Graduate Council Curriculum Report

The Graduate Council Curriculum Report (GCCR), which includes all graduate program curricular proposals approved through the Graduate Council curricular review process, is published 12 times each calendar year.

Questions/comments regarding the GCCR or its contents may be directed to the Director of Graduate Education Administration.

March 11, 2015

1. **New Program:** Data Analytics, offering the Master of Professional Studies (M.P.S.) degree (intercollege graduate degree program academically housed at Penn State Great Valley School of Graduate Professional Studies), page 2

Note: Graduate course proposals approved through the Graduate Council curricular review process, as well as information about postbaccalaureate/graduate credit certificates approved by college/school administrators for graduate education, are published in the Senate Curriculum Report.
GRADUATE COUNCIL
PROGRAM, OPTION, OR MINOR PROPOSAL FORM

Submit 1 original, signed Graduate Council proposal form and 7 hardcopies of the graduate program proposal document, with a copy of the signed proposal form attached to each proposal copy, to the Curriculum Coordinator, University Faculty Senate, 101 Kern Graduate Building. The proposals will be transmitted to the Dean of the Graduate School for entry into the Graduate Council curricular review process; for more information about the process, see the Overview of the Graduate Council Curricular Review Process.

See the Program Proposal Procedures for guidance in preparing a graduate program proposal. If you have questions regarding the preparation of a graduate program proposal or how to complete this form, contact the Office of the Dean of the Graduate School.

NEW GRADUATE PROGRAM, OPTION, OR MINOR: Add

Designation of new graduate program: Data Analytics
Classification of Instructional Programs (CIP) Code: 30.3001

Designation of new graduate option: Two options: Analytics in Industry and Manufacturing Business Analytics

Indicate effective semester (cannot be earlier than the first semester following approval): The first semester following approval

EXISTING GRADUATE PROGRAM, OPTION, OR MINOR: Change Drop

Current designation of graduate program:

Current designation of graduate option:

Current designation of graduate minor:

New designation of existing graduate program (if changing):

New designation of existing graduate option (if changing):

New designation of existing graduate minor (if changing):

Indicate effective semester (cannot be earlier than the first semester following approval):

SUBMITTED BY GRADUATE PROGRAM HEAD:

Colin J. Noll
Printed name: Signature

Date: 2/21/14

NOTED BY COLLEGE/SCHOOL REPRESENTATIVE TO GRADUATE COUNCIL SUBCOMMITTEE ON NEW AND REVISED PROGRAMS AND COURSES:

John I. McCool
Printed name: Signature

Date: 2/26/14

APPROVED BY COLLEGE/SCHOOL DEAN/CHANCELLOR (OR DESIGNEE):

Craig Edelbrock
Printed name: Signature

Date: 2/23/14
RECOMMENDED BY CHAIR, GRADUATE COUNCIL SUBCOMMITTEE ON NEW AND REVISED PROGRAMS AND COURSES:

on behalf of C. Andrew Cole

Printed name

R. Vasilatos Younken

Signature

Date: 2/27/15

RECOMMENDED BY CHAIR, GRADUATE COUNCIL COMMITTEE ON PROGRAMS AND COURSES:

on behalf of Joan Redwing

Printed name

R. Vasilatos Younken

Signature

Date: 2/27/15

NOTED BY DEAN OF THE GRADUATE SCHOOL:

Regina Vasilatos Younken

Printed name

R. Vasilatos Younken

Signature

Date: 2/27/15
Data Analytics (DAAN)
Graduate Degree Proposal, offering the Master of Professional Studies

Units:

- Penn State Great Valley School of Graduate Professional Studies, Engineering Division
- College of Engineering, Harold and Inge Marcus Department of Industrial and Manufacturing Engineering
- Eberly College of Science, Department of Statistics
- Smeal College of Business, Departments of Marketing and Supply Chain and Logistics

Colin J. Neill
Associate Professor of Software Engineering & Systems Engineering
Director of Engineering Programs
School of Graduate Professional Studies
cjnecill@psu.edu
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Introductory Narrative

This proposal seeks approval to establish a Master of Professional Studies in Data Analytics (DAAN) to be delivered online via World Campus. The purpose of this program is to provide professionally oriented technical education that enables graduates to design, implement, and apply data analysis techniques to the broad array of application domains within engineering and business currently experiencing the data deluge often referred to as “Big Data.” Those working in the field of Data Analytics are responsible for the aggregation, storage, and management of very high volumes of data and the subsequent analysis of this data to determine trends, construct descriptive, predictive, and prescriptive models for forecasting and nowcasting, and to aid in strategic decision-making across heterogeneous domains including healthcare, finance, manufacturing, biopharmaceuticals, marketing, education, and in both the private and public sectors.

The DAAN program is proposed by a multi-disciplinary team of faculty from four colleges/units, and the program will be housed academically and administratively by the School of Graduate Professional Studies at Penn State Great Valley. Thirteen new online graduate courses will be created for the DAAN program, and resources have been identified for a smooth and well scheduled program rollout. The expertise, experience, and effort of this team has led to a program plan that we believe to be robust, relevant, and academically outstanding.

New Courses

New courses appearing in the proposed MPS in Data Analytics program are listed in Table 1.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 575:</td>
<td>Foundations of Predictive Analytics</td>
<td>3</td>
<td>Core</td>
</tr>
<tr>
<td>IE 582</td>
<td>Engineering Analytics</td>
<td>3</td>
<td>Option-specific</td>
</tr>
<tr>
<td>IE 578</td>
<td>Production and Distribution Analytics</td>
<td>3</td>
<td>Option-specific</td>
</tr>
<tr>
<td>IE 577</td>
<td>Statistical Learning for System Analytics</td>
<td>3</td>
<td>Option-specific</td>
</tr>
<tr>
<td>DAAN 822:</td>
<td>Data Collection &amp; Cleaning</td>
<td>3</td>
<td>Elective</td>
</tr>
<tr>
<td>DAAN 825:</td>
<td>Large-Scale Databases &amp; Warehouses</td>
<td>3</td>
<td>Base</td>
</tr>
<tr>
<td>DAAN 871:</td>
<td>Data Visualization for Analytics</td>
<td>3</td>
<td>Elective</td>
</tr>
<tr>
<td>DAAN 881:</td>
<td>Data-driven Decision Making</td>
<td>3</td>
<td>Base</td>
</tr>
<tr>
<td>BAN 530:</td>
<td>Business Strategies for Big Data</td>
<td>3</td>
<td>Option-specific</td>
</tr>
<tr>
<td>BAN 540</td>
<td>Marketing Analytics</td>
<td>3</td>
<td>Option-specific</td>
</tr>
<tr>
<td>BAN 550</td>
<td>Prescriptive Analytics for Business</td>
<td>3</td>
<td>Option-specific</td>
</tr>
<tr>
<td>DAAN 888</td>
<td>Design and Implementation of Analytics Systems</td>
<td>3</td>
<td>Capstone</td>
</tr>
<tr>
<td>BAN 888</td>
<td>Implementing Analytics for Business</td>
<td>3</td>
<td>Capstone</td>
</tr>
</tbody>
</table>
Program Statement

Master of Professional Studies in Data Analytics Degree Requirements

The MPS in Data Analytics (MPS-DAAN) degree is a 30-credit online graduate degree program that provides students the skills required to collect, classify, analyze, and model data at large and ultra-large scales and across domains using statistics, computer science, machine learning, and software engineering.

All MPS-DAAN students will be required to take three common core courses (9 credits), three courses specific to the base program or the selected option (9 credits), three elective courses (9 credits) and a capstone course (3 credits).

The base program will create graduates who can design, deploy, and manage the technology infrastructure and data analytical processes of predictive analytics including data aggregation, cleaning, storage, and retrieval. These graduates will work in positions that require them to design and maintain data analytics systems and tools such as data modeler, data architect, Extraction, Transformation, Loading (ETL) developer, business intelligence (BI) developer, data warehouse developer and data analyst.

The Analytics in Industry and Manufacturing Option will create graduates who can identify the best methods, processes and tools for the analysis of data related to engineered systems and the manufacturing, production, and distribution of products and services. These graduates will work in positions that require them to conduct data analyses in context such as data analyst, systems analyst, financial analyst, and BI analyst.

The Business Analytics Option prepares graduates to explore and analyze large data sets to support data-driven business decisions through the complete spectrum of analytics activities: descriptive (what happened), diagnostic (why did it happen), predictive (what will happen) and prescriptive (what should happen). Target audiences include business analysts, analytic system designers and the data scientists who have a focus on problems arising in the contexts of business decision-making.

All students will complete their program of study with the capstone course corresponding to their chosen option. While each capstone course focuses on problems relevant to their specific domains, they all provide students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of data analytics, learned throughout their program, in a culminating and summative experience. The choice of project topic and exact form will be mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students will be encouraged students to upload their capstone work products to be available publically via ScholarSphere: https://scholarsphere.psu.edu/ and to participate in the World Campus Graduate Capstone Exhibition.

