

Analytics in Higher Education: Establishing a Common Language

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Abstract

The use of analytics in higher education is a relatively new area of practice and research. As with any new area of practice, a variety of terms are adopted to describe concepts and processes. Each of these terms is being integrated into the literature, but a preliminary review of the analytics in education and practitioner literature revealed similar terms with different conceptual or functional definitions, as well as different terms with similar conceptual or functional definitions. The intent of this paper is to present the different descriptions of the various types of analytics being discussed in the academic and practitioner literature. Second, we propose a conceptual framework that depicts the types of analytics and their relationship to each other. Finally, we propose a synthesized set of definitions for analytics-related terms commonly found in academia.

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The use of analytics in higher education is a relatively new area of practice and research. As with any new area of practice, a variety of terms are adopted to describe concepts and processes. Each of these terms is being integrated into the literature, but a preliminary review of the analytics in education and practitioner literature revealed similar terms with different conceptual or functional definitions, as well as different terms with similar conceptual or functional definitions. Although these issues are not unusual in an emerging and developing field of research, we believe the analytics field is now at a point where clarification and consensus of terms is merited. We propose a conceptual framework in an effort to initiate discussions to establish common terminology and application in the field of analytics in the academy.

Emergence of Analytics in Higher Education

All types of organizations from, businesses to higher education institutions, share some of the same business reasons for adopting analytics: increasing financial/operational efficiency; expanding local and global impact; establishing new funding models during a changing economic climate; and responding to the demands for greater accountability.¹ Luan illustrated that many of the critical questions in business are paralleled in higher education. For example, while business may ask “who are my loyal customers” or “who is likely to increase his/her purchase,” academia may ask “who are the persisters at my school” or “which alumni are likely to make large donations.”² Like business, higher education is adopting practices to ensure organizational success at all levels by addressing questions about retention, admissions, fund raising, and operational efficiency. Natsu reported that analytics could help education leaders cut costs and improve teaching and learning. She stated that the use of predictive analytics could range from “improving efficiencies to saving money to enhancing student achievement”³ and included examples such as planning courses, recruiting and retaining college students, optimizing the scheduling of classrooms, and maximizing alumni donations.

Yet despite the clear rationale for *adopting/using* analytics, the variety of terms used to *describe* analytics is unclear, especially in the academic domain. Watson stated “analytics is not fully understood. There are many incorrect, imprecise, and incomplete understandings.”⁴

A Plethora of Terms and Definitions

Today’s society is driven by data, as evidenced by the popular use of the term *analytics*. In some cases, the term may reflect specific topics of interest (health analytics, safety analytics, geospatial analytics), while in other cases, it may reflect the intent of the activity (descriptive analytics, predictive analytics, prescriptive analytics) or even the object of analysis (Twitter analytics, Facebook analytics, Google analytics). A variety of terms for analytics also exist in the educational domain. Higher education’s approach to defining analytics is particularly inconsistent. In our review of the literature, we found that some definitions were conceptual (what it *is*) while others were more functional (what it *does*). This lack of a common language causes difficulty, both for institutional collaboration and for setting an agenda for the larger teaching and learning community.

Hawkins and Watson caution that analytics is not a one-size-fits-all endeavor and that one has to consider that analytics is a goal-directed practice.⁵ The objectives and information needs within higher education differ based on what needs to be known or predicted and by whom. Hawkins stated that “there is a substantial difference between the kinds of metrics and indicators that are meant to measure students’ and consumer information needs.”⁶ Along similar lines, Watson indicated that “analytics means different things to different people. There are very different kinds of analytics, and the differences have important implications for where they are used, who performs them, the skills that are required, and the technologies that are involved...be clear about what kind of analytics you are discussing.”⁷

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To address these differences, we offer a view of the current landscape of terminology in use and bring to light the varied and overlapping definitions of analytics in the academic domain. Table 1 contains a variety of definitions for terms seen in popular and research literature related to analytics. Based on the given definition, we have listed the term, the various definitions attributed to the term, and the level where the analytics are focused (e.g., analytics may be conducted at the level of the institution, the department, or the learner, depending on the goals and objectives of the analysis).

