



Data Analytics

Capitalizing on Creative Disruption

COE Forum
Industry Futures Series





Data Analytics

Capitalizing on Creative Disruption

COE Forum

Project Director

Keith O'Brien

Contributing Consultants

Justin Kollinger
Benjamin Wohl

Managing Director

Carla Hickman

Executive Director

Melanie Ho

Design Consultant

Kelsey Stoneham

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We offer our members expert advice and innovative strategies for tackling their most pressing issues, tested and proven to work by their peers at other institutions across the country. Our research terrains of expertise include best-in-class marketing and recruiting, employer-focused market research, and leading campus innovation.

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Supporting Members in Best Practice Implementation

Resources Available Within Your Membership

This publication is only the beginning of our work to assist members in creating and improving data analytics programs. Recognizing that ideas seldom speak for themselves, our ambition is to work actively with members of the COE Forum to decide which practices are most relevant for your organization, to accelerate consensus among key constituencies, and to save implementation time.

We offer a variety of services to assist you with your mission. For additional information about any of the services detailed below, please contact your organization's relationship manager or visit our website at eab.com. To order additional copies of this publication, please search for it by title on eab.com.

Implementation Road Maps and Tools

Throughout the publication, this symbol will alert you to any corresponding tools and templates available in the Toolkit at the back of this book. These tools are also available on our website at eab.com.

Recorded and Private-Label Webconference Sessions

Our website includes recordings of two hour-long webconferences walking through the practices highlighted in this publication.

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Unlimited Expert Troubleshooting

Members may contact the consultants who worked on any report to discuss the research, troubleshoot obstacles to implementation, or run deep on unique issues. Our staff conducts hundreds of telephone consultations every year.

Facilitated Onsite Presentations

Our experts regularly visit campuses to lead half-day to day-long sessions focused on highlighting key insights for senior leaders or helping internal project teams select the most relevant practices and determine next steps.



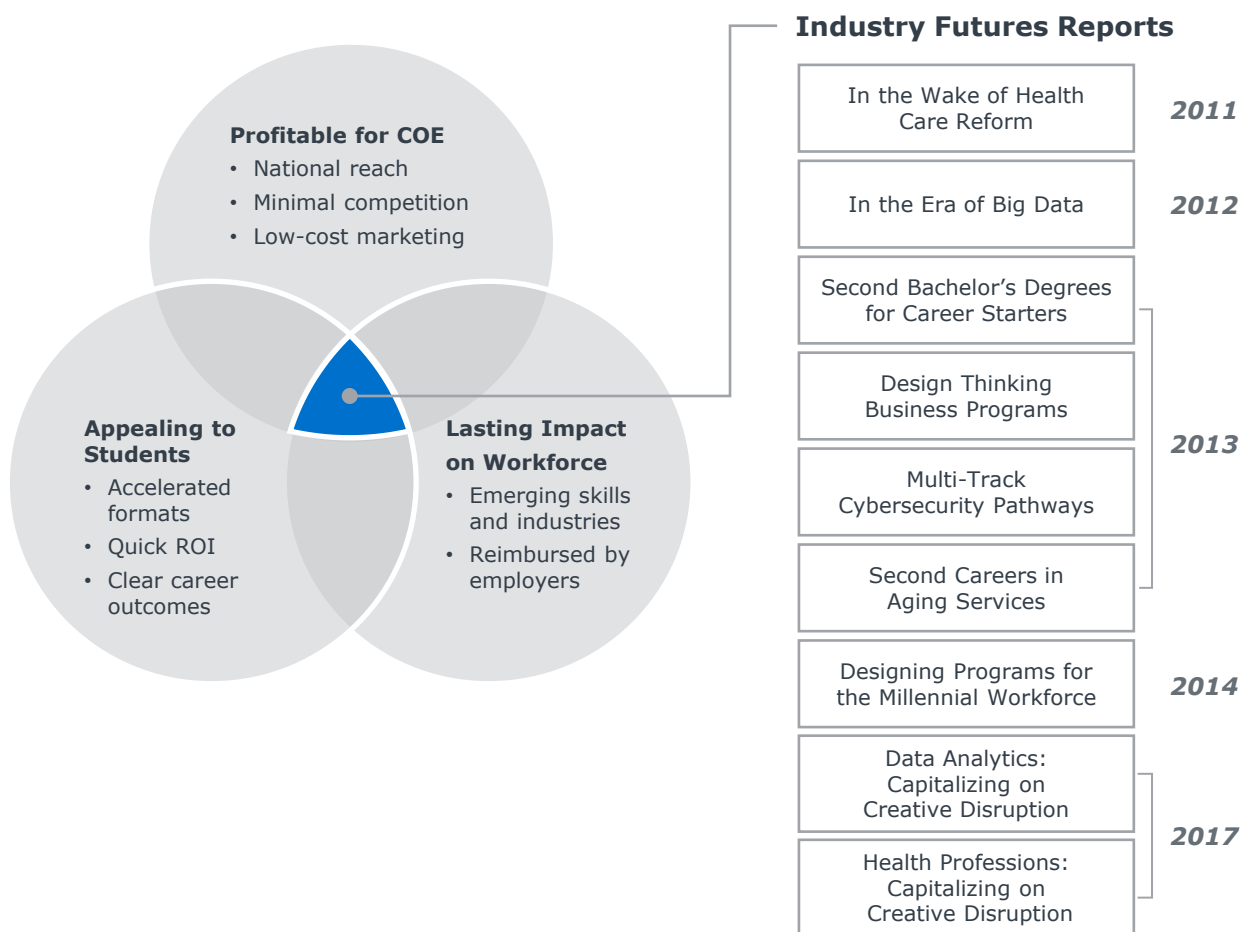
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About the Industry Futures Series

Programs at the Intersection of Profit, Mission, and Employability

This study is the fifth installment of the Industry Futures series. Through analyses of real-time labor market data and interviews with industry thought leaders, COE deans, and program directors, the series examines the trends likely to have the greatest impact on occupation growth and upskilling needs over the next decade.

Based on member feedback, 2017's studies focus on changes in two fast-growing fields: Data Analytics and Health Professions. The studies assess the continued evolution in demand drivers, emerging employer hiring preferences, trends in the competitive environment, changes in student audiences and skill acquisition goals, and the latest developments in the credentials that can serve these two expansive fields.



Top Lessons from the Study

Data Analytics Is Transforming the Working World

- Data analytics capabilities evolve continuously and are entering the Analytics 3.0 era wherein data-driven decision making will be embedded in all organizations and business processes.
- Analytics is moving from a competitive advantage to a competitive necessity for all organizations and industries. Yet many industries and small and medium sized businesses have been slow to adopt analytics. Catching up will further boost demand for analytics talent.
- As analytics becomes ubiquitous and the tools become easier to use, most white collar professionals will need some proficiency in analytics to advance their careers. This phenomenon is evident in the emergence of a new role, the citizen data scientist. A citizen data scientist's primary job function lies outside of analytics, but he/she still uses some analytics in everyday work. Labor market analysis reveals increasing numbers of traditional job postings that require applicants to have some ability in analytics.
- Buoyant job markets and highly compensated data analytics positions have fueled steady enrollment growth in both new and longstanding analytics degree programs. Now is the time for institutions without an analytics offering to seriously consider capitalizing on this opportunity.

Prepare for Emerging Competitive and Automation Threats

- The thriving employment environment has prompted a wide mix of organizations to offer analytics credentials. Since 2011, there has been a 20-fold increase in master's programs from higher education institutions. This expansion has been matched by significant growth in nontraditional providers' offerings—MOOCs, nanodegrees, and bootcamps. All of these trends portend fiercer competition for students.
- Advances in artificial intelligence and other technologies are encroaching on highly-skilled professions. There is no reason to be complacent about analytics professionals being protected from the threat of automation. Deans and program directors must take steps to ensure their analytics programs remain market-relevant and attuned to changes in high-demand skills.
- As automation disrupts workplaces, working professionals are recognizing that lifelong learning is now an imperative to maintain career advancement. COE units are best positioned to capitalize on white collar professionals' need to continually refresh their skill sets (not just in analytics).

Build an Adaptive Portfolio of Analytics Credentials

- As there are many ways to provide analytics credentials to core audiences (career starters, advancers, changers) a "one size fits all" credential strategy is inadvisable. EAB's recommendation is to develop a portfolio of analytics credentials that enables COE units to serve these audiences.
- This portfolio must be adaptive to keep pace with a field where no steady state is foreseeable given technological disruption, greater credential competition and fluctuations in the skills sought by employers. The adaptive analytics portfolio is built on three imperatives:
 1. Maximize Credential Applicability: Ensure the portfolio supports a range of student audiences with disparate career and skill acquisition objectives.
 2. Track the Technological Edge: Develop an ongoing understanding of the competitive threats, technological trends, and emerging employer preferences within the field.
 3. Realign the Practicum to Career Priorities: Embed experiential learning to teach students to apply analytics to business problems and translate analytic insights into actionable business information.

Top Lessons from the Study (cont.)

How to Develop the Adaptive Analytics Portfolio

Maximize Credential Applicability

- Allow specialists to customize their degrees through core skill-, function- and industry-specific electives.
- Test viability of customization options swiftly through rotating electives within analytics masters' programs.
- Accommodate applications from liberal arts graduates through alternative admissions and onboarding processes.
- Attract current or aspiring citizen data scientists via short-form credentials and analytics tracks embedded in existing masters' programs.

Track the Technological Edge

- Track bootcamps' market performance as a leading indicator of market and technological disruption within analytics.
- Compare program curriculum with leading bootcamps regularly to acquire insight on emerging skillsets and employer requirements.
- Supplement market insight gleaned from regional employers and program advisory boards with perspectives from working analytics professionals and leading edge companies.

Realign the Practicum to Career Priorities

- Elevate employers' role in assigning student projects to enhance a student's client problem identification and scoping skills.
- Provide a dedicated project management advisor to instill client and project management skills among students.
- Structure a practicum to demonstrate the importance of communicating project advice effectively to clients.



Charting the Evolution of Data Analytics

INTRODUCTION

- The Data Analytics Landscape
- Anticipating Emerging Threats

Introducing Creative Disruption

Creative disruption is about positioning your COE unit to take advantage of the opportunities and sidestep the challenges created by profound shifts in the marketplace. The advent of data analytics is transforming business models, decision making and the skillsets required of working professionals. The ensuing business and workplace disruption has employers embracing analytics and working professionals seeking to capitalize on the resultant career openings. With analytics in particular, disruption is the new normal due to the rapid advancement of analytics techniques and tools.

While disruption creates threats, creative disruption advocates a way of thinking that emphasizes the growth opportunities created by disruption. And the advantages for organizations that spot them early and act accordingly.

COE units possess the innovative thinking and agility to take advantage of the need for upskilling and upcredentialing due to analytics. As the quote from Michael Horn, co-founder of the Clayton Christensen Institute for Disruptive Innovation, indicates, taking advantage of disruptive innovation is intrinsic to the mindset of COE units.

Disruption Generates Opportunities for COE

Creative Disruption

“In **Creative Disruption**, the goal is to expose flaws in the current business model, highlight areas where improvement/changes are needed, and to help **inspire adaptation of the business model for future growth.**”

*Dr. Kenneth Thurber,
"Do NOT Invent Buggy Whips:
Create, Reinvent, Position, Disrupt"*

COE Units as the Solution



**CHRISTENSEN
INSTITUTE**

“...continuing education programs are less regulated, more responsive to industry and consumer needs... and are often infused with the ‘startup mentality’ critical for **responding to and pioneering disruptive innovations.**”

*Michael Horn,
"Why Continuing Education Programs Are Poised to
Become Hubs of Innovation"*

Source : Horn, M, "Why Continuing Education Programs Are Poised to Become Hubs of Innovation," EdSurge, <https://www.edsurge.com/news/2016-08-30-why-continuing-education-programs-are-poised-to-become-hubs-of-innovation>; Thurber, K, Do NOT Invent Buggy Whips, 2012; EAB interviews and analysis.

Evolution from Big Data to Analytics 3.0

In 2012, the COE Forum reported on the emergence of “Big Data,” its major impact on business operations, and the resulting shortage of data analytics professionals. The study recommended creating data analytics graduate programs to serve this new field.

In 2016, the McKinsey Global Institute found that use of analytics is accelerating due to technological advancements, exponential growth in data, and increasingly sophisticated application by companies.

“Big Data” has been fundamentally transformed into what Tom Davenport, a pioneer in analytics, terms, “Analytics 3.0.”

Analytics 3.0 describes the transformation of all organizations and business processes via the application of analytics. In this new world, data tracking and analysis includes an even wider cross-section of objects (“Internet of Things”), algorithms deliver prescriptive advice, and analytics is embedded in all industries, business functions and employee workflows.

Revisiting Data Analytics’ Disruptive Power

Past: The Rise of Big Data



Present: Explosion of Analytic Capabilities...

Natural Language Processing

Internet of Things

Deep Learning

Sentiment Analysis

Neural Networks

Pattern Recognition

Cognitive Computing

Machine Learning

Predictive Analytics

Behavioral Analytics

Cloud Computing

Facial Recognition

...Signals the Emergence of the Next Generation of Data Analytics

Analytics 3.0

- ☒ Prescriptive Models
- ☒ Analysis of “Internet of Things”
- ☒ Ubiquitous within Industry and Function
- ☒ Embedded in All Workflows



Thomas Davenport

- Co-founder of the International Institute for Analytics
- MIT Fellow
- Distinguished Babson College Professor

IMAGE CREDIT: BABSON COLLEGE

From Game Shows to AI for Everyone

In 2011, IBM Watson's triumph on the Jeopardy game show showcased the power of Big Data. Watson was a sophisticated computer program capable of processing human speech, rapidly querying databases, and applying algorithms to answer questions. Watson's victory garnered significant publicity as it highlighted the power of analytics compared to human intelligence. This achievement still took several years and \$2 billion in R&D spending.

Just five years later, in 2016, Salesforce, a CRM provider, launched Salesforce Einstein. Like Watson, Einstein applies natural language processing and machine learning to data. Unlike Watson, it also predicts future events and prescribes advice. It embeds artificial intelligence (AI) into the workflows of millions of salespeople and account managers.

The launch of Salesforce Einstein garnered little publicity compared to Watson's triumph. This speaks to both the ubiquity of analytics within work and its rapidly accelerating capabilities.

Finally, foreshadowing future analytics evolution, Salesforce and IBM announced a new technology partnership in March 2017. The companies will now offer integrated AI services combining the capabilities of both Watson and Einstein.

Data Analytics Inexorably Gets Faster, Smarter and Cheaper

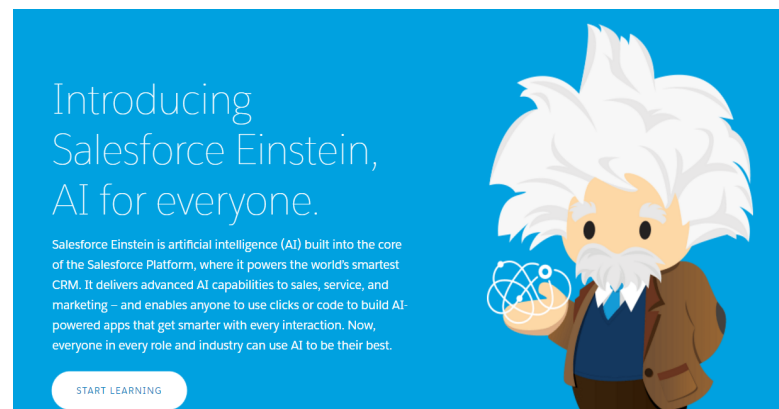
2011: IBM Spends \$2B on Jeopardy!



