Preparing Students to Tackle Data Analytics in the Accounting Curriculum

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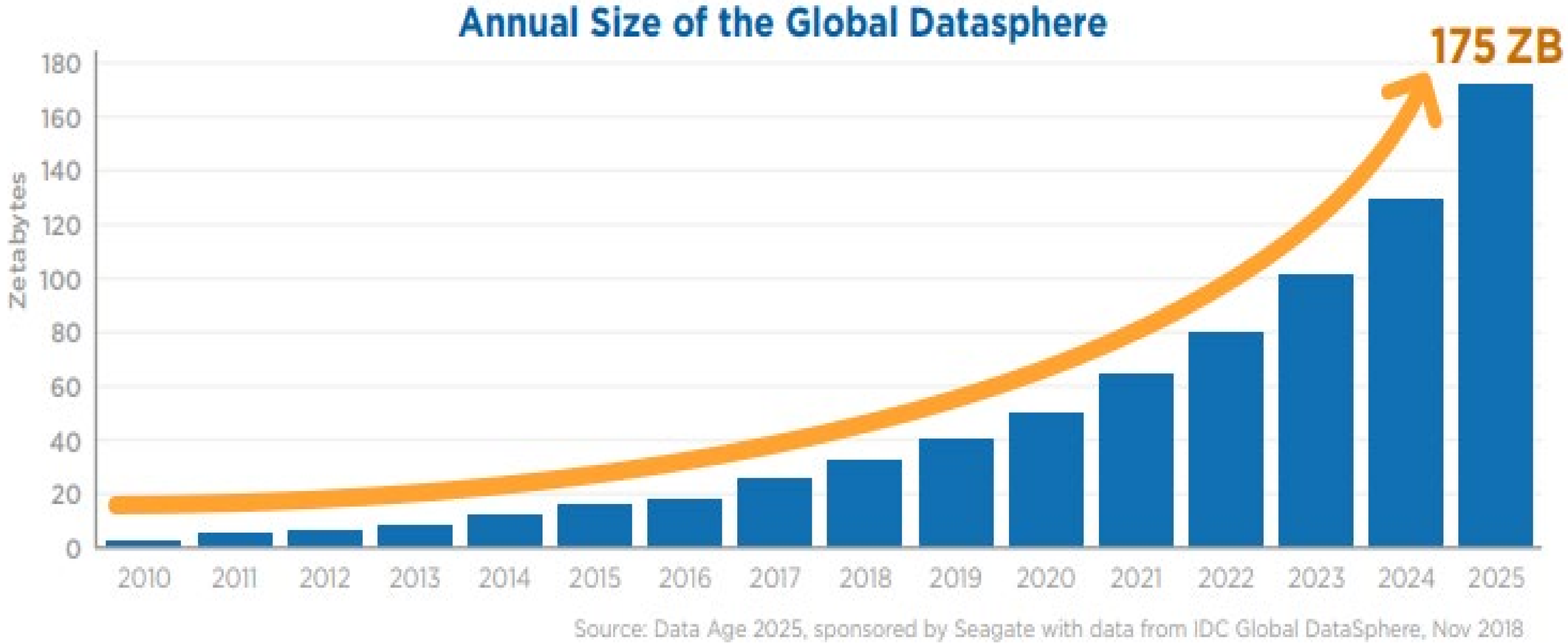
Baruch College

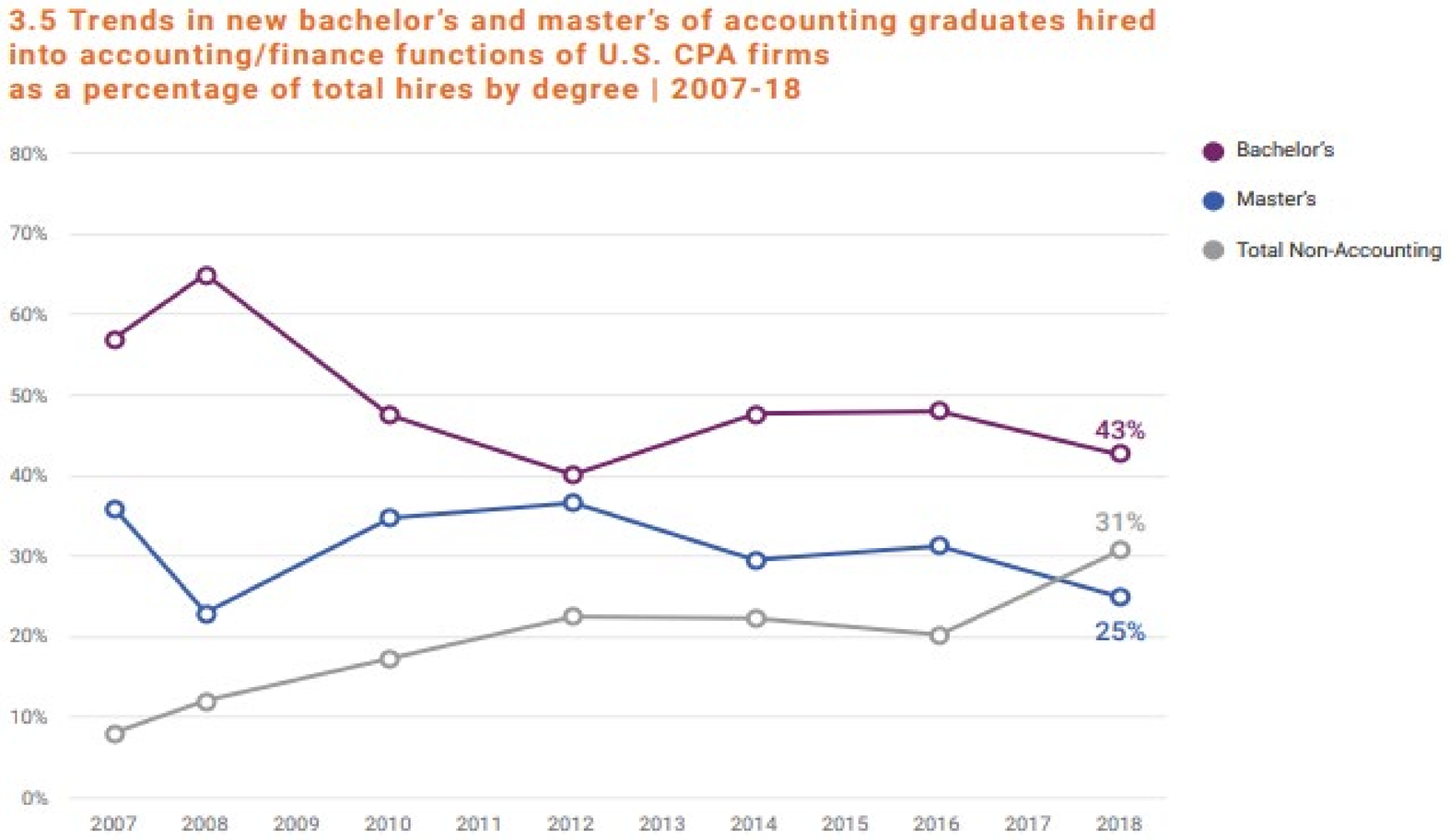
Webinar – November 4, 2021

Data Everywhere!



Source: Data Growth Since 2010 (Source: IDC Global DataSphere, Nov. 2018, page 6) https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf, accessed 7/3/2019)

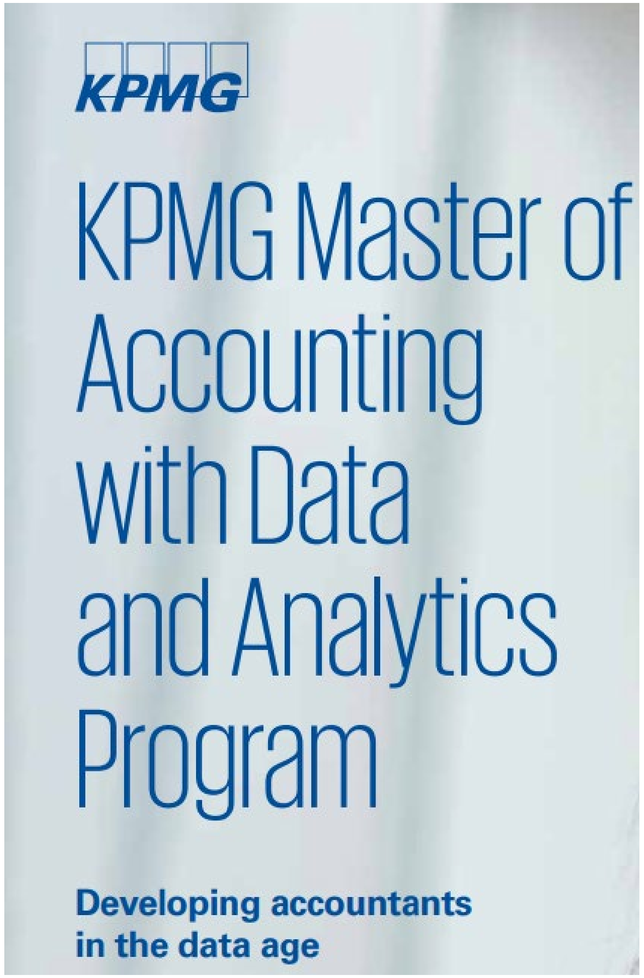
If our accounting grads don't have the needed skills, the firms will find those that do!



Source: AICPA, 2019 Accounting Graduates Supply and Demand Report, page 22.

“The set of skills needed for a successful accounting career is changing.”

Accounting Firms Needing Data Analytics Skills



What Skills Are Needed?

Digital innovations such as artificial intelligence, collaboration technologies and advanced analytics are rapidly disrupting the Finance 2020 workforce. Traditional roles are evolving, and newer roles are increasing in importance.

