

Lastly, we want to discuss findings for RQ3 by identifying research opportunities for LAD research to improve diversity, equity, and inclusion in higher education. We believe it is the responsibility of all communities across education to think about issues of diversity, equity, and inclusion and how dashboards (and dashboard research) can work to highlight these issues in all contexts. LADs are a powerful tool with the potential to highlight and assess equity and inclusion programs. However, more development and research about *how* to use LADs for these purposes is needed first. It is not enough to just identify data patterns that highlight at-risk students; users of

LADs must be equipped to critically evaluate the information and intentionally apply it.

Prinsloo, Slade, and Khalil [22] noted that many research studies label students as helpless vessels waiting for universities to tell them the correct path for success, while also underestimating the structural systems and contexts students have had to overcome to actually attend their university. Using this logic, researchers developing LADs have the responsibility to not merely highlight patterns in data, but to illuminate the socio-technical contexts where so many achievement gaps have persisted. In order for LADs to achieve the goals of improving diversity, equity, and inclusion, they need to display both real-time data to evaluate new diversity, equity, and inclusion initiatives along with longitudinal data to understand the historical context in which the LADs are embedded.

CONCLUSION

We set out to understand the potential impact of LADs to improve diversity, equity, and inclusion in higher education. Through our critical literature review, we identified potential directions for LAD research to advance this goal in the future. This literature review is not exhaustive of the field, but it thoroughly examined a smaller set of papers through a critical lens. The findings from this literature review can aid researchers looking to use LADs to improve diversity, equity, and inclusion outcomes at scale. We will provide a detailed findings about the themes which we identified through this review in future work.

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