The program is intentionally structured such that additional options can be added at a later date through program revision. The common core courses have been chosen to be relevant to the broad field of data sciences and analytics regardless of application domain with future program expansion in mind. Preliminary discussions with several colleges for additional options are underway.
### Prescribed Courses

#### Core Courses (9 cr)

<table>
<thead>
<tr>
<th>STAT 500: Applied Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 575: Foundations of Predictive Analytics</td>
</tr>
<tr>
<td>SWENG 545: Data Mining OR STAT 557: Data Mining 1</td>
</tr>
</tbody>
</table>

#### Base program (9 cr)

| IN SC 521: Database Design Concepts |
| DAAN 825: Large-Scale Databases & Warehouses |
| DAAN 881: Data-driven Decision Making |

<table>
<thead>
<tr>
<th>Analytics in Industry and Manufacturing Option (9 cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 582: Engineering Analytics</td>
</tr>
<tr>
<td>IE 577: Statistical Learning for System Analytics</td>
</tr>
<tr>
<td>IE 578: Production and Distribution Data Mining</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Analytics (9 cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAN 530: Business Strategies for Big Data</td>
</tr>
<tr>
<td>BAN 540: Marketing Analytics</td>
</tr>
<tr>
<td>BAN 550: Prescriptive Analytics for Business</td>
</tr>
</tbody>
</table>

#### Electives (9 credits)

- IN SC 525: Applied Data Mining
- DAAN 822: Data Collection & Cleaning
- DAAN 871: Data Visualization for Analytics
- SWENG 584: Genetic Algorithms
- SYSEN 505: Technical Project Management
- SYSEN 536: Decision and Risk Analysis in Engineering
- STAT 501: Regression Methods
- STAT 502: Analysis of Variance and Design of Experiments
- STAT 483: Statistical Analysis System Programming

#### Capstone (3 cr)

<table>
<thead>
<tr>
<th>Capstone (3 cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAAN 888</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analytics in Industry and Manufacturing Option Capstone (3 cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 596</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Analytics Capstone (3 cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAN 888</td>
</tr>
</tbody>
</table>

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**Core Courses:**

**STAT 500: Applied Statistics** (3) Descriptive statistics, hypothesis testing, power, estimation, confidence intervals, regression, one- and two-way ANOVA, Chi-square tests, diagnostics.

**IE 575: Foundations of Predictive Analytics** (3) This will be a foundational course giving a broader outline of data sciences and big data and the requisite infrastructure. Contents: "Big Data" defined; nature and scope; use cases; IT infrastructure; analysis techniques (foundations of statistical methods) and software tools

**SWENG 545: Data Mining** (3) Practical benefits of data mining will be presented; data warehousing, data cubes, and underlying algorithms used by data mining software.

OR
STAT 557: Data Mining I (3) This course introduces data mining and statistical/machine learning, and their applications in information retrieval, database management, and image analysis.

Base Program-Specific Courses

IN SC 521: Database Design Concepts (3) The requirements capture, design, and development of relational database applications; analysis of business requirements and development of appropriate database systems.

DAAN 825: Large-Scale Databases & Warehouses (3) Examination of large-scale data storage technologies including NoSQL database systems for looser structured data, and data warehouses for dimensional data.

DAAN 881: Data-driven Decision Making (3) The application and interpretation of analytical results for making real-life business decisions that necessarily include the intangible aspects of business strategy including trust and values.

Base Program Capstone Course

DAAN 888: Design and Implementation of Analytics Systems (3) Design and implement Data Analytics systems using contemporary tools and techniques. This course aggregates the material learned throughout the program in a summative educational experience.

Analytics in Industry and Manufacturing Option-Specific Courses

IE 582: Engineering Analytics (3) Advanced information technology concepts, tools and techniques for designing and implementing manufacturing systems.

IE 577: Statistical Learning for System Analytics (3) Statistical learning methods and their applications in design and improvement of complex engineering systems. The focus will be from a quantitative perspective for system informatics through sensing, data modeling, monitoring, pattern recognition, and control.

IE 578: Production and Distribution Data Mining (3) This course will teach students to apply data mining principles in production and distribution environments, including manufacturing, warehousing, and logistics systems.

Analytics in Industry and Manufacturing Option Capstone Course:

IE 596 Individual Studies (3) This is will be culminating capstone course for the Analytics in Industry and Manufacturing Option where students will apply the theories and techniques explored throughout their program of study to a real-world problem. The goal is to provide an experience that helps the student synthesize the material learned throughout the program in a summative experience.

Business Analytics Option-Specific Courses

BAN 530: Business Strategies for Data Analytics (3) BAN 530 attempts to set data analytics problem solving in a real-world business context. The objective is to provide students with experience with noisy business data sets, potential compliance issues, non-standard measures across business units, and other real-world considerations in using data to drive decisions.

BAN 540: Marketing Analytics (3) The objectives of this course are to demonstrate the benefits of using a systematic and analytical approach to marketing decision-making. The course provides "hands on" learning experiences for implementing these concepts in a world that calls for integrated marketing programs that cut across online and offline media and channels. The topics include traditional marketing analytics such as segmentation, targeting, positioning,
product design, and marketing resource allocation as well as emerging analytics such as search engine analytics, social
influence and attribution analysis.

**BAN 550: Prescriptive Analytics for Business** (3) The key objectives for this course are to demonstrate, use
and master a variety of methods for prescriptive decision making within business, especially focusing on business supply
side decisions (supply chain, operations and logistics). The course also examines risk in the context of business decision
making and the role of managing uncertainty in business analytics.

Business Analytics Option Capstone Course:

**BAN 888: Implementing Analytics for Business** (3) The capstone course in the Business Analytics option
sets analytics problem solving in a real-world context, including communication to non-statistically trained executives.
Students will demonstrate their understanding and application of key topical areas derived from the common activities of
the business analyst including framing the problem, selecting appropriate analytical tools and techniques, model building
and benefit assessment.

Typical Scheduling Pattern

Core courses will be offered a minimum of once per year, during fall and spring semesters. Electives
will be offered a minimum of two times every three years. The capstones will be offered once per year in the
spring semester. A typical scheduling pattern beyond the initial start-up is shown in Table 2.

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 500</td>
<td>OFFER</td>
<td></td>
<td>OFFER</td>
</tr>
<tr>
<td>IE 575</td>
<td>OFFER</td>
<td></td>
<td>OFFER</td>
</tr>
<tr>
<td>SWENG 545</td>
<td></td>
<td>OFFER</td>
<td></td>
</tr>
<tr>
<td>IE 582:</td>
<td></td>
<td>OFFER</td>
<td></td>
</tr>
<tr>
<td>IE 577</td>
<td></td>
<td>OFFER</td>
<td></td>
</tr>
<tr>
<td>BAN 530</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN SC 521</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAAN 825</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAAN 881</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAN 540</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IE 578</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>elective</td>
<td>OFFER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Typical Scheduling Pattern after 2 years

Formal Graduate Bulletin Statement

The formal Graduate Bulletin Statement is included in Appendix B.

Admission Requirements
Admission to the MPS in Data Analytics program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant's academic potential. Applicants with undergraduate degree in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior coursework and/or standardized test scores. An applicant must hold either (1) a bachelor's degree from a U.S. regionally accredited institution or (2) a postsecondary degree that is equivalent to a U.S. baccalaureate degree earned from an officially recognized degree-granting international institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. Applications must include a statement of professional goals, a curriculum vita or resume, and two letters of recommendation. Test scores from the GMAT or GRE exams are not also required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

The language of instruction at Penn State is English. International applicants must take and submit scores for the TOEFL (Test of English as a Foreign Language) or the IELTS (International English Language Testing System), with the exceptions noted below. The minimum acceptable score for the TOEFL is 550 for the paper-based test, 213 for the computer-based test, or a total score of 80 with a 19 on the speaking section for the Internet-based test (iBT). The minimum acceptable composite score for the IELTS is 6.5.

International applicants are exempt from the TOEFL/IELTS requirement who have received a baccalaureate or a graduate degree from a college/university/institution in any of the following: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, Liberia, New Zealand, Northern Ireland, Scotland, the United States and Wales.

Justification for the Program

Necessity for the Program

Data Analytics is the discipline surrounding the aggregation, management, storage, retrieval, and interpretation of the "Big Data" onslaught now facing industry and government. Data is being generated at unparalleled rates. Eric Schmidt, Executive Chairman of Google, is quoted as saying that "...every two days we now create as much information as we did from the dawn of civilization up until 2003." Furthermore, the fastest growth is in increasingly unstructured interactional forms of data rather than the traditional structured data to which relational databases are well suited. This has led to a secondary issue, beyond that of mere volume. As Hal Varian, Chief Economist at Google, expresses the challenge: while "...data are widely available; what is scarce is the ability to extract wisdom from them."