"The Question Answering Machine"

- Converts human speech into database queries
- Analyzes 16 terabytes worth of information (32 million books)
- Uses 6 million logic rules to determine best answer

2016: Salesforce Einstein Is Launched



"Salesforce Einstein Is Your Data Scientist"

- Applies AI to CRM data, emails, calendars, social media, and Internet of Things devices
- Delivers predictions and recommendations tailored to each customer service agent or salesperson
- Generates automatic responses to routine inquiries

Source: Milburn M, "The Future of Customer Service is Here: Introducing Service Cloud Einstein," Salesforce, Sept. 18 2016; Kleinman J, "IBM's Jeopardy-Winning Watson is Becoming a Smartphone App," *TechnoBuffalo*, May 21st, 2013; Jackson J, "IBM Watson Vanquishes Human Jeopardy Foes," *PCWorld*, Feb. 16th, 2011; Greene J, "IBM, Salesforce Agree to Partner on Artificial Intelligence," *The Wall Street Journal*, March 6th, 2017; EAB interviews and analysis.

Defining Data Analytics

Data analytics is the process of extracting, organizing, and modeling data to transform it into information for decision-making processes. This definition encompasses both the more technically-sophisticated subfield of data science and the more applied subfield of business analytics.

EAB analyzed the skills required for data analytics jobs and determined that the skills combine three domains:

1. Computing/Programming
2. Statistics/Mathematics
3. Business/Communication

Data analytics professionals fall into two major categories: Data Scientists and Data Analysts. Job titles vary within these categories, but all specialist positions require a mix of the three core domain areas.

Data scientists are the most advanced analytics professionals. Their positions require the most sophisticated combinations of skills.

Data analysts are similar to the data scientists, but have less advanced capabilities in programming, modeling, and machine learning.

It should be noted that data architects, data engineers, and database administrators focus on building technical infrastructure and are not data analytics roles.

Core Data Analytics Skills and Professional Roles



Data Scientists are the most advanced data analytics professionals. They have a sophisticated combination of programming, statistical, and business skills.

Data Analysts extract, organize, and transform data to generate insights for decision-making. They are similar to data scientists, but have less advanced technical training.

From Competitive Advantage to Competitive Necessity

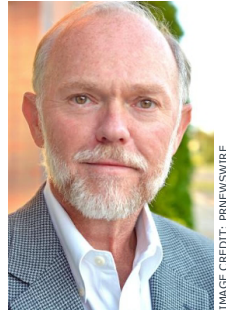
When the Internet launched, most enterprises had no idea what this could mean for their businesses. However, some companies and startups figured out how to leverage the Internet and reaped huge rewards as first movers. Now, the Internet is ubiquitous.

Data analytics' trajectory closely parallels that of the Internet's. Boston Consulting Group coined the term "information asymmetries" to explain how companies with the most advanced analytics and largest datasets obtain immense market power. In 2016, the top three most valuable public companies were all data analytics pioneers.

The academic director of Texas A&M's analytics program, Simon Sheather, noted that, "as we speak, data analytics is moving from a competitive advantage to a *competitive necessity*." Despite this trend, many industries are lagging behind in adopting data analytics. Additionally, in all industries, small and medium-sized businesses are far behind their larger counterparts.

A McKinsey Global Institute study released in December 2016, forecasts that lagging industries and businesses' attempts to catch up will further amplify demand for analytics professionals.

Analytics Is the 21st Century's Internet



“Almost overnight, the Internet has gone from a technical wonder to a business must.”

*Bill Schrader,
Founder of PSINet,
the pioneering internet
service provider*

Information Asymmetry “Winners”

Most Valuable Public Global Companies by Market Capitalization

1		\$590B
2		\$550B
3		\$420B

Many Industries Playing Catch-Up...

Analytics Maturity Assessment¹

Lagging Industry

Maturity Level (1-6)



Telecom

3.05



Utilities

3.05



Insurance

2.89

...Along with Smaller Businesses

“Small and medium-sized businesses are far behind in data analytics adaption.”

*“The Big Data Market,”
O'Reilly Media Report*

1) The International Institute for Analytics conducted a maturity assessment for 12 industries. A sample of organizations within a given industry were scored on a 1-6 scale on their implementation of analytics capabilities, with 6 being the most advanced analytics state.

Source: Alles D, Burshek J, "Ranking Analytics Maturity by Industry," International Institute for Analytics, 2016; "The Rise of the Superstars," *The Economist*, Sept., 17 2016; "Application Service Provider Model," Association of Asset Management Professionals, 2005. Naimat A, "The Big Data Market," *O'Reilly Media*, 2016; "Kennedy, S., Matheson, D, "Data to Die For," bcg perspectives, 2007; Henke N, et al, "The Age of Analytics: Competing in a Data-Driven World," McKinsey Global Institute, December 2016; EAB interviews and analysis.

The Citizen Data Scientist Emerges

The “T-shaped professional” concept proposes that the ideal employee possesses a set of universal skills (top-of-T) complemented by mastery in a skill or process (T-stem).

Analytics is generally seen as the preserve of the T-stem: building mastery. Certainly, this is true for the data analytics specialists. However, as analytics becomes key for decision making, and the tools become easier to use, most professionals need some proficiency in analytics to progress in their careers. Analytics is now becoming an universal competency; part of the top of the T.

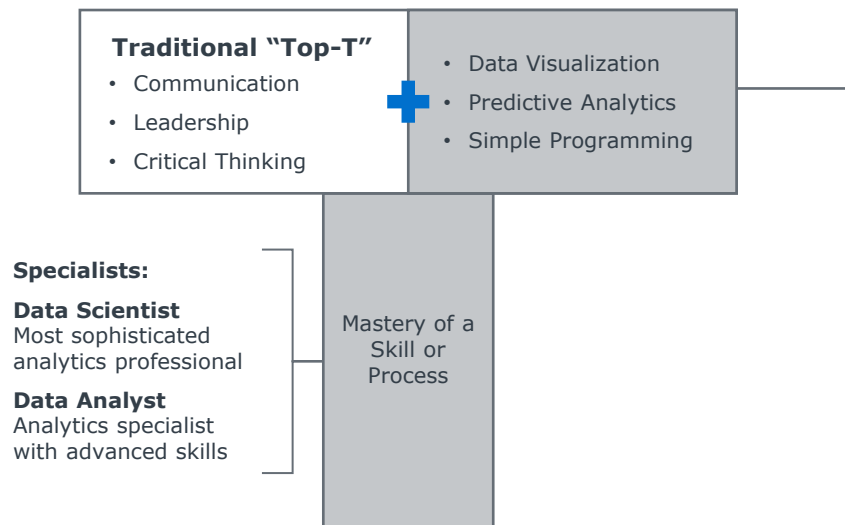
With analytics becoming ubiquitous, a term has been coined, *citizen data scientists*, to describe professionals using data analytics in their job, but whose job function is outside of the analytics field. Examples include marketing managers and business analysts.

Burning Glass Labor/Insight™ job data revealed that citizen data scientist postings are growing. EAB analysis indicates that citizen data scientists work in almost every industry and across the nation.

Finally, there is a looming shortage of analytics generalist talent. According to PwC, by 2021, 69% of employers will prefer job candidates with data science skills. However, only 23% of college graduates are expected to hold those skills.

Greater Number of Jobs Require Analytics Abilities

Analytics Redefines Top of T Competencies



New Generalist Analyst Role Emerges

“A **Citizen Data Scientist** is a person who creates or generates models that leverage predictive or prescriptive analytics but **whose primary job function is outside of the field of statistics and analytics.**”

Alexander Linden
Research Director, Gartner

Strong and Widespread Citizen Data Scientist Demand

≈400K

Citizen data scientist job postings in 2016

+24%

Citizen data scientist job posting growth from 2013 to 2016.

58

Number of MSAs with more than 1,000 citizen data scientists job openings in 2016



Source: Linden A et al., “Doing Machine Learning Without Hiring Data Scientists,” Gartner, 2016; Shacklett M, “Why 2016 might be the year of citizen data scientists,” *TechRepublic*, Jan. 19th, 2016; Krensky P et al., “Hype Cycle for Data Science,” Gartner, 2016; “Investing in America’s Data Science and Analytics Talent,” PwC, 2017; Burning Glass Labor/Insight™; EAB interviews and analysis.

Art Meets Science

The advent of the citizen data scientist role is exemplified by the transformation within marketing. From the age of *Mad Men* to iconic Super Bowl ads, marketing centered on creative ideas and advertising.

Now, marketing is data driven employing analytics to inform, place, track and assess content. This transformation holds true for both online marketing platforms and traditional marketing vehicles such as print and television.

For marketers, career entry and advancement require proficiency in analytics. This is evident in EAB analysis of job postings for marketing managers.

These trends show no signs of abating. A majority of global executives surveyed in Bain & Company's Management Tools & Trends report agreed that, "Advanced analytics are transforming our marketing strategy."

Intensifying Role for Analytics in Marketing

The Art of Classic Super Bowl Commercials



One of Budweiser's Iconic Clydesdale Ads



Apple's 1984 Ad

The Science of Today's Marketing

- 1 "Programmatic buying" is the algorithmic sale, purchase, placement, and optimization of ad space in real time.
- 2 Software is used to A/B test combinations of copy and images.
- 3 Social media analytics enables micro-targeting of content.
- 4 Analytics helps track and compare effectiveness of all marketing channels.

The New Marketing Manager

Responsibilities

- *Create and A/B test high quality content*
- **Track, analyze, and report on campaign performance**

Required Skills

- *Digital content system management*
- **Tableau**
- **SQL**
- *Project management*
- *Presentation skills*

"If they want a career in marketing... [they need to] have a base or deeper understanding of analytics. We are **blending art and science** here, and everyone needs to know something about both."

Brian Harrington
Executive Vice President and Chief Marketing Officer
Zipcar

Source: Davenport T, "What Automation Will Do To Marketing and Marketers," LinkedIn, Apr. 21st, 2015; O'Sullivan R, "What is Programmatic Marketing, Buying and Advertising?," *State of Digital*, Oct. 26th, 2015; Burning Glass Labor/Insight™; Rigby, D, Bilodeau, B, "Management Tools & Trends, Bain & Company; EAB interviews and analysis.

Masters of the Universe

In 2016, the job market for data science specialists was very robust. Burning Glass Labor/Insight™ job data exhibit strong growth trajectories for data analytics scientists and analysts. These jobs continue to be well-paid because of ongoing analytics talent shortages. For instance, in a recent Gallup poll, nearly 95% of surveyed employers reported that it was still difficult to find enough analytics talent.

Lucrative opportunities abound for those moving up the data science career ladder. For instance, a comparison of data science recruiter and university compensation data reveals that the typical mid-level data analytics manager makes significantly more than some university presidents running institutions with tens of thousands of students.

The strong job market has helped fuel a boom in analytics programs. EAB research established that both new and well-established programs are experiencing strong and growing demand for their credentials. This trend is exemplified by enrollment in Central Michigan University's new business analytics program and Northwestern's market-leading MS in Predictive Analytics.

Boom Times for Data Analytics Professionals & Programs

Buoyant Job Market for Data Analytics Specialists

Data Scientist: The most advanced analytics professional with sophisticated computer, statistical and mathematical skills.

Data Analyst: Similar combination of skills as the data scientist, but with less expertise in programming, modeling, and statistics.

\$120K

Median Base Salary

293%

Job Posting Growth
(2013 H2-2016 H2)

\$60K

Average Base Salary

24%

Job Posting Growth
(2013 H2-2016 H2)



Data Science Manager or College President: Who Makes More?

\$254K

Median base salary of a data science manager with 10 or more reports.

\$220K

Salary of the chancellor of a southern regional public university with 18K students and a \$200M budget.

Hot Market for New and Established Analytics Programs

CMU
CENTRAL MICHIGAN
UNIVERSITY

"We launched late so we did very **little promotion**. Yet, we received **40-50 applications** to enroll a class of 16 on-campus students."

*Carl Lee, Program Director
Central Michigan University*

Northwestern
SCHOOL OF
PROFESSIONAL STUDIES

Enrollment in the MS in Predictive Analytics program **doubled to 1,500 students** since 2012.

Source: Bauman D, O'Leary B, "Executive Compensation at Private and Public Colleges," *The Chronicle of Higher Education*, Jul. 17th, 2016; "Data Analyst," Glassdoor; "Salaries of Data Scientists," Burtch Works Executive Recruiting, Apr. 2016; ; "Investing in America's Data Science and Analytics Talent," PwC, 2017; Burning Glass Labor/Insight; EAB interviews and analysis.

The Perils of Success

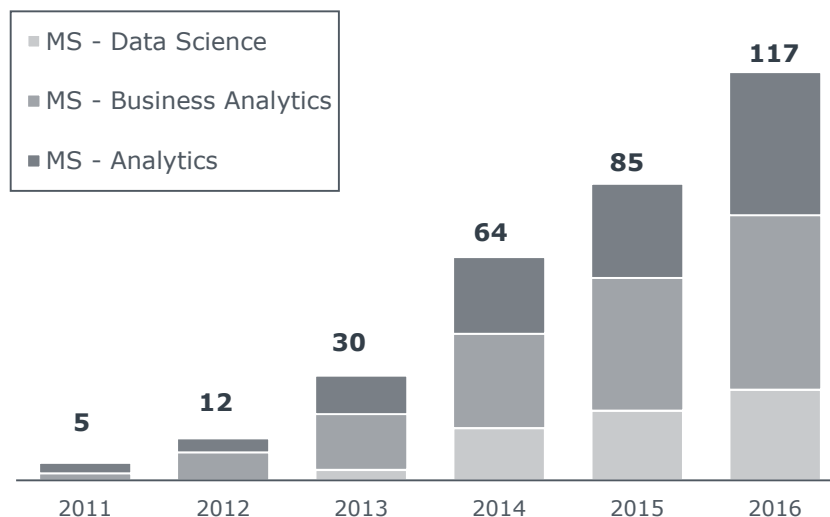
Michael Rappa, founding director of the Institute for Advanced Analytics at North Carolina State University, argues that analytics programs are, "one of the most significant additions to the portfolio of graduate degrees in U.S. higher education in the past 50 years."

A review of the analytics credential market indicates that many institutions agree with Dr. Rappa. There has been a 20-fold increase in graduate programs since 2011. Competition will continue to escalate as the COE Forum's market research division reports a sustained rise in member requests around analytics. Prospective students will not lack for options, and not just from higher education institutions.

Nontraditional providers have rushed into the analytics market too. The highest rated MOOC course in the world (there are 6,850 MOOCs globally) is a Coursera course on Python, a foundational programming language commonly used in analytics. Udacity and Facebook jointly offer an analytics nanodegree, which includes a money back guarantee. Finally, a plethora of bootcamps, from General Assembly to Galvanize, offer short-term intensive programs.

