

# 2022 EDUCAUSE Horizon Report<sup>®</sup> Data and Analytics Edition



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## Data and Analytics Edition

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# EXECUTIVE SUMMARY

**W**ith the 2022 data and analytics edition, we further expand our series of Horizon Reports to focus on an emerging area of practice that is driving institutional decision-making and strategic planning for the future—the trends, technologies, and practices that are shaping the world of postsecondary data and analytics. Based on a methodology that grounds the findings in the perspectives and expertise of a panel of leaders in higher education data and analytics, in this report we summarize the panel’s input on the major trends shaping higher education, including panelists’ reflections on the implications of this research for the future of higher education for particular institutional roles.

## Trends

Higher education is in many ways a product of the larger environments and sociocultural contexts surrounding it, as well as of the particular communities and people designing it and participating in it. To capture these larger contextual forces, we asked the Horizon panelists to provide input on the macro trends they believe are shaping the future of postsecondary data and analytics and to provide observable evidence for those trends. To ensure an expansive view of trends outside the walls of higher education, panelists provided input across five trend categories: social, technological, economic, environmental, and political. After several rounds of voting, the panelists selected 15 trends as the most important.

### Social

- Institutions are increasingly asked to support decisions with data.
- Many big data methods reinforce social inequality.
- A focus on creating equitable learning and work environments is increasing.

### Technological

- Existing data infrastructures are outdated and disorganized.
- Institutions still struggle to implement data governance systems.
- Data literacy and AI skills still lag behind the rapid adoption of big data analytics products.

### Economic

- Free or inexpensive certificates from nonaccredited platforms are becoming more common.
- The value and ROI of a college degree are being questioned.
- Tech salaries are growing at an unprecedented rate.

### Environmental

- Institutions are rethinking the use of their physical spaces.
- Commuting patterns are changing due to the pandemic.
- The demand for green IT services is growing.

### Political

- Data privacy laws are getting more complex around the globe.
- There is increasing political involvement in public education.
- AI technology is being used for policing.

## Key Technologies and Practices

Horizon panelists were asked to describe those key technologies and practices they believe will have a significant impact on the future of postsecondary data and analytics, with a focus on those that are new or for which there appear to be substantial new developments. After several rounds of voting, the following 6 items rose to the top of a list that initially consisted of 25 technologies and practices:

- Data Management and Governance
- Unifying Data Sources
- Modern Data Architecture
- Data Literacy Training
- DEI for Data and Analytics
- Assessing and Improving Institutional Data and Analytics Capabilities

Having identified the most important technologies and practices, panelists were then asked to reflect on the impacts the implementation of those technologies and practices would likely have at the institution. We asked panelists to consider several important dimensions of these technologies and practices: the increased support that would be required from

key stakeholders; their potential to have a significant and positive impact on institutional strategic goals; their potential to support digital transformation at the institution; additional spending that will be required for optimization; the impact of optimization on the size of the institution's workforce; and the workforce upskilling or reskilling that would be required to support optimization.

Panelists see considerable potential for each of these technologies and practices individually to have an impact on overall institutional data and analytics adoption, while also highlighting important interdependencies between these technologies and practices. In particular, institutions' data management and governance practices have implications for other areas of technology adoption and practice, such as their ability to successfully unify data across disparate sources and to design effective and modern data architectures. Practitioners might consider, then, the best approaches to sequencing and coordinating these distinct yet interconnected technologies and practices.

## Scenarios

While it is not the intent of our foresight methodology and this report to predict a single future, we can begin to gather and arrange the information we have into logical patterns that can help us envision a number of scenarios for what the future might look like. In this report we attempt to paint brief but evocative portraits of four possible future scenarios for postsecondary data and analytics:

- **Growth:** "Only measurement matters" has become a common catchphrase in higher education as institutions are increasingly being asked to adhere to data-driven decision-making processes. This data-focused culture has driven up the demand from external funding sources for evidence of outcomes, and it has also presented challenges and opportunities for institutions choosing to focus on serving the "whole student" by blending different sources and types of data.
- **Constraint:** Institutions have been forced to operate on dwindling budgets, and data and analytics teams in particular are understaffed and overwhelmed. The lack of capacity for building mature data and analytics capabilities has put many institutions behind in implementing sound data practices and preventing increasingly sophisticated cybersecurity attacks, leaving them searching for answers on how best to support equitable and accessible data and analytics needs.

- **Collapse:** Public opinion on the value and ROI of a traditional college degree has continued on a downward trend, and underfunded and understaffed institutions lack the data and analytics capabilities for measuring and reporting compelling evidence of their value to skeptical consumers. New for-profit alternative credentialing centers have risen to meet the demand for education and training, and their advanced analytics capabilities are enabling them to identify and target learner preferences and needs.
- **Transformation:** Efficiency is driving value around the world, and higher education has taken on the challenge of improving the health of our global ecosystems by redefining the purposes and uses of physical spaces. Institutions are turning to more complex data ecosystems to inform strategic decisions, relying on improved data architectures as well as data literacy programs to drive investments in areas such as remote work and learning.

## Implications Essays

In light of the trends and scenarios presented throughout this report, what can we say about the implications for institutions now and about what institutions can begin to do today to start preparing for these possible futures? For this section we asked six Horizon panelists to reflect on the report's findings and offer their thoughts on the most important implications for their own roles and contexts within higher education.

Our essayists in this report represent a broad range of institutional functions, recognizing that a variety of roles and functions across an institution must be involved to ensure success with data and analytics. The CIO, for example, needs to envision ways to retrain IT staff with emerging skills in data ops and retool IT departments with technologies necessary to deliver a modern architecture. The institutional researcher needs to play a leadership role in data literacy work. And the chief academic officer needs to encourage appropriate use of data to inform decisions related to faculty, curriculum, and students.

Though not intended to cover all perspectives within the institution, nor to cover all possible institutional types or contexts, these essays can help catalyze thinking and conversations about the ways in which higher education is changing, the opportunities and risks it faces, and the ways in which technology and innovative thinking in data and analytics can help prepare institutions for the future.

# TRENDS: SCANNING THE HORIZON

Continuing a practice we've adopted for other recent EDUCAUSE *Horizon Reports*, we begin this exploration of higher education data and analytics futures by first situating ourselves within the larger global contexts that help shape higher education as well as data and analytics. In both the ways we approach education and in the ways we collect, understand, and use data, the choices we make and the practices we employ are grounded in our identities and experiences as human beings, as well as in the communities and environments that make up the worlds in which we live.

To ensure our *Horizon Report* discussions provide such an expansive view of ourselves and the world around us, we asked our expert panelists to identify trends across five broad categories: social, technological, economic, environmental, and political.

In their trends discussions and voting, panelists highlighted trends directly about data and analytics itself as an area of practice that is ever-evolving and growing: the ways in which data contribute to, but can also help address, equity concerns; institutions' successes and challenges in adopting new data and analytics capabilities; and the ways in which data and analytics serves institutions as a connecting point to larger economic and political interests. Panelists also highlighted trends more indirectly about the ways in which data and analytics can help us make sense of and address larger shifts taking place around us: data and analytics as a tool for communicating institutions' value to an increasingly skeptical world, and the ways in which our global environmental crisis can be better understood and addressed through the power of data.

The summary of these trends in this section is grounded in the discussions and inputs provided by the expert panelists, in keeping with the tradition of the Delphi methodology. Each of the trends was identified and voted on by panelists without influence from the EDUCAUSE *Horizon Report* staff, aside from our work in organizing and synthesizing the panelists' inputs for presentation here.

Each of the trends encompasses far more complexity and variability across types of institutions and regions of the world than can be adequately captured in such a brief summary. Indeed, the expert panelists—some of whom represent communities outside the United States, including Canada, Israel, and Australia—routinely reflected on the ways in which trends affect institutions differently across global settings. Where possible, we've tried to account for that variability, though the reader will certainly bring additional experiences and contexts that would further broaden these considerations.

## Social

**Institutions are increasingly asked to support decisions with data.**

**Many big data methods reinforce social inequality.**

**A focus on creating equitable learning and work environments is increasing.**

## Technological

**Existing data infrastructures are outdated and disorganized.**

**Institutions still struggle to implement data governance systems.**

**Data literacy and AI skills still lag behind the rapid adoption of big data analytics products.**

## Economic

**Free or inexpensive certificates from nonaccredited platforms are becoming more common.**

**The value and ROI of a college degree are being questioned.**

**Tech salaries are growing at an unprecedented rate.**

## Environmental

**Institutions are rethinking the use of their physical spaces.**

**Commuting patterns are changing due to the pandemic.**

**The demand for green IT services is growing.**

## Political

**Data privacy laws are getting more complex around the globe.**

**There is increasing political involvement in public education.**

**AI technology is being used for policing.**

# SOCIAL TRENDS

The practice of higher education, as well as the ways in which we collect, analyze, and use data, are often a reflection of who we are as people living in particular social and cultural contexts. Institutions must contend with the influences and implications of these sociocultural factors as they seek to build data and analytics practices that are responsible and equitable.

## Institutions are increasingly asked to support decisions with data.

**Impact:** In response to a convergence of social, political, and economic shifts threatening the stability and future of higher education, institutions increasingly rely on data and analytics as one solution for building their resilience against broader societal change. This reliance on data, however, requires extensive investments in institutions' data infrastructures and governance, and meaningful engagement with data across the institution requires intentional and coordinated transformation in institutional culture and operations.

**Evidence:** The role of institutional research is becoming more and more critical at colleges and universities as senior leaders explore the best approaches and data for making important strategic decisions. Student learning and success is an area where institutions are investing more resources and efforts into data-informed decision-making.

## Many big data methods reinforce social inequality.

**Impact:** Data collection, analysis, and reporting all rely on human models and processes for categorization—synthesizing complex phenomena into simpler and more digestible pieces of information. These human models and processes are vulnerable to human biases, often resulting in information that is oversimplified and incomplete or, at worst, harmful to historically marginalized, miscategorized, and misrepresented populations. As institutions evolve their data and analytics practices, they must be thoughtful about doing so in ways that help uncover and address these inequities rather than in ways that reify them.

**Evidence:** The White House's Equitable Data Working Group released a report outlining recommendations for more equitable practices in data collection, analysis, and use across all sectors of the federal government. In a recent EDUCAUSE QuickPoll about analytics and equity, "DEI expertise across the institution" was the most commonly selected element that institutions need but currently lack in using analytics to advance DEI goals.

## A focus on creating equitable learning and work environments is increasing.

**Impact:** Institutions will continue developing and advancing their own mission and goals for serving diverse student populations and supporting a diverse workforce, and external public and private demands for improved equity in learning outcomes will further reinforce these institutional commitments. Data and analytics professionals will be met with opportunities to make their practice more inclusive and aligned with these commitments, opening more space for neurodiversity and alternative approaches to data analysis and interpretation, for example, and adopting data visualization and reporting practices that are more accessible to all.

**Evidence:** The Urban Institute partnered with the Tableau Foundation to write a Do No Harm guide outlining equitable approaches to data storytelling and presentation. The MITRE Corporation's Portal Project offers STEM-related internships to neurodivergent higher schoolers, with the goal of building a more neurodiverse workforce for the future.

# TECHNOLOGICAL TRENDS

**T**echnologies that support the use of massive storehouses of data are rapidly becoming more sophisticated and widespread, with the accelerating adoption of advanced tools such as AI, machine learning, and natural language processing. Higher education institutions may benefit from these technologies in the form of enriched decision-making capabilities, but not before they improve their internal processes and resources for supporting, governing, and using those technologies.

## Existing data infrastructures are outdated and disorganized.

**Impact:** Institutions' on-premises systems such as student information systems (SIS) will lag further and further behind the cloud-based technology advances in other sectors and will be unable to meet the increasingly sophisticated expectations and demands of students, staff, and leaders. The persistence of siloed data sources across functional units and departments will ensure the persistence of analytics outcomes that feel untrustworthy and ineffectual.

**Evidence:** In a [2021 APLU study](#), interviewees universally identified "data silos" as being a challenge for their institution's data infrastructure. The Ohio State University announced in December 2021 that it would be [halting plans to become early adopters](#) of Workday Student.

## Institutions still struggle to implement data governance systems.

**Impact:** Data governance is a daunting challenge that requires deep cultural change within the institution, sustained cross-unit collaboration, dedicated leadership and advocacy, and alignment with the institution's broader technology infrastructure and strategy. Lack of attention to any one of these critical components to governance, or an overemphasis on one at the expense of the others, can keep a governance program from getting off the ground, leading to continued mistrust and misuse of the institution's data resources.

**Evidence:** Georgia State University has [hired its first ever data governance manager](#) to help support its expanding stores of data and its increasing use of analytics. The New School's Platform Cooperativism Consortium (PCC) partnered with the Harvard University Berkman Klein Center for Internet & Society (BKC) in fall 2021 to write three research papers [exploring cooperative data governance models](#) as alternatives to centralized data governance.

## Data literacy and AI skills still lag behind the rapid adoption of big data analytics products.

**Impact:** Global advancements in big data capabilities, including machine learning and natural language processing, will further accelerate across sectors in the years ahead, requiring new workforce skills and end-user literacies for supporting those capabilities and using those technologies. Institutions will need to make space for new kinds of leaders and professionals with specialized knowledge and skills, and data literacy training and resources will need to be developed for students and staff. Those institutions with the needed staff and improved end-user literacy will experience more meaningful engagement with and use of their data.

**Evidence:** A [2021 market analysis](#) by Facts and Factors projected that the predictive analytics market will grow at an annual rate of 24.5% between 2020 and 2026. Tableau is [adding more self-service data science features](#) to its suite of products, with the goal of expanding the use of predictive analytics beyond specially trained data scientists.

# ECONOMIC TRENDS

**W**hether one considers higher education institutions to be “businesses” or something different, institutions are nonetheless embedded within larger national and global economies and must contend with and learn to adapt to shifting financial climates and evolving workforce trends. Institutions’ data and analytics capabilities can help support institutions’ data-informed responses to these larger trends, though those capabilities ultimately rely on higher education’s ability to keep pace with those trends.

## Free or inexpensive certificates from nonaccredited platforms are becoming more common.

**Impact:** The decisions of companies such as Google and Amazon to value nonaccredited forms of training and education at the same level as the traditional college degree will open broader swaths of organizations and institutions to the prospects of hiring nontraditional candidates for important leadership and staff positions. Higher education institutions will experience these changes both in the form of increased competition for student enrollments from lower-cost programs and in the form of new infusions of workforce talent from nontraditional candidate pools.

**Evidence:** According to a [recent job postings analysis](#) by the Burning Glass Institute, only 44% of job postings in 2021 required a traditional four-year degree, down from 51% in 2017. Amazon’s [Career Choice program](#) is offering employees free access to a library of college courses through Outlier.org.

## The value and ROI of a college degree are being questioned.

**Impact:** Public opinion on the value of obtaining a college degree has been trending downward for years, and institutions are falling behind in the task of providing compelling evidence to help improve these opinions. Central to this institutional need for compelling evidence is a call for data, yet many institutions struggle to access reliable and useful data on student job placement and work success, as well as national workforce and education data. ROI and other evaluative models adapted from the business sector may prove useful, though they may come with challenges in translating their usefulness to staff and leaders who view the mission of higher education as being fundamentally unlike that of the business sector.

