Reimagining the Role of Learning Analytics to Improve Student Learning Experience: Lessons from a Blended Class

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Abstract

To meet the needs of Generation Z, universities nationwide are creating a more personalized, student-centered and technology-enabled learning ecosystems. The convergence of technology and student expectations has led to redefined teaching models using learning analytics to optimize learning and the environments in which it occurs. The paper will present a case study that incorporates learning analytics data in a blended class and explore the advantages and challenges in the use of learning analytics in the course. Results from the case study indicate that there were small gains in grade point average, student engagement and overall student satisfaction but challenges persisted for both students and faculty. A practical framework to reimagine the role of learning analytics in higher education to create a student-centered learning ecosystem is presented along with recommendations on how faculty and institutions could enhance technology enhanced student outcomes.

Key Words: learning analytics, technology-enabled teaching, blended classroom learning, student success and outcomes
1. Introduction

For the next decade, the bulk of students attending universities will be from Generation Z, born between 1995 – 2009, and this digitally minded and socially connected generation is dependent on technology to accomplish their everyday tasks. Despite Generation Z growing up with technology and actively connecting with others online, they still value face-to-face interactions alongside digitally facilitated ones. To meet the needs of students, universities nationwide are creating a more personalized, student-centered and technology enabled learning experience. Since the learning characteristics of Generation Z as well as millennials are more adept at technology and expect technology to be part of their social learning experience, universities are responding with changes to their teaching delivery and student learning ecosystems (Kozinsky, 2017).

As higher education institutions continue their digital transformation journeys and look to appeal to students’ preferences for adaptive, engaging learning experiences particularly when it comes to Generation Z students, faculty and administrators need to meet students where they live: online. By using resources with Artificial Intelligence (AI) components including AI teaching assistants, in-person courses will start to be used more frequently across campuses in the coming years. Learning ecosystems are becoming more advanced and robust, thanks to the advancement of AI technology. Along with enhancing learning both inside and outside of the classroom, these tools also increase students’ efficiency, as they are available whenever and wherever students need them (Ullman, 2019).

Analytics in higher education has many applications, ranging from the use of data to improve business operations often referred to as institutional analytics to uses that directly impact and assist both the learner and the learning process, referred to as learning analytics (ECAR-ANALYTICS Working Group, 2015). Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs (First International Conference on Learning Analytics and Knowledge, 2011). Learning analytics can assist students and faculty by providing information that enhances learning and teaching by supporting adaptation in the practices and processes of the course to improve learning outcomes and feedback loop.

2. Purpose and Objectives

The purpose of the exploratory case study is to determine whether learning analytics in a blended course at a public university had an impact on student learning success specifically the following objectives:

- Key factors to consider when selecting a course for learning analytics;
• Evaluating learning analytics data to map students’ progression and successful completion;
• Utilizing learning analytics metrics and dashboards to close the feedback loop;
• Determining the challenges in the use of learning analytics; and
• Lessons learned and recommendations to scale up and replicate results of the case study.

3. Review of Literature

3.1 Learning Analytics in Higher Education

Learning analytics is one application of personalized learning and teaching that offers pedagogy, curriculum, and learning environments to meet the individual needs of a student. It can improve learning practices by transforming the ways we support learning processes (Viberg, Hatakka, Balter & Mavroudi, 2018). It is also one of many examples of the profound impact that learning analytics is having on higher education due to the accessibility and understanding of big data (Burnham, 2018). A growing number of institutions, faculty, and administrators now see the value of better leveraging the enormous collection of data from their learning management system.

The next generation digital learning environment (NGDLE) is conceived as an ecosystem—a learning environment consisting of learning tools and components that adhere to common standards. While the learning management system (LMS) is valuable for handling the administrative duties of a course, it is less successful in effectively facilitating learning, especially as higher education actively develops new course models and pedagogical approaches (Educause Learning Initiative, 2015). The LMS data often sit unused on servers and databases, while it has the potential to advance a range of practical and theoretical needs for a variety of potential stakeholders. Learning analytics, as well as related institutional analytics, explores the relationship between learning system usage with a range of outcomes that can positively impact students, faculty, administrators, researchers, and learning system designers (Collins, 2018).

