OFFERING A PIC MATH COURSE

PREPARATION FOR INDUSTRIAL CAREERS IN MATHEMATICAL SCIENCES

CONTEXT

- Previously at Kenyon College
  - PIC Math Program 2014-2015, 2015-2016, 2016-2017
- Currently a Research Scientist at Colorado State University
  - PIC Math Program 2018-2019

PICMath

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Elly Farnell, Colorado State University

PIC MATH: PREPARATION FOR INDUSTRIAL CAREERS IN MATHEMATICAL SCIENCES

- Students work in teams of 3-5 on a problem provided by a BIG partner.
- Students are expected to find and apply relevant mathematical tools, to make appropriate interpretations of results, and to communicate findings to the BIG partner.
- Participating faculty attend a training workshop the summer prior to offering a PIC Math course.
- One student from each course is funded to present at a PIC Math session at a summer conference.

Elly Farnell, Colorado State University

WHAT ARE THE TOP 5 SKILLS DATA SCIENTISTS NEED? (FORBES 2017, WILLIAM CHEN – DATA SCIENTIST, QUORA)

1. Programming

   Implementation, working with large data sets, creating tools for better data science

2. Quantitative Analysis

   Experimental design and analysis, modeling complex systems, machine learning

3. Product Intuition

   Generating hypotheses, defining metrics, debugging analyses

4. Communication

   Communicating insights, data visualization and presentation, general

5. Teamwork

   Being selfless, constant iteration, sharing knowledge with others

PARTICIPATION DATA (2014-2017)

- 107 faculty members
- 101 U.S. universities/colleges
  - in 32 states and D.C.
  - 14 PhD, 23 MS/MA, 63 BS/BA, 1 Associates degree
  - 10 HSIs and 6 HBCUs
- over 1400 undergraduate students
  - 40% female
  - 21% underrepresented ethnic groups
- 147 research papers co-authored by undergraduates
- over 150 conference presentations by undergraduates
- over 100 industrial partners have provided research problems and consultants

EXAMPLE COMPANIES THAT PROVIDED INDUSTRIAL PROBLEMS AND CONSULTANTS

- Field Museum of Chicago
- Coca Cola Company
- Habitat for Humanity
- Colorado Dept of Transportation
- Neptune and Company, Inc.
- Heart Artery and Vein Center of Fresno
- Los Alamos National Laboratory
- City of Kansas City
- AIG Insurance
- National Security Technologies
- Greensboro NC Police Dept
- Applied Geographics
- US Water Utility Group
- Sandia Labs
- Massachusetts General Hospital
- Nationwide Insurance
- Sproxil, Inc.

OFFERING A PIC MATH COURSE:
IS IT WORTH IT?

Example Industry Feedback:

- Please do let the students know how profound their work is on a real life business – we're going to be using their findings to help guide us in a new path of data analysis and their insights have helped us understand what level of education and analytical thinking skills we'll need in a new employee. We'd absolutely love to work with your students next year.
- Great problem solving and unique and useful methodology with understood assumptions. […] Overall, we were very impressed with both your grasp of the business application and the level of detail in the solution.
- Value was easy to see. The students in Professor Farnell's class were able to spend significant time analyzing our data and providing results, with real numbers attached on how to reduce errors *and* three different ways our company could tackle the problem.

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OFFERING A PIC MATH COURSE:
IS IT WORTH IT?

www.kenyon.edu

Example Student Feedback:

- At times the course was frustrating given the nature of the problem, yet this was the course's greatest strength. I strongly believe struggling with the problem and not ever feeling satisfied with the result of our project was a motivator. As a result, I feel as if the experiences during the course will apply to my time after Kenyon.
- Working on real-world problems helped me stay motivated because I knew that at the end of the semester we wanted to be able to provide useful results to the company.
- I really enjoyed working with my classmates. At times it was a challenge especially because of the vast differences in our background but came to be the best part.
- The group work setting was great because we were able to draw on each others' individual strengths. The fact that we were working with real-world information was also valuable to me. The messiness in our data challenged our group to try various modeling techniques before settling on the best approaches.
- I enjoyed this class very much and it was one of my favorite classes at Kenyon!

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Example Student Feedback: Skills Developed

- Being able to do work that is self-motivated. I've never had a class where I wasn't given specific instruction, and I liked this better.
- I developed real world problem solving skills such as working with real-world data that is not always complete or exactly what is needed.
- Writing -being able to explain processes in less technical terms
- The two big ones were people skills and the ability to think critically about how to manipulate datasets to extract useful information.
- I learned how to approach an open-ended problem. This was certainly a unique experience, and I can't say that I approached the problem perfectly, but I think if I were to be given another open-ended problem I would be able to deal with the initial steps much better after having this class.
- I developed skills in communicating in a professional setting and working with others on a real world question.

QUESTIONS?

Elly Farnell, Colorado State University