Traditional finance roles	Main impacts
Financial planning and analysis 	The real work starts when you deliver the report or analysis: • Anticipating alternative scenarios, tracking their emergence and executing on contingency plans • Not just answering the "what happened" and "why did it happen" questions but also answering the "what should we do" questions
Financial controller 	• Focusing on preventative and real-time control rather than relying on detective controls • Managing outcomes, not processes
Accounts payable clerk 	• Focusing on exceptions as routine work is automated • Greater collaboration with other functions

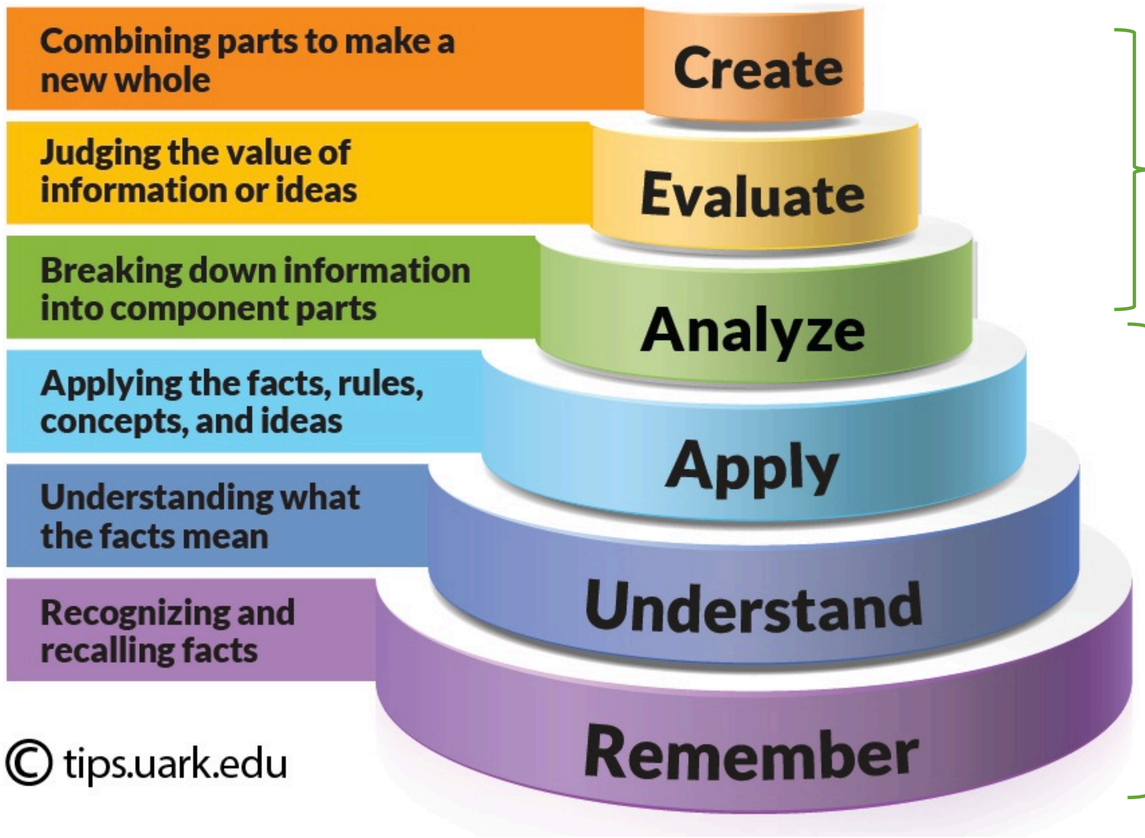
Source: Accenture, Meet the Finance 2020 Workforce

What Skills are Needed? (part 2)

Emerging finance roles	New skills and requirements
Data scientist 	• Ability to understand and manipulate massive volumes of data from internal and external sources • Detailed industry knowledge to pose the right questions of the data • Ability to combine market, operational and financial data into rich data sets
Scenario planner 	• Ability to determine likely scenarios, the triggers for each scenario, and the business impact of each scenario • Ability to run several models simultaneously
Market maker 	• Ability to analyze new business opportunities and ways the organization can profit from them
Social/behavioral scientist 	• Ability to model changes in customer and competitor behavior and describe the financial implications

Source: Accenture, Meet the Finance 2020 Workforce

Towards Critical Thinking Skills



Where accountants must be
Emphasize using data analytics

Computers already do this!

Source: tips.uark.edu

Typical CPA Exam Question, indicative of the past

At June 30, Almond Co.'s cash balance was $10,012 before adjustments, while its ending bank statement balance was $10,772. Check number 101 was issued June 2 in the amount of $95 but was erroneously recorded in Almond's general ledger balance as $59. The check was correctly listed in the bank statement at $95. The bank statement also included a credit memo for interest earned in the amount of $35, and a debit memo for monthly service charges in the amount of $50. What was Almond's adjusted cash balance at June 30?

a. $10,462

b. $10,048

c. $9,598

d. $9,961

Typical CPA Exam Question, indicative of the past, and why it no longer works.

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Typical Solution is to add and subtract a few numbers – <u>Memorization will be fine:</u>

Bank Balance + Outstanding Deposits – Outstanding Checks = Corrected Balance

GL Balance + Notes Collected or Interest Earned – NSF Checks - Bank Fees = Corrected Balance

Using Aging to Estimate an Allowance?

Gem Merchandise Co.
Expected Amount of Accounts Receivable that is Uncollectible
As of August 31, 2017

AGE OF ACCOUNTS RECEIVABLES	ACCOUNTS RECEIVABLE AMOUNT	PROBABILITY OF NOT COLLECTING	EXPECTED UNCOLLECTIBLE AMOUNT
Current	$ 108,075	1%	$ 1,081
Past due: 1 - 30 days	$ 3,335	3%	$ 100
Past due: 31 - 60 days	$ 1,200	10%	$ 120
Past due: 61+ days	$ 18,210	40%	$ 7,284
Totals	$ 130,820		$ 8,585

Source: www.accountingcoach.com

How about a different way to estimate an allowance?

This assumes we only know one thing about them- that they're late . . . but these are our customers!

- We have whole systems, Customer Relationship Management systems, that tell us everything about the customer.

- What should we use to estimate an allowance?
- Do they have a dispute with the items received?
- Are they continuing to purchase from us?
- Has their credit score/financial status declined?
- Are they paying others?
- Can we run our own theory- and practice-informed prediction models of the allowance?

The new CPA exam emphasizes data literacy, but where?

- Core

Accounting + Data Analytics + Auditing + AIS Tax

- Specializations

Business Analysis and Reporting

Information Systems and Controls

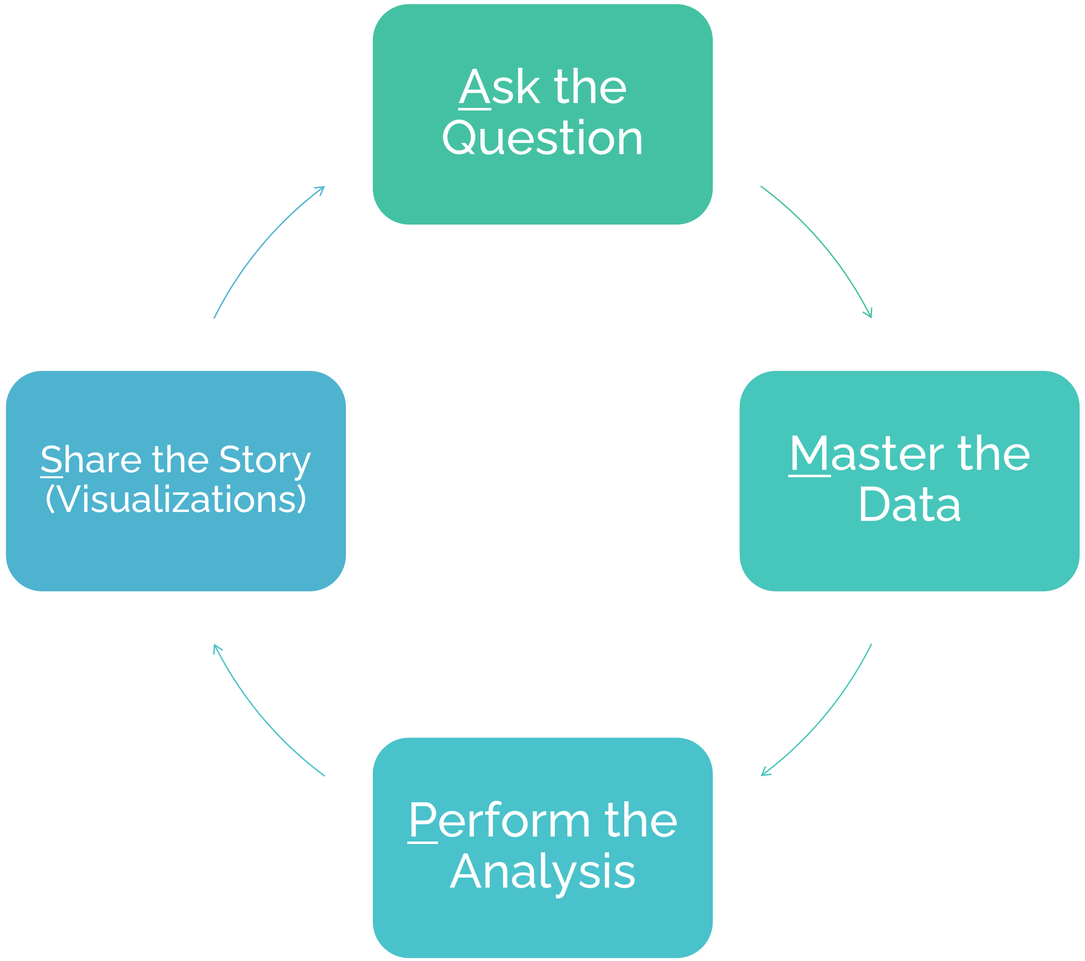
Tax Compliance and Planning

Where does data analytics fit in the CPA Evolution Model Curriculum?

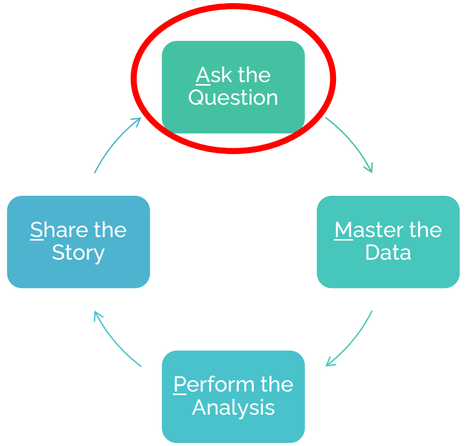
Core		Business Analysis and Reporting	Info Systems and Controls	Tax Compliance and Planning
Intro to Data Analytics	Intermediate Managerial Accounting	Data Analytics	Information Systems Assurance and Advisory	Individual Compliance and Planning
Intermediate Accounting 1	Accounting Information Systems	Advanced Accounting	Information Security and Forensics	Entity Compliance and Planning
Intermediate Accounting 2	Auditing	Governmental and Not-For-Profit Accounting	Emerging Attestation	Tax Research

Early? Late? Throughout? Yes, yes and yes again!
But if only “throughout” with a random Tableau lab here and there – will not be enough.