**Evidence:** The National Student Clearinghouse found that [2021 fall undergraduate enrollments](#) declined 3.1% from fall 2020. According to a [recent survey by Real Estate Witch](#), college students may be overestimating their potential starting salaries after college by as much as \$50,000.

## Tech salaries are growing at an unprecedented rate.

**Impact:** Salaries for technology professionals will continue to grow exponentially, particularly as technology continues to play a central role in our social and economic lives and as the advanced and specialized skills required to support that technology give technology professionals leverage in negotiating higher pay. Higher education institutions will need to invest in their own technology staff and capabilities but might find it challenging to offer salaries and benefits to compete with other industries. Many institutions will struggle to attract and retain the talent they need to support their technology infrastructures well.

**Evidence:** In a recent [EDUCAUSE QuickPoll about the higher education IT workforce](#), a majority of respondents were leaving or considering leaving their institution for a job elsewhere, with a desire for more income being one of the top reasons for choosing to leave. A [recent LinkedIn survey](#) similarly found that 59% of professionals are looking to switch their careers to different industries, most commonly to find better compensation.

# ENVIRONMENTAL TRENDS

**H**igher education data and analytics sits at the intersection of both contributing to and helping address global energy consumption and environmental decline. On the one hand, the powerful computing and data centers critical for institutions' increasingly sophisticated analytics require substantial amounts of energy consumption. On the other hand, data about our environments and our behaviors within those environments can help us uncover insights that can lead to more sustainable and environmentally friendly practices.

## Institutions are rethinking the use of their physical spaces.

**Impact:** As institutions more carefully consider their use of physical campus spaces and seek to make more environmentally conscious decisions, inventories of campus facilities, square footage and occupancy rates, and other related data can help ensure those decisions are appropriate and effective. Many institutions have far to go in making use of such analytics capabilities, however, as their data in these areas historically have not been consistently collected or well maintained. These data deficiencies may hinder effective facilities decision-making where they are not addressed.

**Evidence:** In a recent [EDUCAUSE QuickPoll about learning spaces](#), more than a third of respondents indicated that officials at their institution are actively working to transform “five or more” different types of learning spaces on their campus. In its [2022 report on facilities in higher education](#), Gordian issued a recommendation for increased engagement with facilities data to help guide decision-making and investments in institutions' physical spaces.

## Commuting patterns are changing due to the pandemic.

**Impact:** The widespread continuation of remote and hybrid forms of working will have a meaningful impact on global environmental health—a reduction in the use of personal vehicles and mass transit systems will reduce our consumption of natural resources and the emission of harmful gases. These changes in transportation and work patterns will open new areas of data-informed decision-making for institutions seeking to make the best decisions to fit their particular work contexts and staff needs. And institutions will be better positioned to staff those data needs, as more flexible work environments will enable institutions to attract and retain data and analytics talent.

**Evidence:** The American Public Transportation Association (APTA) found that [public transit levels](#) throughout the first year of the COVID-19 pandemic were 60% below 2019 levels, with levels in 2022 and 2023 expected to remain below 2019 levels as well. The Organisation for Economic Co-operation and Development (OECD) is [tracking global increases](#) in “green economic recovery” spending, including substantial spending in the areas of green energy and transportation.

## The demand for green IT services is growing.

**Impact:** The carbon footprint of IT operations can be sizable, with data centers in particular relying on powerful devices that drive energy consumption and emissions. As pressure mounts for institutions to develop more sustainable and environmentally friendly technology and data infrastructures, solutions such as cloud computing and virtualization can reduce the use of physical devices and lower data center power consumption.

**Evidence:** In its [2021 decadal report](#), the Semiconductor Research Corporation projected that global computing energy needs will exceed energy production capacity by the year 2040. Google has announced a goal of operating [completely on carbon-free energy](#) by 2030, to include sourcing its data centers through clean energy.

# POLITICAL TRENDS

**H**igher education can be deeply political both in its foundations and in its day-to-day practices, assuming the shape of the general political milieu of its contexts and taking on an active role in supporting or pushing against political leaders and agendas. Data and analytics practice is one important connecting point for institutions to the political sphere, as laws dictate specific approaches to that practice and as that practice becomes a vehicle for political expression.

## Data privacy laws are getting more complex around the globe.

**Impact:** Even the largest, most well-funded institutions will be challenged to keep up with evolving and increasingly complex national and international laws around collecting, storing, and sharing data. Federal data oversight and demands will require institutions to build on their existing data-related staffing, resources, and governance and to rethink what data they collect and how. International collaboration and data sharing will be even more difficult to navigate, with data laws and standards varying from nation to nation and with global political tensions eroding trust and willingness to work together.

**Evidence:** Connecticut has become the fifth U.S. state to enact **its own data privacy law**, while China's new Personal Information Protection Law (PIPL) stands to **further complicate** international data sharing practices and relationships.

## There is increasing political involvement in public education.

**Impact:** National and local political leaders increasingly view public higher education as an important platform for advancing their particular worldviews and for protecting and building their desired future society. As institutions come under closer scrutiny from these leaders and legislatures, accurate and verifiable data about institutional operations and student outcomes will be critical for accountability and for defending against untruths and accusations that will inevitably play out on local and national political stages and in the media.

**Evidence:** South Carolina Governor Henry McMaster **has signed the REACH Act into law**, requiring state university students to take credit hours focused on the study of U.S. founding documents. Florida Governor Ron DeSantis has signed the **"Stop WOKE Act"** into law, aiming to regulate the use of critical race theory in state institutions.

## AI technology is being used for policing.

**Impact:** With intensification of political divides in general, and the politicization of higher education specifically, comes the risk of conflict and violence boiling over on college campuses around the world. Many institutions will rely on AI technologies to enhance their surveillance capabilities and monitor campus spaces, raising questions and catalyzing debate on the legal and ethical use of such technologies. The algorithms undergirding these technologies will come under closer scrutiny, potentially exposing biases and forcing institutions to develop more equitable analytics practices across all applications of AI beyond just surveillance and policing.

**Evidence:** In Toronto, **144 police officers** were reported to have downloaded Clearview AI facial recognition technology without authorization, with the technology being used in 84 different criminal cases. Stanford University has announced a decision to **expand video surveillance on its campus**, including limited use of facial recognition technology by law enforcement "if it obtains footage through warrants or subpoenas."

# KEY TECHNOLOGIES & PRACTICES

**G**iven the major trends taking shape outside and inside higher education, data and analytics professionals and their institutions may need to begin planning now for specific technology solutions and practices—or even deploying them—to be better positioned for success in the future. Importantly, these technologies and practices in some cases might be adaptive solutions in response to broader changes taking place across higher education, or they might be innovative solutions that themselves are helping give rise to those broader changes.

For this report, the Horizon panelists began with a blank slate and were tasked with identifying the technologies and practices they believed would have a significant impact on the future of higher education data and analytics. Through panelist discussion and several rounds of voting, an initial roster of 25 candidates was reduced to the list of six key technologies and practices presented here.

- Data Management and Governance
- Unifying Data Sources
- Modern Data Architecture
- Data Literacy Training
- DEI for Data and Analytics
- Assessing and Improving Institutional Data and Analytics Capabilities

The title of this section, “Technologies and Practices,” may seem curious, as many of the six items listed above might not fall neatly into either category as a technology or practice. In reality, each of these items likely represents a blend of technologies and practices. “Unifying Data Sources,” for example, can be accomplished through the implementation of a single data platform for organizing and presenting data from across the institution. But it also requires intentional practices across the institution, such as establishing consistent data standards and processes for collecting and inputting data. In the expert panel’s discussions for this report, then, enlarging their focus on both technologies and practices has made it possible to bring into relief a more nuanced and accurate picture of what is influencing postsecondary data and analytics.

Finally, what kinds of challenges might institutions encounter if they go forward with any of the technologies or practices identified by the expert panel? And what kinds of benefits might they expect? To assess the nature and extent of the impact of these key technologies and practices, we asked panelists to evaluate each of them across several dimensions:

- To what extent will it require increased support from key stakeholders?
- What is its potential to have a significant and positive impact on institutional strategic goals?
- What is its potential to support digital transformation at the institution?
- How much institutional spending will be required for optimization across the institution?
- In what way would optimization impact the size of the workforce at the institution?
- To what extent would optimization require upskilling or reskilling of the institution’s current workforce?

In this way, we asked the panelists not simply to identify what might have an impact but to anticipate just what that impact might be. These results are presented in the charts that accompany the discussions of the technologies and practices.

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**Data Management and Governance**

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**Unifying Data Sources**

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**Modern Data Architecture**

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**Data Literacy Training**

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**DEI for Data and Analytics**

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**Assessing and Improving Institutional Data and Analytics Capabilities**

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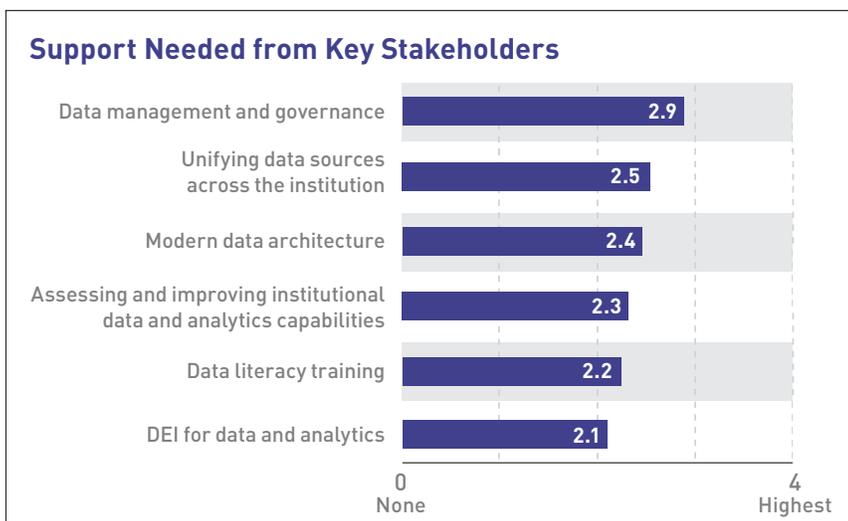
# DATA MANAGEMENT AND GOVERNANCE

## Overview

Data management and governance comprises a broad range of institutional processes, including but not limited to workflow automation, access management, system integration, data integrity management, self-service dashboards, data privacy and security, and consent management. These processes are central to institutional success and generally require broad stakeholder engagement. But their dependence on cross-institutional committees means that they often lack their own dedicated personnel and resources. This has resulted in lost opportunities and wasted effort, particularly as staff turnover among committee and working group members creates gaps in institutional knowledge.

Analytics professionals are advocating for advancements in data management that rely on automated systems and AI-enhanced processes and help minimize the disruptions of shifting (or simply absent) leadership and staff. These technology-enabled changes could be challenging to implement at the ground level, particularly for institutions whose cultures resist such change. Our Horizon panelists noted the simultaneously deep and broad nature of these changes, which may make it challenging for key stakeholders to fully grasp what data management and governance is and why it needs to be supported. Data and analytics leaders should be ready to help their stakeholders and communities understand the need for and the benefits of improving data management and governance. Indeed, panelists ranked data management and governance highest among the key technologies and practices for requiring increased support from key stakeholders (see figure 1).

**Figure 1. Panelists' Ranking of Support Needed from Key Stakeholders for Each Key Technology or Practice**



## Data Management and Governance in Practice

### Re-Envisioning Privacy and Data Governance at ASU

ASU's evolving approach to data governance centers on the individual, embracing "Privacy for All." This initiative includes internal and external benchmarking; overall program design; roadmapping activities to mature the program over the long term; data and privacy policy development and maturation; data mapping the relationship between enterprise data stores, data lifecycle, and workflows; and maturation of processes including Record of Processing Activities, Data Protection Impact Assessment, and Data Subject Access Request.

### Data Asset Management Plan

Three prominent organizations stated that "Analytics Can Save Higher Education. Really." Recognizing the criticality of data and analytics, Montgomery College launched a comprehensive data asset management program that moves beyond data governance to focus on learning, growing, evolving, and helping to future-proof the institution. Informed by an independent assessment, the college developed an inclusive plan to address identified gaps and move the institution forward.

### Improving Data Governance through Uplifting Data Ethics

In 2022, the University of Queensland will continue to improve how it transparently and ethically uses data, considering all stakeholders throughout the university. This is done through a multifaceted program that encompasses training offered to staff around the university, the development of a range of supporting resources (e.g., one-pagers), and the implementation of a streamlined process for the request and approval of data (Data Sharing Agreements).

## Relevance

### Foundational Practices

The effective management and governance of data requires an honest assessment of the institution's existing data practices and the consistent and systematic adoption of new practices. Panelists suggested that new foundational practices in data management and governance could be developed with inspiration from DevOps. Planning, creation, testing, operation, and monitoring could be set in a feedback loop for continuous improvement and optimization. This cycle should integrate data needs across the entire institution, allowing stakeholders to work across unit-level silos.

As institutions adopt integrated research-to-practice cycles for data management and governance, they can tackle challenges they've been struggling with for years. Panelists described practices that could help address persistent challenges, including integrating data across numerous siloed sources, providing secure data access to the stakeholders who need it for decision-making, scaling solutions to accommodate demands for "big data," automating data quality and integrity checks, integrating streaming data solutions instead of relying on data batching, and enhancing services with AI tools to improve efficacy and efficiency.

### Cybersecurity

Local and international data privacy and protection laws are rapidly proliferating across the world. A central theme in the panelists' data management and governance conversations was the growing importance of cybersecurity regulations. An uptick in cloud storage and software service solutions, coupled with more remote work than ever before, has led to increased concern for where data are physically located, where and how people are accessing those data, and how the data are protected. In particular, tenets of zero trust architecture could be a solution for higher education institutions. Though true "zero" is not attainable, privacy experts are working to decrease reliance on trust by leaning on verification and monitoring of data processes.

### Effective Data Governance for Modern Data Systems

To prepare for the development of a modern data architecture, the Rancho Santiago Community College District took a collaborative approach to data governance that incorporated information technology and institutional research teams to design an effective data governance framework that provided enhanced visibility to the issues that needed resolution while applying new organizational structures that better aligned these data with our institution's vocabulary and typical uses.

### Institutional Data Governance

University of Arizona's University Analytics & Institutional Research (UAIR) established a best-practice approach to data governance that comprises seven components. One of these seven components, business process integration, can be described as the "backbone of any data governance process." UAIR's ability to successfully integrate in business processes has been facilitated in part by establishing the chief data officer role to lead the unit, as well as the evolution of campus partnerships.

### DataND

DataND is an enterprise program that provides leadership and support to all Notre Dame academic and administrative units by delivering institutional data for decision-making. DataND allows users to access, combine, explore, and understand Notre Dame's institutional data through easy-to-read reports and graphics, as well as the ability to search, browse and download data. Access to datasets and reports is secure and appropriate to the role of various users.

