In the following report, Hanover Research assesses learning

HANOVER

TABLE OF CONTENTS

EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

As institutions of higher education explore ways to develop cohesive technology-enhanced learning strategies, one important, emerging element of those strategies is learning analytics that supports students' self-assessment of their academic progress. In this report, Hanover Research assesses academic and professional literature on learning analytics at higher education institutions (HEIs). The report consists of the following sections:

- Section I provides an overview of institutional and learning analytics in higher education, including the overall analytics process, major types of analytics, common metrics collected to analyze student

- Specific governance considerations may include:
  - Data types to be used for learning analytics and collection processes
  - Anonymization of the data where appropriate
  - Analytics processes to be performed
  - The purpose or expected outcomes of all analytical processes
  - Retention and stewardship of data used for and generated by learning analytics
- Learning analytics dashboards often emphasize early warning systems. Student retention is a concern at many HEIs, and therefore efforts to identify students at risk of failing and/or dropping out are a common learning analytics application. The majority of at-risk/early warning systems present information to instructors or student advisory personnel. However, some student-facing examples, such as

THE LEARNING ANALYTICS LANDSCAPE

LEARNING ANALYTICS VERSUS INSTITUTIONAL ANALYTICS

As a whole, analytics used by educational institutions can cover a broad range of types, data sources, and areas for implementation. The broad types or focus areas for analytics within the higher education sphere the thethe higher 70004Tc(the)Tj/TT51Tf11.4941823362

Among U.S. higher education institutions, learning analytics initiatives are commonly connected to student

COMMON METRICS AND DATA SOURCES

Institutions collect a wide variety of data for institutional and learning analytics, some of which are summarized in Figure 1.4. For efforts related to student success, the majority of data is derived from two sources:[17]

- The learning management system (LMS) or virtual learning environment (VLE), as these systems already collect data from students as they complete assignments, access materials, take quizzes and exams, or interact with fellow students and professors
- Student information systems within the institution that log information, such as enrolment data, transcripts, and demographics.

Figure 1.4: Common Metrics for Student Success Analytics

CATEGORY	METRIC(S)	DATA SOURCE(S)

CATEGORY	METRIC(S)	DATA SOURCE(S)
Student		

capabilities for data collection and analytics. Some students, upon learning of the practice, were unconcerned, but many expressed discomfort with analyses performed on them individually,

SECTION II: CASE STUDIES FOR STUDENT-FACING ANALYTICS

In this section, Hanover provides several examples of learning analytics for student success at higher education institutions. Specific uses of analytics in the following case studies include early warning/at-risk identification systems for student retention, student progress tracking dashboards, and course selection recommendations.

PEER POSITIONING: UNIVERSITY OF MARYLAND BALTIMORE COUNTY'S "CHECK MY ACTIVITY"

When it examined its learning management system (LMS) usage data, the University of Maryland Baltimore County (UMBC) discovered that students earning below a C continually demonstrated 40 percent lower usage of the LMS compared to students earning a C or better.[24] As such, it was possible that overall LMS usage data could provide an ongoing formative assessment of student performance within the subject. In keeping with institutional priorities that students must be responsible for their own learning, UMBC decided to share LMS usage data with students.

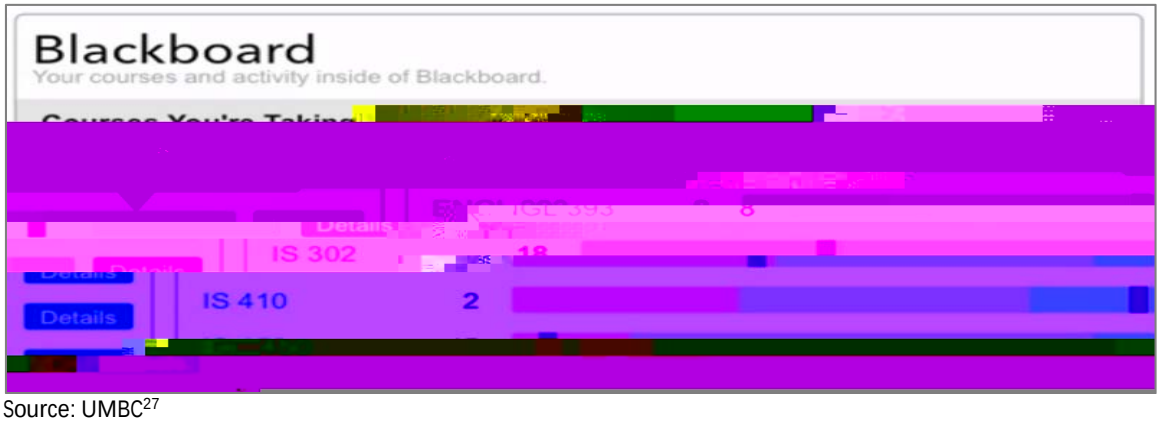
UMBC launched the CheckMy Activity (CMA) feedback tool in 2008 to provide students with information about their own performance within the LMS system. The CMA is built into the Blackboard LMS system used by the University, and students access it through links in the LMS header or in each subject.[25] CMA collects two key pieces of information:

