

The background of the slide is a solid red color. A large, faint, circular seal of Rutgers University is centered behind the text. The seal features a sunburst design in the center and the words "RUTGERS THE STATE UNIVERSITY OF NEW JERSEY" around the perimeter.

# RUTGERS

THE STATE UNIVERSITY  
OF NEW JERSEY

## What do you need to know?

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BYU | BRIGHAM YOUNG UNIVERSITY

**ACME** BYU  
MATH  
Applied & Computational  
Mathematics Emphasis

```
L=dot(adjfaces , adjfaces_tr)  
evecs1,evals1,vt=svd(L,0)  
reversedvalueorder=evals1.argsort()[::-1]  
evecs=evecs1[:,reversedvalueorder]
```

PICMath

IGERT

DEPARTMENT OF MATHEMATICS  
COLLEGE OF SCIENCE | THE UNIVERSITY OF UTAH

## Three Models

1. ACME = Major
2. PIC = Course to solve problems for industry
3. UVU = Research opportunities for Mathematical Biology

**WHY?**

## Student Demand

*...students were saying they don't want to major in math because they don't want to teach – they didn't believe us that there were other career options*

## Career Preparation

*There was a mismatch between courses offered and skills and knowledge required by companies such as Google.  
We needed more comprehensive career prep.*

*One of the main goals is that students are getting experience that they need in non-academic jobs.*

# Enhanced and Different Student Learning

- Working on a long-term project
- Going beyond the “canned problem”
- Dealing with an open-ended problems in a work setting
- Working with a group
- Communicating what they are learning to different audiences

***This experience is uncomfortable for students and it's important to work through this discomfort.***

## Helping Industry

- Serving business needs
- Helping alumni with their needs: hiring, problem solving
- Giving back to the regional and local economy



# Program Development

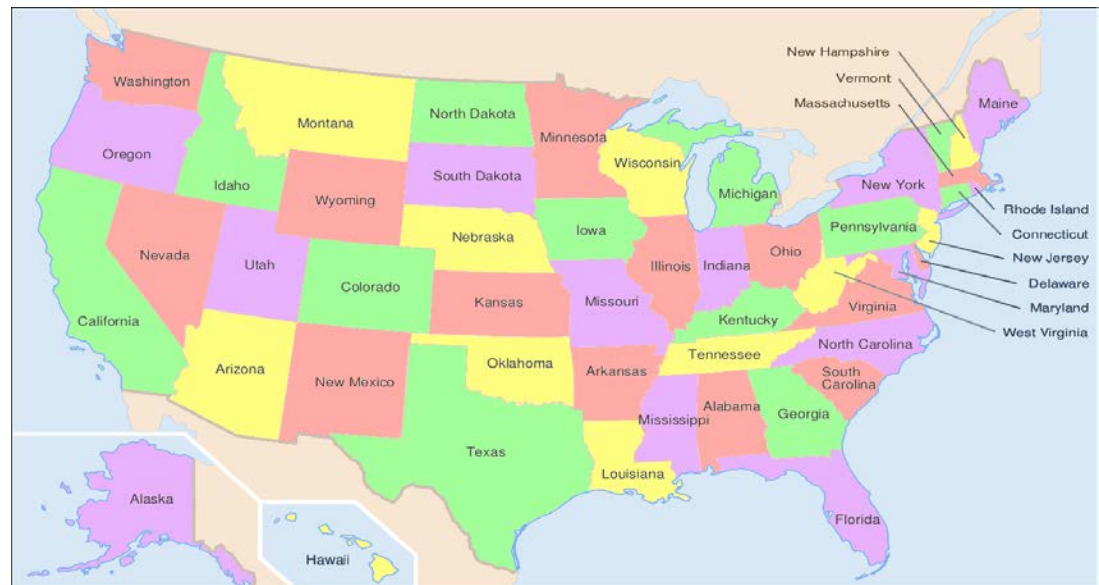
# National or Regional Approach?