Organizations have used big data for decades making data-driven decision based on analytics however, higher education has not yet capitalized on the insights and benefits big data can provide because they look at data differently. While businesses use data to maximize profits, the primary goal of learning analytics is to improve teaching and learning although it is used to attract students and promote curricular offerings (Burnham, 2018).

3.2 Uncovering Learning Analytics’ Potential

Higher education institutions collect hundreds of thousands of data points every day from online courses, online assessments and learning management systems. They report data to local, state, and national governments and education systems, and to students, faculty and universities.
Because of the access to all these data that universities did not have before, the field of learning analytics is growing. However, all these data are useless unless institutions can unlock and leverage their potential. Universities might want to analyze data to detect patterns in student retention or drop out to improve a program’s success or analyze data from a particular course to improve student retention and success in the course.

Wong (2017) summarized empirical data and case studies of learning analytics showing the benefits of learning analytics to facilitate evaluation of the effectiveness of pedagogies and instructional designs for improvement, and help to monitor closely students’ learning and persistence, predict students’ performance, detect undesirable learning behaviors and emotional states, and identify students at risk, take prompt follow-up action and provide proper assistance to students. It can also provide students with insightful data about their learning characteristics and patterns, which can make their learning experiences more personal and engaging and promote self-reflection and improvement.

Viberg, et.al, (2018) found little evidence that learning analytics improved learning outcomes or were widely used but did support learning and teaching. Universities might want to analyze the preparedness of a student by analyzing student’s success or dropout rates to identify at-risk students. If they are missing a pre-requisite course, the faculty may consider allowing the student to concurrently register for the course. This type of adaptive and personalized learning becomes much more realistic when student data are analyzed thoroughly (Burnham, 2018; Collins, 2016).

3.3 Benefits to Students

Learning analytics have the potential to provide students with more detailed information about their performance. For example, learning analytics can help students see and reflect on their learning behavior in a constructive way to help them manage their progress toward their learning goals. Similar to a “Fitbit,” a student-directed analytics framework has the potential to help students monitor their behavioral patterns, track changes over time, and compare their progress toward learning goals against both absolute and normative standards based on peer data (Collins, 2018).

3.4 Benefits to Faculty

According to Collins (2018), by utilizing learning analytics data, faculty can better monitor student progress and understand how course resources are being used. These are common applications of simple analytics and tracking systems often embedded in LMS systems. Analytics also help answer less obvious questions for example, how does variation in the use of course resources influence learning outcomes and whether student resource utilization relates to learning outcomes data, including grades? Analytics will also allow faculty to reflect on their own performance and seek better evidence for improving instructional quality.
3.5 Benefits to Administrators

Learning analytics allows administrators and other decision makers to see how well their programs are performing. In addition to the potential need to drill down into specific faculty, students, and course-level data, learning analytics can allow for meaningful comparisons across courses to shape program offerings (Collins, 2018).

According to Arroway, Morgan, O’Keefe, and Yanosky (2016), learning analytics has three levels that look and function differently, and each has its associated stakeholders and actors. These levels are student, faculty, and administrator. The way learning analytics practices and technologies will evolve and develop will vary by level, so we need to think about what the future means for each of these.

3.6 Future of Learning Analytics

Learning analytics technologies currently rely quite heavily on human intervention at the data-gathering and analysis stage and on relatively limited sources of data. In the future, there will be an increase in automation of learning analytics, data capture, reporting, and even ameliorative action in response to problems identified by the data. Also, data from a greater variety of sources will be used within learning analytics applications.

Future learning analytics will also rely more heavily on and feed into cross-institutional repositories of analytics data in order to create a more robust benchmarking and predictive process. It will emphasize more advanced and personalized dashboards for students and faculty that will allow them to reflect on not just grades and other kinds of raw data but also on more qualitative insights such as how the content of their work (or in the case of faculty, on the work of the class) scores on meta kinds of competencies such as verbal communication, teamwork, critical thinking, or creativity. Learning analytics tools will also show knowledge or content relationships between different courses or parts of courses and use social network analysis to show students’ performance on a range of different measures, not just grades, relative to the rest of the class (Arroway, et. al, 2016).