## FURTHER READING

University of Michigan:  
**Safe Computing**  
[ViziBLUE](#)

Maya Kaczorowski Blog  
["BeyondCorp Is Dead, Long Live BeyondCorp"](#)

### AWS Public Sector Blog

["Modern Data Engineering in Higher Ed: Doing DataOps atop a Data Lake on AWS"](#)

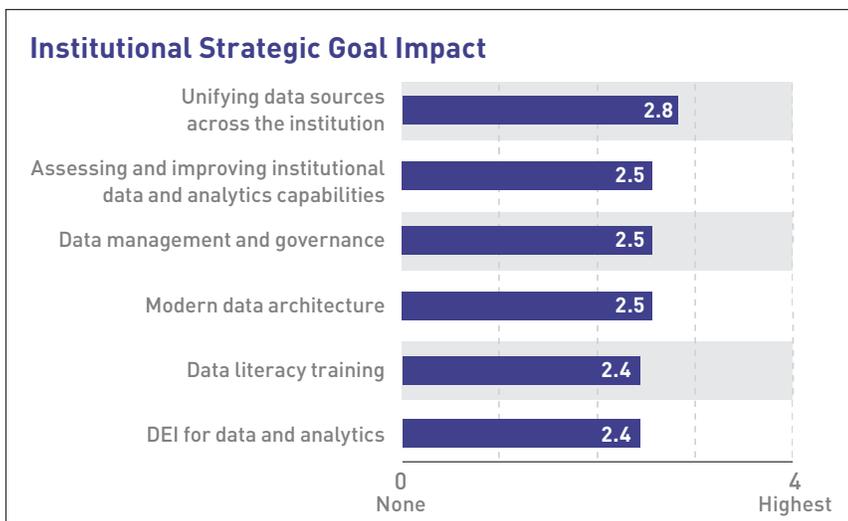
# UNIFYING DATA SOURCES

## Overview

Silos are a ubiquitous problem in higher education culture; they separate pockets of expertise, functional units, and individual personnel within institutions, making it harder than necessary to engage in institution-wide activities such as strategic planning. One of the most challenging silos in higher education separates not people but data. As complex data ecosystems, higher education institutions contain vast data stores that are typically disjointed across computing systems that don't talk to each other, diminishing institutions' ability to engage in holistic data analysis and decision-making practices. Data experts are urging higher education leaders to support significant cultural shifts and financial investments to unify institutional data sources.

In practice, the activity of unifying data sources across and between institutions is a part of data management and governance. Integrating data sources requires elements such as persistent identifiers, consistent dictionaries, and tight security measures. Our Horizon panelists elevated this topic to have its own space among the key technologies and practices because its complexity warrants dedicated conversation and thought leadership. In fact, panelists rated unifying data sources as having the greatest potential impact on institutions' strategic goals and digital transformation (see figures 2 and 3).

**Figure 2. Panelists' Ranking of Institutional Strategic Goal Impact for Each Key Technology or Practice**



## Unifying Data Sources in Practice

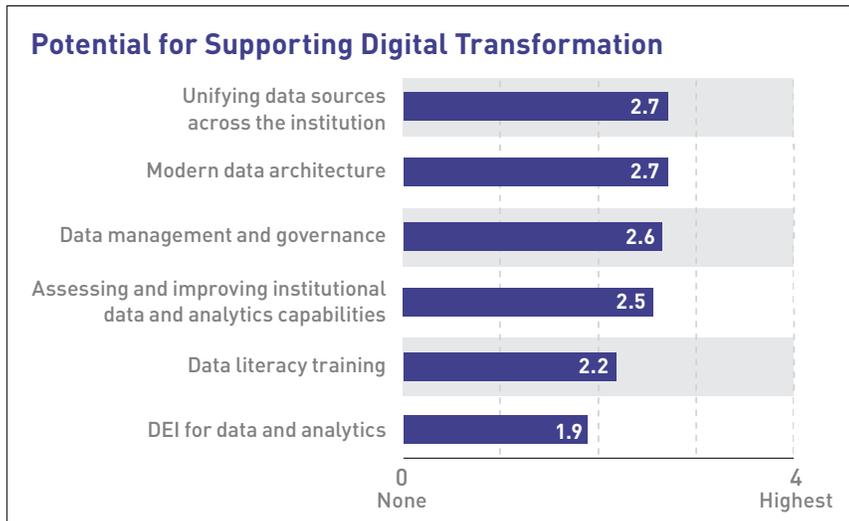
### De-Siloing Campus Data Systems to More Fully Support the “Whole Student”

Siloed data systems are an ongoing challenge for every institution, with valuable information trapped within dozens of isolated sources and unavailable to improve operational efficiency and student success. Ashland University committed to breaking down these silos. Staff at the institution are bringing this valuable information together in support of the mission to shape graduates from on-campus, online, and correctional education programs who work, serve, and lead with integrity in their communities.

### Total Student Engagement Dashboard

To improve understanding of student enrollment and related processes at Georgia State University, the Total Student Engagement Dashboard has begun integrating 20 systems that combine student data across online and in-person interactions. The dashboard has been used to improve roll verification accuracy, translating to improved enrollment and retention tracking. As data are surfaced in new ways, the university is amending its registration agreement to make clear how data are being used.

**Figure 3. Panelists' Ranking of Potential for Supporting Digital Transformation for Each Key Technology or Practice**



## Relevance

### Strategic Operations

As institutional leaders increasingly focus on making data-informed decisions and strategic plans, they are more reliant on robust datasets that span multiple functional areas of their institutions. Data stores can be found almost anywhere: admissions, financial aid, student affairs, human resources, individual academic units, and more. Strategic decisions made using data representing only one or a few of these functional points of view—and without understanding the implications of those decisions for other functional areas across the institution—may fall flat or be less effective than if they were made with a broader view into institutional data. Moving to unified data systems will enable institutional stakeholders to carry out more meaningful analyses to address complex topics such as the ROI of various degree programs, lifelong student engagements, or the different experiences students have with various institutional services.

### Partnering to Promote Analytics for Successful Student Outcomes through Career Engagement

Indiana University is on the forefront of developing data sources—merged from third-party systems, the National Student Clearinghouse, and institutional data—used to evaluate programs and positively affect student outcomes after graduation. We have published interactive visualizations that are used to track and assess student career engagement activities, internships, and career and continuing education opportunities and successes. We are building capacity for doing advanced analytics to support career development stakeholders and students.

### MIT Libraries Research Data Index

The Libraries Research Data Index (RDI), an ongoing collaboration between the libraries' technology and data services teams, aims to index MIT's research data toward the goal of providing a single point of discovery for MIT's research data. Working with a variety of institute partners, we anticipate the RDI will enhance awareness, reuse, and machine accessibility of these datasets.

## Cross-Institutional Partnership

Higher education stakeholders are not able to fully access the power of data to provide insights into student success until cross-institutional data sharing is facilitated. Unifying data sources within institutions will hopefully inspire broader efforts to integrate data and analyses across higher education institutions and other relevant data sources. Though some state-level and consortial data and analytics efforts currently exist, they can integrate only a fraction of relevant student-level data and may be limited in their impacts on institution-level decision-making. Progress here will require national data solutions and more meaningful engagement across institutions.

As just one example, efforts to understand the ROI of various higher education degrees will be facilitated by integration with Post-Secondary Employment Outcomes (PSEO) data provided by the United States Census Bureau. However, the United States has still not created a system for storing and protecting the student-level data required for national investigations. Thus, significant work remains to be done before most federal data can be used by individual institutions.

## Classroom Fleet Dashboards: Integrated Data Visualization to Improve Learning Spaces

This project involves the integration and analysis of multiple data sources concerning physical learning spaces at McGill University. We use Microsoft Power BI to visualize integrated datasets of room information, course schedules, audiovisual equipment, Learning Space Rating System scores, and more. We create interactive dashboards and visuals, filter results, and generate customized reports and dashboards to analyze questions related to university teaching and learning space needs.

## NLU Data Lake

As an increasing number of systems are used across National Louis University, we have sought to unify these data sources into a centralized data lake. In the process we have also sought to unify university-wide strategic metrics and analytics to provide a single source of truth that bakes in our business logic and provides a common access point for trusted data, no matter what reporting tool is used.

### FURTHER READING

#### Gartner

Master Data Management  
Solutions Reviews and Ratings

#### Huron Consulting Group

“Data Governance for Higher Education:  
How to Turn Institutional Data into a  
Competitive Advantage”

#### GOV.UK

National Pupil Database

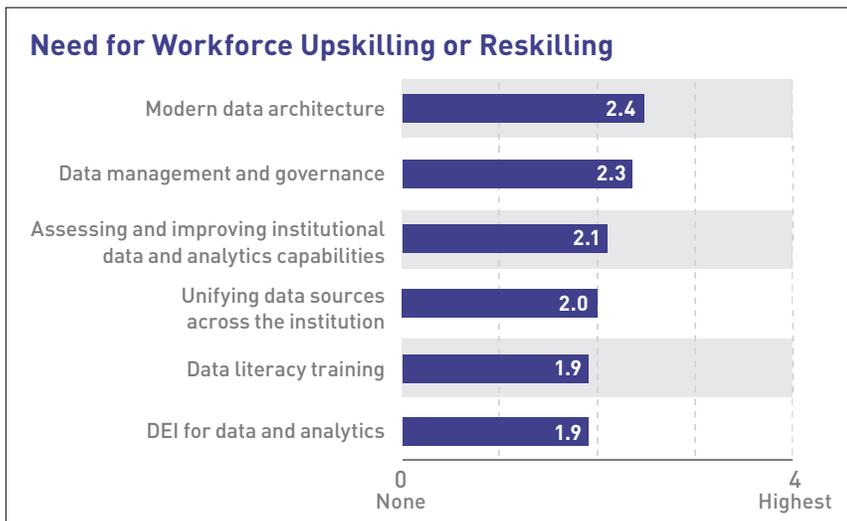
# MODERN DATA ARCHITECTURE

## Overview

Modern data architecture is another key component of data management and governance. After data sources are unified, data structures must be set up to facilitate analysis. Many modern software and service solutions are available for maintaining an institution's data structures, but none of them have gained widespread adoption. Additionally, traditional data architectures seem to be outliving their usefulness and are unable to support more sophisticated analytics capabilities such as machine learning and natural language processing. Without a scalable, adaptable, and flexible data architecture, data users cannot effectively use modern data analysis capabilities, and the trustworthiness of data analytics comes into question.

Modern data architecture ranked highest among all of this year's key technologies and practices for requiring upskilling or reskilling of institutions' current workforces, as well as for the spending that will be required by institutions to optimize their existing data architectures (see figures 4 and 5). Panelists predicted that improvements in institutional data architecture will require professional development investments for existing data personnel, as well as the addition of new data architecture leadership, staff, and skills.

**Figure 4. Panelists' Ranking of Workforce Upskilling or Reskilling for Each Key Technology or Practice**



## Modern Data Architecture in Practice

### Data Analytics Program

Bentley University launched a Data Analytics Program in May 2021 to reimagine the enterprise reporting and analytics environment to support university strategic goals and ensure strategic decision-making based on reliable, high-quality data. A key component of the program is the implementation of a modern data management architecture and environment that is supported by strong data governance and user data literacy training.

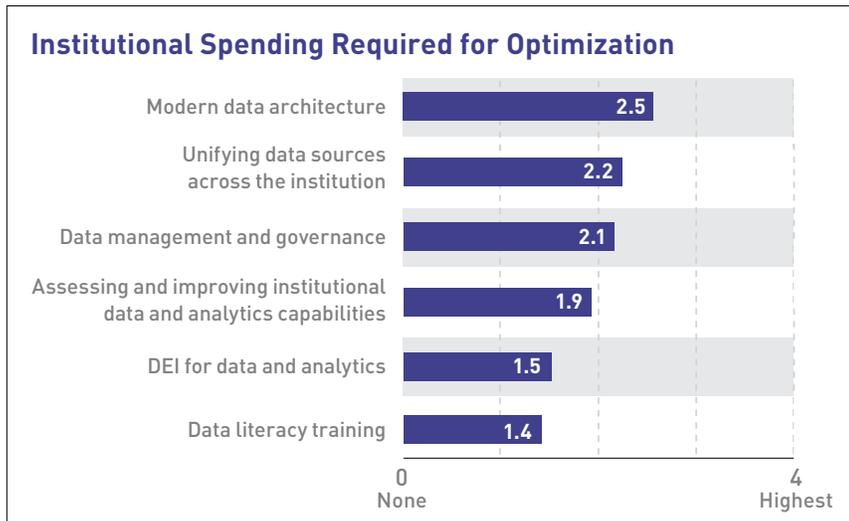
### Data Lake at Kent State University

The data lake at Kent State University is designed to elevate the quality and integrity of institutional data to empower system-wide deep analytics with the view of dramatically enhancing insightful decision-making and forecasting. The system aggregates student, corporate, and finance data into a data lake for the purpose of enhanced insights through advanced analytics. The goals are to enhance student outcomes as well as deepen the relationship with corporate partners on all fronts.

### Comprehensive Historical Stability across Unlimited Data Sources

Most operational data systems in higher education do not provide sufficient effective dating for a wide array of critical data elements needed for analytics and reporting, creating enormous challenges for developing reliable and repeatable reporting—especially if they don't have an existing data warehouse! Mendocino College leveraged advanced cloud technologies to create a modern data architecture that provides comprehensive historical stability across unlimited data sources.

**Figure 5. Panelists' Ranking of Institutional Spending Required for Optimizing Each Key Technology or Practice**



## Relevance

### Data Lakes, Warehouses, and Lakehouses

Modern data architecture must not only store large amounts of data, but it also must provide users with access to databases that are logical, organized, and usable. Institutions have been using data lakes to store raw data, typically without much organization or attention to the form and function of the data, while using data warehouses for data that have been cleaned and organized and are ready for use. Data lakehouses are a newer solution for accomplishing the functions of both lakes and warehouses; data are stored in both raw and usable formats in a single environment.

### Columnar Databases

Traditional row-oriented databases store each row of data in a spreadsheet (referred to as an individual record or case) as a single line item. These traditional databases are simple to use but not conducive to cross-system data sharing and analyses. A more efficient and integrative way to store data is in columnar format. In this format, each column of data is stored as a single line item. When a columnar database is queried, only the relevant columns of data need to be queried, resulting in faster and more efficient analyses. A newer approach to data architecture, columnar databases present an attractive solution for higher education institutions because they facilitate analyses across dissimilar datasets.

### Building a Comprehensive Strategy for Enterprise Data Management

New York Institute of Technology developed a comprehensive data management strategy with four goals in mind: 1) commit to a rigorous data governance program to ensure data are properly managed; 2) improve competency in data management and data analytics across the organization; 3) establish a contemporary and robust technical infrastructure for analytics and business intelligence; and 4) leverage analytics, technology, and process innovations to advance institutional strategies and decision-making.

### Reimagine Data Warehousing: A Modern Data Lakehouse for Higher Education

Founded in 1899, the Philadelphia College of Osteopathic Medicine (PCOM) is one of the nation's oldest medical schools. The "Reimagine Data Warehousing" initiative leverages the latest thinking around combining data lakes and data warehouses into a unified, cloud-based architecture. This highly flexible "data lakehouse" approach eliminates many traditional data challenges in both data lakes and data warehouses while empowering PCOM with the best of both in a streamlined, easily supportable architecture.

### Platform for Open Data

POD, the Platform for Open Data at Duke University, provides infrastructure needed to collect, house, and syndicate collective library metadata of multiple institutions. POD positions consortial data as strategic assets by facilitating their reuse and enabling new service integrations. This project uses open, iterative development in multi-institution agile teams to meet multiple needs and enable innovation in ways that cannot be done through one-off solutions or by relying on vendors and external systems.