So, while the volume of data offers great opportunities for forecasting and prediction, modeling and simulation, and data-centric decision-making, leveraging this opportunity requires a new set of skills. The technologies and techniques involved go far beyond those typically taught in current undergraduate programs in information technology and business, and more specialized than those taught in graduate programs in those disciplines.
A recent McKinsey Global Institute report states that "leaders in every sector will have to grapple with the implications of big data, not just a few data-oriented managers. The increasing volume and detail of information captured by enterprises, the rise of multimedia, social media, and the Internet of Things will fuel exponential growth in data for the foreseeable future" and projects that by 2018 US will face a shortage of 140,000 to 190,000 more workers with "deep analytical" expertise and perhaps 1.5 million "data-savvy" managers.

While the need is great, recent reports and surveys suggest that the supply of qualified personnel is very limited. NewVantage Partners surveyed C-Suite executives at Fortune 1000 and found that 70% of respondents are hiring or plan to hire data scientists and 60% state that it is very difficult to find and hire these individuals. A more detailed breakdown is shown in Table 3.

Table 3: How challenging is it to source analytical skills in general?

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impossible to find and hire sufficient resources</td>
<td>4%</td>
</tr>
<tr>
<td>Very difficult to find or hire</td>
<td>36%</td>
</tr>
<tr>
<td>Challenging</td>
<td>36%</td>
</tr>
<tr>
<td>Somewhat challenging</td>
<td>24%</td>
</tr>
<tr>
<td>No issues in finding skilled resources</td>
<td>0%</td>
</tr>
</tbody>
</table>

A snapshot of top data analytics job postings visibly demonstrates this demand.

Table 4: Top Predictive Analytics Job Postings, 2012

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Job Postings, 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Analyst</td>
<td>20619</td>
</tr>
<tr>
<td>Systems Analyst</td>
<td>14992</td>
</tr>
<tr>
<td>Data Analyst</td>
<td>12388</td>
</tr>
<tr>
<td>ETL Developer</td>
<td>8077</td>
</tr>
<tr>
<td>BI Developer</td>
<td>7122</td>
</tr>
<tr>
<td>Data Architect</td>
<td>6310</td>
</tr>
<tr>
<td>Financial Analyst</td>
<td>4728</td>
</tr>
<tr>
<td>Data Warehouse Developer</td>
<td>3278</td>
</tr>
<tr>
<td>Statistician</td>
<td>2737</td>
</tr>
<tr>
<td>Data Modeler</td>
<td>2193</td>
</tr>
<tr>
<td>BI Analyst</td>
<td>1350</td>
</tr>
<tr>
<td>Data Scientist</td>
<td>278</td>
</tr>
<tr>
<td>Data Engineer</td>
<td>278</td>
</tr>
</tbody>
</table>

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The proposed program is designed to directly address this need by focusing on the foundational aspects of data and data analysis at scale, including its effective collection and storage; efficient analysis; and the application of analytics to a broad array of domains including finance, healthcare, manufacturing, education and social media.

Finally, the need for such programs is well understood across North America, as evidenced by the Master’s programs in data, business, and predictive analytics offered at more than 16 institutions across the country, including peer institutions in the Big Ten, a partial list of which is included in Appendix A.

Program Size and Duration

An initial enrollment of 30 students is anticipated with growth over three years to approximately 150-180 students.

Program Objectives

The overall objective of the MPS-DAAN program is to educate students to become technically outstanding experts in the data sciences and the application of analytics techniques to problems involving high volumes of data, both structured and unstructured.

The specific learning objectives of the MPS-DAAN program are to teach students to achieve proficiency in the following areas:

Data Collection, Storage, and Management

- Develop an understanding of technologies used to develop, optimize, and deploy large databases.
- Demonstrate fundamental understanding of how large-scale data management systems work for storing, organizing and querying large amounts of data, both relational and NoSQL.
- Critically assess properties of high performance database technologies.

Business Analytics

- Analyze large data sets to support data-driven business decisions.
- Explain the balance managers and executives must strike between values and ethics and the data-driven decisions generated from analytics systems.
- Demonstrate use and mastery of a variety of methods for prescriptive decision making within business.
- Execute and evaluate analytics techniques in support of business initiatives including product design, analysis of social influence and attribution, market segmentation, and forecasting.

Engineering Analytics

- Apply statistical learning methods and their applications in design and improvement of complex engineering systems.
- Demonstrate fundamental understanding of data mining principles in production and distribution environments.

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• Evaluate analytics tools and techniques for designing and implementing manufacturing systems.

Statistical Techniques for Data Analytics

• Demonstrate fundamental understanding of statistical techniques including hypothesis testing, estimation, confidence intervals, and regression,
• Execute and evaluate statistical testing techniques including both parametric and non-parametric tests.
• Discriminate between descriptive, diagnostic, predictive, and prescriptive analytics and the techniques used in each.
• Deploy and evaluate system informatics for sensing, data modeling, monitoring, pattern recognition, and control

Ability to Offer a Quality Program

The MPS-DAAN program involves four academic departments across the University working together under the coordination of an MPS-DAAN Program Office.

Departments:

• Engineering Division, School of Graduate Professional Studies
• Harold and Inge Marcus Department of Industrial and Manufacturing Engineering, College of Engineering
• Department of Statistics, Eberly College of Science
• Department of Marketing and Department of Supply Chain and Information Systems, Smeal College of Business

The Engineering Division of Penn State Great Valley currently offers a Master of Software Engineering degree program in Software Engineering, a Master of Engineering degree program in Systems Engineering, and a Master of Engineering Management degree program in Engineering Management online through World Campus. These programs are also delivered via resident instruction along with a Master of Science degree program in Information Science. Courses offered by the Division include decision and risk analysis, database design, information retrieval, business intelligence, data mining, soft computing, genetic algorithms, distributed computing, and bioinformatics.

The Department of Industrial Engineering in the College of Engineering currently offers a Master of Engineering degree program in Industrial Engineering, which is delivered via resident instruction along with a Master of Science in Industrial Engineering. The program also offers a graduate certificate in Human Factors Engineering and Ergonomics through World Campus. The aim of the professional master’s degree is to prepare students with a breadth of technical and managerial skills to make significant immediate contributions in their jobs. Courses offered by the program include optimization, applied statistics, data mining, simulation, information technology, and stochastic processes.

The Department of Statistics in the Eberly College of Science currently offers the Master of Applied Statistics degree program in Applied Statistics both in residence at the Penn State University Park campus and online through the Penn State World Campus. It is a professional degree designed to provide training in statistics focused on developing data analysis skills, and exploration of all core areas of applied statistics. It aims to provide its graduates with broad knowledge in a wide range of statistical application areas with
employable, highly sought-after skills in statistics demanded by government agencies, consulting firms and industries.

The Smeal College of Business offers a Master of Professional Studies degree program in Supply Chain Management online through the Penn State World Campus. It is a professional degree focused on building competence across the foundations of supply chain management. Graduates attain new skill sets to help manage and enhance the value of today’s complex supply chains. Two participating Smeal faculty are Certified Analytics Professionals.

The proposed degree program will be academically and administratively coordinated by the Engineering Division in the School of Graduate Professional Studies. A "Program Office" will be established to coordinate communication and delivery of the program. All of the above colleges and departments have agreed to participate, and Graduate Faculty members have been identified to develop and teach all of the courses. A set of MPS-DAAN Program Bylaws will be established and signed by the College partners. The MPS-DAAN Bylaws will provide an operational framework for the MPS-DAAN program that will expedite the efforts of the faculty in achieving the educational goals of the program. Included in the Bylaws are operational procedures for revenue- and cost-sharing among the Participating Academic Units. The Bylaws are meant to align with University, Graduate Council, and Graduate School policies and guidelines. Established policies and procedures will prevail if contradictions arise. A copy of the MPS-DAAN Program Bylaws is available upon request.

Impact on current course offerings and faculty load

This program involves the creation and delivery of 13 new online courses. This will increase faculty load, both during course development and during delivery. However, the program’s business model is to be financially self-sustaining, including the provision of faculty salary for their delivery of courses. Therefore, it will be possible to hire additional faculty as needed to meet any capacity shortfalls. The projected rollout scenario involves a staggered rollout of courses, offering limited courses during the initial semesters, affording time for the development of all new courses. The full-time Graduate Faculty members who will be associated with the program are listed in Table 5.