Growth Opportunities Drive Competition, Old and New

MS Analytics Programs Grow 20-Fold

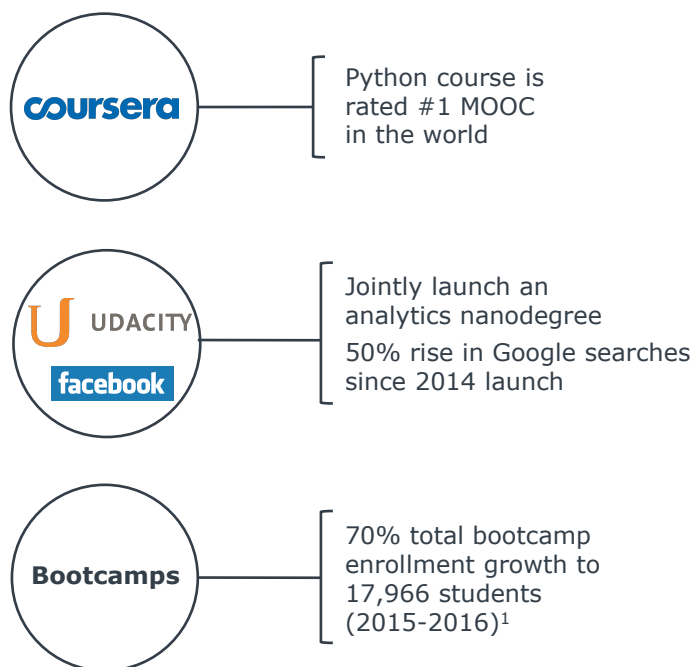


A Robust New Program Pipeline

57%

Increase in COE market research requests on data analytics opportunities, 2015-2016

A Prospective Student's Nontraditional Options



1) Figure is for total bootcamp enrollment. Data analytics/science programs make up only a percentage of this overall figure.

Source: Eggleston L, "2016 Course Report Alumni Outcomes & Demographics Study," Course Report, Sept. 14th, 2016; Eggleston L, "2016 Coding Bootcamp Market Size Study," Course Report, Jun. 22nd, 2016; "Google Trends," Google, Oct. 27th, 2016. Devaney L, "These are the top 50 MOOCs," eCampus News, Oct. 20th, 2016; "Data Analyst Nanodegree," Udacity, Oct. 26th, 2016; "Master Degree Programs in Analytics and Data Science," Institute for Advanced Analytics: North Carolina State University, Oct. 27th, 2016; "The State of Data Education in 2016," Tableau, 2016; Shah D, "Monetization Over Massiveness: Breaking Down MOOCs by the Numbers in 2016," EdSurge, December 29, 2016. . EAB interviews and analysis.

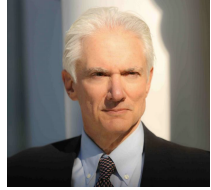
Analytics as ‘Sexiest’ Job of the Century...

Back in 2012, Harvard Business Review famously identified data scientist as the “sexiest job of the 21st century.” However, since that proclamation, AI (artificial intelligence) has advanced far faster than anyone had expected and automation is encroaching on many skilled occupations. As Jerry Kaplan noted, even highly skilled white collar jobs are vulnerable to automation.

Data scientists have been at the forefront of automation, but as AI evolves there is evidence that it will cannibalize, rather than complement, the work of analytics professionals. From Fortune 500 executives to startup founders to program directors, a growing chorus of informed voices argue that automation will reduce demand for analytics professionals.

Most powerfully, as shown in the shaded box, a survey by a leading data science website revealed that a majority of data scientists believe that most of their advanced tasks will be automated within the next ten years or less.

...But What if the Century Only Lasts 10 Years?



“Automation is now blind to the color of your collar.”

*Jerry Kaplan
Humans Need Not Apply:
A Guide to Wealth and Work
in the Age of Artificial Intelligence*

Is Data Analytics Immune from Automation?

Fortune 500 Executive

“Over time, software will do more and more of what data scientists do today.”

*Ronald Coultier
VP and Chief Security Officer
ADP*

Startup Founder

“[Higher level tools are] the sort of automation that eliminates the need for data scientists to a large degree.”

*Sirish Raghuram
Co-Founder and CEO
Platform9 Systems*

Program Director

“Data Scientists always joke about how they automate jobs. Now, **their own jobs might be replaced.**”

*Program Director,
Midwestern Research University*

Data Scientist

51% of Data Scientists surveyed believed that the majority of their expert-level tasks will be automated in the next 10 years or less.

KDNuggets Survey 2015

Source: Piatetsky G, “Data Scientists Automated and Unemployed by 2025?,” KDNuggets; Anders G, “Anyone Can Build A Robot; Who’s Ready To Teach It Ethics?,” Forbes, Sept. 14th, 2015; Darrow B, “Data Science is still white hot, but nothing lasts forever,” Fortune, May 21st, 2015; EAB interviews and analysis.

Automation at Work, in Work

Robot process automation (RPA) is the catch-all term for how artificial intelligence programs will eliminate routine tasks found in every job, including data science. RPA software completes repetitive tasks far quicker than humans and, using machine learning techniques, hones its performance continuously. For one insurer, it used to take a human two days to write 500 premium advice notes. Now, a software program does this in 30 minutes.

WorkFusion is a leading startup in the RPA space that showcases how white collar jobs can be automated. WorkFusion's AI software analyses a client's process and then assign tasks to itself, internal employees, and freelancers. The program hires and quality assures all of the employees and contractors using Six Sigma methods. Freelancers are queried for competence by the AI. For example, it emails questions it already knows the answer to and if workers are inaccurate, it reassigns tasks to others. Finally, its machine and deep learning capabilities enable the software to learn from all its interactions—reducing cycle time for tasks and teaching itself new skills. The objectives are to improve efficiency and reduce dependence on humans for the next client.

"Digitalize Your Enterprise with AI Software Purpose-Built for Operations"



Founded: 2010

Location: New York City

VC Funding: \$71m

Employees: ~200

Smart Process Automation

- AI software divides project into tasks to be automated, crowd-sourced, or done in-house

Continuous Learning

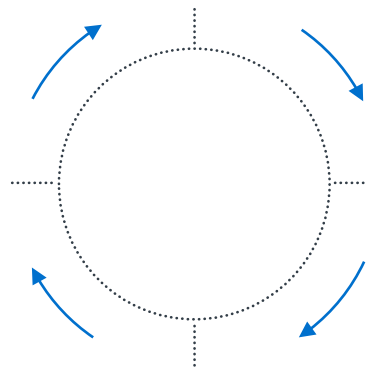
- AI software learns from the data sets generated to automate additional tasks for the next project

AI Project Management

- Sources, trains, and manages workers
- Distributes work based on capacity
- Makes payments with no management overhead

Automatic Quality Check

- Every task is checked using Six Sigma methods
- Pinpoints workers who do not perform and reassigns tasks



Source: Ford M, Rise of the Robots: Technology and the Threat of a Jobless Future, Basic Books, 2015; "WorkFusion Intelligent Automation 2017," WorkFusion, <https://www.workfusion.com/smart-process-automation-spa>; Nichols G, "Bad news for IT: Robots and artificial intelligence will take jobs," ZDNet, 12 May 2015; Lhuer, x, "The next acronym you need to know about: RPA (robotic process automation)," McKinsey, Dec. 2016; EAB interviews and analysis.

Future-Proofing in the Age of Automation

Future-proofing, as defined here, is an effective approach for professionals to maintain their career viability in the face of automation. Future-proofing equates to continuous learning. This is not just an aspiration but a necessity for working professionals.

Awareness of automation and the threat it presents are growing. Pearson's 2016 Adult Learner Survey revealed that anxiety about keeping up with technological innovation is now the top career concern for prospective adult learners. 69% believe their jobs will be fundamentally transformed by technology in the near future and 72% believe that they need more education to keep up with changes in their field.

Providing lifelong learning is intrinsic to COE units and they are well positioned to help professionals upskill and upcredential.

Future-Proofing Your Career Mandates Lifelong Learning

Defining Future-Proofing

“The process of anticipating the future and developing methods of **minimizing the negative effects** while **taking advantage of the positive effects** of shocks and stresses due to future events.”

Principles of Future-Proofing

The Experts Advise

“Finally, **across nearly all industries**, the impact of technological and other changes is shortening the shelf-life of employees' skill sets. So no matter what you choose to study today, **expect to have to keep learning** throughout the course of your career.”

*Saadia Zahidi
Head of Education, Gender, and Employment Initiatives,
World Economic Forum*

COE Prospects Agree

72%

Of prospective adult learners think they will need additional education to keep up with changes in their field

*2016 Pearson
Adult Learners Survey*

Source: Pinsker J, "Ask an Economist: How Can Today's College Students Future-Proof Their Careers?," *The Atlantic*, Sept. 12th, 2016; "Principles of Future-Proofing," Principlesoffutureproofing.com; "Pearson Poll Finds Anxiety about Keeping Up with Innovation Now Top Career Concern for Adult Learners," Pearson, Oct. 19th, 2016.

Credential Versatility Serves Role Diversity

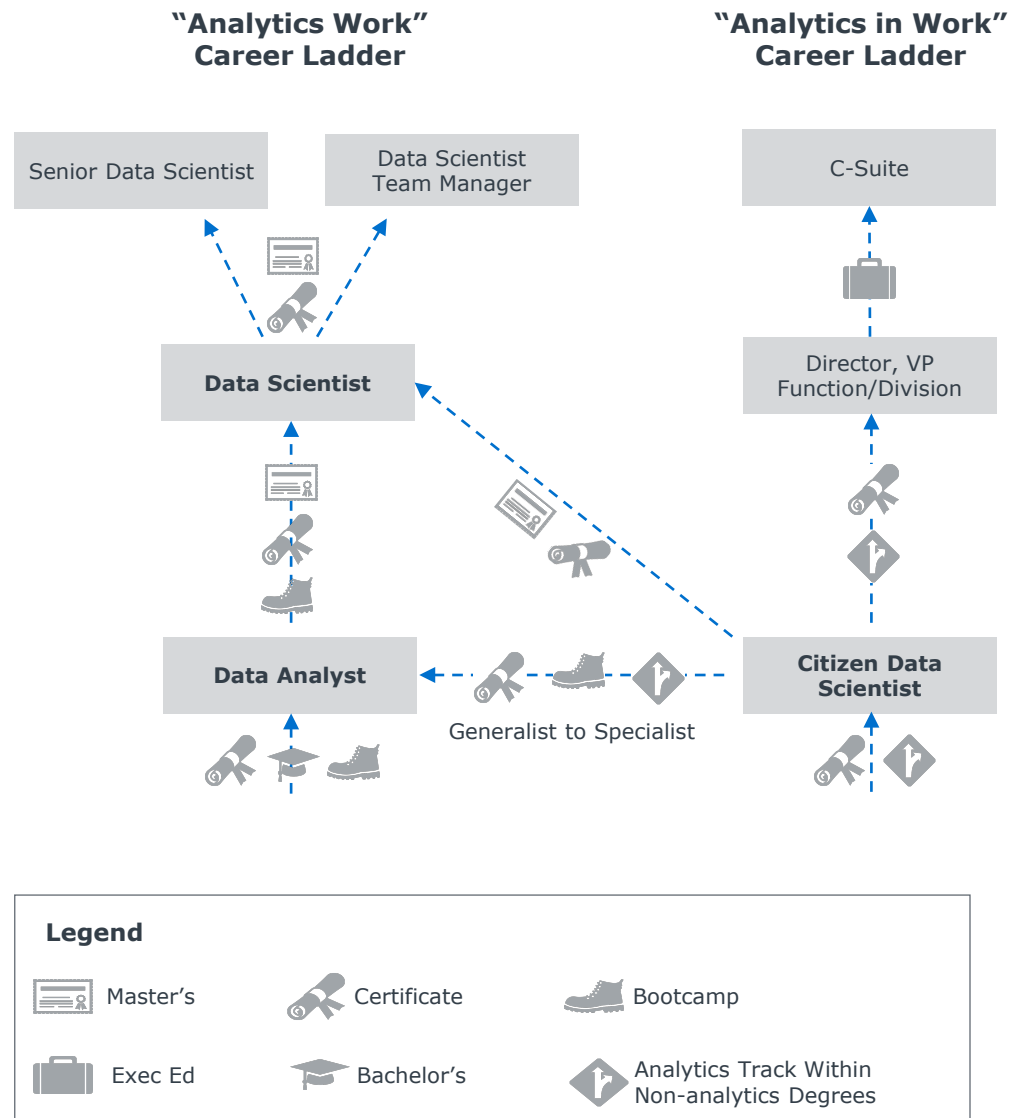
As a new and rapidly changing field, the analytics job landscape is complex. To generalize, there are two career ladders. One for those wishing to specialize in analytics work and one for “analytics in work”, wherein citizen data scientists use analytics to complement core job responsibilities. These job ladders can intersect as generalists look to transition to specialist roles.

The career ladders on the right summarize the most common ways that credentials can serve analytics specialists and generalists.

As there are many ways to provide analytics credentials for career starters, changers,, and advancers, a “one size fits all” credential strategy is inadvisable. EAB’s recommendation is to develop a portfolio of analytics credentials that enables COE units to serve many of these audiences and their different career goals.

This portfolio needs to be adaptive to a field where no steady state is foreseeable given technological disruption, greater competition from traditional and nontraditional credentials, and sea changes in the skills sought by employers.

Variety of Analytics Roles and Pathways Compels a Credential Portfolio



Building the Adaptive Analytics Portfolio

Three Imperatives to Build an Adaptive Portfolio

Maximize Credential Applicability	Track the Technological Edge	Realign the Practicum to Career Priorities
Ensure that the portfolio supports a range of student audiences with disparate career and skill acquisition objectives.	Develop an ongoing understanding of the competitive threats, technological trends and emerging employer preferences within analytics.	Embed experiential learning so students can apply analytics to business problems and translate analytic insights into actionable business information.
<p>Enable Analytics Specialists to Tailor their Degrees</p> <p>Offer advanced technical, function- and industry-specific electives</p> <p>Diversify the Prospective Student Pipeline</p> <p>Widen the enrollment pipeline by targeting non-STEM majors</p> <p>Appeal to career starters and nontraditional students through undergraduate degrees</p> <p>Provide Analytics Generalists with Upskilling Options</p> <p>Offer certificates, analytics tracks within existing degrees, and executive education programs to serve citizen data scientists and senior executives</p>	<p>Monitor Bootcamp Market Performance</p> <p>Track bootcamp pricing, revenues, funding and valuations</p> <p>Analyze Curriculum Gaps</p> <p>Compare program curricula to bootcamps to assess market relevance</p> <p>Enhance Employer Market Sensing</p> <p>Generate broader perspectives on emerging employer skill and hiring preferences</p>	<p>Competitive Practicum Proposals</p> <p>Practice 1: Galvanize/University of New Haven</p> <p>Hardwiring Project Management Skills</p> <p>Practice 2: Louisiana State University</p> <p>Solution Catalyst Hackathon</p> <p>Practice 3: St. Mary's University</p> <p>Analytics Program Evolution Accelerator</p> <p>Coda: Indiana University</p>



Maximize Credential Applicability

PART

1

- Enable Analytics Specialists to Tailor their Credentials
- Diversify the Prospective Student Pipeline
- Provide Analytics Generalists with Upskilling Options

Three Options for Specialists to Tailor Their Credentials

From marketing to IT to liberal arts, prospective analytics students have a wide array of academic and career backgrounds. Correspondingly, they have very diverse skill needs and career aspirations.