- Depends on the institution and student body
- Local resources and needs

ACME – National

UVU – Regional

PIC – Both



## How?

- Started with a prototype – summer bootcamp
- Used a grant - NSF
- Interested faculty member/s

# RESOURCES

- One skilled faculty member

*[One of our faculty members] is a great salesman and was able to calm faculty fears and help them see the big vision and importance of the ACME program.*

- Team of faculty working together to develop curriculum
- Critical mass of experts on faculty
- Internship Coordinator

*...super helpful with building industry relationships. She and faculty would visit employers and potential employers.*

- PIC math summer workshop
- Course releases
- Grant – NSF

## Alumni

*Alumni provided feedback, saying, “I wish I knew this ...”. This feedback pointed to learning gaps and what should be added to make the program more comprehensive.*

*We reached out to alumni and people working in the mathematics of information and gathered a National Advisory Board. They provided information and guidance and also career opportunities and internships.*

# Getting Traction

## Getting Buy-In

*This was a pretty dramatic shift for the department... before the faculty were focused on preparing people for grad school and jobs in higher ed.*

*Faculty were excited about it without much effort. The idea was enticing.*

*We needed a little bit of salesmanship and explanation to the other departments to convince them it was worth their time to invest in the math department and develop relationships.*

*Some faculty felt that the program might not be rigorous enough or that they didn't want to teach it.*

*Faculty from other departments pushed back...fears they would lose students.*

# Marketing and Outreach

- Presentations in classes to promote the program.
- Strong sales pitch

*Math and computers are both cooler together – robots, videos and machine learning applications*

- Targeted emails to students
- Listing in the catalogue may get you students that are not a good fit



# Employer/Industry Relationships

## Existing Relationships

*Before Acme we didn't have many relationships.*

*You have your network and your institutions' network you have to think of it as part of your network*

*You can even connect with alumni from other departments*

# Building Relationships

- Hired a half-time Internship Coordinator

*...super helpful with building industry relationships. She and faculty would visit employers and potential employers.*

- Alumni

*“Our most productive connections have been with alumni or some kind of context.*

- Local industrial park – bio-tech
- Find the right person at a company

*HR people are not the most useful resources – better to talk to those doing the work.*

# Why are companies interested?

- Hiring
- Internships
- Connection to the institution
- Helping their community
- Helping them solve a “back burner problem”

## Challenges and Lessons Learned

- Time and logistics of partnering

*The main thing is getting the industry partner and that takes a long time. Then you have to look for problems and refine them. I usually do that in the summer then offer a course in the spring.*

*I needed a legal agreement in place, because there were competing interests. We wanted to publish and present companies are concerned about proprietary information. There was also the issue of secure data transfer that we had to deal with and insurance.*

# Implementation

## Keeping Current

*There is a lot of changing because we learn by experience. We also talk to students as they go into jobs.*

*Our faculty focus on doing deep learning and keeping up to date. Don't want to fall prey to temptation of teaching the latest fad. We always try to focus on teaching fundamental mathematical ideas.*

# Challenges

- Diversity

*The hardest thing has been getting women into the program.*

- Advising

*Advising is one of the big challenges. It is faculty led, but if I had more resources I would hire a professional advisor.*

- Be clear about the experience

*Managing student expectations and behavior. It is really important to get students to buy in to the course at the outset.*

- Recruiting faculty

*Building a broader group of faculty interested in this type of teaching and learning can be challenging.*

- Assessment

*Assessment is much more difficult in the setting. You are not giving exams instead what you get are progress reports, oral presentations, and conversations.*



# Best Practices

- Lock-step cohort

Students are working together which is different than traditional math students who tend to work alone. That is especially true for the best students. They are together for two hours a day and as a result they develop some strong networks. That has been really good – when students fall behind or become depressed or get anxiety, the cohort goes down and knocks on the door. They work together to get the student caught up.”

- Student Feedback: Journals and Surveys

*I had students keep journals. At least one time had a student trouble with an algorithm he was trying to implement, and he thought that meant he was failing in the course. The journal gave me an opportunity to explain that was not what that meant.*

- Create Structure

Frequent presentations, progress report, check in etc. Open ended questions.

## Sustaining and Scaling

“Part of the reason to develop the curriculum is so that new faculty can come in and teach it even if it isn’t their expertise. And graduate students can help with the coding labs which faculty may not know. This makes to program sustainable.”

“I don’t know we have grown a lot if we continue to grow I hope we get resources – if they don’t we might have to make it closed enrollment. Don’t think it will shrink. I expect it continue to grow.”

- Connection to a single faculty member can mean the program is no longer sustained if that person leaves

# Questions? Comments? Your Experience?

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