Table 5: Members of Graduate Faculty to be Associated with the MPS in DAAN

<table>
<thead>
<tr>
<th>FACULTY</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrian Barb, M.B.A, Ph.D.</td>
<td>Assistant Professor of Information Science</td>
</tr>
<tr>
<td>Russell Barton, Ph.D.</td>
<td>Professor of Supply Chain and Information Systems</td>
</tr>
<tr>
<td>Chia-Jung Chang, Ph.D.</td>
<td>Assistant Professor of Industrial and Manufacturing Engineering</td>
</tr>
<tr>
<td>Mosuk Chow, Ph.D.</td>
<td>Associate Professor of Statistics</td>
</tr>
<tr>
<td>Joanna DeFranco, Ph.D.</td>
<td>Assistant Professor of Software Engineering</td>
</tr>
<tr>
<td>Enrique del Castillo</td>
<td>Professor of Industrial and Manufacturing Engineering</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Paul Griffin, Ph.D.</td>
<td>Professor of Industrial and Manufacturing Engineering</td>
</tr>
<tr>
<td>Terry Harrison, Ph.D.</td>
<td>Strong Professor of Supply Chain and Information Systems</td>
</tr>
<tr>
<td>John Jordan, Ph.D.</td>
<td>Clinical Professor of Supply Chain and Information Systems</td>
</tr>
<tr>
<td>Mohammed Kassab, Ph.D.</td>
<td>Assistant Professor of Software Engineering</td>
</tr>
<tr>
<td>Soundar Kumara, Ph.D.</td>
<td>Pearce Professor of Industrial and Manufacturing Engineering</td>
</tr>
<tr>
<td>Phillip A. Laplante, M.B.A., Ph.D.</td>
<td>Professor of Software Engineering</td>
</tr>
<tr>
<td>John I. McCool, Ph.D.</td>
<td>Distinguished Professor of Systems Engineering</td>
</tr>
<tr>
<td>Colin J. Neill, Ph.D.</td>
<td>Associate Professor of Software Engineering &amp; Systems Engineering</td>
</tr>
<tr>
<td>David Nembhard, Ph.D.</td>
<td>Associate Professor for Industrial and Manufacturing Engineering</td>
</tr>
<tr>
<td>Michael J. Piovoso, Ph.D.</td>
<td>Professor of Electrical Engineering</td>
</tr>
<tr>
<td>Robin Qiu, Ph.D.</td>
<td>Professor of Information Science</td>
</tr>
<tr>
<td>Arvind Rangaswamy, Ph.D.</td>
<td>Anchor Professor of Marketing</td>
</tr>
<tr>
<td>James L. Rosenberger, Ph.D.</td>
<td>Professor of Statistics</td>
</tr>
<tr>
<td>Raghvinder Sangwan, Ph.D.</td>
<td>Associate Professor of Software Engineering</td>
</tr>
<tr>
<td>Durland L. Shumway, Ph.D.</td>
<td>Assistant Professor of Statistics</td>
</tr>
<tr>
<td>Laura B. Simon, Ph.D.</td>
<td>Lecturer in Statistics</td>
</tr>
<tr>
<td>Aleksandra B. Slavkovic, Ph.D.</td>
<td>Assistant Professor of Statistics</td>
</tr>
<tr>
<td>Conrad Tucker, Ph.D.</td>
<td>Assistant Professor of Industrial and Manufacturing Engineering</td>
</tr>
<tr>
<td>John E. Tyworth, Ph.D.</td>
<td>Professor of Supply Chain and Information Systems</td>
</tr>
</tbody>
</table>

How the program strengthens the existing programs of the college and university

This program strengthens the university's position as a world leader in “Big Data” and data science by providing access to an outstanding master's program for students who could not otherwise obtain a Penn State education. Simultaneously, the program will bring in financial resources to the participating departments that will allow them to grow their capacity and impact in this area.
The MPS-DAAN program will be open to addition of new program options (providing a platform for suitable subject areas), and will hopefully encourage others within the university community to develop additional graduate degrees in analytics and informatics. The MPS-DAAN program will not diminish the quality or quantity of applications to the Colleges’ resident graduate programs because DAAN targets students who are not able to move to a Penn State campus for resident education studies. Also, as part-time distance learning students, MPS-DAAN students will not be eligible to compete for graduate assistantships that are reserved for resident education.

Appropriateness of the program for off-campus delivery

This program is designed solely for Internet-based, off-campus delivery via Penn State World Campus to an audience comprised of working adult professionals studying part-time at a distance. The University’s resident programs cannot satisfactorily serve this clientele.

The success of the existing online courses and programs offered by the participating Colleges demonstrates the appropriateness of the subject matter for off-campus delivery. It also indicates that the Colleges and the World Campus possess the capacity and commitment needed to offer the high-quality off-campus graduate program described in this document. The demand revealed by initial market research speaks to the excellent potential for the MPS-DAAN program’s long-term success.

Expected student accomplishments

Students will be able to design and develop analytics systems for use in an array of disciplines, including engineering and business, utilizing the latest technologies and techniques for predictive, prescriptive, and descriptive purposes and understand how to deploy and leverage those systems for competitive advantage. Graduates will be qualified for careers in data science, business analytics, database architecture, web and marketing analytics, business intelligence, and data engineering.

Non-duplication of other degree programs

This program does not duplicate other degree programs within the university. There are a number of information science and information systems programs that incorporate, to varying degrees, elements of data collection, storage, and utilization, including data analysis and data mining, but none which focus singularly on data sciences. The online MPS degree program in Applied Statistics also includes courses related to data science, in particular statistical-based approaches to modeling and analyzing data, but does not cover the technology needs of very large scale data systems or the techniques associated with the storage, retrieval, and presentation of both structured and unstructured data. No existing program applies the methods, processes, and tools of Data Analytics to specific application domains.

Essential Elements of Residency

To best meet the needs of a national and international audience of working adult professionals, the program will be offered online through Penn State’s World Campus. The following items address the elements of residency that will be supported in the online environment.

Interaction Between Faculty and Students Beyond Direct Instruction
The MPS-DAAN Academic Program Coordinator, a member of the Graduate Faculty, will serve as chair of the Faculty Advising Committee. He or she will ensure that all students are assigned an academic adviser from within the MPS-DAAN graduate faculty, and will ensure that all students are receiving appropriate academic guidance.

Academic advisers will speak with their advisees by telephone or other means regularly to help them plan their academic programs of study, as well as their continuing professional development strategy. (E-mail, Web conferencing, and surface mail will also be available as communications channels.)

Online courses will be developed in accordance with the instructional best practices established by the World Campus and follow active, participatory, and social-constructivist learning theories so that students engage in the material, the course facilitators, and each other. This will include a combination of threaded discussions within the ANGEL course management system as well as live video- and tele-conferences when meaningful and relevant.

In addition, the students completing the capstone projects will be invited to participate in the World Campus Graduate Capstone Exhibition where they can showcase what they have accomplished in an online, virtual exhibition.

Interaction Among Students

Interaction among students within the existing online programs represents a challenge that has been met through a combination of techniques including online discussions and group projects which are used in many of the existing courses. These threaded discussions count toward a class participation grade which ensures active student involvement. In addition, a one week online orientation session is held which provides students an opportunity to meet their classmates and learn the tools that are used in the online classes. These same techniques will be employed in this program and courses of the online MPS-DAAN program to replace interaction present in face-to-face meetings.

Course instructors bear primary responsibility for creating and maintaining the learning environment that fosters valuable interactions among students. These instructors have experience facilitating learning in the online environment and have completed the online learning development courses offered through World Campus. They are, therefore, quite familiar with the challenge of actively engaging students who also have busy professional and personal lives.

Access to Information and Instructional Resources

a. Libraries

The Penn State University Libraries provide an extraordinary array of collections and services to students who participate in classes through the World Campus. Like any other Penn State student, MPS-DAAN students will be able to use online and print library resources to identify and locate articles, books, media, and other materials needed for their studies. In addition to a growing number of online resources—more than 15,000 electronic journals and databases—the Libraries also service requests to scan print documents and deliver PDF documents at no charge through the University network. Students can also take advance of the "ASK" reference service, which allows students to seek assistance through phone, e-mail, or synchronous online chats.

b. Hardware and Software
The MPS-DAAN program will require students to possess suitably configured personal computers and Internet connections consistent with the technical requirements specified for using Penn State’s course management system, ANGEL, and Penn State’s Web conferencing system, Adobe Connect.

Ready access to suitable academic advising and support services

a. Academic Advising

The MPS-DAAN Academic Program Coordinator, a member of the Graduate Faculty, will serve as chair of the Faculty Advising Committee. He or she will ensure that all students are assigned an academic adviser from within the MPS-DAAN graduate faculty, and will ensure that all students are receiving appropriate academic guidance.

Academic advisers will speak with their advisees by telephone or other means regularly to help them plan their academic programs of study, as well as their continuing professional development strategy. (E-mail, Web conferencing, and surface mail will also be available as communications channels.)

Students will also be welcome to contact the Academic Program Coordinator at any time with questions about administrative, academic, or professional matters. A Program Assistant provided by the Administrative Program Home (Engineering Division, School of Graduate Professional Studies) will provide administrative support.

b. World Campus Student Services

The World Campus Student Services team will respond to administrative and process inquiries from prospective and current students, and will process enrollments for students who need to register for classes when the University’s eLion registration system is unavailable. The World Campus “Help Desk” provides technical support to students whose system or network configurations interfere with their studies or who need tutoring on basic personal computing skills.

c. Administrative Support

Students may contact the MPS-DAAN Program Office or Penn State World Campus with questions or problems related to program administrative matters.