- Sessions: Number of times the student logged into the particular Blackboard subject
- Hits: Discrete interactions within the subject (e.g., viewing a file or posting to the discussion board)

To contextualize this information, CMA allows students to compare their activity against a summary of anonymized peer data. At a high level, students can see an overview of their activity across all Blackboard subjects compared to the overall class average (see Figure 2.1). If the instructor uses the gradebook function within a subject, CMA allows the student to compare their own activity against the anonymized average activity of students who earned equivalent, lower, and higher grades on any assignment (see Figure 2.2).[26] For online subjects, where students may not interact regularly with their peers or opportunities to discuss course content or performance, aggregated and anonymized peer reports may be particularly helpful.

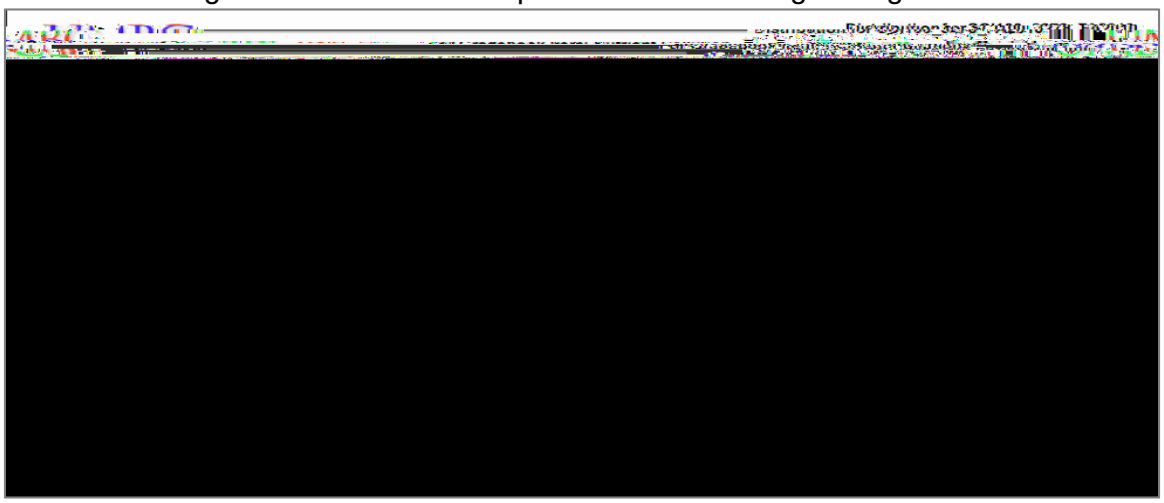
[24] Fritz, J.