Students Need a Foundation for Analytics! I use the AMPS model



Ask the Question: Four Question Types

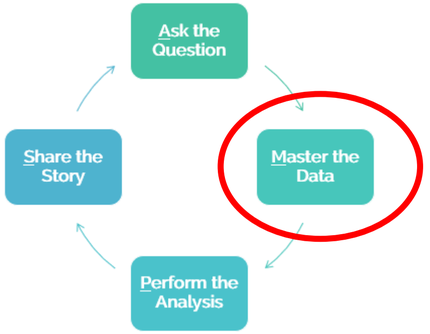


- What Happened?
- Why did it Happen?
- Will it happen and if so, when?
- What should we do, based on what we expect will happen?

Ask the Question

Question Types	Examples	Specific Types of Analysis Employed	Data Analytics Type
What happened? What is happening?	Did we make a profit last year? Which product is the most profitable one for the company?	Counts, totals, sums, averages, financial statements, histogram, pivot tables	Descriptive
Why did it happen? What are the root causes of past results? Can we explain why it happened?	Why did advertising expense increase, but sales fall? Can our variance analysis help explain why the labor expenses increased over the past year?	Variances, differences from expectations, outliers/anomalies, correlations, drill-downs and roll-ups to get detail when needed; PivotTables;	Diagnostic
Will it happen in the future? What is the probability something will happen? Is it forecastable?	What is the chance the company will go bankrupt? Can we forecast earnings? Which borrowers will repay their loans?	Classifications, regressions, simulation, Time series	Predictive
What should we do, based on what we expect will happen? How do we optimize our performance based on potential constraints?	How can revenues be maximized (or costs be minimized) if there is a trade war with China? What is the level of sales that will allow us to breakeven? (Goal Seek) Should the company make its products or outsource? What is the optimal price to charge to maximize profits?	What-if scenarios, Goal-seek, Cash Flow Analysis, Marginal/Incremental Analysis, Sensitivity Analysis, Optimization	Prescriptive

Master the Data

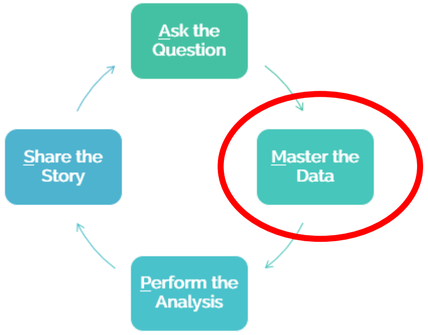


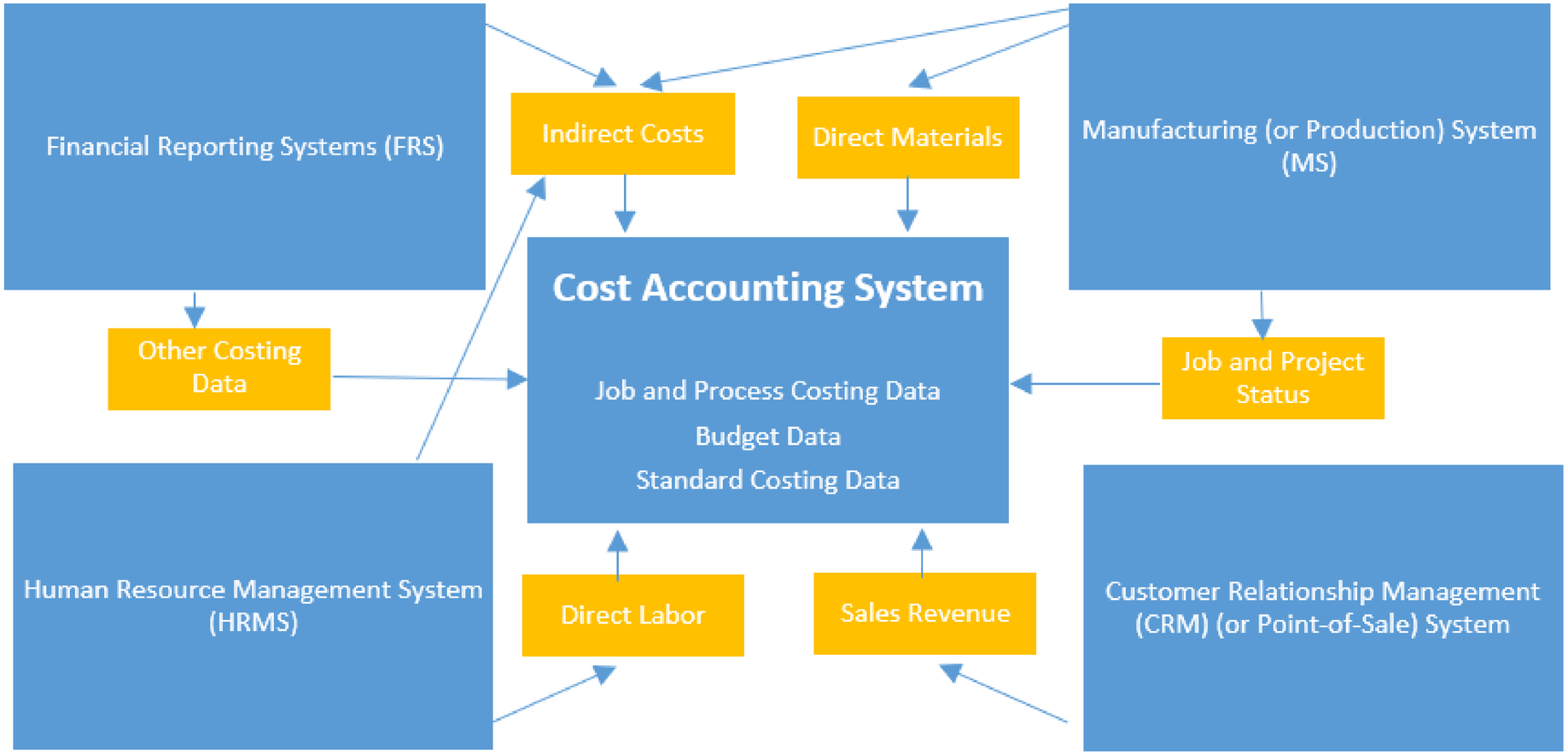
- Mastering the data requires an understanding of what data is available to you and where it is stored:
  - Is it the right data? Will it address the question?
  - Is it of high enough quality?
  - Does it have missing data?
  - Are they facts, opinions or perceptions?
  - Is the data accessible? Is access easy or do I need a data scientist to help me get it?
  - Is the data creation ethical? Is it secure? Does it violate privacy? Could it be misused?

  - Data types – nominal, ordinal, categorical, etc.
  - Relational Databases

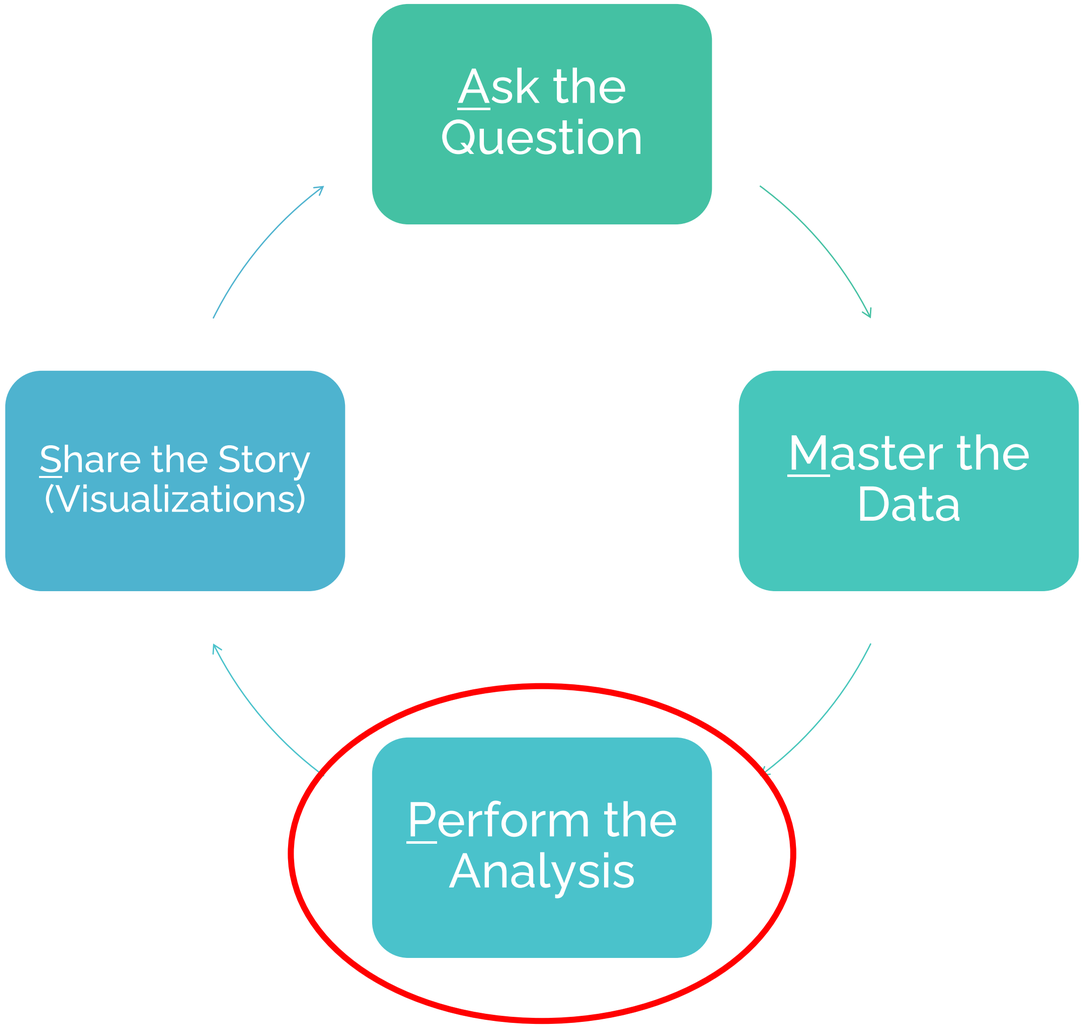
Master the Data

Where does the data come from? How can we gain access to it?