Table 1. Conceptual and Functional Definitions of Various Types of Analytics

Term	Definitions	Level of Focus
Analytics	"[The] processes of data assessment and analysis that enable us to measure, improve, and compare the performance of individuals, programs, departments, institutions or enterprises, groups of organizations, and/or entire industries." ⁸	Institution Department Instructor Learner
	Data-driven decision making, used to inform decisions at all levels of the enterprise. ⁹	Institution Department Instructor Learner
Business Analytics	"The whole category is just using data and analysis to understand and manage your business more effectively, as opposed to simply capturing your customer's address or keeping track of your employees' vacation balances, that transactional kind of stuff." ¹⁰	Institution (enterprise)
	"Business Analytics (BA) is the practice of iterative, methodical exploration of an organization's data with emphasis on statistical analysis. BA is used by companies committed to data-driven decision making. BA is used to gain insights that inform business decisions and can be used to automate and optimize business processes. Data-driven companies treat their data as a corporate asset and leverage it for competitive advantage." ¹¹	Institution (enterprise)
Academic Analytics	"Early academic analytics initiatives are seeking to predict which students are in academic difficulty, allowing faculty and advisors to customize learning paths or provide instruction tailored to specific learning needs." ¹²	Learner
	"[Focused] on academic issues, primarily student access, affordability, and success." ¹³	Learner
	"[The] imperfect equivalent term for Business Intelligence, which [essentially describes] the use of information technology to support operational and financial decision making." ¹⁴	Institution
	"[Marrying] data with statistical techniques and predictive modeling to help faculty and advisors determine which students may face academic difficulty, allowing interventions to help them succeed." ¹⁵	Instructor Learner
	"Mining data from systems that support teaching and learning to provide customization, tutoring, or intervention within the learning environment." ¹⁶	Instructor Learner
	"[A] process for providing [higher education institutions] with the data necessary to respond to the reportage and decision making challenges facing contemporary universities." ¹⁷	Institution Department

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	“[It] can refer broadly to data-driven decision making practices for operational purposes at the university or college level, but it can also be applied to student teaching and learning issues.” ¹⁸	Institution Instructor Learner
	“[Can] identify and even predict students who may be at risk [in a particular course].” ¹⁹	Instructor Learner
Learning Analytics—Academia	“[The] interpretation of a wide range of data produced by and gathered on behalf of students in order to assess academic progress, predict future performance, and spot potential issues.” ²⁰	Institution Learner
	“[The] use of predictive modeling and other advanced analytic techniques to help target instructional, curricular, and support resources to support the achievement of specific learning goals” ²¹ (n.b. Bach presents learning analytics and academic analytics as synonymous concepts).	Department Learner
	“[To] enable teachers and schools to tailor educational opportunities to each student’s level of need and ability.” ²²	Learner
	“It might be used as well to assess curricula, programs, and institutions.” ²³	Institution Department
	“[The] use of data and models to predict student progress and performance, and the ability to act on that information.” ²⁴	Learner
	“[The] collection and analysis of usage data associated with student learning; [to] observe and understand learning behaviors in order to enable appropriate intervention.” ²⁵	Learner
Learning Analytics—Industry	“[The] study of the impact of learning on its learners.” ²⁶	Learner
	“[Gathering] input from multiple databases and, when conjoined with appropriate queries, can pull data and create a real-time slice of an organization’s training metrics.” ²⁷	Institution Department
	“[A] set of activities an organization does that helps it understand how to better train and develop employees and customers.” ²⁸	Institution Department
Predictive Analytics	“[A] set of [business intelligence] technologies that uncovers relationships and patterns within large volumes of data that can be used to predict behavior and events [...] predictive analytics is forward-looking, using past events to anticipate the future.” ²⁹	Institution Department Instructor Learner
	“Predictive analytics connects data to effective action by drawing reliable conclusions about current conditions and future events.” ³⁰	Institution Department Instructor Learner
	“Predictive analytics [...] is both a business process and a set of related technologies. Predictive analytics leverages an organization’s business knowledge by applying sophisticated analysis techniques to enterprise data. The resulting insights can lead to actions that demonstrably change how people behave as customers, employees, patients, students, and citizens.” ³¹	Institution Department Instructor Learner