Figure 2.1: CMA Activity Summary*



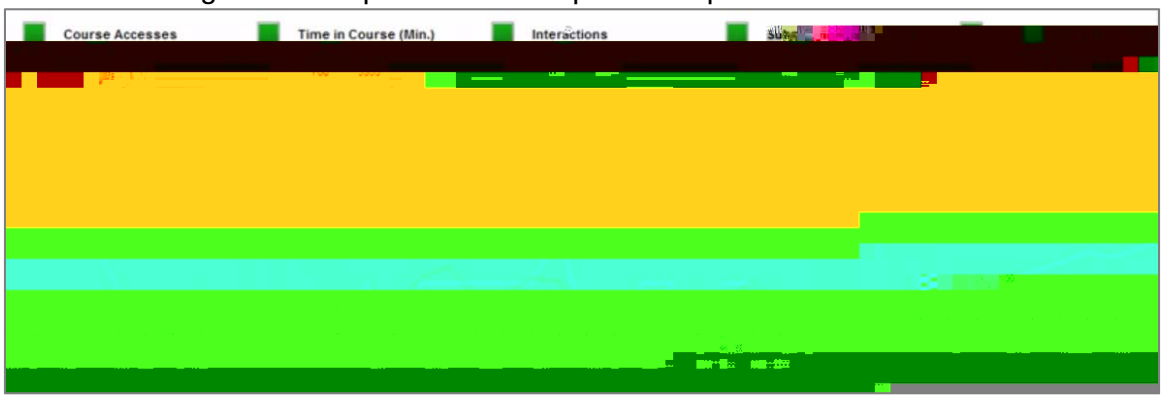
Source: UMBC[27]

Figure 2.2: CMA Peer Comparison Data for a Single Assignment



Source: Fritz[28]

Figure 2.3: Proposed Peer Comparison Report Format for CMA*



Source: UMBC[29]

*Note: These interfaces are prototypes, and it is unclear whether they have been officially rolled out at UMBC.

[27] "SP2013 UMBC Analytics Preview." YouTube. https://www.youtube.com/watch?v=iLifdZ5sRMc&feature=youtu.be
[28] Fritz, "Video Demo of UMBC's 'Check My Activity' Tool for Students," Op. cit.
[29] "SP2013 UMBC Analytics Preview," Op. cit.

Hanover

Course Signals is run manually by the instructor as many times during the semester as they wish, and the instructor updates the at-risk status of all enrolled students accordingly.[33] At a broad level, there are four major metrics components: subject performance, effort, prior history, and student characteristics. Figure 2.5 provides examples of the types of specific data incorporated into each category.

Figure 2.5: Metrics Categories and Selected Examples Used in Course Signals

Performance	Effort	Prior Academic History	Student Characteristics
• Points earned to date	• Interaction with LMS (compared to peers)	• Academic preparation • High school GPA • Standardised test scores	• Residency • Age • Credits attempted

Source: Arnold and Pistilli[34]

Some aspects, such as earned points, are based on thresholds set by the instructor for that particular subject. For example, some instructors may consider 81 percent and above to be low risk, while others might place the bottom of the threshold at 90 percent.[35] The high, medium, and low risk categories are displayed to the student via a traffic signal visualization of red/yellow/green lights (Figure 2.6).

Figure 2.6: Signals Overview Page

Source: Purdue University[36]

[33] Pistilli, M.D., K. Arnold, and M. Bethune. "Signals: Using Academic Analytics to Promote Student Success." Educause, July 17, 2012. http://er.educause.edu/articles/2012/7/signals-using-academic-analytics-to-promote-student-success

[34] Arnold, K.E. and M.D. Pistilli. "Course Signals at Purdue: Using Learning Analytics to Increase Student Success." ACM Press, 2012. pp. 1–2. http://dl.acm.org/citation.cfm?doid=2330601.2330666

[35] Pistilli, Arnold, and Bethune, Op. cit.

[36] "Signals at Purdue University." Purdue University. http://www.itap.purdue.edu/studio/signals/

Students identified as "at risk" receive follow-up interventions including both automated and manual email messages from instructors, referrals to advising services or resource centers, and scheduling for face-to-face meetings with instructors.[37] In addition to help provided from the instructor or institution to the student, Course Signals improves students' own awareness of their performance and may prompt them to reach out for support proactively. Tim Delworth, a mathematics lecturer at Purdue, reported, "Before, no one would e-mail me and say, 'I'm at 58 percent and I want to get to 72 percent, what do I need to do?' But the students who get a red light almost all contact me immediately to ask how to raise their grades."[38]

TAILORED SUBJECT RECOMMENDATIONS: AUSTIN PEAY'S DEGREE COMPASS AND "MY FUTURE"