## FURTHER READING

### Blue Granite Blog

["Data Lakes and Modern Analytics for Education"](#)

### Forbes

["What Is a Data Lakehouse? A Super-Simple Explanation for Anyone"](#)

### Striim

["What Is a Data Lakehouse? A Combined Approach"](#)

# DATA LITERACY TRAINING

## Overview

A common theme embedded within all of this year's key technologies and practices is the increased demand for insights from "big data." The ability of end users to generate insights from data, however, requires that they understand what those data represent and know how to interpret and responsibly use those data. It is no surprise, then, that our Horizon panelists have elevated data literacy training to be one of the top six technologies and practices this year. Though the volume and types of data collected by institutions have increased significantly in recent years, many institutions have not seen parallel advancements in end users' abilities to interpret and use findings.

Implementing large-scale data literacy campaigns at higher education institutions could be costly and time consuming, though such efforts could result in large returns on investment. With more expertise and comfort in using data, stakeholders across the institution (including staff, faculty, and students) could more effectively use data to inform their decision-making and practice and to improve outcomes for students—and do so in ways that respect privacy and minimize institutional risks in data access and sharing. Panelists anticipated that data literacy training would have little impact on the size of an institution's workforce and could be done at a relatively low cost (see figure 5), compared to the other key technologies and practices.

## Relevance

### Valuable Professional Development

Data literacy is arguably one of the most important foundational skills needed for leaders and staff in today's data-centered professional market. Historically, though, degree and other certification programs not explicitly relevant to data and analytics have rarely included much (if any) training in professional data literacy skills. Institutions have an obligation to their employees, then, to support their growth and long-term career paths as professionals by equipping them to understand and use data in their work. Though the direct benefit to institutions comes in the form of employees who are better able to contribute to institutional goals, indirect benefits might also accrue—employees who receive meaningful professional development are more engaged and satisfied with their work, leading to better retention.

## Data Literacy Training in Practice

### CSUMB Data Literacy Initiative

The CSU Monterey Bay Data Literacy and Support efforts are designed to help faculty, staff, and administrators learn about data and the resources available to access those data. Self-help guides are available for the data savvy, while regularly scheduled user groups and individual and curated small-group sessions provide valuable training for employees to fulfill their departmental goals and bolster efforts to support the overall CSUMB strategic plan.

### Thunderbird Data Scholars

The Thunderbird Data Scholars Program is a three-level microcredential program offered by the MCC Office of Institutional Effectiveness with the purpose of increasing employee data literacy, equity-mindedness, and data use for continuous improvement. Employees progress through the program by completing a data literacy course with embedded modules on using data with an equity mindset, applying their knowledge to complete their own continuous improvement project, and mentoring others in data use.

### Data Close to Practice Program

Data Close to Practice (DCTP) is an iterative, team-led, college-wide initiative that incorporates data literacy, data integrity, evidence-based inquiry, and decision-making to improve outcomes for students at Northern Virginia Community College. The program seeks to build a culture that engages practitioners in improving student outcomes. It asks practitioners to rethink the systems, processes, and practices that support students' experiences. DCTP calls for all community members to engage in inquiry and evidence-based decision-making.

## Customizable Training

Investment in data literacy training is beneficial for all levels of institutional stakeholders in higher education, from board members to administrators, faculty, and staff. Further, students benefit from data literacy training as key stakeholders in higher education data analytics *and* as future members of the larger workforce. However, each type of stakeholder uses and communicates about data in different ways. Some differences are quite stark—a faculty member analyzing student success data to improve teaching has vastly different needs from those of a board member interpreting revenue reports. Thus, institutions must create both role-specific and general resources for data literacy training.

## Rio Salado College Data Summer Camp

Rio Salado College's 2021 Data Summer Camp project was an effort led by the Office of Institutional Research to increase the data capacity and literacy of faculty and staff. The Summer Camp consisted of an eight-part series hosted over the summer of 2021 to educate and train attendees on the basics of data and the use of analytics and reporting at the college.

## Data Literacy Program

RMIT is a global university with more than 96,000 students and 9,000 staff. The Data Literacy program was launched in 2020 via a user-centric approach. The data literacy modules have been co-designed with stakeholders across the university. We are observing remarkable success with hundreds of completions, attributed to keeping each module short (bite-sized learning) and positioning the program as knowledge booster for both professional and academic staff.

## Data Innovators

Aiming to empower and upskill faculty and staff, the University of St. Thomas's Institutional Data, Analytics, and Reporting team launched Data Innovators, a custom training program tailored to the data and analytics needs of the university. This 12-month program teaches data management, tools and systems, analytics, and storytelling to continue building a data-driven environment. It also includes a 1:1 mentorship to foster the data network at the university.

## FURTHER READING

**Gartner**

"A Data and Analytics Leader's Guide to Data Literacy"

**InsideHigherEd**

"You Are a Data Person"

**Dataversity**

"The Future of Data Literacy"

# DEI FOR DATA AND ANALYTICS

## Overview

Data and analytics professionals are increasing their focus on diversity, equity, and inclusion (DEI) in the ways they collect, manage, and analyze data. Beyond avoiding unethical practices, stakeholders are working to leverage data and analytics, which touch almost every part of the institution, to drive equity in higher education. Professional norms, however, have been created by and for the majority. Data and analytics professionals are now turning a critical eye toward these norms and questioning the status quo. Collectively, the field is reexamining who makes choices about what data get collected, how they are collected, what they are used for, and what implicit biases are baked into every step.

Beyond these questions, efforts are under way to purposefully leverage data and analytics to support DEI goals and strategic plans. Institutional leaders are now writing goals with specific, observable outcomes so that progress can be assessed with data analytics. In this way, data and analytics can be used to examine how various groups of stakeholders are differentially impacted by current institutional structures, design new structures to eliminate differential impacts, and evaluate the outcomes of those new structures.

## Relevance

### Data Analytics Methods

Best practices for equitable analytics continue to change. Disaggregating data to uncover disproportionate impacts of institutional practices is becoming standard practice. Analysts are learning how to collect accurate and complete datasets that include demographic information without causing further harm to underrepresented groups. Stakeholders are discussing data as evidence of *institutional* outcomes. This is a departure from deficit models of individual success, which place the onus on those being served. Still, panelists emphasized that these changes in analytics practices must be supported by institutional leaders and that culture shifts are slow in higher education.

Panelists ranked DEI for data analytics among the lowest technologies and practices in the area of reskilling or upskilling of the current workforce (see figure 4) and in the need for institutional spending (see figure 5). However, panelists disagreed on some points. On the one hand, many analysts are not trained with enough DEI content knowledge to apply their skills to DEI goals and strategic plans. On the other hand, analysts already have the technical skills needed to perform meaningful analyses; they only need to engage in the right collaborative partnerships to bring DEI knowledge to their work.

## DEI for Data and Analytics in Practice

### Virtual Learning: Identifying Equity Gaps in Student Engagement

In March 2020, the COVID-19 pandemic transformed the landscape of higher education. In addition to providing students with access to laptops and wireless hotspots to enable the possibility of virtual learning, Foothill College went a step further. We created a unique study focused on new methods to identify student engagement in an effort to quantify new equity gaps created in this new virtual learning environment.

### Developing a DEI Strategic Plan for Our Data and Analytics Office

IUPUI's large Institutional Research and Decision Support (IRDS) office engaged in efforts to promote culturally responsive and inclusive data and analytics. We developed a DEI Strategic Plan that addressed the following: (a) ensuring that our mission statement reflects our commitment to diversity; (b) applying an equity lens to our data and analytics work; and (c) supporting campus-wide DEI efforts while helping the campus live out a commitment to DEI.

### Operationalizing Our Mission: Preparing for a Rapidly Changing World with Increasing Diversity of Our Student Body

This initiative analyzes data from different institutional and external sources to understand the diversity of Moravian University's current and projected student body. The conclusions are converted to success metrics and progress trackers used to guide the implementation of the initiative. This work aligns with our mission to prepare the institution for a rapidly changing world and acknowledges the increasing diversity of our student body and the necessary support structures.

## Awareness of Bias in Analytics

By definition, the purpose of data analytics is to draw meaningful conclusions from observable data. But what questions are asked, what data are analyzed, how analyses are conducted, and which stories are told are all questions decided by people. Because all people have implicit biases and different ways of interpreting the world, these biases and differences are baked into analytics processes. Further, systemic inequity is propagated because most analytics methods rely on data inputs from systems that are largely known to produce inequitable results.

Awareness is growing of the biases that are reinforced by existing data analytics processes, particularly those powered by machine learning algorithms. Algorithms only “learn” to improve by training on existing relationships between inputs and outcomes, relationships that are upheld by systemic inequality. As these issues are becoming evident to a broader range of higher education stakeholders, these stakeholders will increasingly examine the assumptions embedded in analytics tools.

## Equity by Design Course Success Dashboards

These dashboards provide actionable data to inform initiatives to adapt equity-minded practices. They illustrate the gaps in success rates between racial and ethnic groups with college-wide trend data that can be drilled down to course level. Thus, faculty members at Saint Paul College can see the equity gaps in their courses and view the impact of introducing equity-minded practices. At the same time, administrators can track college-wide progress in closing the equity gaps.

## Development, Piloting, and Deployment of an ADVANCE Faculty Equity Query Tool

The ADVANCE Faculty Equity Query Tool (AFEQT) was developed as part of the National Science Foundation ADVANCE grant awarded to Michigan Tech. The tool was developed to pull current and historic data from multiple databases (human resources, banner, courses, research) to dynamically and easily compare faculty parameters along gender and race/ethnicity lines, including faculty ranks and tenure status, promotion, tenure applications, years in rank, turnover, hires, leadership promotions, salaries, research space, startup, student credit hours taught, and much more. The tool enables dynamic parameter customizations of reports.

## Using Machine Learning to Predict Student Success Equitably

Machine learning gives researchers and practitioners new and immensely powerful tools to predict student success and intervene proactively rather than reactively. However, without thoughtful planning and specialized technology, machine learning may replicate—or even exacerbate—systemic biases in outcomes experienced by past students. Using a process that prioritizes equity and trust, our team at University of Oregon developed a machine learning model that predicts student persistence several times as successfully as alternatives.

### FURTHER READING

American Council on Education  
[Race and Ethnicity in Higher Education](#)

Postsecondary Value Commission  
[Equitable Value Explorer](#)

WCET  
[“Enabling Difference—Stories of Equity in Higher Education”](#)

# ASSESSING AND IMPROVING INSTITUTIONAL DATA AND ANALYTICS CAPABILITIES

## Overview

The quality of institutional data and the efficacy of analytics processes are under scrutiny at higher education institutions. Though one of the major functions of higher education is to produce new knowledge, institutional practices themselves often fall behind current innovations. Whether the challenge is limited funding or lack of strategic support, data and analytics professionals are assessing and improving their own capabilities in response to increased expectations for high-quality, impactful analytical insights.

Panelists ranked assessing and improving data and analytics capabilities among the most impactful practices discussed (see figure 2). It is particularly encouraging to consider that this practice can be initiated with relatively little spending, depending on specific institutions' needs and resources. In general, higher education stakeholders are already accustomed to continuous assessment because of accreditation processes. Shifting existing capabilities to focus on analytics practices themselves requires only changes in goals and strategic priorities. Certainly, this shift is possible only with support from institutional leaders.

## Relevance

### Comprehensive Assessment

More than ever, subfields within data analytics are connected by shared institutional needs and goals. As the landscape of higher education becomes more and more complex, previously isolated analytics offices and personnel must work together to share resources, especially content knowledge and technical skills. For these reasons, the assessment of data and analytics capabilities requires institution-level efforts. In this context, "comprehensive" not only describes cross-departmental collaboration but also implies that every step in an institution's data analytics workflow must be addressed. Methods for collecting, storing, and analyzing data, as well as processes for dissemination of insights, must undergo a coordinated assessment.

Comprehensive assessment requires support from leaders at all levels of institutional operations, paired with the right types of personnel and expertise. At institutions where assessment teams are small (sometimes only part of a single job role), comprehensive assessment of institutional data and analytics capabilities will likely require additional or outside staff support. Those institutions that are not already primed for this wide-scale effort will not only require personnel and expertise but will also need to effect cultural change. As we know, culture moves slowly in higher education, so this challenge could prove to be insurmountable for some institutions.

## Assessing and Improving Institutional Data and Analytics Capabilities in Practice

### Georgia Institute of Technology's Data Excellence Program

In 2021, Georgia Tech launched the Data Excellence initiative to create the infrastructure for a data market to enable operational data to be made available in and outside of the Georgia Tech data ecosystem as security and governance frameworks are set. Our goal is to improve the institute's capabilities when it comes to our ability to capture, manage, arrange, present, and use data to drive critical decision-making.

### Grinnell College Data Insights Program

The Data Insights Program is a holistic approach to strategic data management that comprises people, process, and technology. This program supports data quality, increases the use of data for decision-making, and expands organizational capacity for analytics. Key milestones include implementing a business intelligence platform, building an enterprise-wide data warehouse, establishing robust data stewardship, and increasing analytic and data literacy throughout the college's administrative units.

### Key Performance Indicator: Enrollment + Awards

Missouri State University's Office of Institutional Research continues to weigh in on the mission-critical role of data and analytics in the search for visible patterns of behavior that could facilitate usable action items that our administration, faculty, and staff could use to leverage continuous improvements of MSU's efficiencies and effectiveness toward increasing enrollment, retention, and completion rates.

## Improving Efficacy

Higher education institutions have been part of wide-scale trends such as an increase in the collection of raw data and an increase in stakeholders' demands for insights from "big data." Efforts to collect more data and use tools such as machine learning algorithms have not always resulted in better outcomes. Institutions often find themselves with larger problems such as designing scalable and ethical consent practices, safely storing and protecting personal data, and describing complex analysis methods to general audiences.

Assessing and improving institutions' analytics capabilities will require institutional leaders and analytics professionals to determine whether they are effectively using their immense stores of data to tell meaningful stories. And with better processes in place, institutional leaders can begin thinking about what role data analytics can play in the future. Cross-institutional collaboration will be safer, more practical, and more advantageous. Ultimately, as data analytics processes improve, analytics officials can expect to drive better outcomes for students, faculty, and staff.

## Establishing Business Intelligence Solutions to Improve the Agility of the University of the West Indies, St. Augustine Campus

IT Services and Campus Office of Planning and Institutional Research (COPIR) collaborated to establish a business intelligence capability. This enables COPIR to monitor university performance against strategic initiatives. It allows the university to reduce dependency on IT for data, improve consistency of interpretations and reporting, and increase confidence in data. COPIR is now a key source of data for external and internal stakeholders because of this initiative.

## The Student Flows Project

The goals of the Student Flows Project are threefold: to create a shared common dataset that can be used by analysts across the institution to explore student courses, specializations, and degree programs during their time at the University of British Columbia; to develop visualizations of student flows and to recommend tools to visually analyze student flows; and to collaboratively document and share best practices for exploring student flow scenarios.

## UNT Insights 2.0: A Comprehensive Data, Analytics, and Data Governance Program

Insights 2.0 is the University of North Texas's campus-wide analytics/data governance program that was developed collaboratively across IT, IR, and functional/technical stakeholders. Deploying diverse self-service analytics has improved the tone and tenor of data conversations on campus. Offering a diverse array of trainings, 25+ analytic products, 1,000+ trained users, and 1,400 terms in active data governance, the program is truly making an impact on the outcomes for our students and institution.

