EQUIPPING
LIBERAL ARTS STUDENTS
WITH SKILLS IN

DATA ANALYTICS

Drake University Partners wth Regional Businesses
to Offer New Programs in a Rapidly Growing Field

BHEF
BUSINESS-
HIGHER EDUCATION
FORUM®

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INTRODUCTION

THROUGH THE COLLABORATION of its business and higher education members, the Business-Higher Education Forum (BHEF) launched the National Higher Education and Workforce Initiative (HEWI) to create new undergraduate pathways in high-skill, high-demand fields such as data science and analytics. Data science and analytics must be integrated with T-shaped skills, such as critical thinking, collaboration, and effective communication, which are critical for all graduates entering the 21st century workforce. Knowledge of data science and analytics in recent years has become as fundamental as any other skill for graduates' career readiness. BHEF's Strategic Business Engagement Model with higher education addresses this demand by moving the two sectors from transactional relationships to strategic partnerships through five strategies:

1. **ENGAGE** corporate leadership;

2. **FOCUS** corporate philanthropy on undergraduate education;

3. **IDENTIFY** and tap core competencies and expertise;

4. **FACILITATE** and encourage employee, faculty, and staff engagement;

5. **EXPAND** the focus of funded research to include undergraduate education.

This case study examines how BHEF member Drake University (Drake), a private university with a strong liberal arts tradition, is equipping its students to become data-enabled professionals.

PROGRAM OVERVIEW

DRAKE IS AT THE FOREFRONT of U.S. institutions of higher education in offering undergraduate major and minor programs in data analytics. The program combines coursework and experiential learning, with classes ranging from algorithmic analysis of data and statistical modeling to ethics and communication. Drake applied BHEF's Strategic Business Engagement Model to respond to an increasing need by business for graduates with strong data science and analytics skills, which have become as fundamental to career readiness as critical thinking, problem solving, effective communication, and collaboration. These so-called T-shaped skills encompass depth of knowledge in a particular subject area (the vertical stroke of the "T") and the capacity for collaboration across disciplines (the horizontal stroke of the "T"). Students and employers are the ultimate beneficiaries of the engagement of Des Moines–area businesses and Drake's commitment to developing deeper learning skills throughout the curriculum.

BUSINESS PARTNERS

GuideOne Insurance

Hy-Vee

ITA

Meredith Corporation

Nationwide Insurance

Pioneer Hi-Bred

Principal

Wellmark Blue Cross and Blue Shield

Wells Fargo

THE NEXT GENERATION OF
TA SCIENTISTS

"The Drake experience in data analytics has reinforced the importance of aligning degrees with the workforce requirements identified by businesses. More than that, however, the Drake experience prepares the next generation of data scientists to appreciate the ethical, social, and historical lens through which the application of a data analysis must be viewed. Being able to thoughtfully use data is just as important as being able to model it."

KEITH S. SUMMERVILLE / INTERIM DEAN, COLLEGE OF ARTS AND SCIENCES / LEVITT DISTINGUISHED PROFESSOR OF ENVIRONMENTAL SCIENCE / DRAKE UNIVERSITY
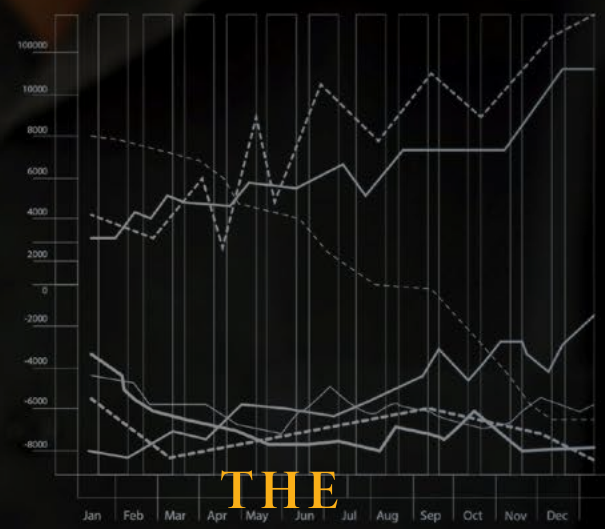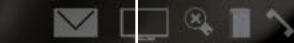
CHALLENGE