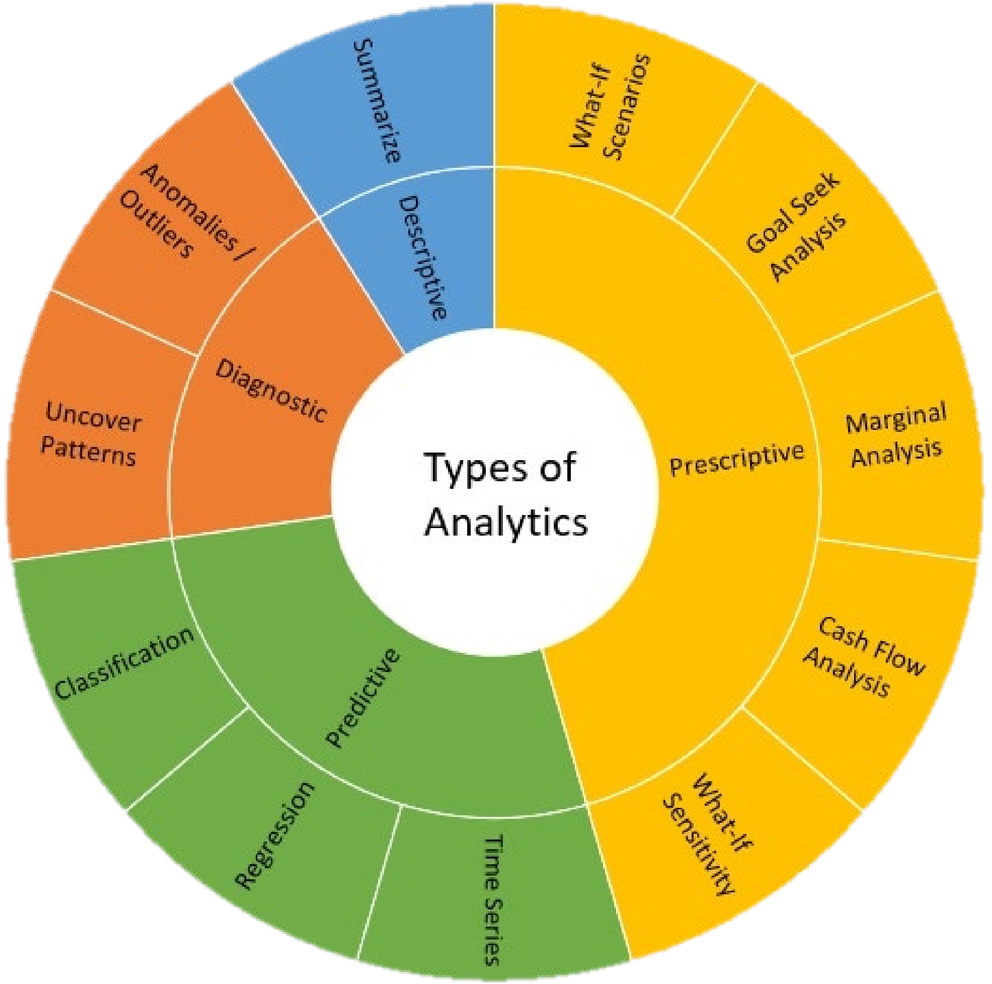




AMPS Model


Ask the Question
Master the Data
Perform the Analysis
Share the Story (Visualizations)

Perform the Analysis – Matching the Analytic Techniques to the Question Asked



How can we teach analytics? Through hands-on labs, of course! Learn by doing! Data analytics in every course!

Analytics Type	Financial Accounting Labs	Auditing Labs	Managerial /Cost Labs	Tax Labs
Descriptive Analytics "What Happened"	• Ratio Analysis	• Aging of Receivables	• Summary Statistics of Contribution Margins by Product	• Summary Statistics of Effective Tax Rates
Diagnostic Analytics "Why it Happened"	• Bank Reconciliation	• Fraud Detection • Misstatement Detection	• Variance Analysis	• Reconciliation between Tax and Financial Income
Predictive Analytics "What may Happen?"	• Predict Sales Returns	• Bankruptcy Prediction • Loan Repayment Prediction	• Predict Sales • Identifying ABC Cost Drivers Using Regression	• Tax Planning – Predict Taxable Income
Prescriptive Analytics "How will we adjust based on what we expect will happen"	• Scenario Analysis - Impact of a Trade War on Company Profitability	• Audit Timing and Scheduling Around End of Year	• Sensitivity Analysis – Breakeven • What-If Analysis – Price Optimization	• Scenario Analysis - Tax Planning

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Diagnostic Analytics:
Bank Reconciliations Using Conditional Formatting

ShareRides
Cash Transactions
September 30, 2021

General Ledger/ Company Books			Bank	
Transaction Type			Transaction Type	
Check 5252	1,511.98		Deposit 1213	1,982.90
Check 5253	1,971.25		Deposit 1214	1,243.61
Check 5254	2,218.49		Deposit 1218	4,538.77
Check 5255	1,996.14		NSF Check 1187	1,418.95
Check 5256	710.39		NSF Fees	25.00
EFT4241	2,572.67		Deposit 1217	3,895.94
EFT4242	1,322.17		Deposit 1215	2,781.14
Check 5257	22,297.62		Deposit 1216	3,192.02
Check 5258	464.06		Deposit 1213	1,982.90
Check 5259	2,728.28		Deposit 1219	416.91
Check 5260	1,717.07		Deposit 1220	3,338.14
Check 5261	1,406.70		Check 5252	1,511.98
Check 5262	1,034.63		Check 5254	2,218.49
Deposit 1213	1,982.90		Check 5255	1,996.14
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Deposit 1219	416.91		Note Collect 1	5,000.00
Deposit 1220	3,338.14		Interest Earned	21.00
Deposit 1221	3,136.31		Bank Fees	33.00
Deposit 1222	4,771.18			
Deposit 1223	4,963.83			

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Diagnostic Analytics: Search for Fraud Between A/P Clerks and Vendors using Conditional Formatting!

Sum of Invoice Amount Column Labels															
Row Labels	Bobs Inc.	Connie Ent.	Dizzy Ind.	Mayday LLC	North Ind.	Perrys Co.	Peters Co.	Richardson	SEC Inc.	Tree Co	Twos Inc.	XNA Inc.	Young Co.	Yuxin Corp.	Grand Total
AP0010	13.57%	10.51%	4.26%	14.02%	9.31%	10.88%	5.71%	9.24%	6.12%	9.35%	7.47%	5.72%	10.64%	6.11%	9.32%
AP0020	7.97%	10.89%	7.43%	7.73%	2.94%	9.21%	0.00%	15.17%	14.68%	14.41%	13.35%	12.33%	20.43%	1.73%	10.63%
AP0030	13.30%	3.52%	29.73%	8.34%	6.89%	13.99%	0.00%	5.61%	15.77%	8.94%	12.74%	9.61%	9.24%	9.86%	10.44%
AP0040	2.68%	6.23%	14.30%	17.17%	14.53%	16.93%	0.00%	17.36%	24.62%	10.62%	23.38%	13.58%	17.59%	17.25%	15.16%
AP0050	17.47%	12.67%	15.54%	10.32%	3.94%	4.33%	4.03%	17.89%	3.17%	14.68%	8.14%	16.84%	8.66%	4.77%	9.48%
AP0060	6.92%	10.45%	8.84%	13.92%	8.94%	11.90%	90.26%	7.46%	12.98%	20.11%	16.00%	1.29%	14.53%	17.07%	13.89%
AP0070	12.15%	12.98%	8.74%	10.67%	15.43%	7.95%	0.00%	12.79%	10.34%	6.28%	8.87%	15.78%	2.44%	6.34%	9.70%
AP0080	13.46%	15.83%	3.72%	5.86%	13.50%	13.74%	0.00%	11.24%	7.61%	4.63%	5.39%	22.21%	12.76%	13.70%	11.44%
AP0090	12.47%	16.91%	7.45%	11.95%	24.52%	11.08%	0.00%	3.25%	4.69%	10.99%	4.67%	2.64%	3.70%	23.17%	9.94%
Grand Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Predictive Analytics: Predicting Bankruptcy Risk