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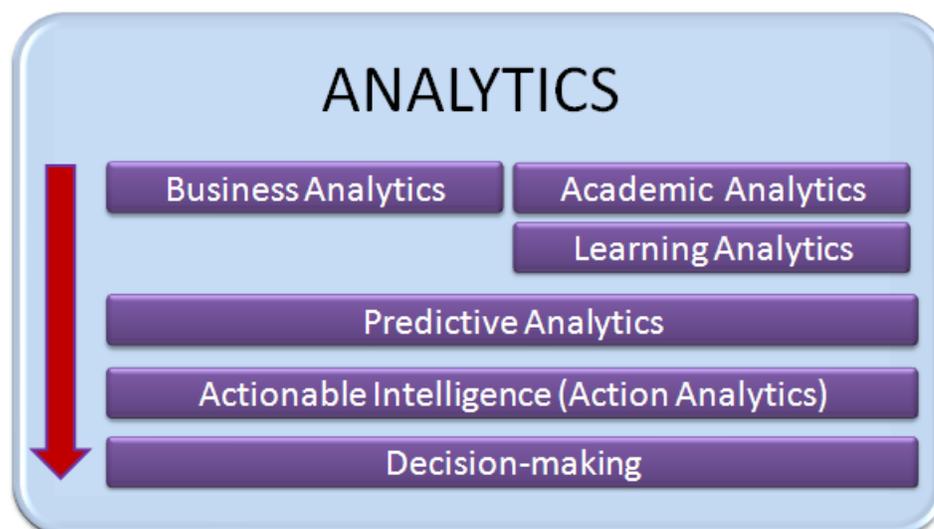
Action Analytics	"[More] comprehensive than academic analytics, encompassing academic and administrative processes, and recognizing the need for transformative reinvention and reimagining [...] focused more broadly on academic and administrative productivity and performance." ³²	Institution
	"The term <i>action analytics</i> refers to analytics capabilities and practices that are powerful, immediate, and useful to a wide variety of stakeholders. But most importantly, action analytics can only happen in enterprises and environments that are genuinely committed to measuring and improving key aspects of productivity, innovation, and performance. These organizations must actively build the capacity and cultivate the behaviors to do so. Achieving action analytics is more about leading and navigating significant changes in organizational culture and behavior than technology." ³³	Institution
	"[A] fusion of new analytic tools with the increasing expectations for higher education accountability." ³⁴	Institution

As is evident, no consensus exists on analytics-oriented terms and their associated definitions. We take advantage of this timely opportunity in the evolution of the field of analytics in academia to contribute our synthesis of the literature, both popular and academic, and propose not only a conceptual model of analytics but also a converged set of definitions.

Conceptual Framework

We propose a conceptual framework for positioning analytics within a business and academic domain (Figure 1). Different data are utilized at different levels of the institution for different analyses for different reasons by different people.³⁵ While we offer conceptually separate and distinct definitions for various types of analytics used in higher education (Table 1), we acknowledge that, functionally, the different analytics are intended to work as a cohesive and integrated whole that serves the needs of the academy at a variety of levels.

Figure 1. Conceptual Framework of Analytics in Business and Higher Education



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Analytics: *Analytics* is an overarching concept described as data-driven decision making.³⁶ Regardless of whether one is in the corporate/business or academic area, the description of analytics remains consistent.

Business and Academic Analytics: *Business analytics* and *academic analytics* are parallel concepts with similar goals and intents. This level of analytics allows management/executives access to indicators—historical or real-time through dashboards—of how the business (higher education institution) and its units (colleges, schools, or departments) are performing.³⁷ Although Goldstein and Katz and Campbell and Oblinger put forth the term *academic analytics* for applicability in educational institutions,³⁸ the purpose is similar in a business setting—to run the business of the institution, the academy.