## FURTHER READING

Gates Foundation  
"Intermediaries for Scale"

Association of Public & Land-grant Universities  
"Assessing Institutional Capacity to Advance Student Success and Equity"

**G**iven the trends we're observing, and the technologies and practices we see taking shape, where might higher education and data and analytics wind up in 10 years' time? How might the people and institutions and practices of tomorrow look different from those of today? And how might the circumstances we find ourselves in evolve, expand, or vanish altogether?

In this section we use a forecasting framework from the Institute for the Future (IFTF) to help us envision not just one definitive future but a collection of alternative futures, each of which takes a different angle on how today might lead into tomorrow. By envisioning several different types of futures, we can be more expansive and flexible in our thinking and planning and be better prepared to anticipate and adjust to whatever future does eventually occur. This section of the *Horizon Report* is a creative exercise, then, that pushes us to consider imaginatively what might be possible. But it's also a grounded exercise, rooted as it is in the concrete trends and technologies and practices we're observing around us today.

We focus here on four possible scenarios for the future, each imagining the course of higher education through the decade beginning 2022. The first scenario we consider is that of "growth," a scenario that sees current trajectories continue to expand into a future in which higher education largely flourishes but leaves some of its issues inadequately addressed. The second is "constraint," a scenario in which higher education is governed by a core guiding value that animates our important decisions and daily practices. Third is "collapse," a scenario in which higher education is beset by rapid breakdowns and forces of change outside its control and that ultimately leave higher education decimated. Finally, in the "transformation" scenario, higher education establishes a new paradigm for itself that allows it to successfully evolve and thrive into the future.

This year's first data and analytics *Horizon Report* finds our panelists reflecting on political influences in higher education, new uses of the physical spaces on campuses, flexible work and learning arrangements, and skepticism around the value of the traditional college degree, all of which are certain to transform higher education as well as practices in data and analytics for many years to come. Across all of these issues, it seems, the use of data and analytics to help drive and improve institutional decision-making can be a key differentiator and help determine an institution's success or failure on the road ahead. Some institutions will invest heavily in these capabilities in the next few years, using new technologies and building up their staff to enable more sophisticated analyses and more targeted decisions. Other institutions will neglect these capabilities and will lag further and further behind in a world that is increasingly learning how to make use of the "big data" at our fingertips.

Whatever we might be able to imagine for our institutions in the future, it feels impossible in 2022 to say with any degree of certainty where things will settle out by 2032. But by focusing our attention on the horizon now, we may begin to take a proactive orientation to the future, to plan and act now to try to bring about the future we want and to **build the higher education that future generations deserve.**



**Growth**



**Constraint**



**Collapse**



**Transformation**

In the wake of “fake news” culture and pressure from a distrustful public, higher education institutions are increasingly being asked to adhere to data-driven decision-making processes. Every decision, from designing new policy to issuing real-time reactions to unexpected events, must be supported by data analytics. “Only measurement matters” has become a common catchphrase, popularized in leadership training, HR documents, and professional development materials.

Higher education policy and practice are heavily impacted by political pressures. In the United States, both federal and state funding is tied to “evidence of outcomes.” This phrase has gained popularity, employed in the design and evaluation of nearly all institutional outcomes. Public institutions that rely on government funding are therefore the most impacted by the current climate. Competing with the private sector, higher education institutions have not been able to hire enough data analysts to keep up with requests for data-driven insights. For-profit companies have also transitioned to data-driven decision-making, and they have been able to offer attractive benefits: flexible work schedules, remote work, and salaries two to three times higher than those of nonprofit institutions. As a result, higher education is experiencing a massive shortage of qualified analysts and is being forced to do more with less.

Overwhelmed by their workloads, higher education data professionals have had no time for professional development and have not been able to update legacy systems. The processes for collecting, storing, and sharing data at higher education institutions is nearly identical to the processes used 10 years ago, except for those that have been delegated to third-party, black-box tools. The volume of available data collected and stored by higher education institutions has made them attractive targets for hackers. Data breaches are accelerating, and those breaches reach far more data (and more sensitive data) than ever before.

Some institutions have resisted the “big data” culture shift. In particular, minority-serving institutions and small private schools, which are now receiving far more private funding, have remained focused on the “whole student” experience and prefer a data-informed approach to decision-making. They use a blend of small and large datasets to achieve a deep understanding of students’ needs, and they use insights from these data to guide, not drive, their decisions. In this data-driven era, many stakeholders do not see value in small-scale, qualitative data. In fact, “data” is now almost universally understood to refer to large volumes of quantitative data, previously referred to as “big data.” Historically marginalized groups of students are largely ignored by big data models, and these students are attracted to the institutions that take care to attend to their unique experiences. These institutions can increase tuition revenue by recruiting students who feel abandoned by institutions implementing new data-driven operations.

Higher education is deeply divided by differing approaches to incorporating data into decision-making. Ultimately, students are voting with their feet. Institutions that demonstrate a commitment to data-driven processes continue to lose students, and institutions embracing data-guided processes are enjoying a new season of peak enrollments.

**T**he past 10 years have been a strenuous time for higher education IT and data analytics professionals. The imperative to accomplish more work with fewer resources has not abated since the early 2020s. In an effort to retain the small number of employees they are able to recruit, institutional leaders are shifting budgets toward rising salaries. Most colleges and universities have not had the funding to update their day-to-day operations infrastructure—particularly their data infrastructures—in years. Fewer IT employees responsible for more infrastructure work means staff are simply treading water, providing piecemeal maintenance for outdated and disorganized systems. Analytics professionals are left trying to provide information for critical institutional decisions with increasingly problematic data. As the rest of the world surged forward in the post-pandemic tech boom, data breaches plagued higher education institutions, which struggled to keep up. It's rare to watch the evening news without a mention of another data breach somewhere in the education sector. Trust in higher education institutions is at an all-time low. Consumers of higher education are insisting that efforts to collect and analyze “big data” are primarily to blame.

News of data breaches has propagated spin stories accusing higher education institutions of generally poor data practices. In particular, the mainstream media questions the veracity of insights generated by data analytics. Students and families are taking these issues seriously. They have initiated large-scale protests against data collection efforts and insufficient security practices. As younger generations are now the biggest population of voters the world has ever seen, lobbyists are supporting the politicization of data analytics in higher education, and politicians have taken notice of new anti-data social movements. Savvy politicians have been able to spotlight data policy in their platforms. Support for strict data laws is mounting from almost all types of political parties. Conservative politicians argue for increased legislation of data processes to bolster individuals' privacy and safety. Liberal politicians agree with these sentiments and add urgent concern for the protection of data related to historically minoritized populations. However, without international standards to address data analytics best practices, global regulations for the collection, storage, and use of human data grow increasingly complex. This complexity has added another layer of work to an already taxed higher education system.

As higher education leaders have struggled to prioritize growing workloads with less support, data analysts have yet to determine how data should be equitably collected, analyzed,

and disseminated. Thus, inequitable practices have remained unchanged, and data analytics applications continue to widen equity gaps across the world. Students have recently started demanding a shift away from data infrastructures that are supported by “big tech.” Envisioning a more equitable approach to data storage and analysis, stakeholders are touting the lower operating costs, stronger computing power, and better security of autonomous systems. Students and some data analysts are pressuring institutions to adopt blockchain technology for their data processes. In many ways, this democratization of analytics processes has improved equitable outcomes in the field. Institutions that take this decentralized approach to analytics are finding that more faculty, staff, and students are able to access and analyze institutional data. The diversity of voices involved in these processes has provided institutions with unique insights. A large body of evidence supports the idea that institutions that make the switch to blockchain data management systems enjoy better outcomes overall.

Budgetary shifts continue to challenge higher education leaders as they work out institutional priorities in today's economy. Doing more with less seems to have no end. One thing has become clear: neglecting the evolution of data analytics has incurred a debt in social capital that institutions might never be able to recover from.

In the early 2020s, students and families were struggling with massive year-over-year inflation and student loan debt. Every financial decision became a process of carefully considering the value of a purchase, weighing options to find the best value. In this time, the value and ROI of a traditional higher education degree came into question. More than any other time in history, students began to recognize themselves as consumers of higher education products—consumers who had options. Now, students take great care to “comparison shop” for their postsecondary educational needs, and the impact this is having on accredited institutions is undeniable.

Accredited higher education institutions are working harder than ever to attract new students. New approaches to recruitment include sharing extensive data about student satisfaction and job attainment, as each institution tries to convince prospective students that it provides better value than competitors. These additional analytics burdens have not been well staffed, and this has strained the higher education technology workforce. Institutions struggle to recruit and retain staff for analytics because they can’t compete with industry salaries and because many resist offering remote or blended work. Without the necessary personnel to support internal analytics, institutions increasingly rely on external black-box data solutions that are less expensive and easier to implement, often leading to less meaningful insights and eroding leadership and staff engagement and trust in data for decision-making. Institutions are unable to produce compelling data stories to compete with for-profit higher education companies. Further, after facing structural barriers at accredited institutions for decades, historically minoritized groups of students are seeking more equitable options for their education. Enrollments at many accredited higher education institutions are dropping, and more institutions are closing every day.

One of the newest competitors providing postsecondary education credentials is...everyone. From accredited institutions to independent educators, anyone can now offer free or low-cost credentials via blockchain education. Though this is not yet the most popular option for higher and continuing education, it is now normalized in the higher education space. Students can combine blockchain credentials from multiple accredited and nonaccredited programs to serve as an autonomously

generated degree-like portfolio. This independence is leading to more equitable options for all types of students, from those seeking comprehensive workforce preparation to those looking for a little bit of personal enrichment. Given the challenges accredited institutions are facing, they are not able to convince prospective students that they provide better value over these less expensive, more equitable options.

For-profit companies have been able to capitalize on trends leading away from reliance on accredited institutions. Large companies use learning analytics to gain insights into learners’ needs and design efficient educational programs. They offer their own credentialing programs to prepare incoming employees and to upskill existing employees. The ecosystem has also seen a proliferation of new edtech companies offering credentials from online classes. Credentialing for work and personal satisfaction is easier and less expensive than ever. All of these credentialing options have only added to the decrease in the demand for accredited higher education degrees. Free-market competition is resulting in better programs offered at lower costs. Students do appreciate that they have more education options, but with so many companies offering credentials, it’s hard to discern which ones hold the highest value and which ones are not valuable. Taking classes that are poorly constructed costs students valuable time and money.

Though traditional higher education systems are failing, new technologies continue to facilitate access to new education options. Open access, flexibility, and autonomy are the new pillars of higher education.



**E**fficiency is a main concern for everyone these days, but in recent years higher education has taken on one of its biggest challenges: improving the health of global ecosystems by redefining the purposes and uses of physical spaces.

Higher education institutions are taking advantage of the newest technology to lead the world in more efficient teaching, learning, and work. Institutional leaders are inevitably turning to increasingly complex data ecosystems to inform strategic decisions, relying on improved data architectures as well as data literacy programs. Faculty increasingly embrace blended and remote activities as they seek ways to improve efficiency and efficacy. Higher education officials are rethinking the use of physical spaces, a move that is widely supported by students, faculty, and staff. In fact, because living and commuting expectations have significantly changed over the 10 years since the start of the COVID-19 pandemic, most people tend to push back on requiring physical presence for activities that could just as effectively be carried out remotely. Increasingly, faculty, staff, and students resist coming to campus unless a physical meeting is justified.

Clearly, the early 2020s ushered in new approaches to work and life for most of the world. Remote work and learning have received a great deal of attention over the past decade, and technologists have raced to keep up with the rapidly changing world. While some stakeholders have focused on best practices and policies for remote and blended work and learning, others have turned their attention to the computing changes necessary to support these activities. With a focus on user-facing processes, software systems have evolved to support more complex data architectures and execute more powerful computing. However, hardware development has lagged. Many important advances in computing still rely on inefficient technology such as server farms. Worldwide efforts are now under way to improve hardware processes. These efforts typically place greater focus on minimizing the impact

IT is having on the environment. The effects of climate change are more tangible every day, and there is nearly a universal commitment to improving environmental impacts all over the world. Colleges and universities are working with private companies in international coalitions for “green IT,” and higher education IT units have been able to lead this effort by bridging silos between big tech and academic researchers.

After leveraging public interest in pedagogy to gain political favor, legislators have over the past few years become increasingly interested in educational institutions’ impact on the environment. A new feature of political discourse is the questioning of continued institutional commitments to extensive brick-and-mortar infrastructures. Certainly, many institutions have valid pedagogical reasons for maintaining these physical buildings, but some are simply holding on to tradition. Political pressure is mounting for colleges and universities to move to virtual operations whenever possible as evidence of their commitment to planetary health.

Trying to keep up with the demands of so many stakeholders, some institutions have moved too fast and too far into blended and remote operations. Workers whose jobs relied on in-person activities were laid off, and this has impacted institutional morale and culture. Further, some historically minoritized groups of students are being disproportionately impacted, especially students with disabilities and those who lack access to robust technology. Higher education leaders are realizing that careful attention must be paid to equity in plans for remote operations, or else valued members of their communities will simply be left behind.

# IMPLICATIONS: WHAT DO WE DO NOW?

**H**aving painted in very broad strokes several abstract portraits of what the future of data and analytics in higher education might look like, we turn our attention now to considering what the report's trends and technologies and practices might mean more concretely for different institutional roles.

For this report, we solicited six implications essays from our panelists to help us explore these more grounded perspectives. A variety of roles and functions across an institution must be involved to ensure success with data and analytics, and our essayists represent that broad range of institutional functions. These essays focus on the implications of current data and analytics trends and issues for the chief information officer (Anderson), institutional researcher (Hamman), chief academic officer (Johnson), chief data officer (Kew-Fickus), enterprise applications director (Snyder), and enterprise architect (Stevens).

These panelists were asked to consider the results of the 2022 panel's work through their own unique lenses and offer reflections on two questions:

- What do these trends and issues mean for your role?
- What plans should individuals in your role make?

The panelists approached these questions with an eye toward their function within the institution, offering a view into the latest trends and current challenges and opportunities for higher education as observed from their particular vantage point.

The CIO, for example, needs to envision ways to retrain IT staff with emerging skills in data ops and retool IT departments with technologies necessary to deliver a modern architecture. The institutional researcher needs to play a leadership role in data literacy work. And the chief academic officer needs to encourage appropriate use of data to inform decisions related to faculty, curriculum, and students.

Although the essays point to different areas of focus and responsibility within the work of analytics, they also share foundational concerns that ultimately make them more similar than different. Essayists point to the growing demand for data and for data-informed decisions, with impacts on staffing, data management, and data literacy. With that increase in the use of data, it's also becoming increasingly important for institutions to focus on data ethics, building an understanding of it into data literacy programs and processes for incorporating it into data governance systems. There is a clear callout for collaboration across institutional contexts to meet these growing needs, with several essayists stressing the importance of giving their role a seat at the analytics table as part of that collaborative approach. Finally, in this time of increasing reliance on data for institutional decisions, more institutions are recognizing that data are strategic institutional assets, linking work across these functional areas to key institutional strategic goals.