Recommendation systems, such as product or movie recommendations through services like Amazon or Netflix, are one common business analytics application. Inspired by these systems, Austin Peay State University developed Degree Compass, a

concentrations and degree paths, as well as career information such as links to U.S. Department of Labor statistics for relevant occupations and job availability. Students without a selected field of study, or who are considering a different field, can retrieve suggestions for various fields in which the student is likely to succeed, much like the predictive subject performance ratings in Degree Compass.[49]

ACTIVITY, PERFORMANCE, & FEELINGS: INTEGRATION IN UNE'S EARLY ALERT SYSTEM

Like other institutions discussed in this report, the University of New England (UNE) student retention is a concern at the University of New England. To address student attrition, UNE implemented an early alert system to identify students at risk of attrition. UNE's system incorporates subjective and emotional data into its early warning analytics, a relatively unique approach.

Over time, the system has incorporated several major components:

- E-Motion captures student emotional states in relation to their subject by providing a self-reporting interface that uses emoticons as well as a free-response text box. Students select an emoticon that represents their current feelings about the subject, ranging from happy to very unhappy.[50] UNE's Student Support Team contacts any students who record a negative emotion ("unhappy" or "very unhappy") within 24 hours.[51]
- The Vibe displays data self-reported by students in the text field next to the emoticon selection. The field accepts a total of 140 text characters, equivalent to a Twitter post.[52] Every 10 minutes, text box comments are processed and repeated key words are counted. The Vibe then displays a word cloud of the key student-supplied terms, with more frequently reported words appearing in a larger font size.[53] Unlike the other data, The Vibe is available to students to communicate a general understanding of how their peers are feeling. When terms reported or felt by the student are emphasized within the word cloud, students' feelings of isolation may be mitigated.[54]
- The Automated Wellness Engine (AWE), implemented in the second and third stages of the early alert system, analyses student data from multiple different systems each evening. The following morning, the system updates the Student Support Team dashboard with an identification of students who need assistance.[55]

[49] Ibid.
[50] "Learning Analytics in Higher Education," Op. cit.
[51] [1] Leece, R. and E. Campbell. "Engaging Students through Social Media." Journal of the Australia and New Zealand Student Services Association, :38, October 2011. p. 11. [2] "Learning Analytics in Higher Education," Op. cit.
[52] Leece and Campbell, Op. cit., p. 12.
[53] "Learning Analytics in Higher Education," Op. cit.
[54] Leece and Campbell, Op. cit., p. 12.
[55] "Learning Analytics in Higher Education," Op. cit.

Hanover

RioPACE considers three main categories of metrics:[60]

Students can view a tooltip for their current RioPACE rating, which displays their status on each of these three categories (Figure 2.8).

Figure 2.8: RioPACE Status Display

Source: Rio Salado College[61]

PERSONALISED COACHING & GAMIFIED STATUS TRACKING: ANALYTICS AT THE UNIVERSITY OF MICHIGAN

E² COACH: FEEDBACK AND ADVISING SYSTEM

As a big university, the University of Michigan has a number of large introductory subjects, sometimes consisting of more than 500 students in a single lecture group.[62] As such, professors face difficulty keeping track of and providing advice to all students during their initial postsecondary experience. To address this challenge, a research team at the University developed E² Coach to provide tailored support communications related to student progress.

Students using the system "receive personalized assistance in large classes, learn best practices, discover opportunities in areas of interest, and avoid common pitfalls."[63] Feedback messages are crafted in template form by a message author

Figure 2.9: On-Demand Performance Feedback Graphics from E2Coach

Source: McKay[67]

GRADECRAFT GAMIFIED LMS

To stimulate learner engagement, UM developed a game-inspired system that implements points and levels, badges, retries for assignments, and selection of assignments.[68] These subjects incorporate a large number of features and metrics for students to track. Therefore, UM developed a gamified gradebook, GradeCraft, which was later expanded into a full LMS.[69] As an LMS, GradeCraft provides visualizations and information to both students and instructors.