*Channel goals and opportunities
into a coherent and comprehensive program.*

DRAKE LEADERSHIP responded to calls from an array of sectors in the Des Moines metropolitan area seeking graduates with broad data analytics and communication skills. In addition, Drake faculty from a diversity of departments and programs—including biology, environmental science, information systems, mathematics and computer science, and actuarial science—expressed concern about the dearth of bioinformatics and big data programs, despite the growth of business analytics programs. At the same time, Drake faculty were searching for ways to build bridges between the College of Arts and Sciences and the College of Business and Public Administration, specifically between the computer science and the information systems programs, as well as between the actuarial science and mathematics programs. The challenge was in channeling these goals and opportunities into a coherent and comprehensive program.

66We view business intelligence and data analytics as a key foundational element in almost every aspect of our business today. We are able to stay competitive in a very dynamic marketplace by gathering and applying the information to truly understand our customers' needs. Our partnership with Drake University's data analytics team allows us to investigate business challenges, discover new ways to use the data, and, ultimately, leverage the data to continue to be innovative in our industry. 99

LUKE TINGLEY / VICE PRESIDENT OF INFORMATION TECHNOLOGY / HY-VEE, INC.

THE
SOLUTION

*Develop students with cohesive, comprehensible skills
based on data analysis.*

IN CONSULTATION with industry leaders, Drake applied BHEF's Strategic Business Engagement Model to construct a data analytics major and minor with business needs in mind, consistent with its commitment to experiential learning and the development of deeper learning skills. Drake shared the draft curriculum with the greater Des Moines business community to solicit feedback and potential funding. Drake realized its goal of engaging corporations in central Iowa to sponsor the start-up costs for the program.

With the aim of building the next generation of data scientists and data-enabled professionals, Drake followed the BHEF approach used in other regions and sectors to identify core competencies needed in the workforce, map those competencies to existing courses across departments, identify gaps, propose new courses to close those gaps, and align the new major to existing strengths at the university, such as writing and public speaking. Drake selected the areas of specialization—actuarial, bioinformatics, computational science, electronic commerce, economics, finance, marketing, and mathematics—based on input from business, an analysis of seat availability in courses, and the willingness and enthusiasm of faculty to teach the specializations.

Core competencies include a broad ability to understand and use data analysis tools such as R and SAS; ability to understand data architecture and extraction/formatting, data visualization, project management, communication, database utilization (SQL, Hadoop); and an understanding of ethical behavior related to big data. Companies provided insight into their business and talent development goals, which enabled Drake to align the data analytics curriculum with those goals.

Consistent with Drake's mission, the data analytics major has an interdisciplinary core curriculum that emphasizes both the liberal arts and professional skills. The program is co-housed in the College of Business and Public Administration and the College of Arts and Sciences, achieving Drake's goal of connecting the two schools through creation of an innovative program. In some cases, program leaders have been able to use courses from the existing curricula (e.g., computer ethics). The major core curriculum includes two semesters of introduction to computer science, computer ethics, machine learning, cloud computing, and database systems, and a series of statistics courses. The major consists of a 30 credit core curriculum, an additional 12–18 hours in a specialty area, and exposure to ethical concerns in the discipline, critical thinking, and the communication skills necessary to interact with clients and end users of big data analyses. To complete the course of study, students apply principles of data analytics to topics of personal interest, for example, biology, marketing, actuarial science, computer science, economics, finance, and additional fields as the program develops.