4. Study Framework

The study framework is based on Clow’s (2012) articulation of Learning Analytics Cycle that is a sophisticated, detailed and theoretically grounded model based on the five-step model of learning analytics and educational theories. This cycle conceptualizes successful learning analytics work as four linked steps: 1) generation of learners’ data, 2) that are used to produce metrics, analytics or dashboards, 3) the key step is ‘closing the loop’ by feeding data back to learners through one or more interventions 4) to place learning analytics practice on a base of established learning theory, and 5) draw several implications from this theory for the improvement of learning analytics projects. These include speeding up or shortening the cycle.
so feedback happens more quickly, and widening the audience for feedback (in particular, considering learners and faculty as audiences for analytics) so that it can have a larger impact.

5. Data

The data were collected from a Personal Finance course, an upper-division course that fulfills major and service course requirements at California State University, Sacramento. The course, popular with and taken by students majoring in Business Finance, Economics, Family Studies, Gerontology, Education, Communication Studies, Criminal Justice, Political Science, Health Science and Natural Sciences, has high enrollments of approximately 90 – 120 students per semester. Because of high course demand and large class sizes, a decision was made to offer the course as a blended class for the past several semesters and more recently as a hybrid class where students meet face-to-face once a week and complete online work during the other class session.

Students in the hybrid classroom use an e-text that incorporates multiple financial and hands-on learning tools that students are assigned for each chapter. Students are also expected to come to class having read the chapter or completed the learning tools so that they are able to fully engage in class. Weekly quizzes, midterms exams and finals are taken on-line, and students have the flexibility of taking it at any time on the day the exam is scheduled. The Learning Management System used at the university is Canvas, a platform that is easy to navigate by traditional as well as non-traditional students. There are time limits for the quizzes and exams but no proctoring is done as the goal of these exams is to evaluate students’ understanding of financial concepts and their applications and not just rote memorization. Students are permitted to refer to their e-text or notes during the exams but are asked to refrain from taking it with other classmates, as a group activity.

While the class is taught in a large lecture hall, the space and design of furniture allows for small group interactions and learning. The role of faculty is more of a facilitator and students participate actively and engage throughout the class period. Students are encouraged to ask questions individually or in small groups during class, on the e-platform or by coming to office hours. After the initial reticence wears off in the first few weeks of the semester, students become more comfortable posting comments, reaching out to other classmates in class or by Canvas mail where all enrolled student email addresses are readily available. Learning analytics data and evaluations using formative and summative assessments are utilized to determine if the current pedagogical model is achieving student learning outcomes and experiences of students are enriching their learning.

The support for faculty endeavors in a blended classroom teaching environment was backed by the university that offers academic technology support through the Division of Information Resources and Technology where Canvas, the learning management system used on campus,
video capture, online exams and assessment are supported. IRT also provides on-line and in-
person student support and maintains several large computer labs on campus. Working with
textbook publisher, Wiley, support for e-textbook tools and resources was worked out. The
Center for Teaching and Learning offers a Summer Teaching Institute where faculty, selected
in a competitive process, are provided with a tablet or laptop to work on innovative data
informed course redesign. The center also offers ongoing faculty professional development
technology series especially for online teaching methodologies, Quality Matters in online and
hybrid courses and other related topics. Institutional resources and support have been in place
for nearly two decades but academic leadership has not yet come up with a more integrated
model to incentivize innovation in classroom teaching, course redesign and use of data to drive
student success. Lack of systematic funding also leads to sporadic active learning classroom
development with faculty having to navigate on their own in finding academic support and
motivation.

6. Findings

The use of learning analytics provided the faculty member with several significant insights
of learning and teaching and helped students gain measurable success in the blended course.
The key to developing this blended classroom learning is to create a customized and enhanced
learning experience for students. The blended or active learning modality was incorporated last
fall semester, so the sample size was approximately 100 students enrolled in the course.

The syllabus was posted to Canvas three weeks in advance, so students who had registered
for the course had the ability to review and familiarize themselves with the e-text, course
objectives, learning outcomes, weekly assignment submissions and other evaluation
requirements. Additionally, the e-text was made available from the publisher for a discounted
price and students had the ability to purchase it ahead of the start of the semester.