The student dashboard in GradeCraft displays "their current score, a chart of the points they have earned so far in the course, and a chart of the points that are available to earn

[67] McKay, T. "What to Do with Actionable Intelligence: E2Coach as an Intervention

Figure 2.11: Level Display and Comparative Analytics Example

Source: GradeCraft[72]

COMPETENCY TRACKING: CAPELLA UNIVERSITY'S COMPETENCY MAP

Capella University has been investing in competency-based education models. Three years ago the institution even began implementing entirely competency-based courses without formal subject structures or credit hours. Instead, it uses "direct assessment" based on assignment completion and demonstration of skills.[73]

To help students track their progress, Capella instituted the Competency Map interface, a dashboard containing the current competencies and assignments required by the subject or course, along with the portion of these that the student has completed, shown in Figure 2.12. Competency graphs are color-coded to denote the degree of competency. This format gives learners "a concise overview of what is expected of them, and how much progress they have achieved."[74]

[72] Ibid.
[73] Fain, P. "Competency-Based Education's Newest Form Creates Promise and Questions. T/TT51Tf.22710r211.22710TD.001_.cr072DTf.35480TD

Figure 2.12: Competency Map Dashboard

Source: Capella University[75]

[75] "Capella Launches Innovative Competency Map Dashboard to Align Student Learning with Employer Needs." Capella University, October 23, 2013. https://www.capella.edu/about/why-

SECTION III:

before attempting to implement predictive systems.[81]

DATA COMPLETENESS AND ACCURACY

- Establish data governance procedures to ensure that data is as clean, accurate, consistent, and complete as possible. In addition to the basic risks associated with taking action based on faulty data, inaccurate or incomplete data can damage or erode trust. Students, staff, and members of the public may resent and oppose learning

behavior, improving the control system to more effectively optimize the results will make the learning worse."[92]

- If requesting data from students directly, avoid "survey exhaustion." The University of Michigan's E²Coach system initially required students to complete the survey each time they wanted to access their next message to update the profile. As a result, many students stopped using the system. Later, the University found that the system could operate based only on the initial survey.[93] In some cases, repeat measures may be unavoidable, but these should be made as simple as possible to obtain.

TOOLS

- Make data manipulation and visualization tools as user-friendly as possible. Clear and easy to use systems allow staff or students to not only understand the data, but to translate the information into action. Students and staff are more likely to make regular and full use of a tool that is simple and pleasant to use. For students, appropriately usable tools can support student empowerment by encouraging and enabling students to "take increasing responsibility for their own learning, rather than control student behavior or mechanically direct students to resources."[94]
- Dashboards should be integrated with the learning management system (LMS) already at use within the university.[95] This limits the number of separate locations students or other users need to access to view pertinent information, and may also reduce the number of credentials users are required to retain if single sign-on (SSO) systems are not in place.
- Consider LMS improvements when implementing learning analytics. Much analytics data derives from the institutional LMS, and adding features and expanding use of the LMS will increase the data usable for analysis and potentially increase student engagement with the system. EDUCAUSE surveys of LMS systems across a significant number of global higher education institutions report that nearly half (46 percent) of students believe that better LMS features are needed, most commonly in the following areas:[96]
    - Communication mechanisms (e.g., IM, video chat, online tutoring, social group discussions and forums, and access to other students' contact information)
    - Alerts and calendaring (e.g., posting grades, assignment due dates, exam reminders)
    - Grading tools (e.g., calculating and projecting)
    - Multimedia access (e.g., recorded lectures and podcasts)
    - Mobile interface (e.g., access from smartphones and tablets)

[92] Clow, "The Learning Analytics Cycle," Op. cit., p. 137.
[93] Huberth, Michelotti, and McKay, Op. cit.
[94] Colvin et al., Op. cit., p. 19.
[95] Reimers and Neovesky, Op. cit., p. 400.
[96] Dahlstrom, E., D.C. Brooks, and J. Bichsel. "The Current Ecosystem of Learning Management Systems in Higher Education: Student, Faculty, and IT Perspectives." Educause Center for Analysis and Research, September 2014. p. 19. https://net.educause.edu/ir/library/pdf/ers1414.pdf

PROJECT EVALUATION FORM

Hanover Research is committed to providing a work product that meets or exceeds client expectations. In keeping with that goal, we would like to hear your opinions regarding our reports. Feedback is critically important and serves as the strongest mechanism by which we tailor our research to your organization. When you have had a chance to evaluate this report, please take a moment to fill out the following questionnaire.