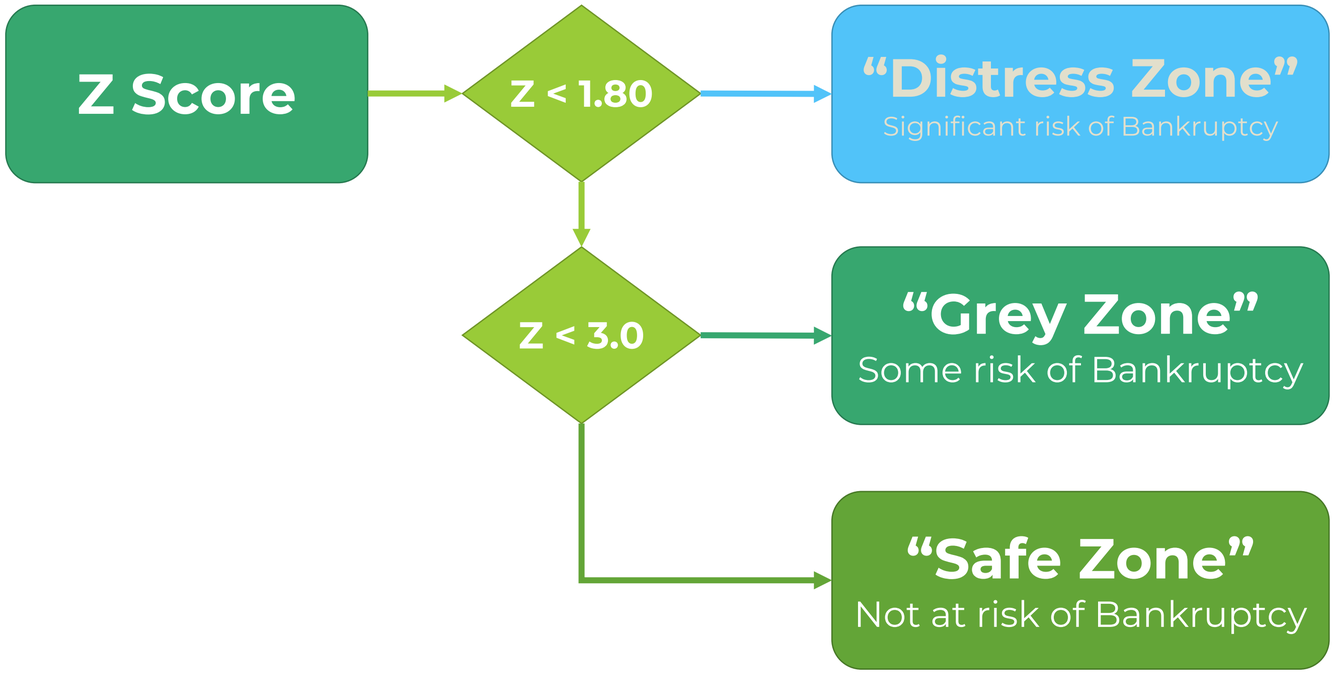
- Altman (1969) Bankruptcy Prediction
- Altman considered many variables (22 in total) and combinations of variables, but this set did the "best overall job."

$$ZScore_t = 1.2\left[\frac{NWC_t}{TA_t}\right] + 1.4\left[\frac{RE_t}{TA_t}\right] + 3.3\left[\frac{EBIT_t}{TA_t}\right] + 0.6\left[\frac{MVE_t}{TL_t}\right] + 1.0\left[\frac{Sales_t}{TA_t}\right]$$

NWC – net working capital (current assets minus current liabilities)
TA – total assets
RE – retained earnings
EBIT – earnings before interest and taxes
MVE – market value of equity
TL – total liabilities

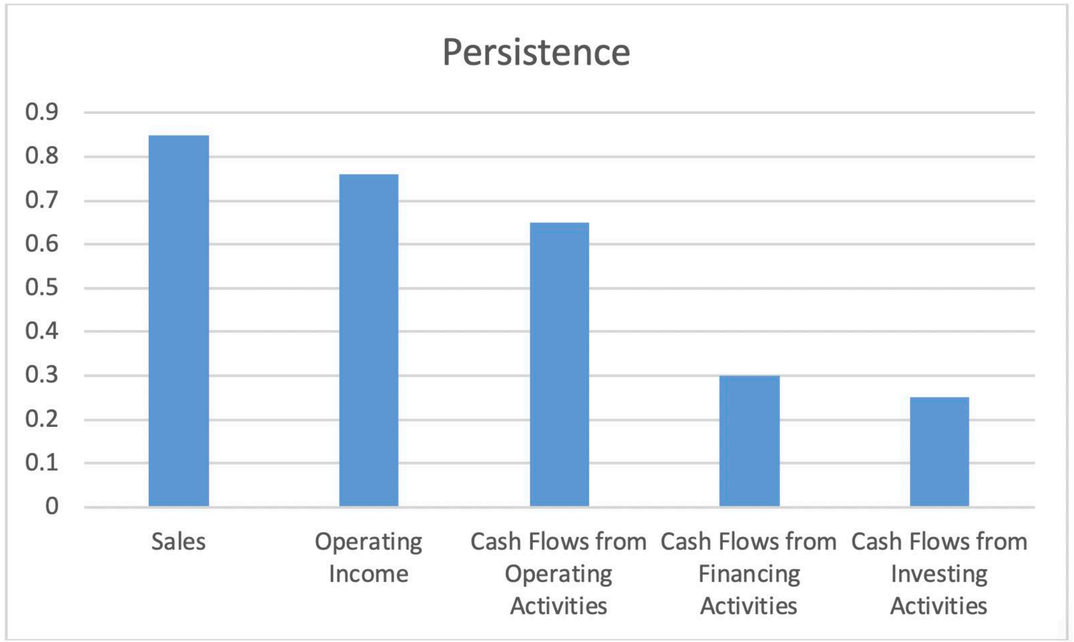
	1. Liquidity	2. Long-term profitability	3. Short-term profitability	4. Long-term solvency	5.Asset utilization
Z=	1.2 * Work Cap / Assets	+ 1.4 * Ret. Earn / Assets	+ 3.3 * EBIT / Assets	+ 0.6 * MV Equity / BV Debt	+ 1.0 * Sales / Assets

Predicting Bankruptcy Risk Using a histogram

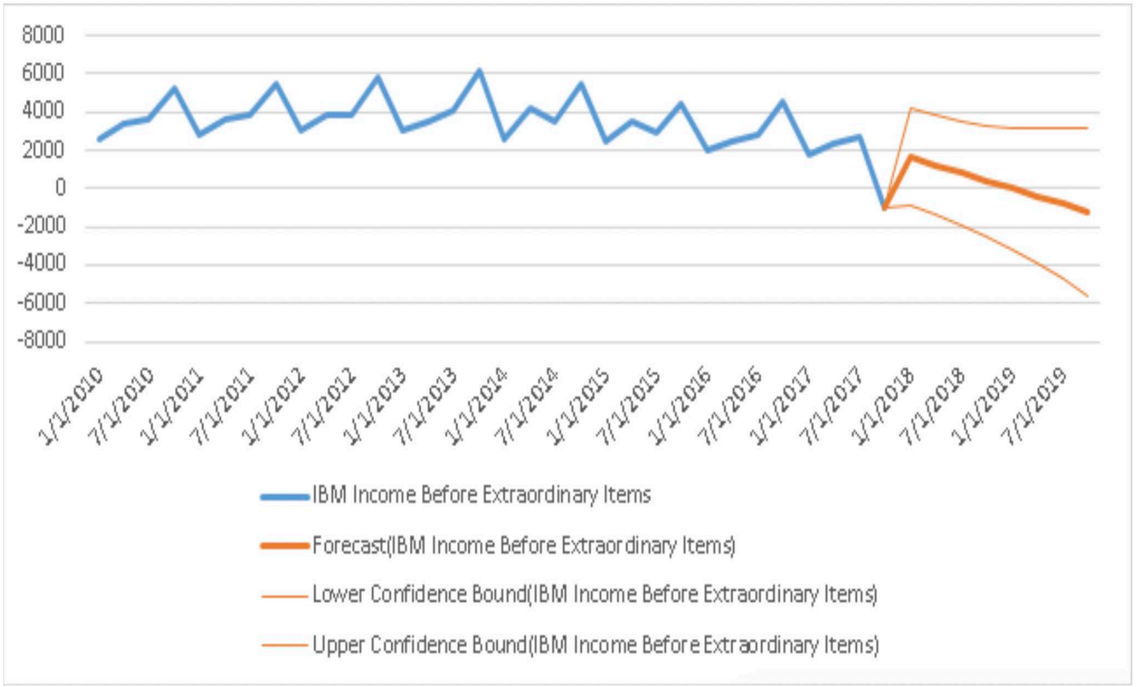


Predictive Analytics: Forecasting Earnings

- Persistence and Time Series of Real-World Companies (IBM): Excel Forecast Sheet



Source: Dechow and Schrand, 2004



Prescriptive Analytics: Sensitivity Analysis

I	J	K	L	M	N	O	P	Q	R	S	T	U
			Horizon Period Sales Growth									
		$ 74.67	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
		4%	156.64	161.90	167.31	172.87	178.60	184.48	190.54	196.76	203.15	209.71
Cost of Capital		5%	118.33	122.07	125.91	129.86	133.93	138.11	142.41	146.82	151.36	156.02
		6%	95.35	98.18	101.09	104.08	107.16	110.33	113.58	116.92	120.35	123.87
		7%	80.03	82.26	84.56	86.92	89.34	91.83	94.40	97.03	99.73	102.50
		8%	69.09	70.90	72.76	74.67	76.63	78.65	80.73	82.86	85.04	87.29
		9%	60.88	62.38	63.92	65.50	67.12	68.79	70.50	72.26	74.06	75.92
		10%	54.50	55.76	57.05	58.37	59.73	61.13	62.57	64.04	65.55	67.10
		11%	49.40	50.46	51.56	52.68	53.84	55.02	56.24	57.49	58.77	60.09
		12%	45.22	46.14	47.07	48.04	49.02	50.04	51.08	52.15	53.24	54.37
		13%	41.75	42.53	43.34	44.17	45.02	45.89	46.79	47.71	48.66	49.62
		14%	38.80	39.49	40.19	40.90	41.64	42.40	43.18	43.97	44.79	45.63

Remember how we teach Allowances?