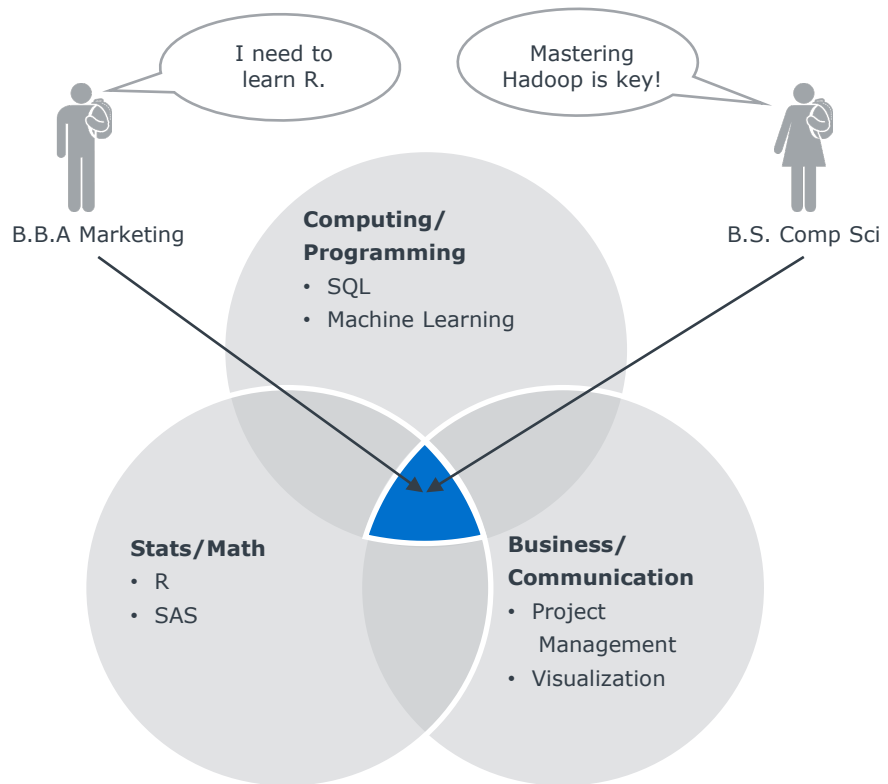
Skill specialization entails offering a range of courses from all three core analytics domain areas enabling students to address particular skill gaps.

A number of analytics programs are starting to add function and industry electives foci, or even specialized degrees, to their portfolios. Some students seek function-specific skills, such as marketing analytics. Others seek skills within a particular industry, such as government.

As the analytics field matures and program competition intensifies, function/industry offerings will become key for market differentiation. COE units should look to the intersection of market demand and their institutional strengths to determine which function and/or industry specializations would convey competitive advantage.

Enable Core Customization and Support Specialization

1 Skill Specialization



2 Function Focus

Electives and specialized degrees enable students to build business function-specific analytics skills

SYRACUSE UNIVERSITY

MS in Business Analytics

-Accounting analytics coursework



MS in Marketing Analytics

3 Industry Focus

Electives and specialized degrees permit students to build industry-specific expertise

Northwestern

SCHOOL OF
PROFESSIONAL STUDIES

MS in Predictive Analytics

-Sports analytics focus



MS in Government Analytics

From 'Made to Measure' to Bespoke

Programs should offer a wide range of electives to maximize credential applicability. The type and number of electives are based on program branding, student audiences, location and institutional strengths. The table opposite shows the multitude of skill mix, function, and industry customization options in existing master's programs.

Northwestern University's MS is designed to support all three types of customization.

American University also supports all three types of customization. The focus on cybersecurity industry illustrates how specialization reflects institutional expertise and location.

UC Berkeley targets electives for students seeking advanced technical skills. This focus on data scientists reflects its proximity to Silicon Valley.

The newer programs tend to quickly expand electives to broaden appeal and pursue differentiation in a crowded market. For example, at Indiana University's program (launched in 2015), students have no core requirements and tailor their degree via 60 electives. This is made possible by accessing courses from other programs within the wider university.

Customization Options Vary, but Proliferating Fast

Northwestern
SCHOOL OF
PROFESSIONAL STUDIES



Berkeley
UNIVERSITY OF CALIFORNIA

INDIANA UNIVERSITY

Name	MS in Predictive Analytics	MS in Analytics	Master's of Information and Data Science	MS in Data Science
Launch Year	2011	2016	2014	2015
Electives	12	15	6	60
Skill Mix Options	<ul style="list-style-type: none"> • Heuristic Modeling • Deep Learning 	<ul style="list-style-type: none"> • Managerial Economics • Strategic Thinking 	<ul style="list-style-type: none"> • Natural Language Processing • Machine Learning 	<ul style="list-style-type: none"> • Artificial Intelligence • Applied Machine Learning
Function Options	<ul style="list-style-type: none"> • Analytics Consulting • Marketing Analytics 	<ul style="list-style-type: none"> • Brand Strategy • Marketing Management 	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • Social Media Mining • Web Mining
Industry Options	<ul style="list-style-type: none"> • Sports Analytics • Medical Data Science 	<ul style="list-style-type: none"> • Cybersecurity Risk Management • Cybersecurity Governance 	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • Drug Discovery Analytics • Government Analytics

Source: "Curriculum," American University, <https://onlinebusiness.american.edu/analytics/curriculum>; EAB interviews and analysis.

Certificates Fund Innovation Pipeline

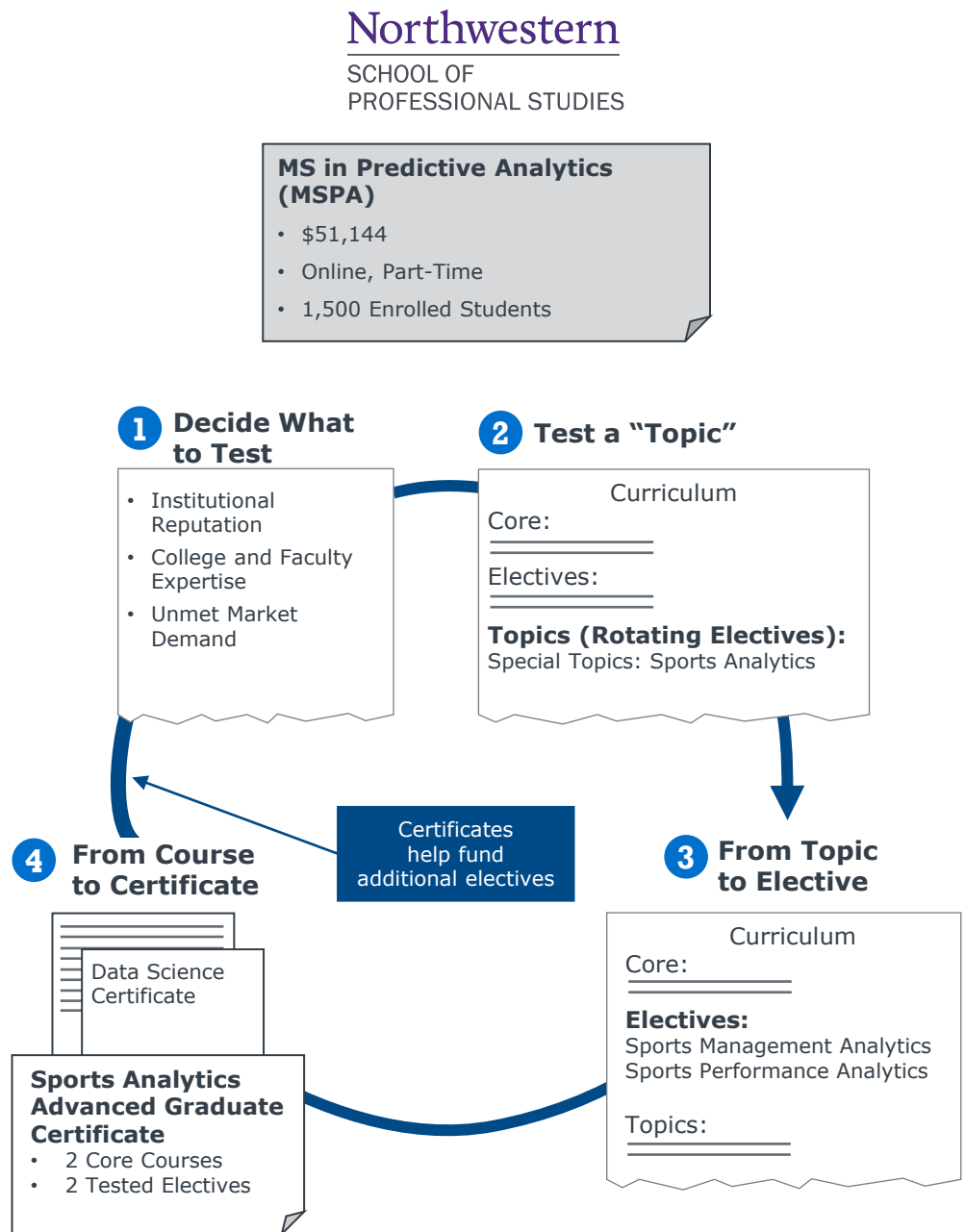
Northwestern's MS in Predictive Analytics (MSPA) program developed an innovation process that tests the viability of electives quickly; launching the most compelling as standalone certificates.

Northwestern's program director identified sports analytics as a potential market opportunity. The MSPA offered a sports analytics "topics course," one of a set of rotating electives offered to test market demand. As student demand was strong, Northwestern made the elective permanent. And in response to continued demand, a second sports analytics elective was introduced.

Northwestern launched a standalone graduate sports analytics certificate composed of the two sports electives with two core analytics courses. The certificates are labeled as "advanced" as a master's degree in any field is required to enroll. Northwestern does this to avoid cannibalizing its core MSPA market.

The MSPA program director uses profits from the certificate (Northwestern has six certificates in total) to fund more "topics" for testing within the program.

While especially valuable for data analytics, this test and learn process can be applied to other programs within the COE portfolio.



A Word About Certificates

EAB research indicates there are over 150 certificates on the market as of December 2016. The certificates facilitate a wide array of analytics career paths. The three examples to the right showcase the diversity of target audiences, entrance requirements, modalities, and formats.

Johns Hopkins' certificate is explicitly designed for aspiring or current citizen data scientists in the government, and stacks into their MS in Government Analytics.

University of Washington's non-credit certificate requires a high level of analytics abilities for admission. It is designed for analytics specialists, reflecting Seattle's status as a high-tech hub.

Mercer University's open enrollment certificate targets senior managers who want to gain a high-level overview of data analytics knowledge through an in-person class.

Certificates Serve a Range of Upskilling Goals



Government Analytics Certificate

- **School:** Krieger School of Arts & Sciences: Advanced Academic Programs
- **Cost:** \$18,365
- **Student Career Goal:** Citizen data scientist
- **Admission Criteria:** No quantitative or programming skill requirements or recommendations
- **Modality:** Online/hybrid/in-person
- **Format:** For-credit
- **Number of courses:** Five
- **Details:** Stackable into MS in Government Analytics

Data Science Certificate

- **School:** Professional & Continuing Education
- **Cost:** \$3,735
- **Student Career Goal:** Data analytics specialist
- **Admission Criteria:** Score of at least 18/30 on test measuring programming, database, and quantitative skills
- **Modality:** Online/hybrid/in-Person
- **Format:** Non-credit
- **Number of courses:** Three
- **Details:** Predates MS in Data Science

Data Analytics Certificate

- **School:** Stetson School of Business and Economics
- **Cost:** Variable
- **Student Career Goal:** Executive roles
- **Admission Criteria:** Open enrollment
- **Modality:** In-person
- **Format:** Non-credit
- **Number of courses:** One two-day class

Source: "Government Analytics," Johns Hopkins University, <http://advanced.jhu.edu/academics/certificate-programs/government-analytics/>; "Certificate in Data Science," University of Washington, <https://www.pce.uw.edu/certificates/data-science/>; "Certificate Programs," Mercer University, <http://business.mercer.edu/centers-initiatives/executive-education/certificate-programs/>; "The State of Data Education in 2016"; Tableau, 2016; EAB interviews and analysis.

Growth Lever Available

EAB research found that many program directors were surprised to discover a number of liberal arts applicants despite marketing exclusively to STEM graduates. Many non-STEM students were subsequently admitted and were successful.

Programs should accommodate non-STEM students to help scale and prepare for more competition from traditional and nontraditional providers.

From interviews with programs supporting non-STEM applicants, EAB identified three lessons to broaden prospective student audiences while maintaining academic rigor.

1. Instead of purely focusing on undergraduate major, Syracuse University uses a set of alternative criteria to determine applicants' quantitative ability.
2. University of San Francisco mandates a pre-program bootcamp to ensure all students possess baseline technical skills. UC Berkeley also provides a pre-program Python course and has even spun that prep course out into a popular non-credit offering.
3. Indiana University offers two pathways within its MS program to accommodate students with very different backgrounds and career goals.

Non-STEM Students Represent Untapped Opportunity

“We marketed mainly to prospects with STEM backgrounds. However, we also received many applications from liberal arts graduates. We’ve evolved our admissions process to better accommodate them.”

*Donald Harter
Associate Dean for Master’s Programs,
Syracuse University*

Lessons from Early Adopters

Reshape Admissions Criteria

SYRACUSE UNIVERSITY

MS in Business Analytics

- ✓ Quant. Academic Courses
- ✓ Quant. Work Experience
- ✓ Upward Career Progression
- ✓ If <5 years exp., GMAT

Bridge the Gap



UNIVERSITY OF
SAN FRANCISCO

MS in Analytics

Pre-Program Summer Boot Camp

- Foundational knowledge courses in statistics, programming, and linear algebra
- Skills course on R (Stats Package)

Offer Guided Pathways



INDIANA UNIVERSITY

MS in Data Science

- Technical: Focused on advanced programming and computational models
- Non-Technical: Focused on domain-specific applications; data visualization

Source: “Program Details,” University of San Francisco, <https://www.usfca.edu/arts-sciences/graduate-programs/analytics/program-details>, 7 Nov. 2016; EAB interviews and analysis.

Embracing Career Starters and Changers

For entry-level analytics jobs, most employers only require a bachelor's degree, but still pay a data analyst \$60,000 on average.

In response to these bachelor's degree-only job opportunities, more institutions are launching or exploring undergraduate analytics programs. Some universities are repositioning existing majors as analytics programs. For instance, the University of Iowa restructured its existing Management Information Systems major and renamed it, "Business Analytics & Information Systems." Within two years, enrollment more than doubled and the first class of graduates have a 95% job placement rate.

Additionally, Drake University has added a data analytics minor to its curriculum. Regardless of major, all Drake students can enhance their future careers by picking up this multidisciplinary minor.

Given the job opportunities, data analytics is a viable option for a core COE student audience—degree completers. Multiple programs are in the pipeline, but none have launched as of this study's publication. It is noteworthy that Southern New Hampshire University has a fully online data analytics B.S. degree that allows for up to 90 transfer credits.