A few significant differences were noted from the previous semesters in that the course is
well attended each week and student interactions with their peers and the professor was
relatively high. Comments and questions posed during the face-to-face sessions indicate that
students have read the materials and have attempted to understand the concepts, formulas and
theories within the chapter. Another helpful tool that support student learning are the hands-on
mathematical formulas and exercises that are imbedded within the chapter assignments. Many
students complete the exercises before class and have the opportunity to get clarification or
their questions answered while interacting in class. Weekly assignments and quizzes, midterm
and final exams enable the students and the professor to track progress and extend any
additional help needed. The grade distributions in the course, compared to previous semesters,
indicate that the grade point average increased by 5 percentage points, from 77% to 82% or a
grade of “C+” to a “B-”.

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Learning analytics data retrieved from the e-text platform metrics and dashboards indicate that students spent on average 14 hours and 24 minutes while the top 10% of the class spent 61 hours 32 minutes reviewing the e-text, completing learning tools and attempting practice questions for each chapter. As shown in Figure 1, student engagement in the course ranged from a high of 100 hours to less than 2 hours with more than two-thirds of the class having spent 14 hours or less. The average questions attempted for all chapters was 172 while the top 10% of the class attempted 672 questions. Questions attempted would not be meaningful without looking into the performance. The average question performance was 60% but the top 10% of class was 98%. Figure 2 shows the number of questions attempted by students by time spent in the course. The one student who spent 100 hours attempted 620 questions followed by 354 and 231 questions posed by students who spent 20 – 40 hours and 42 – 52 hours respectively. Questions and comments posted by students on the e-text platform and in discussion groups on Canvas are other indicators of student engagement.
Learning analytics and summative assessments conducted during the semester showed that the students, for the most part, were very satisfied with the course and commented that they learned important concepts, which were presented in an easy-to-understand format. Students were pleased with the accessibility and flexibility that the e-textbook, online learning tools and online exams and would like to see them replicated in other courses. Students also commented that the weekly quizzes and the hands-on learning tools were very instrumental in their learning and course success.

Based on comments from formative student evaluations received mid-semester, course activities and format were adjusted to enable student progress and success. The grades earned in the course and end of semester summative course evaluations indicate that students, for the most part, were successful in navigating the course and had a positive learning experience. Open loop feedback to provide quick interventions without considering the output were provided on an ongoing basis. Additionally, closed loop feedback was used to provide direction and insights to students and make necessary adjustments to course objectives, learning outcomes and modalities, assignments and evaluations.

One of the challenges to embed the use of learning analytics is the time commitment needed to integrate the analytical tools with the learning management system, data quality concerns and developing the right set of metrics that are essential for student success. Since learning analytics are not yet mainstream, faculty have to plan individual course deployment on their
own. Although there is help available from Information Resources and Technology staff, it is a major time commitment to plan ahead of the onset of instruction. While administrators and university leadership are supportive of the overall concept of using learning analytics for student success, they are not adept in coming up with a systematic plan to implement it on a larger scale. Faculty while maintaining an openness to leaning analytics are not willing to make the investment in deploying it in their own courses indicating a culture of resistance or an inability to operationalize the overall concept.

Learning analytics outcomes are not easy to evaluate because of the lag time required to measure the results of analytics-triggered interventions. Although some quick wins resulted in the course from implementing learning analytics systems and programs, the university, as a whole, will need time to assess the impact of learning analytics initiatives as students progress through courses and programs. The areas with the most room for improvement are technologies and information systems that support student success initiatives, and analytics maturity specifically related to student success.

The recommendation to scale up and replicate results is not a one-size-fits-all as programs and courses need to evaluate how learning analytics can best meet the needs of students in their journey to successfully complete their degrees. The challenge is to utilize learning analytics tools that are actionable to help faculty, students and universities to better understand the support their students’ needs. What is important to take away is that just as students should have access to their academic progress, faculty and administrators should be able to tap into learning analytics to improve student success.