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Expected Amount of Accounts Receivable that is Uncollectible
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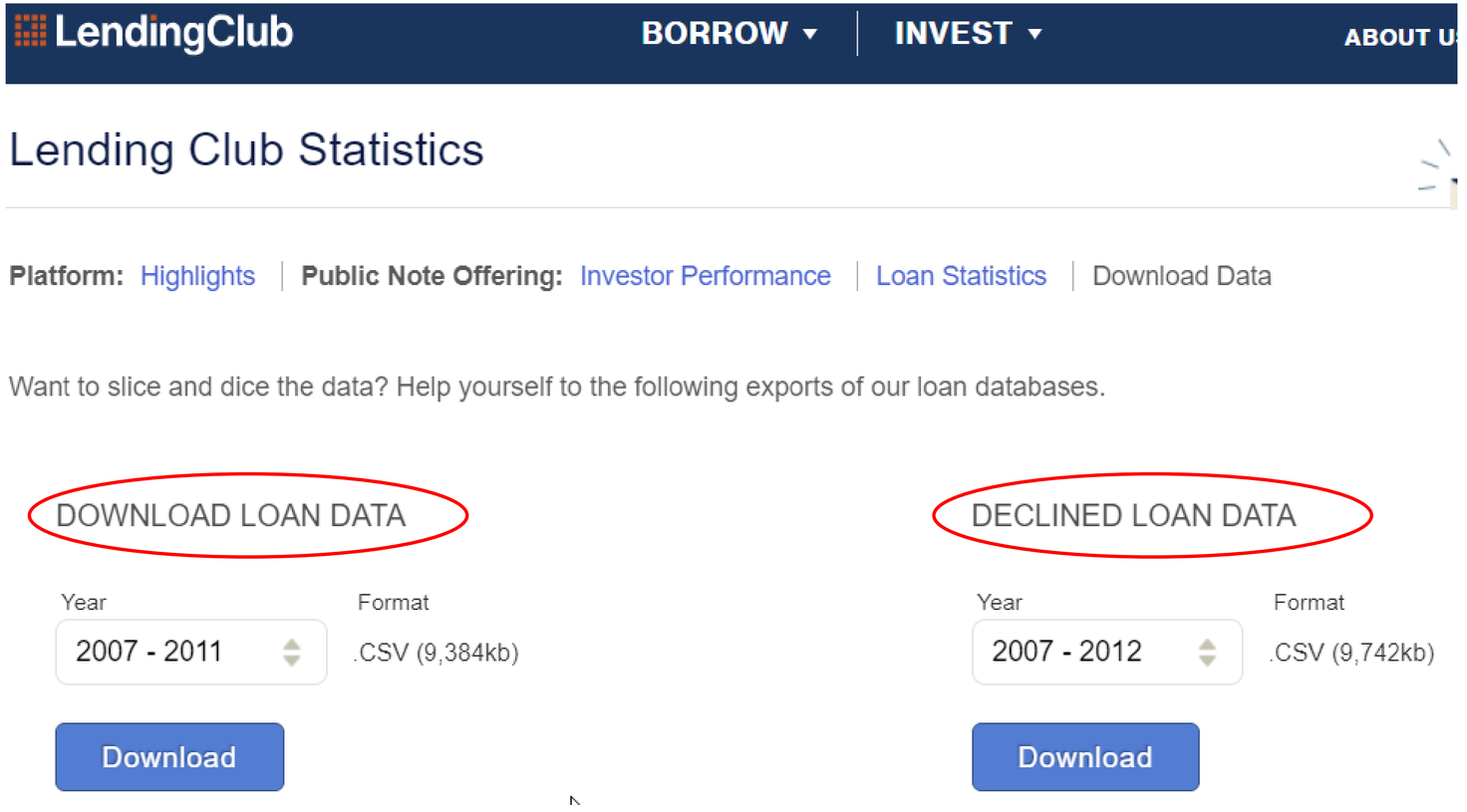
Source: www.accountingcoach.com

How about we use hypothesis testing instead?

- Which of these businesses will/will not be able to pay their debts/receivables?
- Or, would you give Dr. Richardson a loan? What questions would you ask?
- Critical thinking:
  - Students, what would we like to know? How can we predict this?
  - What hypotheses do you have? What is your proposed model?
  - How will you test it?

Then test the hypotheses using real-world data



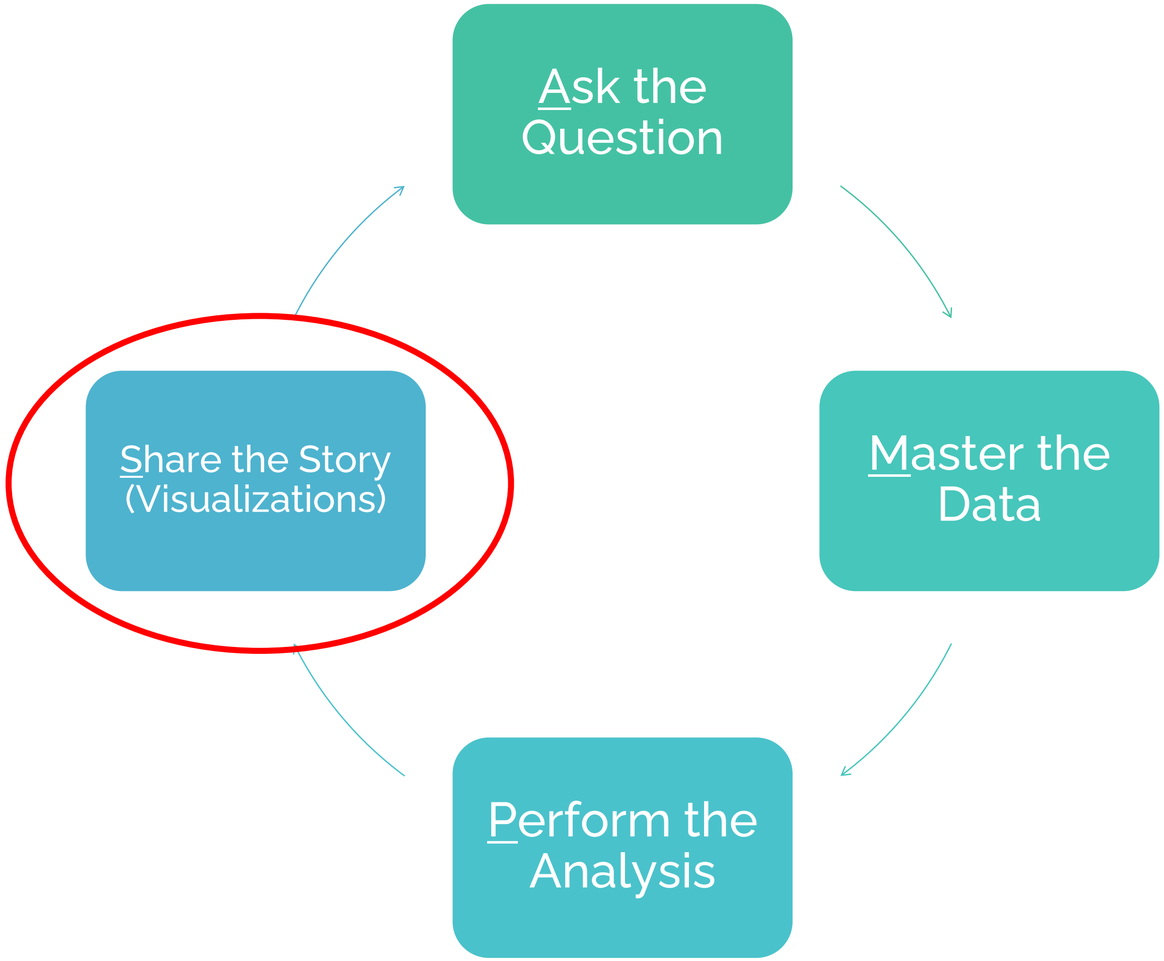
Source: Lending Club

Let's learn from accepted/declined loans

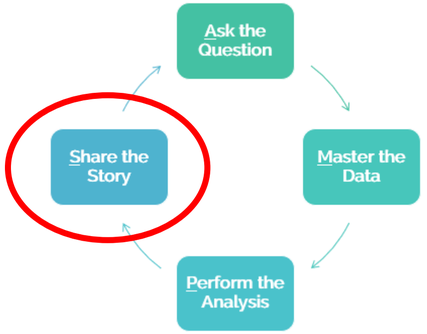
Amount Requested	Application Date	Loan Title	Risk_Score	Debt-To-Income Ratio	Zip Code	State	Employment
1000	4/1/18	Major purcha	727	0.32%	840xx	UT	< 1 year
5000	4/1/18	Debt consolic	578	0.42%	221xx	VA	< 1 year
30000	4/1/18	Credit card re	699	8.77%	065xx	CT	< 1 year
10000	4/1/18	Debt consolic	860	4.02%	921xx	CA	< 1 year
5000	4/1/18	Vacation	541	0%	735xx	OK	< 1 year
6000	4/1/18	Other	626	1.50%	923xx	CA	< 1 year
10000	4/1/18	Vacation	687	0.81%	967xx	HI	< 1 year
7500	4/1/18	Car financing	659	0%	456xx	OH	< 1 year
2000	4/1/18	Other	600	0%	763xx	TX	< 1 year
10000	4/1/18	Debt consolic	563	0.46%	454xx	OH	< 1 year
1000	4/1/18	Home buying	581	0%	276xx	NC	< 1 year
2000	4/1/18	Car financing	600	14.88%	850xx	AZ	< 1 year

Source: Lending Club

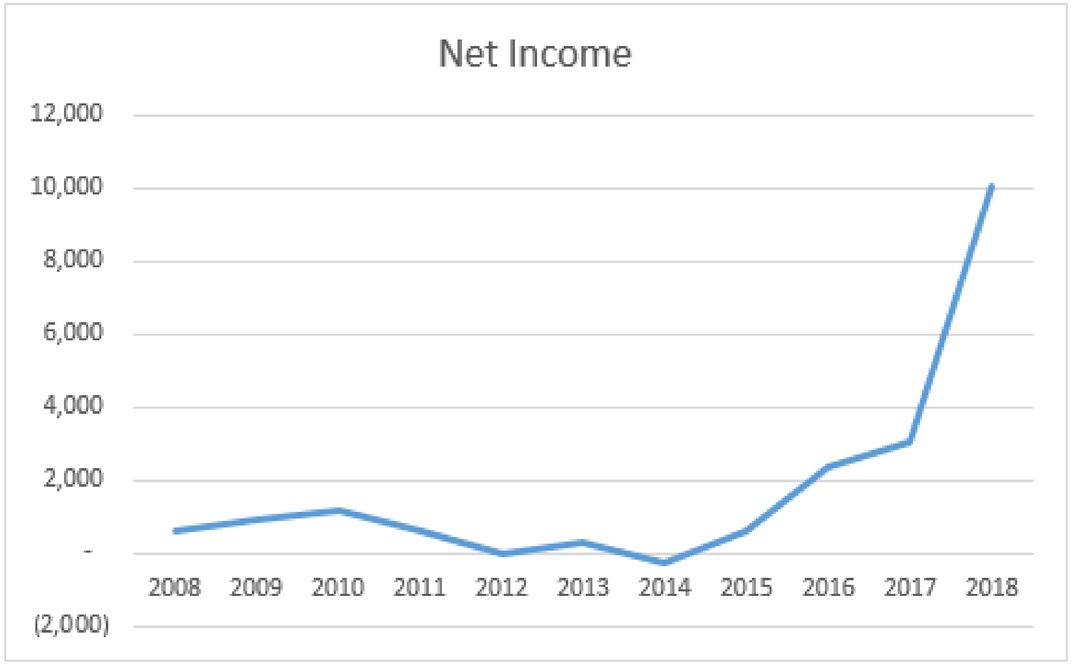
AMPS Model


Ask the Question
Master the Data
Perform the Analysis
Share the Story (Visualizations)