Students are also required to complete a one-semester capstone course, working with other students from various specialties and fields on a combined project. In some cases, business partners have provided capstone students with access to data sets to seek real-world solutions. Through the capstone experience, students learn how to be adaptable problem solvers in areas important to business. Drake has signed nondisclosure agreements with businesses to gain access to their data to allow for predictive modeling exercises in courses. In addition,

> The program is co-housed in the College of Business and Public Administration and the College of Arts and Sciences, achieving Drake's goal of connecting the two schools through creation of an innovative program.

THE SOLUTION

the university intends to invite business experts to teach courses as the major matures.

In addition to the major, Drake students in any undergraduate field of study can enhance their degree with a minor in data analytics, developing basic skills and proficiencies through six courses. The minor includes coursework in computer science, math, statistics, and a series of electives. Rather than producing a data analyst, per se, the minor produces a graduate with content expertise in another field (e.g., pharmacy, biology, finance) but "enabled" in data analytics, and thereby able to serve as an intermediary between the more highly trained data scientists and someone in their chosen field. Program leaders report a high level of interest from students in other major programs wishing to earn a minor in data analytics.

Experiential learning is a central feature of the Drake programs. Student internships offer a powerful reciprocal relationship between the university and the greater Des Moines business community in that students gain real-world experience while employers gain early access to cutting-edge expertise and future employees. Drake is pursuing a number of internship agreements with various Des Moines area businesses for students in the data analytics program.

Program leaders are mindful of the need to produce data-enabled graduates who can communicate in both technical and non-technical terms when analyzing business decisions. They also acknowledge the importance of developing students who understand the skills associated with project management—that is, how to do the "right" analyses rather than how to perform "an analysis." A key skill sought by business and industry is the ability to develop a cohesive, comprehensible narrative based on data analysis for use in business decision-making. To achieve these skills, students must understand the importance of stakeholder engagement, communication, data visualization, and use of data for decision-making.

"The catalyst for the development of Drake University's data analytics program was my participation in BHEF, in particular the intensive discussions at BHEF meetings about the shortage of T-shaped data analytics professionals. I realized that Drake could be part of the solution to this workforce deficit, especially with the university's emphasis on the integration of the liberal arts and sciences with professional preparation. Further, the collaboration between Northrop Grumman and the University of Maryland in cybersecurity—a program that also found its genesis in BHEF member collaborations—served as a compelling model of strategic partnerships with the business community."

DAVID MAXWELL / PRESIDENT EMERITUS / DRAKE UNIVERSITY

T-SHAPED SKILLS

The data analytics major represents an excellent example of how development of T-shaped skills can be integrated into the curriculum. Students gain a mastery of core academic content in the major through the 30-credit core curriculum and are exposed to problem solving and critical thinking throughout their studies—for example, the statistics and machine learning and database courses use real data sets supplied by the private sector. The service-learning projects in the ethics course require students to grapple with the types of issues that arise in the real world. Each course emphasizes problem solving using predictive, algorithmic, or exploratory methods.

Areas of specialty afford students the opportunity to apply core content knowledge to a specific discipline—actuarial science, bioinformatics, computational science, electronic commerce, economics, finance, marketing, and mathematics. Drake is building capacity in health care informatics, advertising, and political science.

During their junior year, students enroll in "Case Studies in Data Analytics and Big Data," which exposes them to real-world problem solving as "consultants" to businesses. Students must apply their core content knowledge, but they are also challenged to develop and refine skills associated with data visualization, communication, and project management. Faculty in this course co-mentor students with business stakeholders in a highly innovative real-world learning environment in which students mine data to contribute to business intelligence. Finally, in the one-semester capstone course, students from various specialties work as a team on a combined project.