Students’ Contribution to the Program, College and University

As is the case with our resident programs, students often share experiences from their work which provide valuable insight to the other class members as well as to faculty. This shared knowledge is a valuable contribution to the program. Furthermore, students, through their provision of tuition and participation in the program, contribute significantly to the financial status and capability of the university. Finally, as mentioned earlier, students will be encouraged to submit their capstone projects to the annual World Campus Graduate Capstone Exhibition to demonstrate what they have learned and accomplished.

Identification with Penn State

Surveys reveal that Penn State’s reputation is frequently an important factor in students’ choice to enroll for World Campus classes (Outreach Office of Marketing Research and Planning 2003b). More than half of graduates of World Campus programs surveyed in 2002 expressed interest in keeping in touch with program faculty and fellow students (Outreach Office of Marketing Research and Planning 2002).
Students from the online MPS-DAAN program will be considered to be part of the Engineering Division of Penn State Great Valley in that they will receive the same notices of Division events and activities and copies of the Division’s quarterly newsletter.

Justification for the Program Name

There are a number of names given to degrees in this field including Data Analytics, Business Analytics, Data Sciences, and Predictive Analytics. We have selected the name “Data Analytics” for two primary reasons. First, as a multi- and inter-disciplinary program we feel that the program name should be distinct from any one college’s area of specialty and instead reflect the collective strength of the University; second, the focus of this program is not restricted to data collection or information processing, but to the strategic leveraging of data for predictive, prescriptive, and descriptive purposes. Data Analytics, therefore, most clearly describes the intent of the program while maintaining the flexibility for the program to be expanded with additional options from other units in the future.

Accreditation

There is no recognized accrediting body for a graduate program in Data Analytics.

Program Quality

Online programs must incorporate a mechanism for assessing program quality through student surveys for feedback at critical milestones in the program as well as a student exit questionnaire at the time of graduation. The Academic Program Coordinator is responsible for the proposed program’s quality assurance plan in cooperation with the World Campus associate director for evaluation, Janet May. At the end of each online course in the program, Office of the Vice Provost of Academic Affairs will administer an online Student Rating of Teaching Effectiveness (SRTES) survey to determine student satisfaction with instruction, course content, technology tools used for course delivery, and students’ experience with World Campus support units. The results will be shared with the respective instructor, Academic Program Coordinator and the World Campus program manager, and used to inform course and program improvements.

At the end of the program, students will be asked to complete an online end-of-program survey in order to gain student feedback on the overall program. This survey will be designed by the Academic Program Coordinator and World Campus Associate Director for Evaluation to assess student satisfaction against the program’s objectives. Other areas that might be assessed in this survey include student overall satisfaction with the curriculum, instructional design, faculty online teaching skills and related attitudes, academic support services, capstone course, and the program’s impact to date on student careers.

The Academic Program Coordinator also will lead the faculty in a content review of each course at least once every two years. Additionally, the Academic Program Coordinator will arrange peer evaluations of instructors each year when they teach an online course in the program. Access to the online MPS-DAAN courses for these reviews will be gained with the full knowledge of the respective instructors and students.
Per Graduate Council policy, the Data Analytics program will report back to the Committee on Programs and Courses three years after beginning the enrollment of students with information to assess success and quality of the program. Guidelines for reporting are provided by the Office of the Dean of the Graduate School.

Written Responses from Units Affected

Consultation on the proposed program was sought from a wide range of units across the university as shown in Table 6. Responses received are included in Appendix C.

Table 6: List of Units from which Consultation was sought

<table>
<thead>
<tr>
<th>Unit</th>
<th>Respondent</th>
<th>Remarks</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Graduate Professional Studies</td>
<td>Craig Edelbrock, Chancellor</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>Penn State World Campus</td>
<td>David Silvia, Director of Graduate Programs</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>College of Engineering</td>
<td>Renata Engel, Associate Dean</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>Smeal College of Business</td>
<td>Russell Barton, Senior Associate Dean for Research and Faculty</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>Eberly College of Science</td>
<td>James Rosenberger, Director of Outreach and Online Programs, Department of Statistics</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>University Libraries</td>
<td>Dolores Fidishun, Head Librarian Abington &amp; Great Valley</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>College of Information Science and Technology</td>
<td>Pete Forster, Assistant Dean for Online Programs and Professional Education</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>Penn State</td>
<td>Peter Idowu,</td>
<td>Full support</td>
<td>Program objectives section</td>
</tr>
<tr>
<td>Institution</td>
<td>Role</td>
<td>Comment</td>
<td>Note</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Harrisburg, The Capital College</td>
<td>Assistant Dean of Graduate Studies</td>
<td>Identified the omission of the program objectives.</td>
<td>was added.</td>
</tr>
<tr>
<td>College of Health and Human Development</td>
<td>Michael Rovine, Director, Health and Human Development Methodology Consulting Center</td>
<td>Full support</td>
<td></td>
</tr>
<tr>
<td>College of the Liberal Arts</td>
<td>Aviz Kunz, Assistant Dean for Online Education and Outreach</td>
<td>“Support the program, but we would not want to see its existence pose problems for forthcoming programs out of other disciplines… We think this could be easily accomplished with some slight changes to language (to) clarify the scope of the major would address our concerns”</td>
<td>We have changed the name of the option that concerned Liberal Arts (originally named Applied Analytics) so that it does not appear all-encompassing and thus preclude them from pursuing related degree programs. The option description has been amended to the following: “The Analytics in Industry and Manufacturing Option will create graduates who can identify the best methods, processes and tools for the analysis of data related to engineered systems and the manufacturing, production, and distribution of products and services.”</td>
</tr>
</tbody>
</table>
Table A.1 Universities offering master's degrees in related fields

<table>
<thead>
<tr>
<th>School</th>
<th>Degree</th>
<th>Estab.</th>
<th>Format</th>
<th>Duration (mths)</th>
<th>Credits</th>
<th>Cost ($1000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona State University</td>
<td>MS Business Analytics</td>
<td>2013</td>
<td>FT</td>
<td>9</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>DePaul University</td>
<td>MS Predictive Analytics</td>
<td>2010</td>
<td>PT/OL</td>
<td>20+</td>
<td>52</td>
<td>37</td>
</tr>
<tr>
<td>Drexel University</td>
<td>MS Business Analytics</td>
<td>2012</td>
<td>PT/OL</td>
<td>20+</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Fordham University</td>
<td>MS Business Analytics</td>
<td>2012</td>
<td>FT</td>
<td>12</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>Louisiana State University</td>
<td>MS Analytics</td>
<td>2011</td>
<td>FT</td>
<td>12</td>
<td>36</td>
<td>22</td>
</tr>
<tr>
<td>Michigan State University</td>
<td>MS Business Analytics</td>
<td>2013</td>
<td>FT</td>
<td>12</td>
<td>30</td>
<td>39</td>
</tr>
<tr>
<td>New York University</td>
<td>MS Business Analytics</td>
<td>2013</td>
<td>PT</td>
<td>12</td>
<td>42</td>
<td>63</td>
</tr>
<tr>
<td>North Carolina State University</td>
<td>MS Analytics</td>
<td>2007</td>
<td>FT</td>
<td>10</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>MS Analytics</td>
<td>2012</td>
<td>FT</td>
<td>15</td>
<td>33</td>
<td>58</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>MS Predictive Analytics</td>
<td>2011</td>
<td>PT/OL</td>
<td>20+</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>Rutgers University</td>
<td>MBS Analytics</td>
<td>2012</td>
<td>FT/PT</td>
<td>12-21</td>
<td>43</td>
<td>38-62</td>
</tr>
<tr>
<td>Saint Joseph’s University</td>
<td>MS Business Intelligence</td>
<td>2008</td>
<td>FT/PT/OL</td>
<td>15-24</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>Southern Methodist University</td>
<td>MS Applied Stat and Data Analytics</td>
<td>2013</td>
<td>FT</td>
<td>18-24</td>
<td>36</td>
<td>65</td>
</tr>
<tr>
<td>Stevens Institute of Technology</td>
<td>MS Business Intelligence and Analytics</td>
<td>2012</td>
<td>FT/PT</td>
<td>20+</td>
<td>36</td>
<td>46</td>
</tr>
<tr>
<td>University of Connecticut</td>
<td>MS Business Analytics and Project Management</td>
<td>2012</td>
<td>FT/PT</td>
<td>20+</td>
<td>33</td>
<td>22</td>
</tr>
<tr>
<td>University of San Francisco</td>
<td>MS Analytics</td>
<td>2012</td>
<td>FT</td>
<td>11</td>
<td>35</td>
<td>39</td>
</tr>
<tr>
<td>University of Tennessee at Knoxville</td>
<td>MS Business Analytics</td>
<td>2010</td>
<td>FT</td>
<td>17</td>
<td>39</td>
<td>40</td>
</tr>
</tbody>
</table>
GRADUATE BULLETIN STATEMENT