Analytics as Degree Completion Program Opportunity

High ROI of Data Analytics Jobs requiring only a Bachelor's

Data Analyst Job Posting

Requirements:

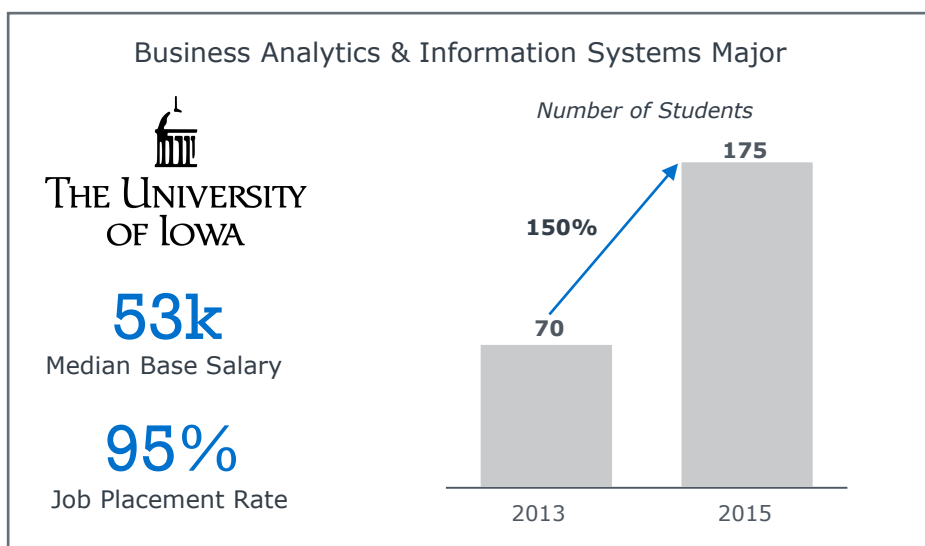
Bachelor's Degree

Salary:

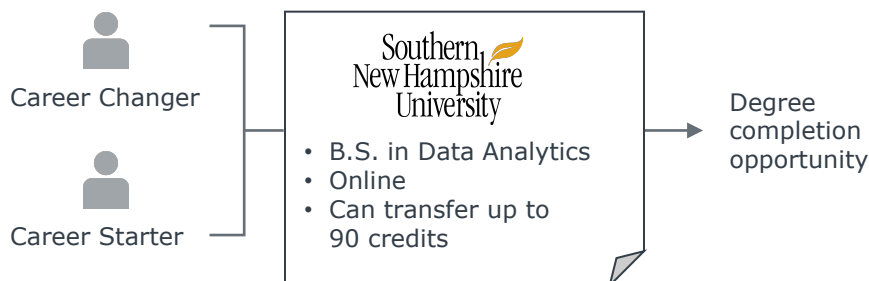
\$60,000

New Analytics Bachelor's Degree Programs in High Demand

Case in Point



SNHU Foreshadows Degree Completion Opportunity



Source: "Data Analyst," Glassdoor, Oct. 27th, 2016; "BS in Data Analytics," Southern New Hampshire University; "Series 11 (Section 5): Intent to Plan for Shepherd's Proposed Bachelor of Science in Data Analytics," Shepherd University, October 1st, 2015; "Business Analytics & Information Systems Major," University of Iowa; ; "Investing in America's Data Science and Analytics Talent," PwC, 2017; EAB Interviews and Analysis.

Many, Many Types of Citizens

There is a large aggregate number of “citizen data scientist” jobs—those that combine domain expertise and analytics ability. But the jobs are dispersed over an assortment of positions. The top five most common job titles cover only 10% of job postings.

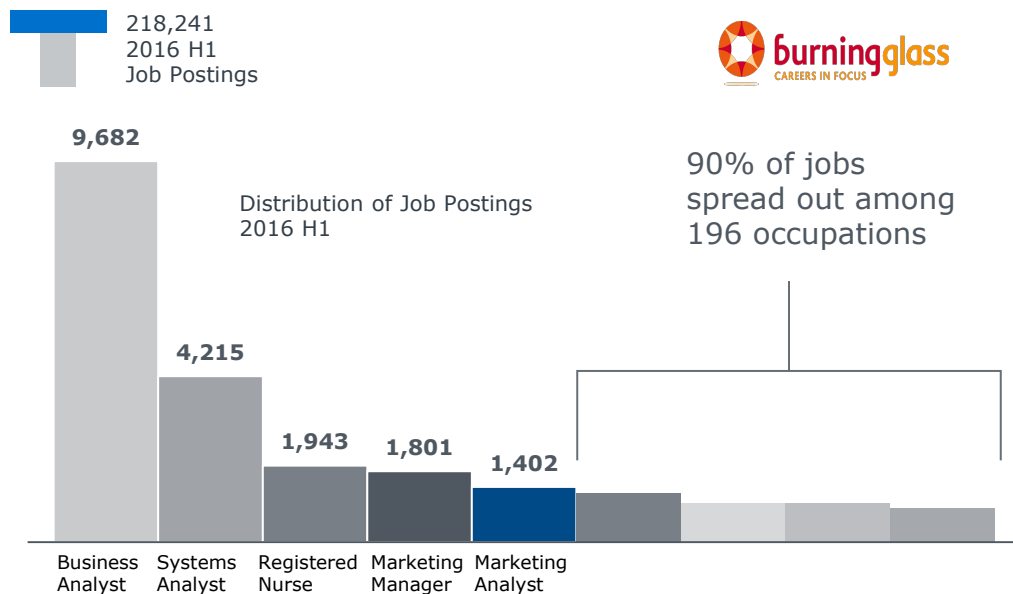
Serving current and aspiring citizen data scientists entails accommodating this wide range of occupations. To do so, COE units should offer an array of credentials.

Senior executives comprise the second major category of analytics generalists. As analytics become indispensable to business decision-making, executives need to have a working knowledge of analytics. Supporting this, a recent PwC study revealed that nearly half of employers will require all executives to have data analytics skills by 2021. This means being able to determine where analytics can enhance operational and strategic decisions and to judge the value of analytical recommendations.

There is an untapped opportunity for COE units to provide some foundational analytics training to senior managers—a significant and less price-sensitive audience.

Significant Job Diversity Prevents One-Size-Fits-All Offerings

A Very Long Citizen Data Scientist Tail



Senior Management Market: Hiding in Plain Sight



49%

Of employers will require **all of their executives** to have data science and analytics skills by 2021.

“A working knowledge of data science can help leaders turn analytics into genuine insight. It can also save them from making decisions based on faulty assumptions.”

“A Leader’s Guide to Data Analytics”
Kellogg Insight

Source: Brown B, Court, D, Willmott, P, “Mobilizing your C-suite for Big-Data Analytics,” *McKinsey Quarterly*, November 2013; Occupational Outlook Handbook, “Top Executives,” Bureau of Labor Statistics; “A Leader’s Guide to Data Analytics,” *KelloggInsight*, May 2015; Burning Glass Labor/Insight™; Investing in America’s Data Science and Analytics Talent,” PwC, 2017; EAB interviews and analysis.

Many Ways to Make ‘T’

There are three ways to provide credentials that help citizen data scientists build “top of T” analytics skills:

1. Highly customizable certificates, such as the one at Indiana University, allow current or aspiring citizen data scientists to tailor short-term degrees to specific career and skill building objectives.
2. Adding analytics tracks within non-analytics graduate degrees improves the marketability of the degrees and graduates. For instance, Northwestern has added a sports analytics track within its existing Master’s in Sports Administration to attract aspiring sports business professionals who need a working knowledge of analytics.
3. Corporate training programs unlock B2B growth opportunities. The University of San Francisco (USF) created The Data Institute as a corporate training program that teaches analytics to specialists and non-specialists alike. The institute is positioned as a service to teach employees analytics using a company’s data, to obtain priority access to USF analytics graduates, and network with analytics pioneers.

Opportunities to Serve Citizen Data Scientists Aboard

Tailored for Me...



Certificates

- Serve multiple audiences
- Typically online
- Low startup costs



INDIANA UNIVERSITY

Certificate in Data Science

- Four courses
- For-credit
- Online
- Entirely customizable, choose among 30 courses in data science program

My Degree...



Tracks within Master’s

- Enhances existing programs
- Boosts enrollment
- Cross-marketing opportunities

Northwestern

Sports Analytics Track within Master’s in Sports Administration

- Four courses from MS in Predictive Analytics:
 - Two core analytics courses
 - Two sports analytics electives

...My Company



Executive Education

- High margin
- Limited customization
- Employer partnerships



UNIVERSITY OF
SAN FRANCISCO

The Data Institute

- Four-hour customized executive education sessions
- Use company’s own data
- Held on-site or on USF campus

More than Exec Ed

- Priority graduate hiring
- Priority selection of practicum students
- Members-only events

Source: “Trainings,” University of San Francisco,
<https://www.usfca.edu/data-institute/trainings>;
EAB interviews and analysis.

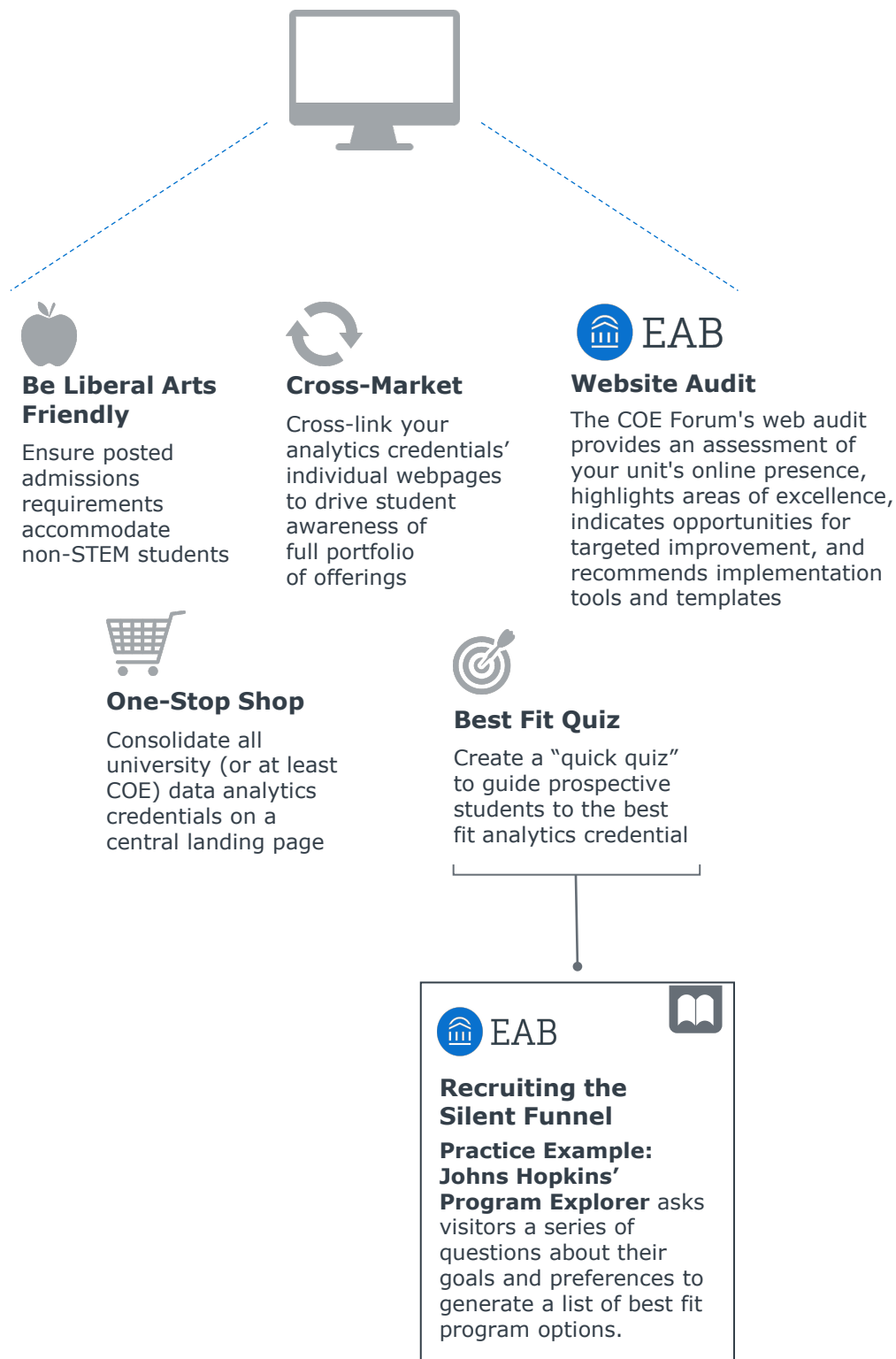
Showcase your Portfolio

EAB's research into existing analytics programs involved reviewing many program websites. This page provides five lessons for improving the end-user website experience.

- If the program accommodates liberal arts applicants, it is important that admissions requirements highlight this and are posted prominently.
- COE units should consolidate all analytics offerings on one central landing page and cross-link them to drive awareness of the full portfolio.
- Ideally, an interactive "best fit quiz" would enable students to determine which analytics offering is right for them.

EAB can help apply these insights and many others as part of a website audit. This service is included in all COE Forum memberships.

Key Website Lessons from Adaptive Portfolio Pioneers



Source: EAB interviews and analysis.

Maximize Credential Applicability

Key Lessons for Implementation

1

Allow specialists to customize their degrees through core skill-, function- and industry-specific electives.

2

Test viability of customization options swiftly via rotating electives within analytics masters' programs.

3

Accommodate applications from liberal arts graduates through alternative admissions and onboarding processes.

4

Attract current or aspiring citizen data scientists via short-form credentials and analytics tracks embedded in existing masters' programs.

Building the Adaptive Analytics Portfolio

Three Imperatives to Build an Adaptive Portfolio

Maximize Credential Applicability	Track the Technological Edge	Realign the Practicum to Career Priorities
<p>Ensure that the portfolio supports a range of student audiences with disparate career and skill acquisition objectives.</p>	<p>Develop an ongoing understanding of the competitive threats, technological trends and emerging employer preferences within analytics.</p>	<p>Embed experiential learning so students can apply analytics to business problems and translate analytic insights into actionable business information.</p>
<p>Enable Analytics Specialists to Tailor their Degrees</p> <p>Offer advanced technical, function- and industry-specific electives</p> <p>Diversify the Prospective Student Pipeline</p> <p>Widen the enrollment pipeline by targeting non-STEM majors</p> <p>Appeal to career starters and nontraditional students through undergraduate degrees</p> <p>Provide Analytics Generalists with Upskilling Options</p> <p>Offer certificates, analytics tracks within existing degrees, and executive education programs to serve citizen data scientists and senior executives</p>	<p>Monitor Bootcamp Market Performance</p> <p>Track bootcamp pricing, revenues, funding and valuations</p> <p>Analyze Curriculum Gaps</p> <p>Compare program curricula to bootcamps to assess market relevance</p> <p>Enhance Employer Market Sensing</p> <p>Generate broader perspectives on emerging employer skill and hiring preferences</p>	<p>Competitive Practicum Proposals</p> <p>Practice 1: Galvanize/University of New Haven</p> <p>Hardwiring Project Management Skills</p> <p>Practice 2: Louisiana State University</p> <p>Solution Catalyst Hackathon</p> <p>Practice 3: St. Mary's University</p> <p>Analytics Program Evolution Accelerator</p> <p>Coda: Indiana University</p>



Track the Technological Edge

PART

2

- Monitor Bootcamp Market Performance
- Analyze Curriculum Gaps
- Enhance Employer Market Sensing

Race Against the Machines

Ongoing advancements in artificial intelligence are undermining the viability of skilled occupations formerly safe from automation. In one widely cited 2013 Oxford University study, 47% of American jobs were found to be at risk of being replaced by automated software programs and/or machines. Even jobs that survive will be significantly altered. Witness the 2016 declaration from the executive chairman of the World Economic Forum that technological innovation will have a transformative effect upon the entire workforce.

In this new era of automation, deans and program directors must take steps to ensure their analytics programs remain market relevant and attuned to changes in high-demand skills.



“Machines are learning to do things that once could only be done by humans, and I see no obvious endpoint to their progress...and machines will keep getting smarter, faster, and cheaper.”

*Erik Brynjolfsson
Professor of Information Technology,
MIT Sloan School of Management
Co-author, *The Second Machine Age: Work,
Progress, and Prosperity in a Time of
Brilliant Technologies**



“We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before.”

*Klaus Schwab
Founder and Executive Chairman,
World Economic Forum*

Follow the Money

Analytics programs can get insight on the pace of technological change by tracking their nontraditional competitors. From new tools to hot skills, bootcamps can act as “canaries in the coalmine” for universities by providing advanced notice of what is happening at the frontier of analytics.

Bootcamps position themselves as the leading source for up-to-the-minute job skills. They must adapt rapidly to technological change to deliver the career outcomes that students are paying for. The largest bootcamp in America by enrollment, General Assembly, has graduated 35,000 students and grown into a half-billion dollar company based on this career transformation value proposition.