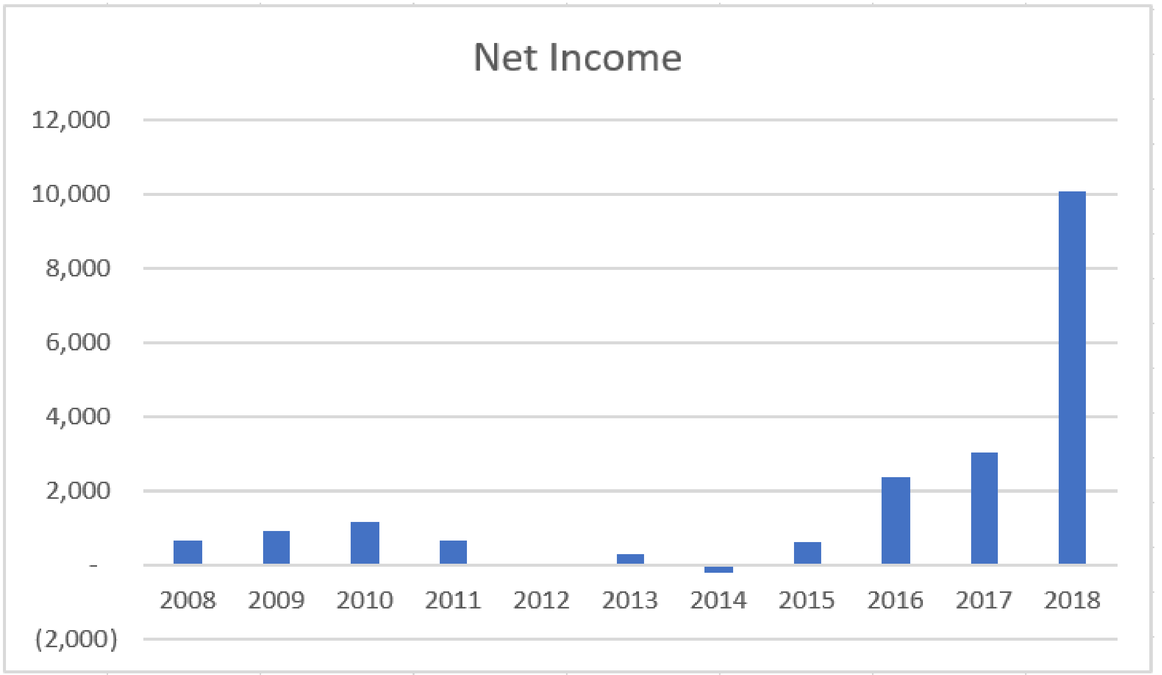
Share the Story: Line Charts vs. Bar Charts



- Line charts are preferred (over bar charts) if trend is the most important point to communicate.

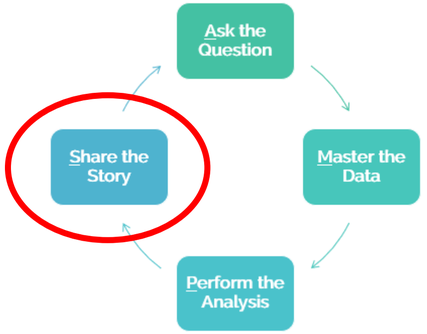


Line Chart of Net Income for Amazon from 2008–2018

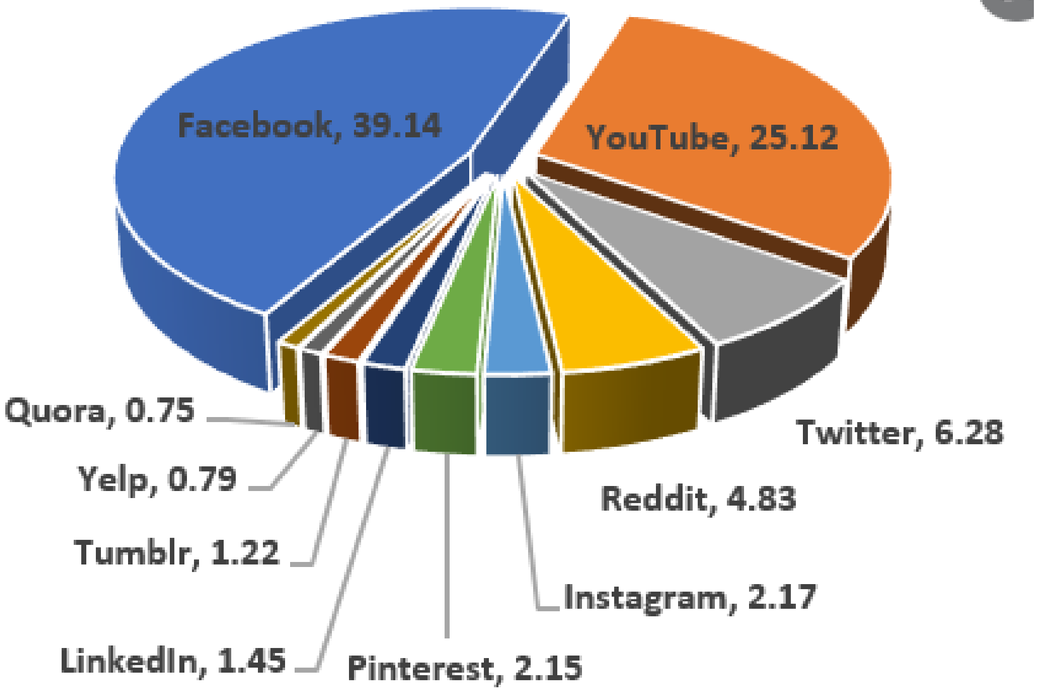


Bar Chart of Net Income for Amazon from 2008–2018

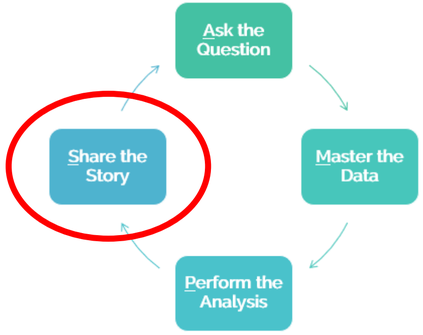
Share the Story
Pie Charts



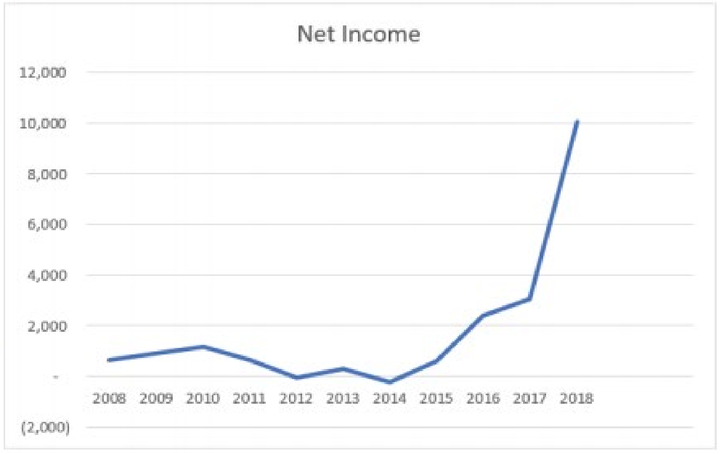
- Pie charts are good for categorical data and for showing proportions.
- Pie charts are *rarely* preferred if there are more than four categories.



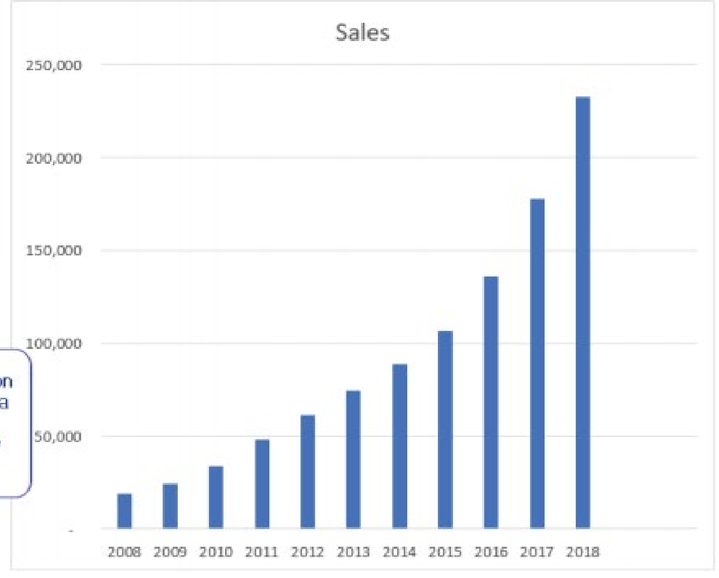
Share the Story: Create and Evaluate Dashboards



Year	Net Income	Sales
2008	645	19,166
2009	902	24,509
2010	1,152	34,204
2011	631	48,077
2012	(39)	61,093
2013	274	74,452
2014	(241)	88,988
2015	596	107,006
2016	2,371	135,987
2017	3,033	177,866
2018	10,073	232,887