Data Analytics

Program Chair

Colin J. Neill
Associate Professor, Software Engineering and Systems Engineering
School of Graduate Professional Studies
Penn State Great Valley
30 E. Swedesford Road
Malvern, PA 19355-1443
610-725-5285
cjneill@psu.edu

Degree Conferred:
M.P.S

Graduate Faculty

- Adrian Barb, Ph.D. (University of Missouri) Assistant Professor of Information Science
- Russell R. Barton, Ph.D. (Cornell) Professor of Supply Chain and Information Systems
- Chia-Jung Chang, Ph.D. (Georgia Tech) Assistant Professor of Industrial and Manufacturing Engineering
- Mosuk Chow, Ph.D. (Cornell) Associate Professor of Statistics
- Joanna DeFranco, Ph.D. (New Jersey Institute of Technology) Assistant Professor of Software Engineering
- Enrique del Castillo, Ph.D. (Arizona State) Professor of Industrial and Manufacturing Engineering
- Paul Griffin, Ph.D. (Texas A&M) Professor of Industrial and Manufacturing Engineering
- Terry P. Harrison, Ph.D. (Tennessee) Strong Professor of Supply Chain and Information Systems
- John M. Jordan, Ph.D. (Michigan) Clinical Professor of Supply Chain and Information Systems
- Mohammed Kassab, Ph.D. (Concordia) Assistant Professor of Software Engineering
- Soundar Kumara, Ph.D. (Purdue) Pearce Professor of Industrial and Manufacturing Engineering
- Phillip A. Laplante, Ph.D. (Stevens Institute of Tech) Professor of Software Engineering
- John J. McCool, Ph.D. (Temple) Distinguished Professor of Systems Engineering
- Colin J. Neill, Ph.D. (Wales) Associate Professor of Software Engineering & Systems Engineering
- David Nembhard, Ph.D. (Michigan) Professor of Industrial and Manufacturing Engineering
- Michael J. Piovoso, Ph.D. (Delaware) Professor of Electrical Engineering
- Guanghua Qiu, Ph.D. (Penn State) Professor of Information Science
- Arvind Rangaswamy, Ph.D. (Northwestern) Anheil Professor of Marketing
- James L. Rosenberger, Ph.D. (Cornell) Professor of Statistics
• Raghvinder Sangwan, Ph.D. (Temple) Associate Professor of Software Engineering
• Durland L. Shumway, Ph.D. (Penn State) Assistant Professor of Statistics; Research Associate
• Laura B. Simon, Ph.D. (Penn State) Senior Lecturer in Statistics
• Aleksandra B. Slavkovic, Ph.D. (Carnegie Mellon) Assistant Professor of Statistics
• Conrad Tucker, Ph.D. (Illinois) Assistant Professor of Industrial and Manufacturing Engineering
• John E. Tyworth, Ph.D. (Oregon) Professor of Supply Chain and Information Systems

Program Description

The MPS in Data Analytics (MPS-DAAN) degree is a 30-credit online, interdisciplinary master’s program that provides students the skills required to collect, classify, analyze, and model data at large and ultra-large scales and across domains using statistics, computer science, machine learning, and software engineering.

The curriculum consists of 30 credits, delivered online through the Penn State World Campus. The program provides broad coverage of topics related to predictive analytics while provide in-depth coverage of topics such as data collection and quality, large scale data storage and retrieval, and business and enterprise analytics.

Students select to follow either the base program, which prepares them to design and deploy predictive analytics systems, or a specialized option in Analytics in Industry and Manufacturing or Business Analytics.

Admissions Requirements

Admission to the MPS in Data Analytics program will be based on baccalaureate academic records, applicable work experience, and two letters of recommendation from a previous professor or supervisor who can attest to the applicant’s academic potential. Applicants with undergraduate degree in a quantitative discipline such as science, engineering, or business may apply. Students from other disciplines will be considered based on prior coursework and/or standardized test scores. An applicant must hold either (1) a bachelor’s degree from a U.S. regionally accredited institution or (2) a postsecondary degree that is equivalent to a U.S. baccalaureate degree earned from an officially recognized degree-granting international institution. This degree must be from an officially recognized degree-granting institution in the country in which it operates. Applications must include a statement of professional goals, a curriculum vita or resume, and two letters of recommendation. Test scores from the GMAT or GRE exams are not also required. An undergraduate cumulative grade-point average of 3.0 or better on a 4.0 scale in the final two years of undergraduate studies is required.

The language of instruction at Penn State is English. International applicants must take and submit scores for the TOEFL (Test of English as a Foreign Language) or the IELTS (International English Language Testing System), with the exceptions noted below. The minimum acceptable score for the TOEFL is 550 for the paper-based test, 213 for the computer-based test, or a total score of 80 with a 19 on the speaking section for the Internet-based test (iBT). The minimum acceptable composite score for the IELTS is 6.5.

International applicants are exempt from the TOEFL/IELTS requirement who have received a baccalaureate or a graduate degree from a college/university/institution in any of the following: Australia, Belize, British Caribbean and British West Indies, Canada (except Quebec), England, Guyana, Republic of Ireland, Liberia, New Zealand, Northern Ireland, Scotland, the United States and Wales.
Degree Requirements

The MPS-DAAN degree is conferred upon students who earn a minimum of 30 credits of coursework while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 level or above (with at least 6 credits at the 500 level). The program curriculum includes 9 credits of core courses, 9 credits of either a selected option or the base program, 9 credits of electives, and a 3-credit capstone course.

Required Courses

Prescribed courses for the degree include the following 9 credits of core courses:

- STAT 500: Applied Statistics (3 cr.)
- IE 575: Foundations in Predictive Analytics (3 cr.)
- SWENG 545: Data Mining (3 cr.) OR STAT 557: Data Mining 1 (3 cr.)

Base Program

Director: Colin Neill, Ph.D. Associate Professor of Software Engineering and Systems Engineering

The base program will create graduates who can design, deploy, and manage the technology infrastructure and data analytical processes of predictive analytics including data aggregation, cleaning, storage, and retrieval. These graduates will work in positions that require them to design and maintain data analytics systems and tools such as Data Modeler, Data Architect, Extraction, Transformation, Loading (ETL) Developer, Business Intelligence (BI) Developer, Data Warehouse Developer and Data Analyst.

Base program required courses

- IN SC 521: Database Design Concepts (3 cr.)
- DAAN 825: Large-Scale Databases & Warehouses (3 cr.)
- DAAN 881: Data-Driven Decision Making (3 cr.)

Additional Courses

An additional 9 credits of elective courses must be selected from the approved list.

Analytics in Industry and Manufacturing Option

Director: Paul Griffin, Professor of Industrial and Manufacturing Engineering

The Analytics in Industry and Manufacturing Option will create graduates who can identify the best methods, processes and tools for the analysis of a given dataset or problem and apply them to determine trends, patterns, and predictions as necessary. The Option will provide students with a technical background in the area and the skills to develop and use analytics tools. These graduates will work in positions that require them to conduct data analyses in context such as Systems Analyst, Data Analyst, Financial Analyst, BI Analyst, and Data Engineer.

- IE 582: Engineering Analytics (3 cr.)
- IE 577: Statistical Learning for System Analytics (3 cr.)
• IE 578: Production and Distribution Data Mining (3 cr.)

Business Analytics Option

Director: John E. (Gene) Tyworth

This option prepares graduates to explore and analyze large data sets to support data-driven business decisions. Target audiences include business analysts, analytic system designers and the data scientists who have a focus on problems arising in the context of business decision-making. The Option is organized around the industry-standard rubric of the spectrum of analytics activities: descriptive (what happened), diagnostic (why did it happen), predictive (what will happen) and prescriptive (what should happen).

• BAN 530: Business Strategies for Data Analytics (3 cr.)
• BAN 540: Marketing Analytics (3 cr.)
• BAN 550: Prescriptive Analytics for Business (3 cr.)

Culminating Experience

All students will complete their program of study with the capstone course corresponding to their chosen option. While each capstone course focuses on problems relevant to their specific domains, they all provide students with an opportunity to apply their knowledge of the theories, methods, processes, and tools of data analytics, learned throughout their program, in a culminating and summative experience. The choice of project topic and exact form will be mutually determined by the instructor and each student. A written paper based on the applied project is required and must contain project description, analysis, and interpretation of its findings. Students will be encouraged students to upload their capstone work products to be available publicly via ScholarSphere: https://scholarsphere.psu.edu/ and to participate in the World Campus Graduate Capstone Exhibition.

Student Aid

Graduate Assistantships available to students in the program and other forms of student aid are described in the STUDENT AID section of the Graduate Bulletin.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.
DATE: February 17, 2014

TO: Graduate Council Committee on New Courses and Programs

RE: Support for Program Proposal

I enthusiastically support Penn State Great Valley’s proposal to offer a Master of Professional Studies program in Data Science and Analytics to students at a distance through the World Campus. This new program will address a significant education needs pertaining to big data and data mining and allow Penn State to take the leadership role in delivering this high priority master’s program online.