Learning Analytics: *Learning analytics* is a point of divergence in our conceptual model, as it does not have the same goals in the business and academic streams. From a training industry perspective, learning analytics focuses on two areas—learning effectiveness and operational excellence—with the latter referring to the metrics that provide evidence of how the training/learning organization is aligning with and meeting the goals of the broader organization.³⁹ Learning analytics in the academic domain is focused on the learner, gathering data from course management and student information systems in order to manage student success, including early warning processes where a need for interventions may be warranted.⁴⁰ Indeed, Brown distinguished learning analytics from other types of analytics by virtue of the fact that learning analytics is focused specifically on students and their learning behaviors.⁴¹

Predictive Analytics: *Predictive analytics* is a process that serves all levels of higher education and business and acts as a connector between the data collected, intelligent action that can be taken as a result of the analysis, and, ultimately, informed decision making. In step with much of the work in analytics, higher education must now move beyond simple reporting.⁴² Our conceptual model reflects the need—once data are collected, reported, and analyzed—not only to make meaning of them but also to take action.

Scholarship of Teaching and Learning

In the second framework below, the scholarship of teaching and learning (SoTL) is the key transformative piece and is at the heart of academic analytics. SoTL, a research domain focused on the enhancement of the student learning experience in higher education, has been inserted as a substantial part of the framework. SoTL calls for practitioners and scholars to

- make their teaching and learning research available to the community at large,
- be open to critique and evaluation, and
- present findings in ways which others can build upon them.⁴³

To clarify the relationship between academic analytics and SoTL, we are not suggesting that analytics originated from SoTL, but rather that analytics can supplement the established theory and practice of the field. Ideally, academic analytics will iteratively feed back into SoTL, informing future directions.

In the proposed framework, SoTL encompasses the institutional, departmental, and learner levels and is the driving force behind the theory, pedagogy, and student learning research (see Figure 2). Notably the organizational levels of an institution of higher education are encircled by SoTL. By doing so we are not simply asking what we can add to the academy at large but, more specifically, how the work we are doing today can contribute specifically to the academic analytics community and move the agenda forward. It is our hope that this paper will draw critique and evaluation from fellow practitioners as well as cultivate a more robust, collaborative framework and consensual lexicon for the field.

Figure 2. Analytics in Higher Education



Scholarship of Teaching and Learning and Its Relationship with Analytics

In 1999, in their seminal book *The Scholarship of Teaching: New Elaborations, New Developments*, Hutchings and Shulman outlined a set of challenges facing the then emerging field of SoTL, and today, academic analytics faces the same set of challenges.⁴⁴

Challenge 1—Credibility: The first challenge is that of credibility and, as a field emerges, a set of rigorous standards and practices must be established and widely accepted. For analytics, this process has begun with conferences such as the International Conference on Learning Analytics and Knowledge (LAK) and program themes such as business intelligence at the EDUCAUSE Annual Conference. For the field to progress, peer-reviewed publications must be established.

Challenge 2—Transformation: The second challenge that faces SoTL is “keep[ing] the scholarship of teaching open to a wide set of inquiries,” especially to theory building and creation of conceptual frameworks in the field. For analytics in higher education, faculty and practitioners in different disciplines need to transform their current practices into formal inquiries regarding teaching and learning in their classrooms. The transition must move from *if* students learn in their classes to exactly *what* (content) or *how* (process) students learn.

Challenge 3—Open and accessible scholarship: The third challenge facing the budding SoTL field is keeping the scholarship open and accessible. Again, this is similar to analytics in higher education today, since analytics is viewed as a competitive advantage, particularly in times of tighter budgets. Furthermore, initiatives are often shrouded in secrecy (sometimes due to the lack of institution-wide support) and fail to build upon established scholarly work.