LIBERAL ARTS INSTITUTIONS ARE WELL POSITIONED TO DEVELOP DATA-ENABLED PROFESSIONALS

Liberal arts colleges and universities with strong liberal arts traditions provide students with broad-based knowledge and in-depth study of a specific area. Data science and analytics has the potential to become part of this broad-based education. Liberal arts students who acquire data-science and analytics skills can become data-enabled, that is, able to identify appropriate data and request, consume, capture, and synthesize data and information that develops and communicates data-driven insights. Additional benefits for faculty and students include new opportunities for liberal arts faculty to collaborate with specialists from analytics-intensive organizations.

BUSINESSES NEED UNDERGRADUATES WITH DATA ANALYTICS SKILLS

Companies of all sizes rely on data-driven decision-making as a transformational component of their core operations. They have defined a need for the data-enabled professional who can marry a deep background in a particular field (e.g., the arts, agronomy, economics, finance, health, or business) with the ability to apply analytics and visualization tools. Data-enabled individuals with discipline-specific expertise can turn data into intelligence, which will be increasingly critical to the ability of government, businesses, and nonprofits to implement data-driven decision-making

UNIVERSITIES ARE MORE AGILE AND RESPONSIVE THROUGH SHARED GOVERNANCE

The data analytics major and minor resulted from a collaboration that demonstrates how a university can be flexible, agile, and responsive to address industry needs when governance is shared among the faculty, administration, president, and Trustees in a collaborative simultaneous manner rather than the serial decision-making process that is common in higher education.

CHALLENGES POSED BY WORKING WITH MULTIPLE ACADEMIC UNITS ARE MANAGEABLE

Drake leadership is encouraged by how quickly early challenges were overcome, including those related to course development, administrative cooperation between the College of Business and Public Administration and the College of Arts and Sciences, greater-than-anticipated student interest, and faculty expertise. Linking curriculum goals between the business and arts and sciences schools in a complementary, non-duplicative fashion remains a challenge. Furthermore, although Drake employs a single course registration system, each college has a different policy on who can register for its course offerings, so registration procedures had to be coordinated as well, involving increased cooperation between the colleges.

PHILOSOPHICAL DIFFERENCES ABOUT DATA ANALYTICS EXIST

Beyond the administrative lessons learned, program leadership discovered subtle philosophical differences between the schools about data analytics. The business school focuses more on the application of analytics to business problems, while the arts and sciences school focuses more on computational and theoretical foundations and scientific applications. Intensive consultation yielded a mutually accepted balance between the two philosophies with regard to curricula. The key to resolving differences was building trust and communication, which was fostered in part by naming co-directors with a prior history of cooperation. Although each college has its own "culture," a collateral benefit of this collaboration has been the enhanced spirit of cooperation between the schools.

> "Data analytics is one of the most exciting in-demand fields today. It will remake virtually every industry and company. It offers us the ability to operate more efficiently, do a better job of anticipating our customer's needs, and gain valuable insights into how we run our businesses. Drake has been very responsive to the needs of central Iowa businesses to increase the talent pool of individuals trained in business analytics. Drake and Principal's partnership is another example of successful collaboration between higher education and business."

LARRY ZIMPLEMAN / RETIRED CHAIRMAN, CEO, AND PRESIDENT / PRINCIPAL FINANCIAL GROUP

EARLY RETURNS

THE DRAKE PROGRAM has already garnered interest from students: 66 students enrolled in the program when it was officially announced. The university has benefited from generous corporate philanthropy, which funded course development, student presentations at national conferences, and faculty participation in workshops. Working with Drake's service-learning coordinator, program leaders introduced a service-learning component: the ethics course partnered with a local high school and the Young Women's Resource Center, a local nonprofit organization. Drake students developed a database and web interface to connect low-income and refugee students at Hoover High School with local resources and assisted the Resource Center in mining social media for potential donors.

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Based on partner enthusiasm, Drake is developing a summer data analytics certificate program for working professionals in the Des Moines business community. In addition, program leaders hope to internationalize pieces of the curriculum through arrangements with businesses and nonprofit organizations in South Africa and Belize through which students will perform data analytics work abroad during semester breaks.

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