Organizations large and small are drowning in data and need people trained to find the patterns, discover the relationships, and build the predictive models that can lead to better decision making, improved strategic planning, and more efficient operations. Recent market analyses conducted by Penn State World Campus have shown both high student interest and employer demand for people holding a professional master’s degree in data analytics.

Penn State Great Valley is well positioned to offer a high quality online master’s program in this area given our 50 years history serving adult graduate students, our ability to build instructional capacity at the graduate level, and our existing services for online students. We are proven partners with World Campus in the design, development, and delivery of high quality online graduate programs in math intensive areas such as Systems Engineering, Software Engineering, and Finance.

I support the plans detailed in the attached Proposal and assure you that Penn State Great Valley will provide the necessary resources and support for successful delivery of the proposed online degree program.

Sincerely,

Craig Edelbrock, PhD
Chancellor
MEMO

To: Colin Neill, Director of Engineering Programs
School of Graduate Professional Studies

Fr: David Sylvia, DAA for Graduate Programs

Date: Dec 19, 2013

Re: Proposal for MPS in Data Science and Analytics

I am pleased to support the proposal to offer the MPS in Data Science and Analytics off-campus and online to students at a distance via the World Campus. The World Campus is prepared to deliver this degree in partnership with the Penn State Great Valley School of Graduate Professional Studies, Engineering Division; College of Engineering, Department of Industrial and Manufacturing Engineering; Eberly College of Science, Department of Statistics; and Smeal College of Business, Departments of Marketing and Supply Chain and Logistics.

If during the review process for the proposal by the Graduate School there are questions or concerns to which the World Campus can help respond, please feel free to contact me.

Thank you.

An Equal Opportunity University
February 10, 2014

Dr. Colin J. Neill  
Director of Engineering Programs  
Associate Professor of Software Engineering & Systems Engineering  
School of Graduate Professional Studies  
Penn State Great Valley  
Malvern, PA 19355

Dear Dr. Neill:

Thank you for sharing the proposal to establish and offer the MPS degree in Data Science and Analytics (DSCAN) to students through the World Campus. Having reviewed the proposal and discussed it with Dr. Paul Griffin, I am pleased to provide the College of Engineering support for this new program.

Several faculty in the Harold and Inge Marcus Department of Industrial and Manufacturing Engineering Department have been involved in curriculum design, particularly the Applied Analytics Option, and have identified courses that contribute to the range of topics in this multidiscipline and interdisciplinary program. It is clear to me that the curriculum, as currently designed, has sufficient depth and breadth to launch the degree program at this time, while also allowing opportunity to expand as interest in the program evolves and other units at the university are engaged to participate with relevant subject matter or complementary options.

The program will benefit from Penn State Great Valley’s role as the academic and administrative lead for the program, given the valuable experience your campus has with other MPS interdisciplinary programs, and programs that are made available through World Campus.

The College of Engineering looks forward to contributing to this innovative and valuable program.

Sincerely,

Renata S. Engel  
Associate Dean for Academic Programs

CC: P. Griffin
Memo

Date: January 28, 2014

To: Colin Neill, James Nemes

From: Russell Barton

Subject: Support for Master of Professional Studies in Data Science and Analytics

I am writing in support of the proposed Master of Professional Studies in Data Science and Analytics. This well-structured initiative will provide a Penn State presence in an important and growing discipline. I am very familiar with this area, and I was one of the first individuals to receive professional certification in this area. As a Certified Analytics Professional, I now serve on the Appeals Committee of the offering organization, the Institute for Operations Research and the Management Sciences (INFORMS).

The proposed degree program and associated options are well structured and align well with the discipline. We at Smeal have had significant interactions with Great Valley in planning and coordinating our own participation in this MPS, through an option and certificate in Business Analytics. The teaching team for Smeal includes Terry Harrison, who is CAP-certified and a former president of INFORMS.

As an affiliate faculty member in the Department of Industrial and Manufacturing Engineering, I know that Great Valley has also worked carefully with that department to participate in this degree program. The IME effort has involved contributions of internationally recognized faculty.

I have no concerns about the structure, content or delivery talent for this program. I strongly support its approval. Smeal will commit the necessary resources to ensure the success of our portion.

cc: C. H. Whiteman, J. E. Tyworth, H. Baumgartner, M. J. Gilpatrick, P. M. Griffin
Date: 29 January 2014

James A. Nemes, D.Sc.
Director of Academic Affairs
Professor of Mechanical Engineering
School of Graduate Professional Studies
Penn State Great Valley

Re: Letter of Support for the MPS in Data Sciences and Analytics

The Department of Statistics supports the development and delivery of the proposed MPS in Data Sciences and Analytics. As noted in the proposal, we have several courses which are part of our professional Master of Applied Statistics program, which are included in the required and elective courses for students in this proposed MPS program. We anticipate that we can meet the demand for these courses with appropriate planning.

I look forward to working together with you in the development of this program.

If I can be of further assistance, do not hesitate to contact me.

Sincerely,

[Signature]

Director of Outreach and Online Programs
Department of Statistics
January 23, 2014

Dr. Colin Neill  
Engineering Division  
Penn State Great Valley  
30 E. Swedesford Rd.  
Malvern, PA 19355

Dear Dr. Neill,

Thank you for sharing the proposal to offer an MPS degree in Data Science and Analytics (DSCAN). University Libraries, including the Great Valley Library, The Engineering Library, the Physical and Mathematical Sciences Library and the Schreyer Business Library will be available to support students as they pursue this degree.

University Libraries is one library geographically dispersed and students will have access to books, databases and other resources held at any library including the many that are available online. The Ask A Librarian virtual reference service provides a venue to assist students with their reference needs. This will be particularly helpful for World Campus students.

Librarians in the above libraries will also be available to answer reference questions and provide course-related instruction as necessary. In addition, librarians will work closely with faculty teaching in the program to be sure that students across all campuses have access to the resources they need to succeed in the program.

If we can be of any further assistance please feel free to contact us.

Sincerely,

Dolores Fidishun, Ed.D.  
Head Librarian, Great Valley School of Graduate Professional Studies and Abington College Libraries

Diane Zabel  
Ben zak Business Librarian and Head of the Schreyer Business Library

Bonnie A. Osif  
Acting Head, Engineering Library

Nancy J. Butkovich  
Associate Librarian and Head, Physical and Mathematical Sciences Library
January 28, 2014

Dear Jim:

The College of Information Sciences and Technology (IST) supports the development and delivery of the MPS in Data Sciences and Analytics. IST sees the value of such a program and has a strong interest in offering an option in the near future.

Good luck with the program and we look forward to collaborating on our future contribution.

Sincerely,

Peter K. Forster
Re: Consultation Requested for Proposed MPS in Data Science & Analytics

From: PETER IDOWU <pbi1@psu.edu>  
Mon, Feb 24, 2014 10:35 AM
Subject: Re: Consultation Requested for Proposed MPS in Data Science & Analytics
To: Colin J. Neill <cjn6@psu.edu>

Hi Colin,
Glad to help and we wish you well as you complete the program proposal.
Peter

Peter Idowu, Ph.D., P.E.
Assistant Dean of Graduate Studies, Capital College
Professor of Electrical Engineering

Penn State Harrisburg
C-114 Olmsted Building
777 W. Harrisburg Pike, Middletown PA 17057
(717) 948-6315 - Phone
(717) 948-6737 - Fax
idowu@psu.edu

From: "Colin J. Neill" <cjn6@psu.edu>  
To: "PETER IDOWU" <pbi1@psu.edu>  
Sent: Monday, February 24, 2014 10:24:17 AM  
Subject: Re: Consultation Requested for Proposed MPS in Data Science & Analytics

Dear Peter,

Thank you for your consultation response. We are readying our final submission of the program to Graduate Council and I wanted to let you know that I appreciated your colleague alerting us to the missing program objectives. Those have now been added.

Best regards,
Colin

Dr. Colin J. Neill  
Director of Engineering Programs  
Associate Professor of Software & Systems Engineering
From: "PETER IDOWU" <pbi1@psu.edu>
To: "Colin J. Neill" <cjin6@psu.edu>
Subject: Re: Consultation Requested for Proposed MPS in Data Science & Analytics

Dear Colin,

Thanks for the opportunity to review and offer a feedback on this proposal. We support the proposal and wish you well in the implementation. Comments from one of our graduate program directors is included below.

Peter,

A well written proposal, but it is missing a required component. It does not contain a list of objectives of the program itself, nor does it have an explanation of how the proposed program meets new educational objectives or strengthens existing ones.

IE 575 is listed as an "introductory" course, which may, more than likely, cause a problem since 500-level courses are not supposed to be designated "introductory."