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Challenge 4—Scale: The final challenge relates to the notion of scale and how analytics can be applied to more learning- and discipline-specific environments. The number of potential data sources and models will continue to challenge institutions attempting to bring analytics to scale. One scaling issue is in extracting, transforming, and using data (for example, LMS data). Data are plentiful and typically easy to extract, but the resources (e.g., human) needed to transform the data into useful information are often scarce. In cases where human resources are available, it is frequently on a “one off” basis rather than a regular, consistent responsibility, meaning that scale and long-term sustainability usually become crucial issues. Within the field of SoTL, issues of sustainability and scalability have mainly been resolved. However, the continued advancement and acceptance of analytics in academia is still in progress. Therefore, we believe that the scale issue exists in analytics with regard to useful information.

These are challenges SoTL has faced and that analytics must face. At their very cores, SoTL and learning analytics have a symbiotic relationship. Both have the opportunity to inform the other. Learning analytics can deepen our understanding of teaching and learning, while SoTL can inform the learning analytics community on important areas of focus. Both are collaborative processes that continually seek to improve pedagogy and learning theory. Both are inquiry-based disciplines that go beyond content knowledge into the broader realm of student learning. These similarities make SoTL a natural and necessary part of the framework, and, in the end, each field can inform the other.

Proposed Definitions

We offer the following definitions and levels of focus to establish a clear delineation of terms when we speak of analytics in the educational domain (Table 2).

Table 2. Proposed Definitions for Analytics in Higher Education

Term	Proposed Definition	Proposed Level of Focus	Sample Projects (see below for links)
Analytics	An overarching concept that is defined as data-driven decision making (from Ravishanker).	All levels	<ul style="list-style-type: none"> • M-Reports Dashboard • Learning and Career Outcomes
Academic Analytics	A process for providing higher education institutions with the data necessary to support operational and financial decision making (adapted from Goldstein and Katz).	Institution	<ul style="list-style-type: none"> • Effectiveness Sources Portal (ESP) • Sponsored Project Excellence Achieved through Redesign (SPEAR)
Learning Analytics	The use of analytic techniques to help target instructional, curricular, and support resources to support the achievement of specific learning goals (adapted from Bach).	Department/learner	<ul style="list-style-type: none"> • Course Signals • Check My Activity
Predictive Analytics	An area of statistical analysis that deals with extracting information using various technologies to uncover relationships and patterns within large volumes of data that can be used to predict behavior and events (adapted from Eckersen).	All levels	<ul style="list-style-type: none"> • Student Success Plan • Student Readiness Inventory

Links to Sample Projects

- Course Signals, <http://www.itap.purdue.edu/learning/tools/signals> (Purdue University)
- Check My Activity, <http://screencast.com/t/eIS8tviCgWw> (University of Maryland, Baltimore County)
- Effectiveness Sources Portal (ESP), <http://net.educause.edu/ir/library/pdf/ers0508/cs/ECS0509.pdf> (University of Phoenix)
- Learning and Career Outcomes, <http://www.capellaresults.com/ourapproach.asp> (Capella University)
- M-Reports Dashboard, http://www.bi.umich.edu/products/web_reporting.html (University of Michigan)
- Sponsored Project Excellence Achieved through Redesign (SPEAR), <http://net.educause.edu/ir/library/pdf/ers0508/cs/ECS0510.pdf> (UC San Diego)
- Student Readiness Inventory, <http://www.act.org/engage/> (ACT, Inc.)
- Student Success Plan, <http://www.sinclair.edu/organizations/ssp/> (Sinclair Community College)

Final Thoughts

We developed a conceptual model of analytics to demonstrate not only the connections between business and academia but also within higher education. The field of academic analytics is relatively new; however, its short life has produced numerous terms and conceptualizations. In an effort to add clarity to this landscape, we developed a framework to place academic analytics within the broader field and to differentiate between the varying forms of analytics described in the literature today. Further, we placed SoTL into the model, illustrating how the use of analytics can contribute to the improvement of teaching practices. In creating this framework, we also have developed a lexicon of terms that should serve as a common language for practitioners. We believe these contributions represent a major step forward in the discussion regarding the use of analytics in higher education. It is our hope that our work will allow for the development of a rich community of practice focused on the continued advancement of the field.

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