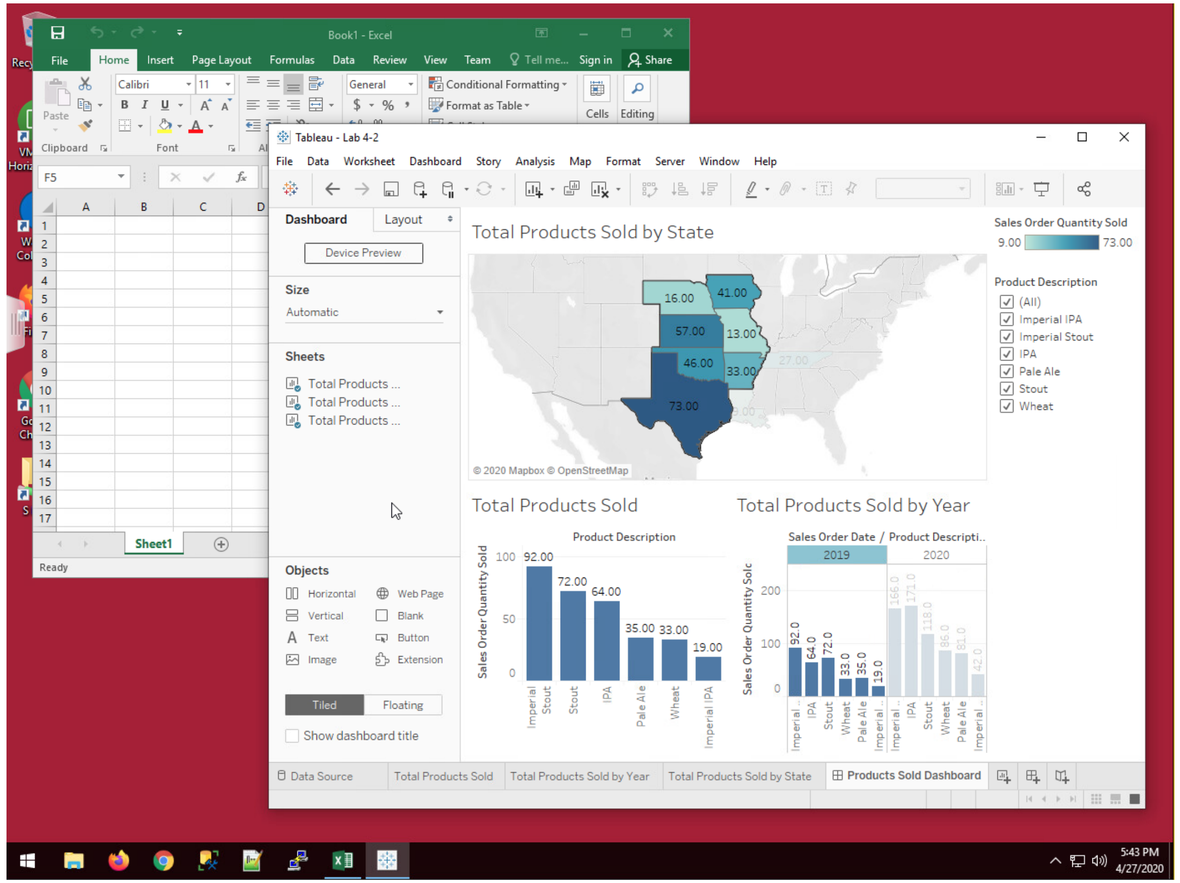


These are "slicers," which function as dynamic filters. Each item is a button that can be used to interactively filter the data in the dashboard.



Which software tools to start? Why use two tools?

- Excel
  (Can do all analysis needed for undergrad curriculum)
- Tableau (or Power BI)
  (For visualizations)

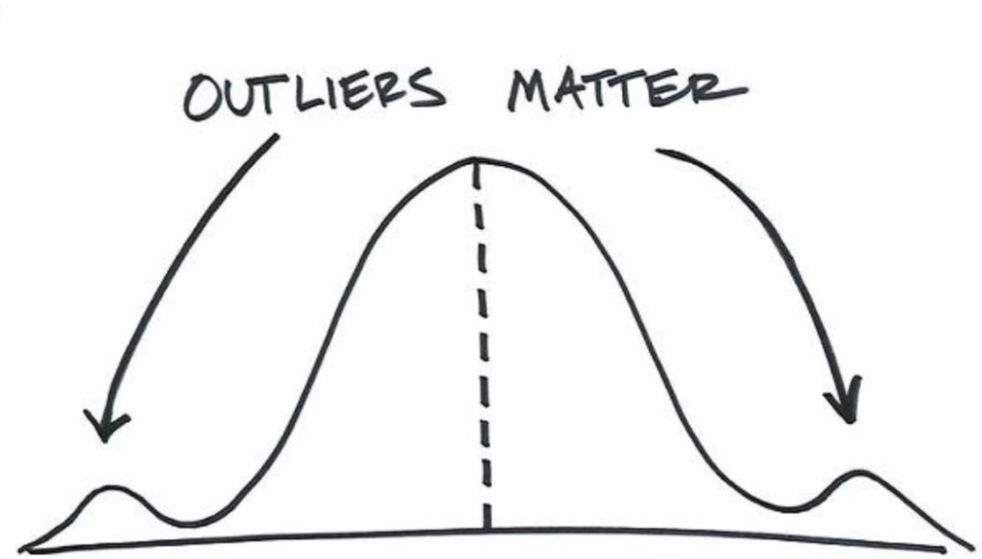


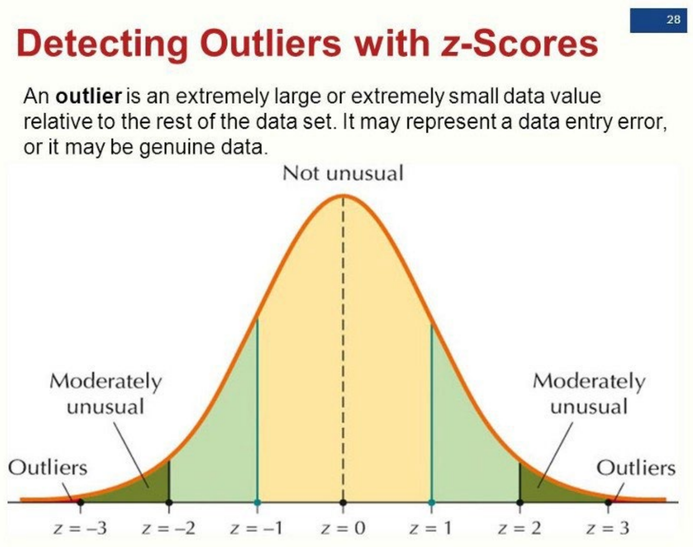
- Later, More Advanced?
  - SQL
  - Power BI:
    Power Query, Power Pivot
  - Alteryx,
  - Tableau Prep

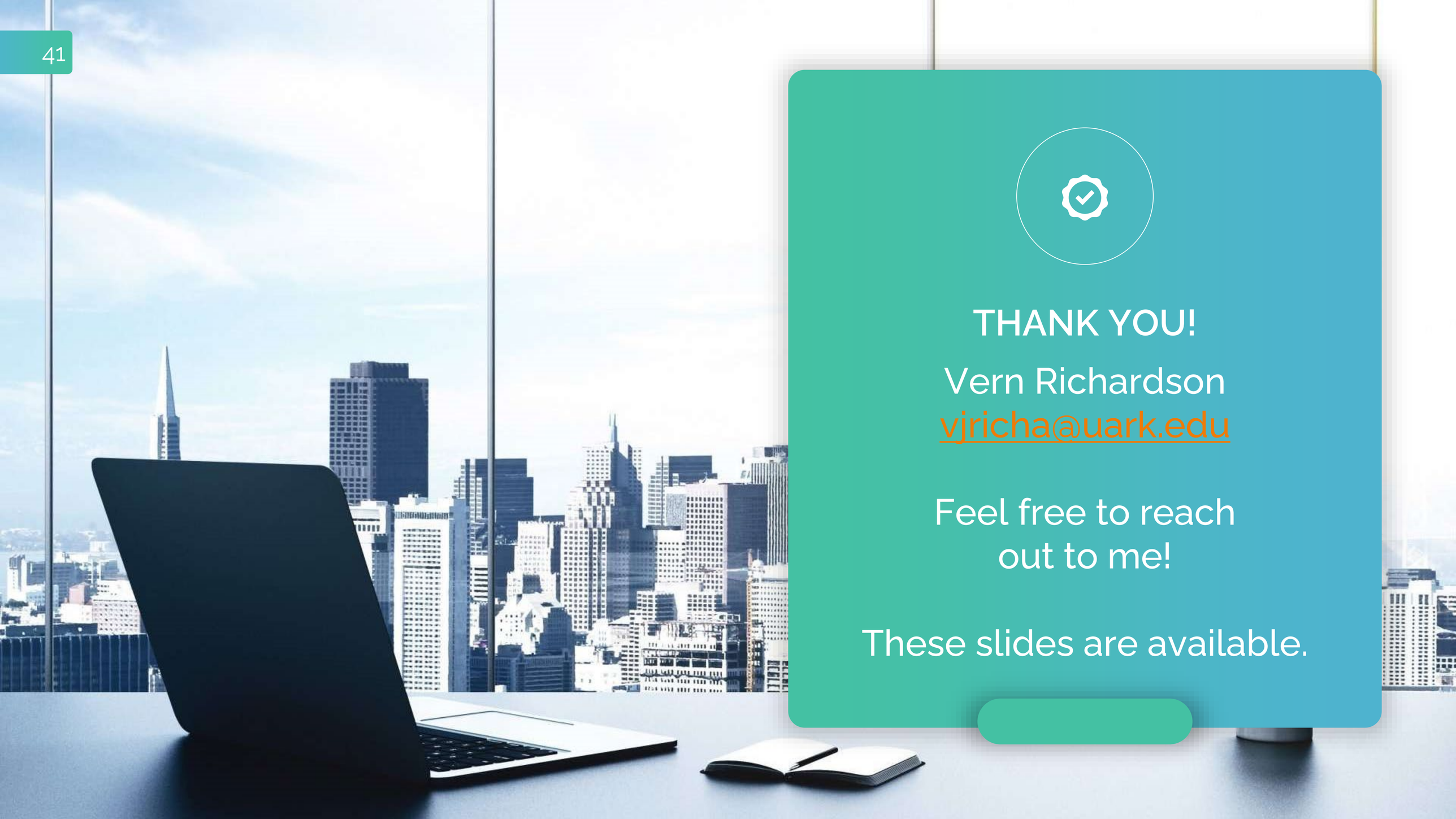
Biggest Barrier to Teaching Data Analytics in the Accounting Curriculum?

- Us - You and me. ☺

How will our students be able to evaluate outliers, if they've never plotted data?







THANK YOU!

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vjricha@uark.edu

Feel free to reach out to me!

These slides are available.