Bootcamp have to pursue the “bleeding edge” with their analytics programs to ensure graduates attain their desired job and to continue growing enrollments. General Assembly has significant VC funding and investors like Jeff Bezos. Generating the return these investors require has led to speculation about an IPO in 2018.

Bootcamp Business Model Necessitates Innovation

Market-Based Mission...

“General Assembly is a pioneer in education and **career transformation**, specializing in today’s most in-demand skills. The **leading source** for training, staffing, and career transitions, we foster a flourishing community of professionals pursuing careers they love.”

*General Assembly
Market Positioning*

...Reflects VC Backing...

\$120M

VC Funding

\$450M

Market Valuation

...And IPO Goal

“Every business that has investment, you need to pay those investors. [And in the tech sector], they’re looking for five-to ten-times returns on investment.”

*Jeff Casimir,
Executive Director, Turing
School of Software & Design*



IMAGE CREDIT: FORTUNE

Jeff Bezos,
Seed Investor

**IPO Goal:
2018**

The Learning Manifesto

Learning from the strategic and operational behaviors of the bootcamps involves three steps for program administrators:

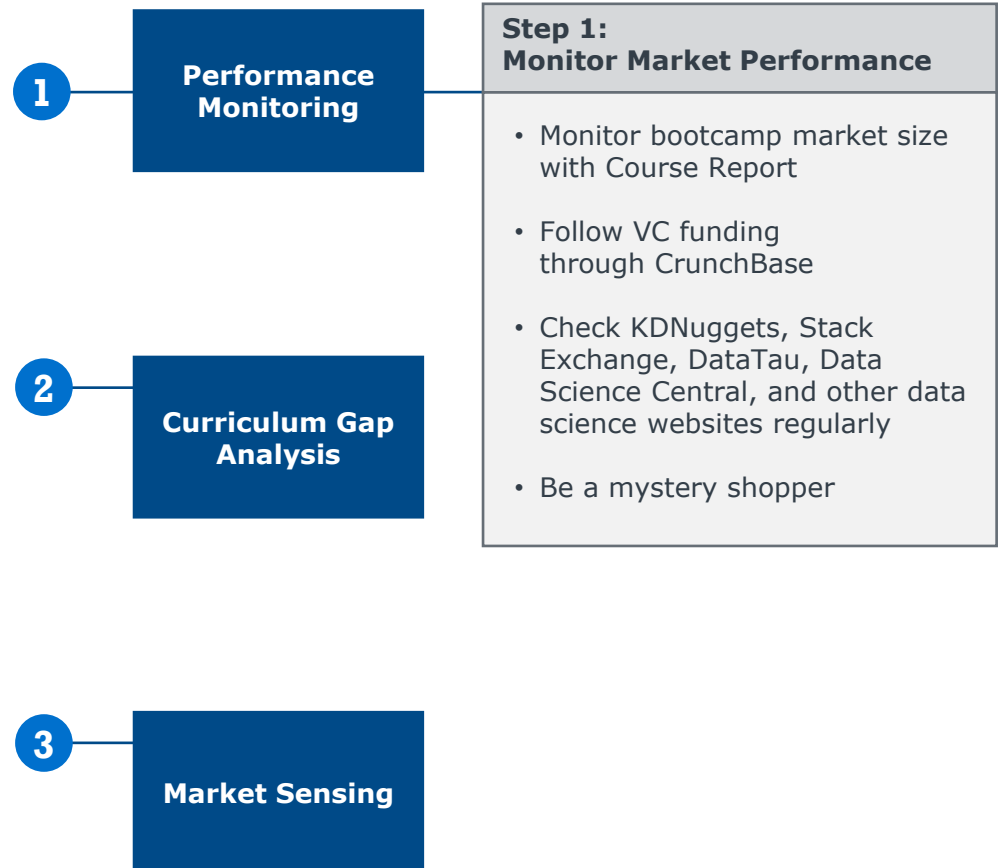
1. Programs should monitor bootcamps' market performance.
2. Programs should perform periodic curriculum comparisons to determine whether their curricula are keeping pace with a rapidly changing field.
3. Programs should mimic bootcamps methods for assessing the skill and hiring preferences for both traditional and leading edge employers.

For step one, program directors monitor bootcamp market performance to keep abreast of trends in student enrollment and job placement. Key resources to support research include Course Report, the foremost bootcamp market research and ratings website, plus CrunchBase, the startup funding database.

Data science focused websites, such as KDNuggets and Stack Exchange, are helpful in understanding the practitioner view on emerging trends and skillsets in the field.

Finally, mystery shopping bootcamps to learn from their marketing and enrollment tactics yields insights on the prospect and applicant experience.

Three-Step Process for Learning from Bootcamps



The Curriculum Time Machine

Program directors should periodically compare their programs' current and past curricula to those of bootcamps. Current bootcamp curricula can be obtained online; past curricula can be accessed through a free internet archive service like The Wayback Machine.

Using the Wayback Machine, EAB conducted a curricula gap analysis of a university's analytics program launched in 2016 and General Assembly. It found the program's curricula resembled General Assembly's 2014 topics. Unsurprisingly, the contrast with General Assembly's 2016 data science topics was stark.

This difference in market responsiveness is the invisible hand at work because bootcamps have to keep pursuing growth. General Assembly promises career transformation and thus its curriculum tends to be very sensitive to in-demand skills. This market responsiveness is a characteristic of leading bootcamps as illustrated by the Flatiron School example.

Step 2: Curriculum Gap Analysis Highlights Skill Gaps

2014 GENERAL ASSEMBLY	2016 Regional Public University
Data Science Bootcamp Topics	MS in Data Science Courses
<ul style="list-style-type: none">Fundamental Statistical MethodsAdvanced Modeling TechniquesMultivariate AnalysisIntro to Machine Learning	<ul style="list-style-type: none">Applied Statistical MethodsData ModelingMultivariate AnalysisStatistical Programming

2016 GENERAL ASSEMBLY
Data Science Bootcamp Topics
<ul style="list-style-type: none">Natural Language ProcessingSpark and Big DataPrescriptive Modeling through HadoopData Visualization

Turning on a Dime

“The school’s staff calls tech firms throughout the week, both to promote their graduates’ abilities and to learn employers’ constantly shifting needs, including what software they use. For example, **when Apple announced a new programming language** for its products, **Flatiron [a leading bootcamp provider] adjusted its curriculum within days.**”

“Coding Boot Camps Attract Tech Companies”
Wall Street Journal (08/11/16)

A New Take on Market-Smart

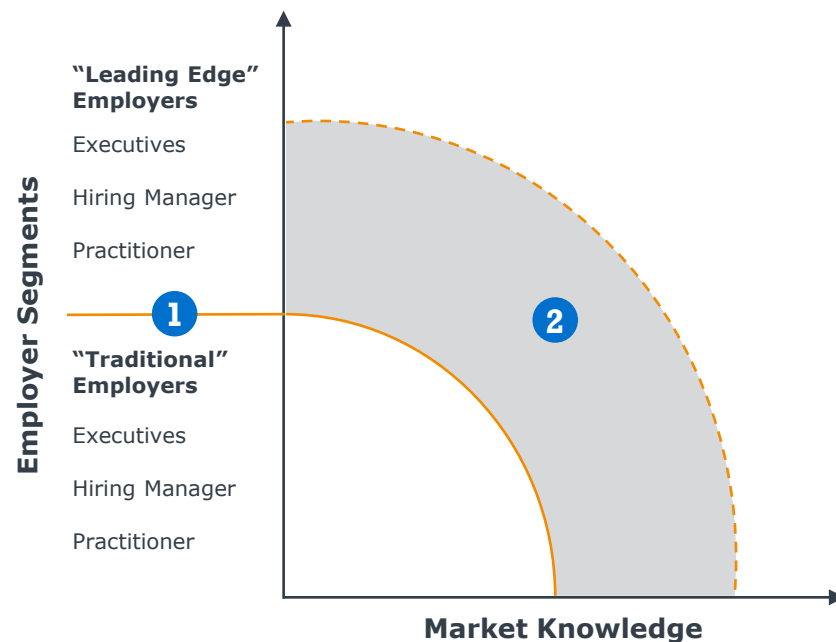
In a fast-changing field like analytics, program directors need to monitor changes in employer requirements and hiring. This page demonstrates how bootcamps monitor changes in employer requirements and hiring. EAB research identified two key steps for programs directors to emulate:

1. Gather bottom-up insight. Conversations with executives on an advisory board and company recruiters should be complemented by talking to analytics practitioners and managers. These individuals typically know more than anyone in the firm about hiring needs and the most relevant analytics skills.
2. Avoid traditional market myopia. Local employers provide useful perspective, but programs should supplement these insights by talking with leading edge employers whose skill needs are ahead of the analytics curve.

Finally, this two-pronged approach to market demand analysis could be applied to other COE degree programs.

Step Three: Market Sensing Captures a Nontraditional View of Employer Needs

Bootcamp Market Intelligence



1 Gather Bottom-Up Insight

To understand demand, from traditional employers, interview hiring managers and practitioners, not just executives.

2 Avoid "Traditional Market Myopia"

To anticipate changes in required skills, interview employers from leading edge firms in the industries hiring your graduates.

Track the Technological Edge

Key Lessons for Implementation

1

Track bootcamps' market performance as a leading indicator of market and technological disruption within analytics.

2

Compare program curriculum with leading bootcamps regularly to acquire insight on emerging skillsets and employer requirements.

3

Supplement market insight gleaned from regional employers and program advisory boards with perspectives from working analytics professionals and leading edge companies.

Building the Adaptive Analytics Portfolio

Three Imperatives to Build an Adaptive Portfolio

Maximize Credential Applicability	Track the Technological Edge	Realign the Practicum to Career Priorities
Ensure that the portfolio supports a range of student audiences with disparate career and skill acquisition objectives.	Develop an ongoing understanding of the competitive threats, technological trends and emerging employer preferences within analytics.	Embed experiential learning so students can apply analytics to business problems and translate analytic insights into actionable business information.
<p>Enable Analytics Specialists to Tailor their Degrees</p> <p>Offer advanced technical, function- and industry-specific electives</p> <p>Diversify the Prospective Student Pipeline</p> <p>Widen the enrollment pipeline by targeting non-STEM majors</p> <p>Appeal to career starters and nontraditional students through undergraduate degrees</p> <p>Provide Analytics Generalists with Upskilling Options</p> <p>Offer certificates, analytics tracks within existing degrees, and executive education programs to serve citizen data scientists and senior executives</p>	<p>Monitor Bootcamp Market Performance</p> <p>Track bootcamp pricing, revenues, funding and valuations</p> <p>Analyze Curriculum Gaps</p> <p>Compare program curricula to bootcamps to assess market relevance</p> <p>Enhance Employer Market Sensing</p> <p>Generate broader perspectives on emerging employer skill and hiring preferences</p>	<p>Competitive Practicum Proposals</p> <p>Practice 1: Galvanize/University of New Haven</p> <p>Hardwiring Project Management Skills</p> <p>Practice 2: Louisiana State University</p> <p>Solution Catalyst Hackathon</p> <p>Practice 3: St. Mary's University</p> <p>Analytics Program Evolution Accelerator</p> <p>Coda: Indiana University</p>



Realign the Practicum to Career Priorities

PART

3

- Practice 1: Competitive Practicum Proposals
- Practice 2: Hardwiring Project Management Skills
- Practice 3: Solution Catalyst Hackathon
- Coda: Analytics Program Evolution Accelerator

Hot Markets, Cool Thinking

To support their career outcomes, students need to work with companies to gain hands on experience with business problems and translating analytic insights into actionable business information.

EAB research found a surprisingly high number of programs with minimal investment in capstone projects or practica. As the analytics' job market becomes more competitive and the number of programs proliferates, administrators need to reassess the caliber of their practica.

The Bay Area exemplifies the future of analytics programs. It contains the hottest analytics job markets and a high percentage of the region's universities offer analytics programs. Many of these have invested in comprehensive experiential learning.

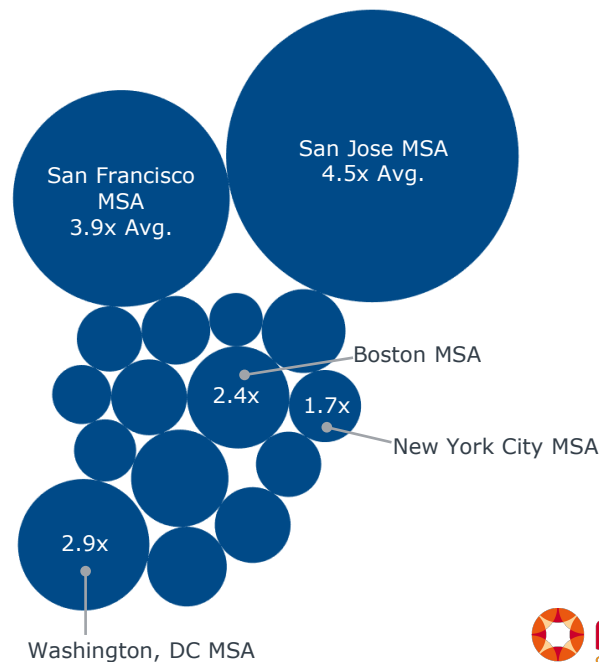
University of San Francisco and GalvanizeU (a partnership between University of New Haven and Galvanize, a bootcamp) have invested in intensive practica for two reasons.

1. They generate better career outcomes by providing graduates with a portfolio of real data science projects.
2. Experiential learning is a core way of differentiating them from their Bay Area competitors.

Competitive Analytics Market Boosts Practicum Importance

Bay Area at the Epicenter of Job Boom

Relative Per Capita Labor Demand for Data Analysts and Data Scientists by Metropolitan Statistical Area (MSA)



Local Programs Invest in Practicum for Sustainable Advantage



“The practicum is a required, central part of our curriculum... Each project is sponsored by a company, allowing students to work with partner companies to gain analytics experience and reconcile mathematical theory with business practice.”

MS in Analytics



“As a part of our innovative industry-focused data science curriculum, students complete a practicum consisting of a 3-credit capstone project and a 3-credit internship.”

MS in Data Science

An Employer-Friendly Spin on the Practicum

There are key project breakdowns within each of the three stages of a typical analytics project.

All of these breakdowns relate to analytics professionals' struggles with core client engagement skills. The three core challenges are scoping business problems, managing client expectations, and delivering findings in a meaningful way.

Intensive analytics program practicums constitute an opportunity for universities to teach graduates these core client engagement skills.

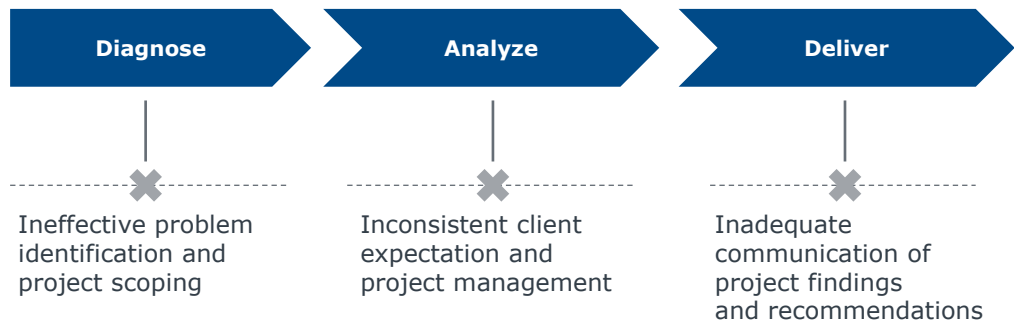
EAB research has identified and profiled practices that use the practicum to address each one of these common project breakpoints.

Finally, independent of the practicum, EAB research found that many programs' coursework data sets are uncoupled from business challenges.