Whatever your institutional context, then, the essays provided by these six panelists will likely ring true in many ways because they emerge from our shared experiences, even as they take root in their functional areas. These essays do not cover all possible institutional functions related to analytics, but their diversity of perspective can nonetheless inform conversations about opportunities and risks for higher education and the ways innovative thinking in data and analytics can help institutions prepare for the future.

Chief Information Officers

Leaders of Institutional Research

Chief Academic Officers

Chief Data Officers

Directors of Enterprise Applications

Enterprise Architects

# CHIEF INFORMATION OFFICERS

**Jeremy Anderson**, Vice President of Learning Innovation, Analytics, and Technology at Bay Path University

**A**cross this inaugural data and analytics *Horizon Report* we see a broad theme of needing to generate a culture of data-informed decision-making in higher education. The challenging headwinds of competition, demographics, and outside disruption add to the level of urgency. Within this context we have seen the rise of the chief data/analytics officer (CD/AO) to close the loop on data's value proposition—**nearly three-quarters of firms now have a CD/AO**. Concurrently, there will be impacts to the expectations placed on the chief information officer (CIO), a role that already often serves as the leader of digital transformation at many institutions. The biggest changes for the CIO will be in collaborating with the CD/AO to advance the message that data are strategic assets and to realize democratization of data on campus.

## Data Management and Governance

One of the technologies and practices in this report with direct implications for the CIO is data management and governance. Broadly constructed, data governance is an institutional program comprising policies and practices that protect and extend the value of data. One of the leading ways in which the CIO will need to support governance is in the access, security, and privacy domains by designing scalable access control models that account for users' roles and attributes. These permissions will need to follow the user from source systems to databases and finally to analytics platforms with high fidelity.

One of the leading ways in which the CIO will need to support governance is in the access, security, and privacy domains by designing scalable access control models that account for users' roles and attributes.

The CIO also will need to play a role in supporting the life cycle of data, particularly during upstream stages before data are turned into business intelligence. Ensuring that metadata are captured along the way is one way the CIO can increase the transparency of data lineage to ensure business partners are more capable of matching data elements to business needs. Placing quality monitors, such as checks on conformance to field types and business rules, as early in the data flow as possible—ideally in source systems—also will be the purview of the

CIO who oversees enterprise applications. Through this work, the CIO will be a strong partner to the CD/AO and institutional leadership in ensuring we are putting more high-quality, uniform data into the right people's hands.

## Data Literacy Training

Access to data is only the first part of the equation. One study published in *EDUCAUSE Review* found that **data literacy is the next barrier to using data for teaching and learning**. The CIO will need to be an active participant in driving literacy, again at the front end of the data journey, by promoting an understanding of where data are sourced and how they are transformed along the way. Such context is important for ensuring higher levels of trust in data and a greater capability to understand the best uses of individual elements. It also complements the responsibility of the CD/AO, who may be better positioned to support business partners in downstream sensemaking and embedding analytics in decision processes. Collaboration on developing training that infuses both halves of data literacy—context and application—will be necessary to empower producers and consumers of analytics.

## Modernizing Data Infrastructures

Modern and emerging analytics, especially machine learning and artificial intelligence, benefit from holistic views of people (students, faculty, and employees) and processes (such as onboarding, registration, and persistence). Greater emphasis will be placed on integrating data in real time between systems, whether in a centralized data lake or a decentralized data mesh, to piece together disparate, incomplete views produced in individual systems and siloed databases. Only the paradigm behind these approaches is different. Will the CIO seek to flow data into a central repository for serving analytics, or will the CIO view data “as a service” being stored and served from local systems for use elsewhere in the business? What remains is the commonality of making data available universally and on-demand for business intelligence. The CIO will need to react to these changes by charting a course in one of the directions, envisioning ways to retrain IT staff with emerging skills in

data ops and retooling IT departments with the technologies necessary to deliver the modern architecture. Ultimately, it again will be necessary to strengthen the collaboration with the CD/AO to match the architecture to the analytics vision.

## Conclusion

The future CIO is going to play a central role in delivering on the promise of data as an institutional asset. It will be necessary to divide and conquer portions of the data life cycle, with the CIO tackling earlier stages of data’s journey across the institution and the CD/AO addressing the later stages. At the same time, the CD/AO will be a key partner to advocate for continued digital transformation that will yield even more high-quality, actionable data. Synergizing across these functions holds the promise of unlocking the next level of organizational effectiveness and efficiency in support of student and employee success.

## Author Bio

**Jeremy Anderson** is vice president of Learning Innovation, Analytics, and Technology at Bay Path University, where he creates and executes a vision for coupling digital transformation and data-informed decision-making. Prior to this role, he advanced business intelligence, data governance, and original research pertaining to student success while serving as the inaugural associate vice chancellor of Strategic Analytics at Dallas College. Anderson has published and presented nationally on applied analytics and teaching and learning innovations. He earned his EdD in interdisciplinary leadership from Creighton University and holds a bachelor’s degree in history education and a master’s degree in educational technology.

# LEADERS OF INSTITUTIONAL RESEARCH

**John Hamman**, Chief Analytics and Insights Officer, Montgomery College

Institutional research has a long and rich **history** in higher education. These offices have always been steeped in data, but the types of data requested, the frequency with which they are requested, and the people making those requests have all changed significantly over time. The institutional need for rapid access to actionable data has grown significantly to include a more holistic view of students, potential students, and employees that focuses on information and insights without reducing the demands of traditional analysis and reporting. No longer limited to outside agencies and senior leadership, data requests can come from decision makers at all levels of the institution. This increased demand for and interest in data are advantageous for institutions and for institutional research offices that have felt siloed but can be a challenge as those offices also see an increase in mandatory state and federal reporting demands.

The need for institutions to support decisions with data has never been more acute than it is now, and this growing importance of data extends to all of higher education—two-year and four-year institutions, graduate programs, and specialty and professional schools. During the pandemic, institutions were using internal and external data to make decisions about closing campuses, requiring masks, and allowing remote teaching and telework, among other critical decisions. There was **public scrutiny** of what data were being used, how they were being interpreted, and the decisions being made on the basis of those data. Even as we begin to move past those decisions, there is an increased desire to know—at an almost instantaneous rate as conditions change—about student learning, barriers to success, and attitudes about returning to campus. Much of the demand for these data and their interpretation has fallen to institutional research offices.

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Research offices need to be integral in the conversations about what data elements are used in the decision-making process and the potential limitations of the data.

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With all these additional data points, **accreditors** and **others** are asking not just what information is collected but how institutions use data to support decisions and improve institutional effectiveness. While all institutions have had data and made decisions, calls are increasing for documenting the connection between the two and identifying the key metrics used to make important decisions. Research offices need to be integral in the conversations about what data elements are used in the decision-making process and the potential limitations of the data.

They should not be viewed as neutral or passive producers of the data.

For institutions to be able to access and analyze data at increased speeds without loss of accuracy, improved data management and governance are **vital**. Improvements in the way data are collected and housed can make finding insights in the data much easier. However, good data management goes beyond governance structures to consider data quality, analytics, and training. This broad view of data as institutional assets includes data security and assesses the risks associated with collecting, storing, and distributing data. In this period of increased competition for students in higher education, institutions with robust data management strategies will have a definite competitive advantage.

Institutional research offices, even with the help of robust data management and sophisticated artificial intelligence (AI) guidance, will still require human insight and oversight to ensure that output is desirable and reasonable. Some of the decisions made can significantly impact student lives, making this human oversight of the outcomes imperative. Even though AI might be capable of **grading** a written exam, it is still not preferable to human feedback. Similarly, data practitioners need to determine which questions can be left to AI or automation and which require human intervention.

As institutions work to get actionable data into the hands of more decision makers, at all levels of the institution, data literacy of the whole institutional community must also increase. Data literacy in this context will use **Gartner's definition of data literacy** as “the ability to read, write, and communicate data in context, including an understanding of data sources and constructs, analytical methods and techniques applied, and the ability to describe the use case, application and resulting value.” Data practitioners certainly need to be data literate, but at this point that requirement extends into the rest of the institutional community as well. As we work to improve access to data across the institution, we need to help end users make sense of the information they have.

Much like 30 years ago, when the mathematics education community realized that algebraic skills alone didn't give students the competencies necessary to be critical quantitative thinkers and started advocating for **quantitative literacy**,

the institutional research office needs to be at the forefront of the data literacy work on campus, making sure that the descriptions of how to best use the data match the data that are being produced. Additionally, institutional research officers will want to make sure there is a component of data ethics embedded into the trainings.

In summary, the requests to institutional research have evolved from static reporting on past data to dynamic insights into the future. This increased desire and need for data are assets for these offices, making them even more central to the institution's core mission. As a result, changes are needed in the location, physical and spiritual, of institutional research offices away from a siloed back room to a prominent place where they can lead these changes and help make data-informed decision-making a part of the higher education culture.

## Author Bio

**John Hamman** is the chief analytics and insights officer at Montgomery College, serving on the senior leadership team and charged with helping the college use data more effectively. Hamman has been at Montgomery College since 2006, previously having served as a professor of mathematics, as well as both chair and dean of the mathematics area. He has been active in several organizations outside the college, including the Mathematical Association of America, Achieving the Dream, and the Charles A. Dana Center. In 2012 Hamman was recognized by a NISOD Excellence Award and as the Maryland Professor of the Year, cosponsored by CASE and the Carnegie Foundation for the Advancement of Teaching. Hamman loves talking about data to anyone who will listen.

# CHIEF ACADEMIC OFFICERS

**Connie Johnson**, Chief Academic Officer and Provost, Colorado Technical University

**D**ata and analytics is part of the decision-making process at Colorado Technical University (CTU). Academics uses dashboards for several kinds of information, including course completion data (at the course and aggregate levels), student grades (including course withdrawals), and faculty course completion data at the individual and aggregate levels, to name a few. Our challenge is training users to interpret the data, as well as parsing through many large datasets.

With an increased public focus on student outcomes and student achievement in higher education, institutional leaders are increasingly asked to support decisions with data. Historically, academics relied on personal experience and expertise for decisions related to curriculum, classroom content, and instruction. Although this is still the case, an increasingly important aspect of making such decisions is to review relevant data. Data review by faculty and academic leaders can include such information as course grades, course completion, retention and graduation rates, submission of assignment data, and progression with course content. As online learning has grown in general, and in particular due to the pandemic, learning management systems (LMSs) and digital tools provide rich datasets for review. As academics works to improve student progression and graduation rates by using data to inform decisions about classroom content, the efficacy of all digital tools, and faculty success, the reliance on data will continue to grow.

The implementation of data protocols for faculty and academics is both timely and relevant. Although many faculty have a research and science background, the interpretation of data related to student achievement and course performance is often daunting if the data are provided without structure. One recommendation to get started is to agree on the datasets that are used for follow-up. It is important to start with a

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A basic understanding of data analytics will provide CAOs with knowledge to develop plans for choosing data that inform decisions related to faculty, curriculum, and students.

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manageable dataset. While it is tempting to review data for analysis without action, using data for improvements and measuring this progress promotes institutional effectiveness as part of the culture. The key is having agreed-upon metrics and collating data points from many different sources to support improvements and to influence student outcomes.

Chief academic officers (CAOs) are engaged in many discussions about the format of courses and programs. The COVID-19 pandemic has increased thinking

about the use of institutional physical spaces, and in 2020, many institutions provided students with options for taking courses online. Generally, the conversations included three options:

- Online programs and courses
- A blended format with classroom time at the physical campus and in an online LMS
- HyFlex, which gives students the option to move back and forth to an online form classroom format

As courses move to online, blended, and HyFlex formats, the need for classroom space can decline. As students increasingly prefer online programs, previously filled classroom spaces might now be empty.

Based on the change in classroom preference, academics needs to focus on faculty training. Many faculty who were not—or might have even been opposed to—teaching online are now teaching online. At the onset of the pandemic, institutions rapidly developed training to provide faculty with the basics of student engagement in an online classroom setting. Many faculty continue to find it challenging to engage with students in a meaningful way in an online or blended format without the ability to use classroom space.

The change in the use of classroom space also creates the need for a redesign of curriculum. Courses that were previously taught solely on campus may now contain an online element. Many faculty are not trained to develop online classes, which may create greater needs for instructional designers and to test digital tools, along with protocols for decision-making for digital course content. This decision-making often includes a financial impact to the institution.

In addition to instruction, curriculum, student, faculty, and cost considerations, the rethinking of the classroom physical space impacts an institution overall. In some cases, institutions are responding by creating a separate cost unit for online programs. In this model, academic oversight of the content does not fall under the purview of the CAO. Alternatively, institutional officials might choose to incorporate online programs in the colleges as a means to keep revenue from these offerings in the college. The changing physical space of the classroom and the contributing factors may affect the overall financial structure of the institution.

As a result of the growth and use of data in institutions during the past decade, existing data infrastructures are often outdated and disorganized. In academics, faculty and academic leaders increasingly rely on data to make decisions. With the proliferation of online classes and online tools, data can emerge from a number of sources, including the LMS, student information system, internal dashboard, and external vendors. Academics and faculty rely on data infrastructures to review data to make decisions. As data sources and systems have increased, institutions may have systems that do not “talk” to each other. Without the considerations of academics and faculty, challenges may not surface or be addressed as solutions are developed to integrate data systems. The CAO should have a seat at the table with IT and other leaders when discussing solutions to integrate data systems.

Admittedly, IT discussions are challenging at times for academic leaders and faculty. Discussing Learning Tools Interoperability (LTI) integration and data pass-through issues, including security concerns, may seem like a foreign language. Vendor discussions to ensure that grades and data integrate with current learning or student management systems may not seem important.

As data continue to influence decisions in academics and in the classroom, CAOs would be well served to familiarize themselves with the basics of data analytics. This can be a daunting task! A basic understanding of data analytics will provide CAOs with knowledge to develop plans for choosing data that inform decisions related to faculty, curriculum, and students. Potential challenges are data avoidance and not working on anything else but reviewing data. Data submersion can result in reviewing data in perpetuity and avoiding making any decisions. Embracing data and working with faculty and leaders who also welcome data-informed decisions can positively influence the student experience.

## Author Bio

**Connie Johnson** is chief academic officer and provost at Colorado Technical University, working with both online and on-ground degree programs with oversight of academic affairs, including faculty, curriculum, classroom experience, and accreditation. Johnson has served in higher education for over 30 years and has served as a faculty member and administrator. During her time at CTU, she has initiated adaptive learning technology implementation, including adaptive learning at scale, leading academics through change, and effective technology implementation in the online classroom, including using data to influence decisions.

# CHIEF DATA OFFICERS

**Olivia Kew-Fickus**, Chief Data Officer and Executive Director for Data and Strategic Analytics, Vanderbilt University

**T**he Office of Data and Strategic Analytics at Vanderbilt University leads on analytics, data governance, data innovation, data partnering, institutional research and assessment, and survey research. We support increased demand for meaningful data and analysis across the institution; work closely with IT to introduce modern data tools, including a cloud data warehouse and Tableau Server infrastructure; and lead on data governance.