Regards,
Peter Idowu, Ph.D., P.E.
Assistant Dean of Graduate Studies, Capital College
Professor of Electrical Engineering

Penn State Harrisburg
C-114 Olmsted Building
777 W. Harrisburg Pike, Middletown PA 17057
(717) 948-6315 - Phone
(717) 948-6737 - Fax
idowu@psu.edu

From: "Colin J. Neill" <cjin6@psu.edu>
To: rengel@psu.edu, rbarton@psu.edu, "James L Rosenberger" <JLR@psu.edu>, "PETER IDOWU" <pbi1@psu.edu>, "MICHAEL ROVINE" <mr7@psu.edu>, "DAVID M SYLVIA" <dmsylvia@psu.edu>
Cc: "JAMES A NEMES" <jan16@psu.edu>
Sent: Thursday, January 9, 2014 2:21:48 PM
Dear Colleagues,

I wanted to follow-up on my request last month for your consultation on the attached proposal for an online MPS degree in Data Science and Analytics from the School of Graduate & Professional Studies, the College of Engineering, the Smeal College of Business and the Eberly College of Science. We would appreciate your feedback as soon as possible so that we can pursue Graduate School approvals.

Happy New Year

Best Regards,

Colin Neill

Dr. Colin J. Neill
Director of Engineering Programs
Associate Professor of Software Engineering & Systems Engineering
School of Graduate Professional Studies
Penn State University
610-725-5265
To: Colin Neill  
From: Mike Rovine  
Re: MPS degree in Data Science and Analytics  
Date: January 26, 2014

The two programs in Predictive Analytics I am most familiar with are those at Northwestern and Drexel University. I think that the proposed degree compares favorably with each of those two programs. Given the growing importance of predictive analytics in engineering, business, the medical and pharmaceutical sciences, I think this program is timely and should meet an important need. As suggested in the proposal, the need is there, and this program would seem to help satisfy that need.

The coursework available seems to cover everything a student interested in such a degree would want. The faculty both at Great Valley and at University Park is strong and, along with the Penn State brand, should be a major selling point for the degree. The opportunities for emphasis in either engineering or business make this a very flexible and appealing program. The coursework and complementary activities seem excellent and would provide a rigorous education for this degree.

As our program in Human Development and Family Studies with the area emphasis in Quantitative Development has had a long term interest in statistical modeling very often using engineering and econometric models, and given that our department is heavily involved in the university initiative to added faculty in the area of Big Data, we would be extremely interested in the development and success of this program. I am sure there would interest among the Quantitative faculty.

As someone who has a developing interest in Predictive Analytics, I am excited about the possibility of this degree being offered. Penn State Great Valley has shown success in identifying a need and providing an excellent educational opportunity to meet that need. Given the participation of faculty at Great Valley along with University Park faculty representing the critical disciplines involved in the degree, I believe this program will be extremely successful. Given my interest in modeling and statistics, I would certainly be willing to provide whatever support I could to this endeavor.
Re: Consultation Requested for Proposed MPS in Data Science & Analytics

From: Avis Kunz <alm2@psu.edu>  
Mon, Feb 24, 2014 05:00 PM  
Subject: Re: Consultation Requested for Proposed MPS in Data Science & Analytics  
To: Colin J. Neill <cjn6@psu.edu>

Hello Colin:

Thanks so much for the update. I appreciate your attending to comments from our social science department heads. The change also looks like it will help potential students best understand the application of the program of study.

Warmest Regards,
Avis

Hi Avis:

I wanted to get back to you briefly to let you know what changes were made following your response. We have changed the "Applied Analytics" option title to "Analytics in Industry and Manufacturing" and edited the option and program objectives accordingly narrowing the scope of the program as requested. The text for the option description is quoted below:

"The Analytics in Industry and Manufacturing Option will create graduates who can identify the best methods, processes and tools for the analysis of data related to engineered systems and the manufacturing, production, and distribution of products and services. These graduates will work in positions that require them to conduct data analyses in context such as Business Analyst, Systems Analyst, Financial Analyst, and BI Analyst."

I trust that these changes satisfy the concerns of the college.

Best regards,
Colin
From: "Avis Kunz"<alm2@psu.edu>  
To: "Colin J. Neill"<cjn6@psu.edu>  
Cc: rengei@psu.edu, rbarton@psu.edu, "James L Rosenberger"<JLR@psu.edu>,  
"PETER IDOWU"<pbi1@psu.edu>, "MICHAEL ROVINE"<mr7@psu.edu>, "DAVID M SYLVIA"<dmsylvia@psu.edu>, pforster@ist.psu.edu, "JAMES A NEMES"<jan16@psu.edu>, "Christopher Long"<cpl2@psu.edu>, "Jennie Ishler"<jci2@psu.edu>  
Sent: Thursday, January 2, 2014 9:16:35 AM  
Subject: Re: Consultation Requested for Proposed MPS in Data Science & Analytics

Hello Colin:

After consulting with the heads of our social science programs, I am submitting the following response for the College of the Liberal Arts:

The proposal is generally strong. Obviously there is growing need in data analytics across a wide spectrum of disciplines and applications. It is important to consider that data analytics is a growing area of interest in the social sciences. There are many different ways to conceive and implement a useful data analytics program that will appeal to different audiences with different backgrounds and interests.

The Department of Political Science is developing (in residence and online) an undergraduate Social Data Analytics program, and we already have the Social Data Analytics program moving forward at the Ph.D. level (with classes in Big Data analysis already being taught). Liberal Arts is also the home of the Big Data Social Science IGERT program. See http://bdss.psu.edu/

Much of the narrative casts a very broad net -- about data analysis generally and Big Data, specifically. That breadth isn't apparent in the descriptions of the courses and the faculty involved. We would like to see more attention in the narrative to the business element of this degree, and some clarification is needed for the Applied Analytics option as well. That option, as described, could make a lot of other programs seem redundant.

This MPS program -- which is primarily focused on business -- is compatible with the Liberal Arts programs, which are focused more on social data, theoretical analysis, and analysis for government. But the social science programs in the Liberal Arts also have as a key hallmark the development and integration of the technical skills explained here, and a focus on Big Data. Our concern with a bit of the phrasing of the MPS proposal is that as sections of the proposal are framed, the proposal could be read as laying claim to all analysis of Big Data, and this is too broad.
For example, consider: “The MPS in Data Science and Analytics (MPS-DSCAN) degree is a 30-credit graduate degree program that provides students the skills required to collect, classify, analyze, and model data at large and ultra-large scales and across domains using statistics, computer science, machine learning, and software engineering.”

“The base program will create graduates who can design, deploy, and manage the technology infrastructure and data analytical processes of predictive analytics including data aggregation, cleaning, storage, and retrieval. These graduates will work in positions that require them to design and maintain data analytics systems and tools such as Data Modeler, Data Architect, Extraction, Transformation, Loading (ETL) Developer, Business Intelligence (BI) Developer, Data Warehouse Developer and Data Analyst.”

Especially as paragraph one is phrased, this description could apply to any program – including the dual-degree Social Data Analytics program – that incorporates skill building in these areas. Some of the jobs that are listed (e.g. Data Modeler) would also be appropriate outcome jobs for students from the graduate or undergraduate Social Data Analytics programs, and indeed, programs like IST.

Now, on the one hand, a detailed read of the proposal and especially of the curriculum suggests that the applications and courses are primarily business oriented, and this is perfectly appropriate given the participants and their expertise. But we would be much more comfortable if the introductory narrative, and program description (pages 1, 4, 5) would clarify that the domain is primarily business here, and hence that this program will not exclude the creation of other majors/programs that will similarly include a focus on Big Data.

The focus within the Liberal Arts will more likely be for government, academic, or think-tank analysis (e.g. for purposes of understanding international conflict; international trade; network ties among individuals). However, w one Ph.D. graduate from Political Science initially get a job at a large insurance firm doing data analysis with social data. So we can’t exclude other programs that will necessarily have a different focus (i.e. non-business) but also will be justified in part by the need to understand Big Data.

We think this could be easily accomplished with some slight changes to language. In terms of program options, the “Business Analytics” option is quite clear. But the “Applied Analytics” option as presented is quite broad, and again we just worry that the breadth will lead to problems down the road with other programs that also “create graduates who can identify the best methods, processes and tools for the analysis of a given dataset or problem and apply them to determine trends, patterns, and predictions as necessary.” Perhaps something as simple as adding a phrase “…in business” or “in business settings” or “in business applications” at the end of several sections would clarify the scope of the major would address our concerns.

Overall, DSCAN certainly looks like a useful and Interesting degree program. We certainly support the program, but we would not want to see its existence pose problems for forthcoming programs out of other disciplines.

Best Regards,
Dear Colleagues:

I am seeking your consultation on the proposed Masters of Professional Studies in Data Science and Analytics. This program is proposed by a consortium of departments across the School of Graduate Professional Studies, the College of Engineering, the Eberly College of Science, and the Smeal College of Business.

The proposal document is attached.

Please send any comments or concerns to me. A response by Friday December 20 would be greatly appreciated.

Best Regards,
Colin Neill