7. Discussion

The success of using learning analytics in a blended classroom was predicated on the following:

1. Setting clear learning objectives and student expectations. It was important for the course syllabus and information to clearly articulate the learning objectives and student expectations because many students assume that online class meetings are easy, flexible needing minimal effort to be successful. While there is some flexibility in learning, students do not realize that they have to be motivated and self-directed in order to be successful in blended classes. They also have to be familiar with technology and must have the ability to navigate that e-text and supplemental materials to take full advantage of the learning experience. The weekly assignments and quizzes help students stay on track and the use of discussion board in Canvas allows students to discuss complex concepts in groups. The university’s Academic and Creative Technology Services also provide onboarding workshops to help students learn the skills including academic strategies, time management and self-discipline.
2. Creating a sense of community among students. Students have to post online comments and take part in discussions on Canvas as well as on the e-text platform for each chapter even though they are considered informal learning experiences. This created opportunities for students to connect with each other and at the end of the semester, some students commented that they felt that having other students validate their questions and concerns reassuring. If the postings are not required, students tend to just do the minimum to pass the course.

3. Providing support for students struggling in the course. Data from the e-text provide a picture of students who are disengaged and those who are struggling. The number of questions attempted and question performance provide evidence of students who are not fully engaged or those who are struggling and need support. Student comments also provide some understanding of what stragglers are experiencing and how much support he/she may need. In some instances, students who are not proficient in using the e-text learning tools and Canvas also struggle in completing course requirements. Providing in-class demonstration during the first week of the semester was helpful in addressing this problem. The Information Resources and Technology division at the university also provide ongoing trainings, resources and individualized assistance for student drop-ins.

While there is no one-size-fits-all methodology for learning analytics, an easy-to-follow model is being presented for faculty who are interested in using student-learning tools and analytics to improve outcomes.

- Organize course
- Collect learning analytics data
- Provide open loop feedback to students
- Analyze and evaluate data
- Improve learning outcomes
Learning analytics is still in its infancy at the university but there is an interest among faculty to utilize it in their courses and there is potential for considerable growth if the university and programs make it a priority. Following suit, investment in learning analytics is more often described as minor rather than major. While learning analytics is not widely implemented or used at this time, there is potential for notable growth in the future should institutions meet indicated priority and investment expectations.

The key factors that encourage investment in and large-scale deployment of learning analytics are student retention, course-level academic success, and progress to degree. Reducing costs and optimizing institutional resources are considered secondary. Institutions more commonly use learning analytics data to monitor or measure student progress than to predict success or prescribe intervention strategies. The latter activities are better indicators of learning analytics, while the former are conventional best practices of using data and information in traditional ways to inform decisions.

8. Conclusion and Implications

Universities offer courses combining the flexibility and personalization of online adaptive learning, the connectedness of an in-class active environment, and enhanced faculty interaction. Generation Z’s and millennials’ ownership of learning may be at an all-time high, moving even higher given the changes in pedagogy. Students are provided with a technology-rich environment where they can work independently and collaboratively and at the same time have on-demand assistance from learning tools, faculty and classmates. Future course design will need to respond to more personalized learning experiences and faculty and administrators will have to make critical decisions about incorporating learning analytics to promote student success.

The findings have implications for higher education stakeholders who must acknowledge that learning tools and analytics trends will continue to evolve, and they must recognize the relationship between pedagogy, faculty capabilities and today’s university students’ expectations. Students have come to expect flexibility, increased accessibility and to engage with faculty who are willing to create a more personalized learning experience. The culture, climate and infrastructure at the university must be evaluated to increase the implementation of learning analytics. It is important to identify key stakeholders on campus who will champion the cause to increase faculty buy-in. Universities could benefit from forming a collaborative team to mobilize implementation, use initiatives and make learning analytics a priority to increase overall implementation success.

The implications for higher education institutions and policymakers is that success of their students and institutions rely on their agility to offer student-centered, problem-based, mobile, blended learning that can scale-up effective best practices. Initial efforts can be highlighted for
early wins and since student success and retention are a priority for most universities and aligns well with learning analytics, it would be an ideal area to target.

Faculty members are a critical element to classroom and student success and institutions must be committed to faculty development and support to create technology-enabled teaching and learning to enhance their students’ enrollment, retention and graduation rates. Learning analytics is an ongoing initiative and not a one-time event so it is central that regular and formal formative and summative reviews of learning analytics efforts continue. Funding must be earmarked to enhance e-learning platforms and expand learning analytics. Educators and academic leaders must explore their own unique variables in order to optimize the learning experience for their students.

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