A universal recommendation is that programs use real data sets derived from actual business problems in all analytics courses. Acquiring data sets with underlying business problems is easier when programs employ working professionals as adjunct faculty.

Experiential Learning Around Client Engagement

Analytics Project Breakpoints



Practicum: Improvement Opportunity



Coda: Analytics Program Evolution Accelerator



A Curricular Improvement: Real Data and Real Problems

Incorporate datasets linked to actual business problems throughout curriculum. For instance, a course should not just include real sales data. It should also ask students to use that data and their analytics skills to answer an open-ended question, such as, "what leads should the sales team prioritize to maximize new revenue?"

From Back Seat to Front Seat

The University of New Haven partnered with Galvanize, a prominent bootcamp provider, to offer a MS in Data Science. The program is branded as “GalvanizeU” and taught by UNH faculty at Galvanize’s San Francisco headquarters.

Students learn to define and scope business problems and analytics solutions through the employer-led project matching process of their practicum.

First, employers’ practicum ideas are vetted by the program director. Then, on “Pitch Days,” companies pitch their projects to students, who begin to scope them through a live Q&A.

Subsequently, each student independently crafts proposals that pinpoint the key business issue and the analytics-based solution. Students must rank the top three projects they wish to work on. Each employer reviews the proposals and selects the students they wish to work with. This approach pairs students and companies via a mutual preference matching system similar to the medical resident matching program.

This free market-like matching process raises the bar for students’ problem identification and scoping skills, while elevating the decision-making role of employers.

Employer-Led Project Matching Prioritizes Problem Identification



Step	Participants	Tasks	Duration
1 Idea Vetting	Employer Faculty	Preparing a Pitch <ul style="list-style-type: none"> Companies (executives or hiring managers) prepare a 20 minute presentation Faculty work with employer to hone pitch, determine timelines and datasets 	1-2 Weeks
2 Pitch Day	Employer Students Faculty	Pitch Day <ul style="list-style-type: none"> 12 companies have 20 minutes each to pitch business problems. Student Q&A follows. Pitch establishes company mission, data science project, and support provided to students 	1 Day
3 Proposal Development	Students Faculty	Crafting Proposal <ul style="list-style-type: none"> Each student develops data science project proposals. Faculty assist with creation and vetting. Focus is on pinpointing key business issue and application of data science to solve 	3 Weeks
4 Project Assignment	Employer Students	Student Selection <ul style="list-style-type: none"> Companies select individual proposals based on problem definition, structure and potential solution 	2 Weeks

Source: EAB interviews and analysis.

A Win-Win for Students and Faculty

GalvanizeU's practicum runs concurrently with coursework for six months. The practicum consists of a three month project followed by a three-month internship, usually involving the same company.

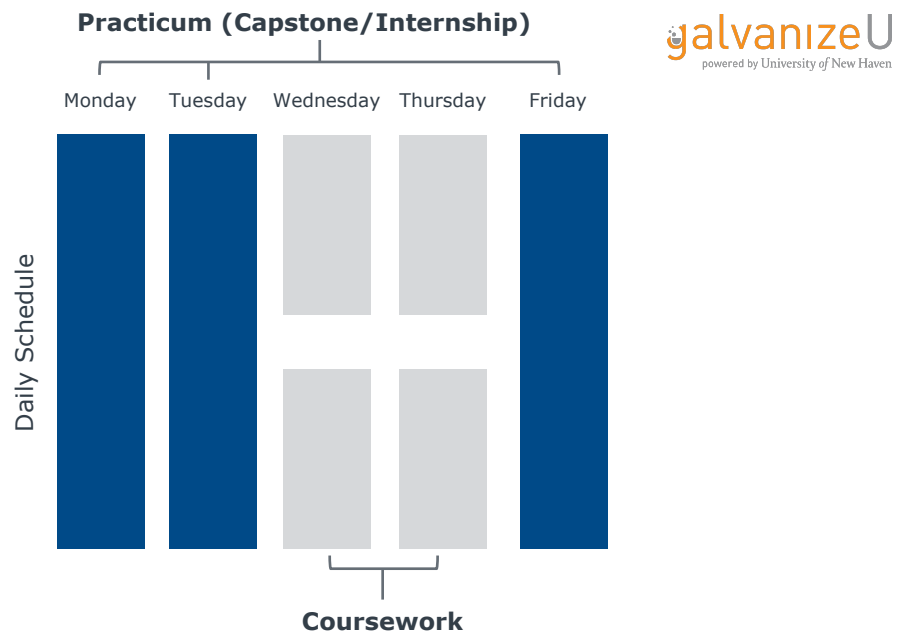
GalvanizeU runs coursework and the practicum simultaneously to keep students connected to the program and to refresh faculty expertise. The interplay between students and faculty around projects helps sharpen faculty skills. This is especially important due to the fast-changing nature of analytic tools and applications.

Students' questions about their practicums and internships allow faculty to learn from leading companies' analytics work. For instance, an advisor to a Tesla practicum found Tesla was using a new machine learning technique. The faculty member went on to modify GalvanizeU's curriculum to include this new technique.

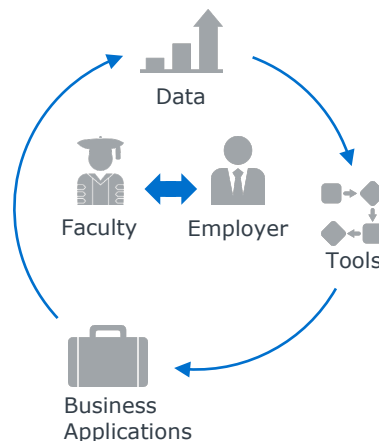
Since the practicum and coursework have begun to run concurrently, another benefit has been a rise in faculty engagement and retention. This result is not to be underestimated as private sector demand for analytics talent makes it difficult for universities to find and keep staff.

Pairing Coursework with Practicum Bears Dividends

Six-Month Practicum/Coursework Sequence



Extends Half-Life of Faculty Skills



Tesla Self-Driving Car Project:

1. Student assigned complex deep learning project; seeks faculty help
2. Faculty advisor discovers Tesla is using a new type of sophisticated machine learning
3. Faculty adds machine learning methodology to the program curriculum



Competency-Based Learning

The typical practicum focuses on helping students master core analytics skills such as finding true causality patterns, integrating disparate data sets and generating analytical insight. However, many practicums ignore the opportunity to embed project management skills—a universal competency that underpins project execution.

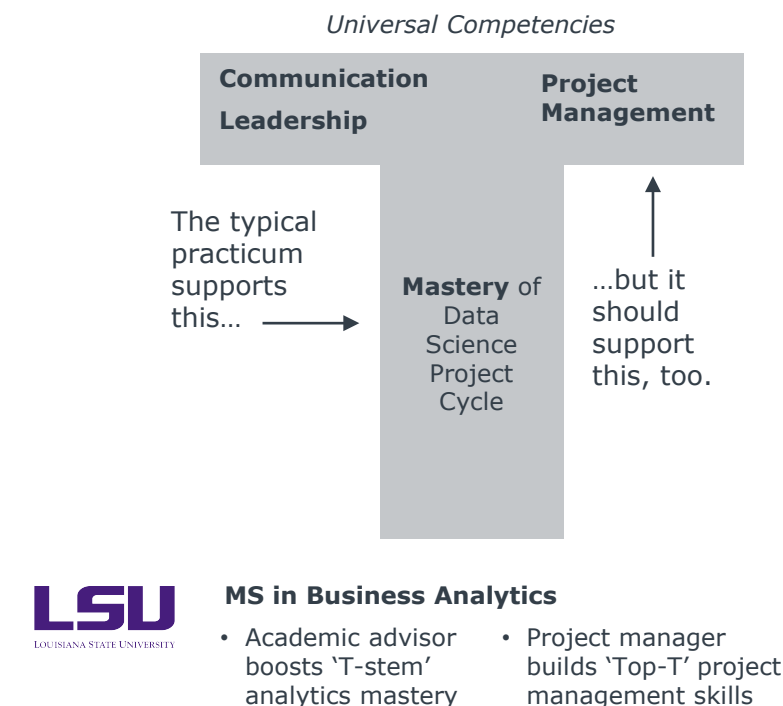
LSU teaches students project management by role modeling it through a dedicated practicum project manager.

Similar to most practicums, each LSU project team is assigned a faculty advisor to support the analytical workstreams for the project.

LSU complements the advisor by assigning a professional project manager to oversee projects for all of the student teams. The project manager ensures students are on track to finish their projects and also sets and manages companies' expectations. This role modeling helps students experience and build project management skills.

A secondary benefit is that the practicum manager's presence helps strengthen employer relationships and support for future practicums.

Project Manager Role Models Client Engagement



Academic Advisor



Practicum Project Manager



Responsibilities:

- Prepare project schedule
- Assign tasks
- Manage team
- Communicate progress to employer

Position Snapshot:

- Adjunct professor in business school
- Project management consultant

D-Day (Delivery Day)

One of the most difficult tasks for analytics practitioners is translating analytic insights into actionable business recommendations. This challenge is intensified by the proficiency gap that typically exists between the project sponsor and the analytics team.

St. Mary's University's M.Sc. in Computing and Data Analytics addressed this pitfall through hackathons that condense an end-to-end project into a few days. The length varies from two to seven days depending on the business issue being tackled.

The hackathon's focus and time pressure means students have to ask the right questions of the employers in the room to scope the problem quickly and accurately.

To test the solutions' viability and presentation skills, student teams present their solutions to a diverse set of judges that emulate the mix of decision makers seeking insight from analytics: senior executives, analytics managers, and non-technically skilled managers. Using specific evaluation criteria, a subset of the teams make it through to a final set of presentations that determine the winner.

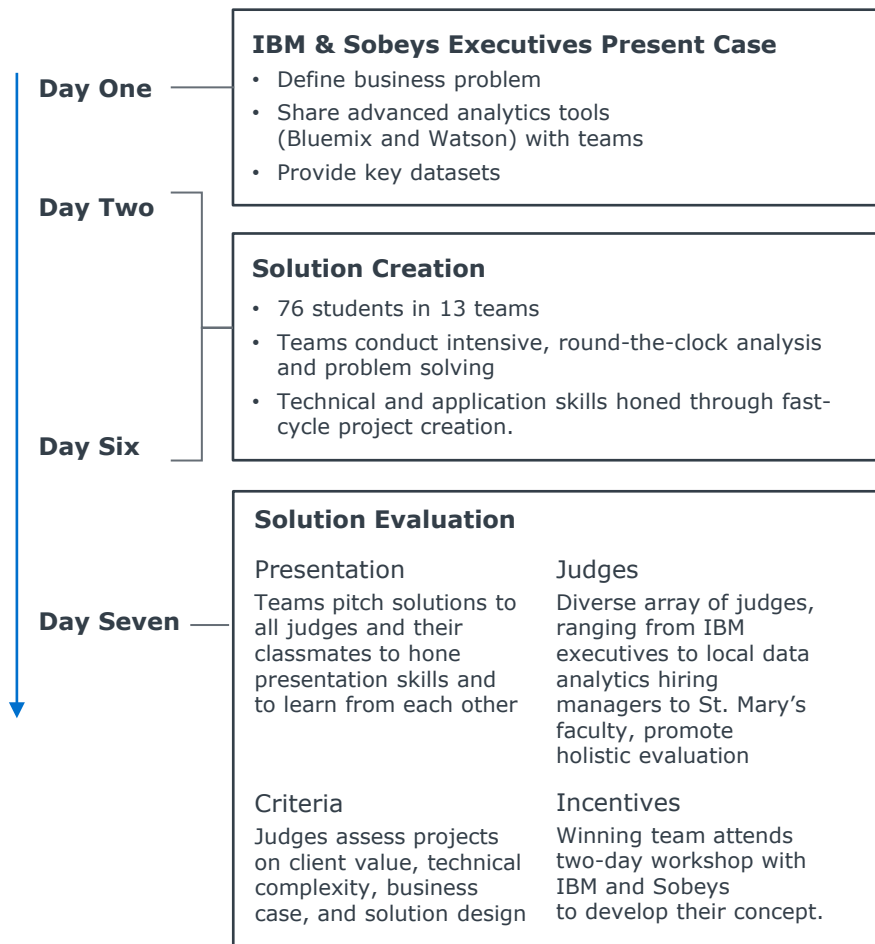
Teams are incentivized to deliver actionable findings as the winning team earns an IBM-led workshop to develop the project.

Holistic Solution Evaluation at Hackathon's Core



Hackathon:

- "Practicum in a Box" condenses business problem diagnosis and solution development
- Seven days long in this case
- Held twice a year



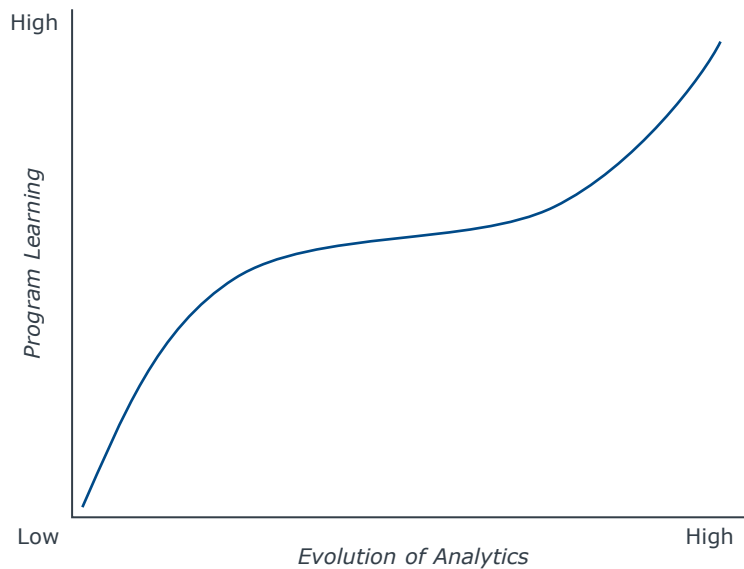
Lifelong Learning Applies to You, Too

Analytics programs operate in an environment where continuous change is a reality for the foreseeable future. Program administrators have to recognize that there is no steady state within this field and it is imperative to keep pace with the capability and experiential learning needs of their students.

Maintaining a program's market relevance from keeping curriculum current to meeting employer skill preferences is not easy. This requires navigating many campus constituencies and competing priorities.

Adapt Your Program to the Evolution of Analytics

Fast Pace of Change Requires Programs to Evolve Throughout Their Lifecycles



Competing Priorities in Keeping Analytics Programs Relevant



Curriculum Relevance



Practicum Applicability



Faculty Expertise



Student Career Advancement

A Swiss Army Knife Approach

Indiana University, based in Bloomington, made a strategic hire to accelerate its program's evolution and responsiveness to market trends.

When Indiana University launched its data science program in 2015, it faced two challenges. First, it was launching later than many of peers. Second, its location was not adjacent to major analytics job markets.

To surmount these and help catalyze program development Indiana hired a "Silicon Valley Liaison"; the role is outlined to the right. This full-time position was filled by a Silicon Valley veteran with thirty years of experience.

The liaison splits their time between the Valley and Bloomington. This bridging role is designed to maximize the impact from forging employer partnerships in the Valley to honing curriculum relevance and practicum applicability at Indiana.

The faculty approved the hire and the salary and supported the strategic intent of the investment.