The demand for data has increased in higher education, buoyed by the pervasiveness of data and information in so many aspects of our lives. However, there is also a lack of awareness about where data come from and how to use those data. People assume that data are like electricity: ubiquitous and easy to use. Unfortunately, making sense of data is harder than flipping a switch. A large part of the job of the chief data officer (CDO) is to educate colleagues. The good news is that most people in higher education have the critical thinking and basic math skills needed to become data literate. My office helps people understand the data life cycle and how each of us shapes the data we then report and analyze. We also spend a lot of time assisting colleagues to develop data use cases, explaining that instead of just asking for “some data,” they need to consider how they will use the data and what will change. Savvier data producers and consumers ultimately get more value more readily from institutional data.

As demand and use have increased, so too has the need for better ethical frameworks, especially around the use of personal data. Existing legislation such as FERPA (1974) has not kept up with either the ways data are being used or the

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People assume that data are like electricity: ubiquitous and easy to use. Unfortunately, making sense of data is harder than flipping a switch.

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public’s expectations about privacy. Recent privacy legislation in the United States is geographically patchy and not focused on most educational uses. Data can also unintentionally enhance existing biases. The CDO must catalyze these ethical discussions, working with other stakeholders and experts (registrar, general counsel, audit, information security, project management) to ensure that data collection and use are guided by an ethical and policy framework that reflects the institution’s values. This

frequently means exceeding the basic compliance threshold. Improved policies help decision makers with challenging judgment calls (e.g., should we release this requested information? FERPA says it’s directory information, but it feels intrusive). Policies also help protect institutional reputation and prepare the institution for future legislative developments. Most important, improved ethical frameworks ensure that we are treating students’ and others’ data with appropriate respect.

Higher education is also in the middle of the transformation of data infrastructure away from on-premises applications and warehouses to cloud-based technologies. These technologies are more powerful and faster but require a different approach to management. The CDO must partner closely with IT to develop a strategy for using new tools, integrate cloud and on-premises resources, collaborate with consultants and vendors, and manage costs. The CDO must also stay informed about technological developments, not to replace the expertise of IT but to be an informed partner able to ask the right questions and shape institutional recommendations, strategies, and investments. New technology should never be the goal, but it is an important enabler to getting full value from data.

Trends in data and analytics underscore how the CDO role is fundamentally collaborative and spans boundaries across multiple domains: strategic, ethical, and technological. While technology is important, the role's success ultimately hinges on the CDO's ability to shape institutional data culture. Data are not something "done" by a select few but rather are the responsibility of many, from the receptionist in admissions entering a visitor's name to the institution's president asking

the right questions of a report. What we do with data should also reflect our values. Treating data ethically protects and can even bolster institutional reputation and influence. The CDO must champion, teach, translate, explain, and ultimately persuade people to do things differently and better so that the full potential of higher education data—and of higher education—can be unlocked.

## Author Bio

**Olivia Kew-Fickus** is a higher education professional who has worked in senior roles in the United Kingdom and the United States. She started her career in international development in Ukraine before moving into research management, strategic planning, and ultimately data analytics and governance. As Vanderbilt's first chief data officer, she draws on her intercultural, interdisciplinary background to work with multifunctional teams and serve as a data sense-maker. She holds an AB in history from Princeton University and an MBA from the University of Leicester.

# DIRECTORS OF ENTERPRISE APPLICATIONS

**Rob Snyder**, Associate Director of Enterprise Applications, Data, and Integrations, Ithaca College

The area of enterprise applications is a continually evolving component of the campus digital experience; even the nature and scope of what constitutes an enterprise application in a distributed, hybrid environment is up for reconsideration. As the primary source of both student and operational data, these systems play a critical role in data and analytics, although data and analytics is often a secondary consideration in development and purchasing. In this essay, I look at three items from this *Horizon Report*—data-driven decision-making, data literacy, and governance—and briefly explore their impact on the enterprise applications space.

## Data-Driven Decision-Making

The ongoing challenges from changing demographics, economics, and expectations will continue, and we all believe that data and analytics is key to finding solutions. Those of us charged with supporting ERP systems may think that our prime focus is the stable and reliable delivery of needed operational functionality. While our traditional customers and demands remain, we will need to prioritize our analytics teams and data scientists as first-class citizens on campus. Their needs will equal, and may even eclipse, the traditional operational roles we've delivered to in the past.

Our evaluation of new solutions must include the downstream impact on analytics. Finding ways to include the analytics team in lead roles on purchasing decisions will avoid situations in which we cannot access and integrate data at the level and speed required for machine learning, predictive modeling, and other emerging analytics approaches. Determining how our data lakes, warehouses, and other data stores will work with our ERP systems may need to become the starting point for our enterprise architectures, not something we bolt on later.

Determining how our data lakes, warehouses, and other data stores will work with our ERP systems may need to become the starting point for our enterprise architectures, not something we bolt on later.

## Data Literacy

Data literacy and data science are now inescapable parts of our roles. The growth in turnkey analytics solutions betrays the complexity of meaningful analytics work. If an institution could solve its problems by dragging a few fields into an interactive dashboard and running an automatic machine learning tool, we all would have done that by now.

As we look at upgrading and replacing enterprise systems—especially considering the need to make analytics a primary decision point—we will find more vendors including analytics as a product offering. Our campus partners will be attracted to enterprise systems that offer built-in analytical data modeling and insights, and it will be our role as service partners to understand these capabilities. Enterprise applications with analytics features can be an asset, but they will often be as siloed as the systems they are built into. “One size fits all” can be synonymous with “lowest common denominator”; vendor-delivered schemas and data models may not provide anywhere near enough flexibility or insight into your institution’s specific challenges.

IT will need to evolve to understand campus data as well as we understand networks and servers. We should consider having the same competencies in statistical modeling as we do in maintaining our firewalls. Support for a holistic approach to data and analytics is as key a requirement as any other functional demand we need to deliver in our enterprise applications.

## Data Governance

If we accept that we, as enterprise application service providers, need to include data and analytics as a primary focus in our architecture and offerings, and if we further accept that to make this happen we will need to expand IT to include data literacy and fundamental data science understanding, then what follows is governance. We can't deliver data capabilities without a mechanism around data usage.

Data governance is neither traditionally nor necessarily a problem that we want to own in the enterprise application space, but it is one we need to be aware of. We can think of data governance as two sides of the same problem: on one side is the creation of a shared understanding of how to interpret campus data (e.g., what exactly constitutes a "current" student?), and on the other are the complex questions of equity, transparency, and ethics around our use of data. These are clearly not the types of questions that IT is alone in answering and may not be questions that IT has to answer at all.

We may be called on to provide tools for data governance, either as a stand-alone implementation or as something integrated within one or more enterprise application environments. We will likely be involved in implementing and enforcing data governance decisions. Either way, we'll have to be sure we have a seat at the data governance table.

## Conclusion

As a director of enterprise applications, I am excited to see this role expanding across higher education. At Ithaca College, we combined this role with our business intelligence team to help ensure alignment between systems and data. Because my group is the delivery point for enterprise application functionality, a daily requirement is that we understand the analytics needs and desires of the entire institution. Analytics capabilities are now as important as registration, housing, learning management, finance, and other prime systems functionality, and we will serve our organizations best if we evolve our roles and our understanding with this evolving requirement.

## Author Bio

**Rob Snyder** is the associate director of Enterprise Applications, Data, and Integrations at Ithaca College, where he has worked since 2018. This is his first time working in higher education; prior to joining the college, his career covered software development, analytics, and large systems computing. In his role at the college, he supports data warehousing and BI efforts, enterprise applications, and campus-wide development and integration work. He holds a bachelor's degree in music (from Ithaca College) and an executive master's degree in business administration.

# ENTERPRISE ARCHITECTS

**Mary Stevens**, Technology Architect, University of Illinois-Urbana Champaign

The University of Illinois at Urbana-Champaign has historically operated as a distributed IT ecosystem. As we look to the future, especially as the organization embraces the power of data and analytics, we must design a data ecosystem that removes silos and provides wider access while addressing security and privacy in a way that advances the mission of the university. The enterprise architect plays a key role in helping the organization design and develop solutions that cut across traditional silos, as well as ensuring that technology solutions meet the needs of the university.

To shift data from being a liability to an asset, officials must change their mindset from focusing solely on the defense of their data to finding ways to use those data in a proactive mode and leveraging them to further the missions of the university. Moving from an organization where data are siloed and only accessed by a few people to a state where data are incorporated into many business processes allows higher education to create opportunities not only to meet the expectations of students but also to create the ability to amaze and delight them by delivering convenience, awareness, and control of many aspects of the student experience.

This means that enterprise architects will need to understand where data are, how they are integrated across the organization, and what foundational capabilities the organization possesses or will need to cultivate to successfully leverage data in a manner that is secure and meets privacy regulations and the expectations of the community. Architects should leverage their wide range of skills to help institutional constituents understand the business drivers, the technology challenges (including security and privacy concerns), and the role of stakeholders. The architect should strive to provide information in a manner that creates insight so that the leaders

As data privacy laws become increasingly more complex around the globe, organizations will need to be more aware of the data they maintain and how their business model is impacted by domestic and foreign regulations.

can balance the competing needs of the organization. It is also important that the architect remains aware of and connected to the various efforts that are likely to spin up in different parts of the institution. The architect should strive to act as a connector within the organization to ensure that efforts are not developing in silos.

As data privacy laws become increasingly more complex around the globe, organizations will need to be more aware of the data they maintain and how their business model is impacted by domestic and

foreign regulations. To deliver on the promise of data privacy, enterprise architects will need to ensure that privacy principles are included early in the design process. The design process and the documentation that architects maintain become increasingly important for the success of the organization as it navigates an increasingly complex regulatory environment.

Enterprise architects should examine the existing documentation of their organization and determine if visibility into the data ecosystem is sufficient. Additionally, the architect should focus on processes that will allow the organization to include and improve privacy as part of the design process. Documentation should be a key component of all data and technology efforts. Architects should engage with subject-matter experts and add information about the data ecosystem to the architectural model of the organization

As institutions increasingly rely on data to make strategic and operational decisions, all levels of the organization will need to become more proficient in collecting, maintaining, and leveraging data and supplying data to others. Enterprise architects will need not only to help others find meaning in data via architecture artifacts but also to combine data from multiple sources and provide views of data that are relevant to a diverse set of audiences.

Enterprise architects should examine their current toolsets and determine whether they are sufficient for the data-driven future. Architecture tools should be able to consume data from multiple sources and provide data as part of the institutional data ecosystem. The architect should strive to develop a model of the organization based on data that can be leveraged to answer a multitude of questions about the organization. The model should be easily queried to provide insight and provide answers to strategic and operational questions. By making the model useful for operational personnel, architects will incentivize an army to keep data up to date and guarantee that the quality of the data will make those data relevant for strategic decision makers.

Enterprise architects should act as a partner for both strategic decision makers and operations personnel in higher education. By actively engaging with the organization, enhancing our tools and models, and exposing data about the organization, we help our organizations address the transformations necessary to leverage data. Our work is foundational in helping the institution successfully navigate the challenges facing higher education.

## Author Bio

**Mary Stevens** is a technology architect at the University of Illinois Urbana-Champaign. She has worked at the university for 25 years in various positions mainly focused on networking and led the infrastructure team for several years. After completing her MBA, she discovered that architecture was an almost perfect balance of leveraging her business skills and the technology expertise she had gained through her various positions at the university. She holds several certifications related to architecture, including TOGAF 9 Certified and TOGAF Business Architecture certification. She has worked to instantiate an architecture practice that will help the university design and deploy better services and adapt to the challenging business environment that higher education now faces.

The *Horizon Report* methodology is grounded in the perspectives and knowledge of an expert panel of practitioners and thought leaders who represent a diversity of roles and functions within higher education data and analytics. The members of this group, all first-time data and analytics Horizon panelists, were sought out for their unique viewpoints, as well as their contributions and leadership within their respective domains. The panel represents different roles and perspectives from within the institution, from CIOs to data officers to institutional research leadership. We also sought balances in gender, ethnicity, and institutional size and type. Dependent as the *Horizon Report* is on the voices of its panel, every effort was made to ensure those voices were diverse and that each could uniquely enrich the group's work.

This year's expert panel research followed a modified Delphi process, in addition to adapting important elements from the Institute for the Future (IFTF) foresight methodology. Following the Delphi process, our expert panelists were tasked with responding to and discussing a series of open-ended prompts, as well as participating in subsequent rounds of consensus voting (see sidebar "Panel Questions"), all focused on identifying the trends, technologies, and practices that will be most important for shaping the future of data and analytics in postsecondary education. Ideas for important trends, technologies, and practices emerged directly from the expert panelists and were voted on by the panel. EDUCAUSE staff provided group facilitation and technical support but minimal influence on the content of the panel's inputs and discussions. This was done to protect the core intent of the Delphi process—that an organized group of experts themselves discuss and converge on a set of ideas for the future, based on their own expertise and knowledge.

The framing of the questions and voting across each round of panel input was adapted from IFTF's foresight methodology and drew on the IFTF trends framework and process for collecting "signals" and "impacts" for trends. Ensuring an expansive view

across all the many factors influencing the future of higher education, the IFTF "STEEP" trends framework enabled our panel to focus on Social, Technological, Economic, Environmental, and Political trends. This effectively broadened the panel's input and discussions beyond the walls of higher education to more explicitly call attention to the larger contexts within which data and analytics practices take place. These larger trends—and the current evidence and anticipated impacts of these trends—served as the grounds on which the panel built its discussions on emerging data and analytics technologies and practices.

As they provided their inputs and engaged one another in discussion, panelists were encouraged to share news articles, research, and other materials that would help reinforce their inputs and provide evidence for their particular viewpoints on current and future trends. In addition to enriching the panel's discussions and supporting the panel's voting and consensus processes, these materials were collected by EDUCAUSE staff for use as evidence and further reading in the writing of this report. In the Delphi and IFTF methodologies, these collected materials also serve the purpose of ensuring that the panel's ideas are sufficiently grounded in "real" data and trends.

## Panel Questions

The following questions were designed to elicit an open range of responses from the expert panel and then to narrow those responses to a consensus through rank-order voting. Voting on trends was done separately for each of the five STEEP trend categories: social, technological, economic, environmental, and political.

### STEER Trends

#### **Round 1 (for each STEEP trend category):**

Please use the discussion board below to propose trends that will impact data and analytics in higher education. We encourage you to engage with posts of your colleagues as well. Rich discussion helps improve the data we are able to collect for the next step of the process. Please note agreement or disagreement, and provide additional signals or counterfactuals that support your position.

**Round 2 (for each STEEP trend category):** The list below summarizes the trends provided by this year's Horizon panel. From this list, please select the top six (6) trends you believe will have the most influence on the future of data and analytics in higher education.

### Key Technologies and Practices

**Round 1:** We're interested in hearing from you about those key technologies and practices that you believe will have a significant impact on the future of data and analytics in higher education. There are no right or wrong answers—use your imagination, be bold, and don't feel limited by what you think others on the Horizon panel may or may not have included in their responses. We want your voice reflected in these responses!

What do we mean by "key technologies and practices"? For the purposes of the *Horizon Report*, these are data and analytics technologies or practices that are either new or for which there is substantial, perhaps transformative, new development. An important dimension of these technologies and practices is that they have the potential to have significant impacts and effects on postsecondary data and analytics (or are already having such impacts).

Each answer should include three elements: 1) the key technology or practice, 2) a brief explanation of why you believe this technology or practice will have a significant impact on the future of data and analytics in higher education, and 3) an example of a program or institution that exemplifies this key technology or practice.

