Earth Science Data Analytics/Science Skills Needed: 
Overall Experiences /Operational Needs

**Data Analytics / Data Science**
- Need skills in: mathematics, numerical modeling, statistics, software, engineering and the ability to integrate data across multiple domains.
- Need expertise in tools and techniques: rule learning, classification, cluster analysis, data fusion, machine learning, neural networks, anomaly detection, modeling, time series analysis, visualization.

**Operational Needs**
- Need to facilitate making data more useful.
- Should be interdisciplinary from the start.
- Learn your math and statistics.
- Know the importance of the data lifecycle.
- Understand what the data says and how to understand the data.
- Know the territory: What information is available. Where to get it. How is it generated. How to use it. How it can be used.
- Understand data, metadata, and data integration.
- Know how to apply the techniques to the discipline.
- Learn through internships.

**General Experiences**
- Need skills in: data scientist, data fusion, machine learning, neural data across multiple domains. The role is a hybrid one.
- Once acquired, it becomes up to the individual to determine how best to use these skills, based on their interest and aptitude.

### What the Universities Offer (July, 2016 study and comparison with 2013 Study)

#### Program Focus Areas

<table>
<thead>
<tr>
<th>Program Focus Areas</th>
<th>B.S. online</th>
<th>B.S. campus</th>
<th>M.S. online</th>
<th>M.S. campus</th>
<th>PhD online</th>
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#### Relevant Courses Most Offered in 2013 and 2016


#### List of Interdisciplinary, Heterogenous Data!
- Scientists spend 30% of time programming, but 80% are self-taught.
- Unlike laboratory and field equipment, software is often not carefully validated.
- Computing errors can have disproportionate impacts on scientific process.

**my perspective on what Earth Science Needs (from Data Science)**
- Repeated Exposure
- Sharing of Vocabulary
- How, Where, When and Who to Find/Ask for Resources & Help
- Sharing of Community: "both ways" Communication

**Summary Table of Best Practices**

1. Offer programs that people want to learn.
2. More student training and professional development.
3. Offer programming skills training.
4. Offer project-based learning.
5. Do not hesitate to introduce new technologies.
6. More collaborative opportunities.
7. More cross-disciplinary training.

**What Else Universities Should Consider Offering**

- Ability to integrate data across multiple domains
- Support domain scientists with data and computational needs to communicate across domains (be interdisciplinary)
- Knowledge of data life cycle
- Software engineering - Programming

**Program Pertaining to Data Science/Data Analytics: Course Topics Most Offered**

- Statistics, Data Mining, Database Management, Analysis
- Data Science, Data Analytics, and Computer Science
- Data Mining, Mathematics, Statistics, Machine Learning, Data Visualization

**Data Science, Data Analytics, Information Systems**

- Database Management/Analysis
- Quantitative Analysis:
  - Data Mining, Mathematics, Statistics

**Other Relevant Courses Offered:**
- Programming, Neuro Networks, Data Analysis, Artificial Intelligence, Clustering, Time Series, Data Warehousing, Pattern Recognition, GIS, Remote Sensing, Text Mining, Information/Knowledge Management

**Data Analysts/Science Techniques Practiced**

- Ability to integrate data across multiple domains
- Support domain scientists with data and computational needs to communicate across domains (be interdisciplinary)
- Knowledge of data life cycle
- Software engineering - Programming

**Every Earth science program should contain training in Data science/analytic and Programming**