New Role Catalyzes Change, at Home and Away



INDIANA UNIVERSITY

Associate Director of Data Science Strategic and Industry Initiatives



Qualifications

- Extensive Silicon Valley data science experience
- Strong track record of teaching or mentoring
- Based in Silicon Valley

Time Allocation

- **60%**: Identify and develop partnership and entrepreneurship opportunities between IU and Silicon Valley companies
- **20%**: Student career advising
- **10%**: Support internship programs
- **10%**: Engage faculty via research and team-teach industry opportunities

"Silicon Valley Liaison" Impacts



Curriculum Relevance



Practicum Applicability



Faculty Expertise



Student Career Growth



Realign the Practicum to Career Priorities

Key Lessons for Implementation

1

Elevate employers' role in assigning student projects to enhance a student's client problem identification and scoping skills.

2

Provide a dedicated project management advisor to instill client and project management skills among students.

3

Structure a practicum to demonstrate the importance of communicating project advice effectively to clients.

COE Forum Recommendations

Ten Recommendations for Building and Sustaining an Adaptive Portfolio

Maximize Credential Applicability

- 1 | **Allow specialists to customize their degrees** through core skill-, function- and industry-specific electives.
- 2 | **Test viability of customization options swiftly** via rotating electives within analytics masters' programs.
- 3 | **Accommodate applications from liberal arts graduates** through alternative admissions and onboarding processes.
- 4 | **Attract current or aspiring citizen data scientists** via short-form credentials and analytics tracks embedded in existing masters' programs.

Track the Technological Edge

- 5 | **Track bootcamps' market performance as a leading indicator** of market and technological disruption within analytics.
- 6 | **Compare program curriculum with leading bootcamps** regularly to acquire insight on emerging skillsets and employer requirements.
- 7 | **Supplement market insight gleaned from regional employers and program advisory boards** with perspectives from working analytics professionals and leading edge companies.

Realign the Practicum to Career Priorities

- 8 | **Elevate employers' role in assigning student projects** to enhance a student's client problem identification and scoping skills.
- 9 | **Provide a dedicated project management advisor** to instill client and project management skills among students.
- 10 | **Structure a practicum to demonstrate the importance of communicating** project advice effectively to clients.



Appendix

-
- Launching a Data Analytics Program
 - Glossary of Data Analytics Terms
 - Advisors to Our Work

Launching a Data Analytics Program

Analytics' transformative impact on industry has led to strong demand for analytics talent. The field's rapid evolution creates opportunities for COE units to support upskilling by current and aspiring analytics specialists as well as working professionals seeking to keep abreast of technological advances.

For universities yet to capitalize on the growing demand for analytics credentials, the next five pages distill key new program development lessons. These lessons are summarized in the below checklist.

The COE Forum is ready to further help with market research studies, expert calls, webconferences, and onsite presentations for you, your staff, and your faculty.

Data Analytics Program Launch Checklist

Implementation Step	Components	Completed?
1. Opportunity Fit	Institutional Strengths Assessment	
2. Capability and Stakeholder Engagement	Program Alignment with Existing Portfolio	
	Faculty Support, Capability, and Capacity	
	Program Ownership and Naming	
	Credential Selection	
3. Program Design	Program Content	
	Program Modality	
	Experiential Learning Components	
4. Marketing	Program Website Design	
	Search Engine Optimization	

Source: EAB interviews and analysis.

Step One: Opportunity Fit

How Does a New Data Analytics Program Align with Institutional Strengths?

The first step to developing a data analytics program is to assess alignment with institutional strengths. This involves determining how a data analytics program fits with specific institutional capabilities.

Institutional Strengths Assessment Questions:

- **Question 1:** How will a data analytics program fit with your institutional brand and strengths?
 - Assess existing highly ranked programs or departments on campus. Investigating such recognized “signature programs” for relevance to analytics is a required step in helping to determine potential analytics program specializations and market positioning.
- **Question 2:** Do we have the necessary faculties or departments to support a data analytics program?
 - Due to the interdisciplinary nature of the field and curricula, data analytics programs can leverage some existing on campus resources. Typically, analytics will draw on “close-in” departments for courses and instructors. The “close-in” departments are most often:
 - Computer Science
 - Mathematics
 - Statistics
 - Administrators considering the development of a data analytics program will, of course, have to secure buy-in and support from “close-in” departments. (This is addressed in Step Two). Moreover, developing an analytics curriculum requires more than just combining existing coursework; additional investments will be necessary.

Step Two: Capability and Stakeholder Engagement

How Would a Data Analytics Program Fit with the Existing Portfolio?

The second step in the process is to analyze internal capabilities and resources, program ownership, and credential type. Factors for consideration include existing courses and programs, faculty member capacity, school and departmental willingness to support the program, and program credential types.

Program Alignment with Existing Portfolio Questions:

- **Question 1:** Would a data analytics program complement or compete with existing coursework and programs at our institution?
 - Consult with faculty members to determine if a data analytics program would satisfy unmet student demand for analytics skills. This need can be at the undergraduate as well as the postgraduate level.
 - Review existing program offerings to see if a data analytics program would compete for enrollments.
- **Question 2:** Could existing courses or credentials be repurposed or repackaged?
 - Determine which courses or programs offered by “close-in” departments could be repurposed for a data analytics curriculum.

Faculty Support, Capability and Capacity Questions:

- **Question 1:** Do faculty members, especially in close-in departments, support the development of a data analytics program?
 - Think broadly about the departments or colleges that may be impacted. For example, the engineering or the business school may see opportunities to provide their own analytics offerings.
- **Question 2:** Are there sufficient faculty members with the capabilities and capacity to develop and teach data analytics courses?
 - While the “close-in” departments (Computer Science, Mathematics, and Statistics) are a viable source of analytical expertise, there might be other departments (Economics or Engineering for example) that can contribute faculty members and coursework. The dynamic nature of the field means that additional hiring is frequently necessary, say in artificial intelligence, to develop and staff key courses. Consider the use of working analytics professionals to address capability and capacity constraints.
 - Review faculty member teaching loads and research responsibilities to determine capacity for an analytics offering.
 - Consider the expansion of existing course sections to include data analytics students. However, relevant existing courses may not have capacity for additional students. Administrators may need to introduce new course sections to accommodate analytics students, which can present funding and staffing issues.

Program Ownership and Naming Questions:

- **Question 1:** Which faculties or departments will contribute to the program?
 - In addition to the “close-in” departments, determine which other departments or colleges which will contribute faculty and coursework to the program.
 - Colleges and departments that support the data analytics program can create opportunities for program specializations and a wider range of electives.

Step Two: Capability and Stakeholder Engagement (cont.)

How Would a Data Analytics Program Fit with the Existing Portfolio?

- **Question 2:** Which college or department will own the program?
 - Since several colleges and departments will potentially contribute to a data analytics program, it's crucial to determine upfront which school or department will house and manage the program's operations.
 - Some institutions house data analytics program in a "close-in" department, while others choose a neutral school or department, such as a school of graduate studies.
- **Question 3:** How will the name of the program be determined?
 - As a multidisciplinary offering, contributing colleges and departments may wish to promote their own brand in the program name. For example, a school of statistics may wish to include "applied statistics" in the program title. The selected name has major implications for how prospective domestic and international students will find the program online as well as the credential's positioning and marketing. Terminology evolves with the field, but currently there is momentum behind having masters' programs tagged as data science.

Credential Selection Questions:

- **Question 1:** What type of data analytics credential should we develop?
 - Data analytics programs are offered as a wide range of credentials, such as:
 - Certificates
 - Master's degrees
 - Analytics specializations or tracks within a master's degree program
 - Executive education programs
- **Question 2:** Is there a particular student audience or analytics role we are targeting?
 - It is possible to serve students seeking either data analyst or data scientist roles or advancement. Doing so requires a curriculum that enables students to go deeper on core analytics skills—Statistics/Mathematics, Computer/Programming, and Business/Communication skills. Citizen data scientists are generalists and need programs that provide a range of core and elective courses so they can select coursework to develop specific skills. Finally, consider institutional brand and mission, when selecting credential type.
 - Certificate programs and other short-format offerings, such as bootcamps, are often faster to develop and launch. Accordingly, some institutions use certificates to test the market before investing in masters' degrees. Other institutions have created a master's degree program first.
 - Programs shorter than two years align with the needs of working professionals, but these programs may hinder international student enrolments given work authorization limitations.

Step Three: Program Design

How Will We to Structure Our Data Analytics Program?

At this stage, faculty members and prospective program administrators will need to develop the key elements of the program, such as curriculum, admissions requirements, and tuition. The nature and complexity of these factors will vary widely from institution to institution, based on program objectives and mission as well as internal policies. The major considerations in this step include program modality and experiential learning components.

Program Content Questions:

- **Question 1:** Does our curriculum confer in-demand skills?
 - Review labor market demand trends to identify the data analytics techniques and tools sought by employers.
- **Question 2:** Do our courses cover the most up-to-date methodologies and technologies?
 - Data analytics is a rapidly advancing field and many of the technologies and methods become obsolete quickly. Review labor market trends regularly to ensure the program is meeting employer requirements for up-to-date skills.
 - Review and update program curricula regularly to align with workforce needs.

Program Modality Questions:

- **Question 1:** What delivery format best aligns with the data analytics program curriculum?
 - Many data analytics programs include some distance learning options. However, few programs are offered fully online. Experiential learning typically requires some face-to-face interaction. The targeted student audience, skills conferred, location, and type of credential are key factors in determining modality.
- **Question 2:** What modality best meets the preferred career outcomes of our target student audience?
 - Working professionals often seek programs with part-time or distance learning options to accommodate works schedules and to apply learning in their current roles. However, international students primarily seek full-time, face-to-face programs to obtain visas.

Experiential Learning Questions:

- **Question 1:** How do we ensure the curriculum provides the technical coursework combined with hands-on data analytics projects?
 - Coursework teaches the underlying analytical methodologies and applications, while experiential learning projects allow students to get hands-on experience using real datasets that builds a portfolio of analytics projects.
 - Successful data analytics programs must include theoretical and experiential learning components. Experiential learning typically includes:
 - Course projects
 - Capstone/practicum projects
 - Internships
 - Some data analytics programs also include shorter experiential learning opportunities in the curriculum, such as hackathons.

Step Four: Marketing

How Will We Market Our Program Offerings to Prospective Students?

Program marketing efforts depend largely on credential type, program budget, target audiences, and student demand. Program websites serve as one of the primary methods of program promotion given prospect student search behavior. At institutions where multiple analytics credentials are offered, administrators should ensure programs' websites cross-link so students can easily find and investigate all data analytics offerings. Supporting students in assessing which option best fits their needs is vital given the diverse backgrounds and career goals of prospective students. This support ranges from an online "best fit" questionnaire to on-call counsellors. As mentioned previously, program administrators need to consider the impact of program naming on student online searches and perception of program content.

Program Website Design Question:

- **Question:** How do we design our program website to effectively communicate our data analytics program offerings to students?

EAB reviewed many analytics program websites. Page 34 provides advice to improve the effectiveness of these websites. To summarize:

- If the program accommodates applications from liberal arts graduates, it's important that admissions requirements highlight this and are posted prominently.
- Consolidate all analytics offerings on one central landing page and cross-link them to drive awareness of the full portfolio. Ideally, an interactive "best fit quiz" would enable students to determine what analytics offering is best for them.
- EAB can help apply these insights and many others as part of a comprehensive website audit. This service is included in all COE Forum memberships.

Search Engine Optimization Question:

- **Question:** How does program naming impact enrollments?
 - Program websites often convert student inquiries to applications, but students must first be able to identify potential programs of interest.
 - Prospective students typically identify potential programs through online searches of an institution and/or a program name. Programs with out-of-date (e.g., big data is being superseded by data analytics) or irrelevant names may not appear in student searches.¹
 - Align data analytics program names with common program search terms to attract prospective students. Refresh program names as needed to ensure continued relevance

1) EAB, "Making the Academy Market-Smart," 2016.

Glossary of Data Analytics Terms

Big Data-Increasingly outmoded term that refers to the many applications of analyzing extremely large amounts of data.

Business Intelligence-Analyzing data and presenting actionable information on how a business is currently functioning to help business end users make decisions.

Citizen Data Scientists-Traditional employees who use analytics, but whose primary job function is outside of the D&A field. An example would be a Marketing Manager.

Data Analyst-Employee whose primary job function is to extract, organize, and transform data to generate insights for decision-making. Similar to the data scientist, except holding less expertise in programming, modeling, and machine learning.

Data Analytics-The process of extracting, organizing, and modeling data to transform it into information for decision-making processes.

Data Science-Often used interchangeably with Data Analytics, Data Science is an interdisciplinary field combining statistics, machine learning, data mining, and predictive analytics, to extract knowledge or insights from data. Sometimes, Data Science is perceived to be a more technically sophisticated branch of Data Analytics.

Data Scientist-The most advanced data analytics professionals. They have a sophisticated combination of programming, statistical, and business skills.

Deep Learning-A branch of machine learning that is concerned with mimicking the actions of the layers of neurons in the human brain.

Descriptive Analytics-Using data to just learn what has happened and what is currently occurring. Bakery Example: If one owned a bakery, descriptive analysis would reveal that it just ran out of flour.

Internet of Things (IoT)-Everyday objects having network connectivity, allowing them to send and receive data. Examples: Sensors in a car or embedded in every piece of equipment on an oil rig.

Machine Learning-Software programs with the ability to improve without being explicitly programmed.

Natural Language Processing-Interdisciplinary field drawing on computer science, artificial intelligence, and computational linguistics that is concerned with the interactions among computers and natural (human) languages. In data science, used to describe the ability for computers to derive meaning from direct human language input, rather than software commands.

Predictive Analytics-Using data to predict what will happen in the future. Bakery Example: Predictive Analytics would have told the bakery in advance that it was going to run out of flour.

Prescriptive Analytics-Using data to both predict what will happen and suggest the best future course of action. Bakery Example: Prescriptive Analytics would both predict when it would be out of flour and also recommend the best supplier to call at the right moment to correct this issue in advance.

Structured Data-Information with a high degree of organization. An example would be a prospective student's Salesforce entry.

Unstructured Data-Information not organized in a pre-defined manner. An example would be the contents of an prospective student's email to a COE dean.

Advisors to Our Work

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Keith Bain

Graduate Program Manager,
Faculty of Science
Saint Mary's University

Paul Berger

Academic Director,
Master of Science in
Marketing Analytics
Bentley University

Kathleen Burke

Associate Dean for Graduate and
Professional Programs
Johns Hopkins University

John Caron

Senior Associate Dean,
Academic & Faculty Affairs
Northeastern University

Jeff Casimir

Executive Director
Turing School of Software
& Design

Nick Ducoff

Vice President,
New Ventures
Northeastern University

Hans Engler

Professor, Mathematics
Georgetown University

Donald Harter

Associate Dean,
Masters Programs
Syracuse University

Nir Kaldero

VP, Head of Data Science
Galvanize

Charles Kilfoye

Senior Director,
Experiential Network
Northeastern University

Carl Lee

Program Director, Data Mining
and Analytics Program
Central Michigan University

Thomas Miller

Faculty Director, Predictive
Analytics Program
Northwestern University

Ravi Nath

Jack and Joan McGraw Chair
in Information
Technology Management
Creighton University

Ania Rynarzewska

Director, Business
Analytics Program
Mercer University

AnnaLee Saxenian

Dean, School of Information
University of
California, Berkeley

Simon Sheather

Academic Director,
Master of Science in
Analytics Program
Texas A&M University

Stuart Sidle

Associate Provost,
Strategic Initiatives
University of New Haven

Eric Walden

Director, Data Science Programs
Texas Tech University

Edward Watson III

Department Chair, Information
Systems and Decision Sciences
Louisiana State University

David Wild

Director, Data Science
Academic Programs
Indiana University Bloomington

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**EAB**

2445 M Street NW, Washington DC 20037

P 202.266.6400 | F 202.266.5700 | eab.com