**Round 2:** Please select the top 12 technologies and practices you believe will have the most influence on the future of global higher education data and analytics.

**Round 3:** Panelists provided ratings on the following dimensions for each of the top six techs and practices:

- To what extent do you anticipate that <tech/practice> will require increased support from key stakeholders?
- Thinking about the evidence currently available, how would you rate the potential of <tech/practice> to have a significant and positive impact on institutional strategic goals?
- Thinking about the evidence currently available, how would you rate the potential of <tech/practice> to support digital transformation at the institution?
- Relative to institution size and budget, how much institutional spending do you anticipate would be required for optimizing <tech/practice> across the institution?
- In what way would optimizing <tech/practice> impact the size of the workforce at your institution?
- To what extent would optimizing <tech/practice> require upskilling or reskilling of your institution's current workforce?

# EXPERT PANEL ROSTER

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# APPENDIX: ADDITIONAL EXAMPLES OF DATA AND ANALYTICS TECHNOLOGIES AND PRACTICES

## Assessing and Improving Institutional Data and Analytics Capabilities

### Data Democratization through the Foundation of Collaboration

Case Western Reserve University improved analytics capability by making data widely accessible across the organization and connecting users who have technical knowledge with functional teams.

### Bringing Digital Learning Activity Data to a University Data Warehouse

The University of Waterloo created a centralized data dashboard that led to improved budgeting, more accurate forecasting, better market analysis, and improved understanding of student satisfaction.

### Visualizing Institutional Data for College Impact

College of the Canyons developed an innovative, visually compelling approach to integrated institutional research data that serves constituencies through on-demand, filterable data-visualization tools.

### Georgia Tech Office of Information Technology (OIT) Operational Analytics Assessment

Georgia Tech Office of Information Technology (OIT) defined and categorized available operational data reporting capabilities to improve the narratives, transparency, and overall accountability for operational services

### Academic Metrics 360: Data Analytics to Support Strategic Decision-Making in Higher Education

Academic Metrics 360 provides a portfolio of standardized, comparative, and real-time academic metrics that are invaluable to academic leadership at Indiana University.

### Social Network Analysis Applications and Beyond

Officials at Indiana University Bloomington applied social network analysis (SNA) to understand constraints imposed by the pandemic and used the experience to expand their capacity to use other methods grounded in graph theory.

### National Louis University's Centralized Analytics Initiative

National Louis University's Centralized Analytics Initiative included an assessment of the current state of analytics capacity and provided a recommendation for a centralized approach that supports the consistent, efficient, and strategic use of data across the institution.

### Digging for Treasure in NWTC's DataMine

Northwest Wisconsin Technical College's DataMine provides access to an extensive library of reports and data visualizations with interactive filters and drilldown capabilities, allowing each user a customized experience based on the specific students they serve.

### Campus Reporting 2.0: Combining the Powers of IT and IR

University of Michigan–Dearborn's multifaceted analytics project upgraded reporting and established greater trust and reliability in data and analytics tools and services.

## Data Literacy Training

### The Data Literacy Institute for APLU's Powered by Publics

The Association of Public and Land-grant Institutions collaborated with the Association for Institutional Research to pilot a five-institution, cohort-based data literacy institute to strengthen the ability of university personnel to identify and adopt evidence-based practices to advance student success outcomes.

### Inquiry-Based Student Success Data Workshops

In inquiry-based workshops, deans, chairs, and other faculty at California State University, Northridge learn how to answer key student success data questions, from program graduation rates to how grades in prerequisites predict outcomes in later courses.

### The DataSquad: Sustainable Data-Support and Student Professional Development in a Unified Service

Carleton College's DataSquad model is designed to be sustainable, student based, solution oriented, and flexible, as well as being a valuable professional development opportunity for students.

### Innovative Multi-Scaled Data Literacy Initiatives

Indiana University Bloomington's innovative data literacy approaches provide data, metadata, and analytic support for advisors, campus leaders, and faculty researchers, often resulting in peer-reviewed publications/presentations.

### Institutional Research and Decision Support

Data workshops at Indiana University-Purdue University Indianapolis teach faculty, staff, and students about available data resources related to specific topics such as financial aid, enrollment, faculty and staff data, how to develop surveys, and using course evaluations.

### Data Dessert Informational Sessions

Hands-on topic-focused sessions at Lorain County Community College let participants explore, complete challenges, and dig into data through a guided experience with campus experts. Plus, each session has dessert!

### Learning Stairways to Enhanced Data Literacy

Montgomery College's data literacy program builds deep internal skillsets through mandatory training, asynchronous self-paced learning, face-to-face instruction, and microcredentialing.

### NC State University Libraries Data and Visualization Services

The NC State University Libraries has developed a growing program of data and visualization workshops, course-embedded data literacy instruction, and data consultations.

### Year of Data and Society

At the University of Pittsburgh, this project set an example of how an institution can take a medium-sized budget and a team of volunteers from across the institution and show that ethics and equity are institutional priorities.

### Responding to a Changing World with Data Literacy

Multiple outreach activities across the University of Queensland are undertaken to improve data literacy by raising the visibility and engagement of the Enterprise Data Governance Program.

### UNT Helps Faculty and Staff Make a Difference with Data: Teaching Data Literacy

Through a series of three webinars, the University of North Texas helps elevate skills in understanding data and sources, analytic approaches, and how to leverage data to impact student/institutional outcomes and ROI.

### Customized Data Learning Sessions at VCU

Virginia Commonwealth University customizes data learning sessions to address department-specific challenges, demonstrate relevant self-service dashboards, and walk through nuances in interpreting and leveraging data.

# Data Management and Governance

## Data Governance: Policies and Standards for Managing Data

Key aspects of Arcadia University's data governance program include data governance structure and policy, roles and responsibilities, data asset inventory, data dictionary, assessment process, data literacy program, and communication strategy and plan.

## Joining Forces: ITS and IR Department Unification to Foster Data Governance

A merged IT and IR organization allowed Bristol Community College to implement strategies such as a transparent data request system, comprehensive disparate systems inventory, and clear data classification process.

## An Institutional Approach to Student Success Reporting, Resource Accountability, and Data Integrity Verification

Cal Poly Pomona's inter-divisional data integrity verification process highlighted student support resources, and it enabled conversations to move beyond clean data to actionable insights based on the data.

## Data Governance Program at Georgia State

A cross-institution effort included IR, cybersecurity, legal, risk management, policy, and IT, as well as analysts and enterprise data management, resulting in a robust data governance structure and six active working groups.

## Establishing a Single Source of Truth for Operational Data

A multidisciplinary committee at Harrisburg University established internal data processes to support consistent reporting from one source of truth instead of separate, and occasionally differing, silos.

## Creating a Culture of Data Excellence at Princeton University

The University Data Office is in the early stages of collaborating with data stewards and leaders to recommend a data governance framework and planning for a data governance committee, as well as an institutional data strategy and roadmap.

## Data Governance at Kent State University

A cross-institutional Data Governance Council consists of three layers to ensure buy-in across the university: vision (cabinet-level members), strategy (university leaders and data owners), and tactics (process experts).

## Effective High-Level Data Governance Framework for Higher Education and Research Institutions

At MIT, a data governance framework focusing on people, process, and technologies established policies, guidelines, and principles to define and manage data, identify data literacy opportunities, and supply data architecture and technology support.

## Data Management and Information Governance Transformation

A data management and governance transformation at RMIT University established a vibrant network of 150 information stewards, led by the chief data and analytics officer and guided by an executive information governance board.

## Data Governance and Master Data Management

Southern Alberta Institute of Technology undertook a multiyear initiative to enable data democratization, enhance holistic and integrated data management and quality, and implement data governance to drive evidence-based decision-making in a unified, trusted, secure, and sustainable manner.

## Collections Data Governance: Stronger Together

Based on "non-invasive data governance," this collaborative model at Smith College leverages existing but heretofore disparate resources for digital preservation and cross-collection discovery, facilitating collaboration across the collections through regular operational work.

## Data Strategy and Governance Project

Adopting a federated network model involving faculty, staff, and administrators, this project at Universitat Oberta de Catalunya focuses on developing a new data governance model, providing a new data repository and building capacity for evidence-based decision-making.

### **Using Strategic Data with Confidence at University of Calgary: Data Governance**

An Institutional Data Governance (IDG) Practice provides a central and common understanding of how business data are defined, produced, and used across the university, thus enabling the use of strategic data with confidence.

### **Data Governance: Upgrading Student Experience with Data Standards**

To support unified accreditation, a data governance program at the University of Maine System is collaboratively developing data standards for key course data fields, providing transparency into course offerings and improving student experience and success.

### **Notre Dame Data Governance Framework**

The University of Notre Dame's data governance framework is the process, policies, and procedures for data collection and use, ensuring data are consistent, based on common language, and available, while ensuring that access to sensitive data is restricted.

### **Governing Teaching and Learning Data: A New Frontier**

At the University of Wisconsin–Madison, data governance established a data domain that vests authority for data generated through teaching and learning activities with the vice provost for teaching and learning while placing governance responsibilities within the Learning Analytics Center of Excellence.

### **Data Integration for Campus Population Health**

A data mart built for pandemic-related data at Yale University strengthened a data-driven culture and key daily operational decisions related to the campus health, with standard guidelines, data definitions, and metrics used across all units.

## DEI for Data and Analytics

### Defining, Identifying, and Tracking First-Generation Students

At Albertus Magnus College, a working group led by Institutional Research and Assessment developed a common definition of first-generation student, implemented a data collection and verification strategy, and integrated the results into internal and external reporting.

### Using Race Equity Gap Data to Inform Teaching Practice

A professional development opportunity at California State University Northridge supports faculty as they view race equity-gap data in their courses using a dashboard and reflect on their teaching practice in response to their results.

### Using Natural Language Processing to Highlight Student Voices for Instructors of Large Classes

A researcher-faculty collaboration at Indiana University used student surveys to capture and analyze “thick data” in students’ feedback using natural language processing to improve analytical processes and classroom teaching.

### Getting Them to the Finish Line: Using Course Placement and Completion Dashboards to Support Persistence

The Maricopa Placement and Course Completion Dashboard’s ability to filter by various demographic groups provides the data needed to identify equity gaps in placement, course completion, and course success.

### From Data to Equity-minded Action: Strategies to Analyze, Interpret and Act on Data through an Equity Lens

At National Louis University, a data-use framework with an equity lens promotes the importance of disaggregating data by demographics, facilitates equity-minded dialogue to engage with the data, and enables action on the data to further student success.

### DEI Dashboards: Using Data Transparency to Advance Diversity, Equity, and Inclusion

A set of goals and related metrics advances diversity, equity, and inclusion initiatives at St. Olaf College, drawing from multiple data sources and reported and tracked through public-facing DEI dashboards.

### DEI Data Tools, DEI Reports, and Dashboard

Collaboration across campus determines what data are needed, shares reporting needs, and identifies areas for improvement to provide the data and tools to empower University of Arizona’s new DEI policies.

### University of Calgary Equity, Diversity, and Inclusion Data Hub

An interactive data hub monitors key demographic data necessary to maintain and sustain an equitable, diverse, and inclusive campus community and to drive meaningful change to programs and services.

### The Collaboratory for Data Analytics for Student Success (CODAS)

The University of California, Irvine’s initiative leverages data from across the institution to create a unified dataset. DEI serves as a “North Star” for integrating data across silos to facilitate a comprehensive understanding of underrepresented student groups.

### Using Machine Learning to Examine Student Perspectives on Inclusivity and Accessibility

This University of Oregon project uses machine learning to analyze student comments about inclusive and accessible teaching practices to better understand student perspectives, improve inclusive teaching, and target professional development efforts

# Modern Data Architecture

## Architecting and Implementing Enterprise-Level Predictive Models

At Arizona State University, an enterprise-level system for automating daily persistence probability estimates harnesses sophisticated machine learning techniques, broad institutional collaboration, and a variety of cost-effective cloud architecture solutions.

## Kent State Data Pipeline

An end-to-end data pipeline currently being developed will ensure that enterprise data are defined, discovered, transformed, and consumed with principles of uniformity, high availability, security, and visibility maintained throughout.

## Real-Time Inquiry-to-Enrollment Data Pipeline

Regent University designed, developed, and refined a real-time data pipeline that gathers, evaluates, integrates, and feeds information across multiple enterprise systems to seamlessly follow prospective students from inquiry to enrollment.

## RIT Data Hub: A Healthy and Vibrant Data Insights Ecosystem

Rochester Institute of Technology is building an enterprise data hub in the cloud as a foundational step toward establishing a comprehensive, flexible data and analytics infrastructure.

## Data Empowered Learning at Penn State

Cloud-based technologies integrate information from a variety of data stores, and data science provides individual student and course-level insights at scale, which are delivered to instructors, advisers, and staff via integrations into enterprise systems.

## Bringing Digital Learning Activity Data to a University Data Warehouse

Notre Dame is bringing learning analytics to the university data warehouse by adding online learning activity from our LMSs and using the data warehouse to support student success and diversity, equity, and inclusion initiatives.

## Unifying Data Sources

### Commonwealth University of Pennsylvania's Institutional Research Data Warehouse

Three merging universities created a small data warehouse with IPEDS census data captures for all three institutions to produce longitudinal analyses, and they use this warehouse to feed dashboards.

### Responding to Aid Appeals with Art and Science

Fordham University combines admissions and financial aid data to determine the effect of additional aid on yield, but the institution also relies on the experience of university managers to review individual financial aid appeal cases.

### Advising-Focused Learning Analytics: Augmenting Advisors' Knowledge with Machine Learning Predictions

At Indiana University Bloomington, advising rosters, course enrollment data, and machine learning predictions were combined into a single interactive data report allowing advisors to review their rosters and identify students who may need extra outreach/intervention.

### Kentucky Education to Workforce GIS Application

The Kentucky Education to Workforce GIS Application is an online data system that allows users to explore networks and trends in education and workforce alignment.

### Unifying SIS Data and Student Life Data: How Moravian University Uses Data Analytics to Meet Student Basic Needs

A dashboard created by unifying data from student information and door access systems with an analysis of students' basic needs informs Mo's Cupboard, a food and resource pantry.

### Collaborating to Integrate Personnel, Courses, Publications, Grants, and Service Activities in a Research Information Management System

The Oklahoma State University Library formed a number of partnerships to implement a research information management system, creating data feeds comprising personnel information, courses taught, and externally funded grants from university databases.

### Stanford Center for Professional Development Data Lake Project

A data lake aggregates learner data from multiple sources, including the online learning platform, business and enrollment data, course evaluation data, marketing, and financials, enabling the design of more effective online learning experiences.

### Connecting Libraries and Learning Analytics for Student Success (CLLASS)

Syracuse University developed a library profile for Caliper to provide a vehicle for integrating library data with other institutional data while maintaining library control over the data type, amount, and level of detail provided.

### Arizona Profiles

Using data integrated from 30 systems, Arizona Profiles allows decision makers at the University of Arizona to access—at a glance—trends and figures in areas such as workforce, faculty, demographics, students, and financials.

### Learning Analytics Inclusion in Enterprise Data Warehouse

At the University of Illinois Chicago, learning analytics from the LMS were integrated with the SIS Enterprise Data Warehouse, allowing reporting on academic progress by program or demographic background for initiatives in DEI.