“Power” Tools for IR Reporting

Tim Metz and Alison Joseph

AIR Annual Forum 2015

- 10,382 students
- Master’s Comprehensive
- Mountain location
- Residential and Distance

2

Outcomes for workshop

You will:

- leave with a meaningful understanding of the capabilities of the "Power" tools from Microsoft
- learn basic techniques for leveraging multiple software systems to simplify and streamline reporting
- be able to apply basic techniques leveraging the power of Power Pivot, Power View, Power Map, and Power Query
- have a roadmap for reproducing these concepts into your own offices

3

Assumptions for workshop

- **Familiarity with Excel**
- **Comfortable with basic functions (SUM, IF, etc.)**
- **Desire to connect to “dynamic” data**

4

Why Pivot Tables

- Summarize large datasets
- Quickly add, remove, rearrange elements
- (Little to) No formula-writing
- Can be a basis for self-service data
- Can connect to a refreshable data source

5

Limitations of Pivot Tables

- Connected to only 1 table
- Formatting not maintained
- Calculated fields need to be created for each Pivot Table
- Can't count the way universities usually want to count
- Row limitation

6

Connecting to Data

7

Connecting to Data

- **Wide variety of data sources, including:**
  - Access
  - SQL Server
  - Text files (csv)
  - XML
  - OLEDB
  - Etc.

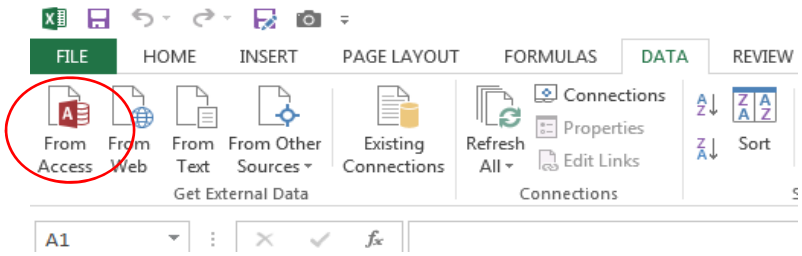
8

Connecting to Data

- **Connects to:**
  - Tables
  - Queries

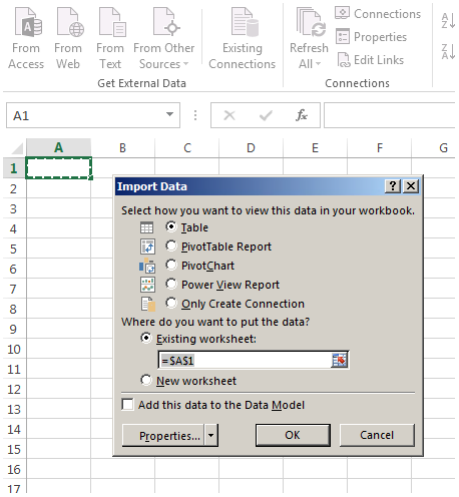
9

Connecting to Data



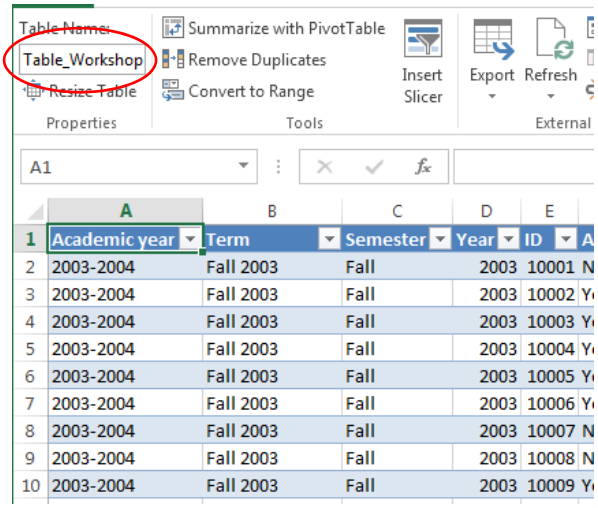
10

Connecting to Data



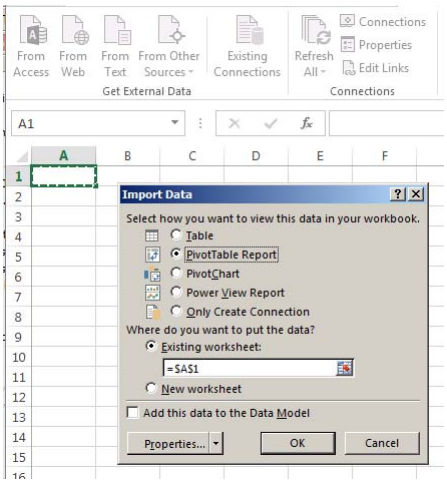
11

Connecting to Data



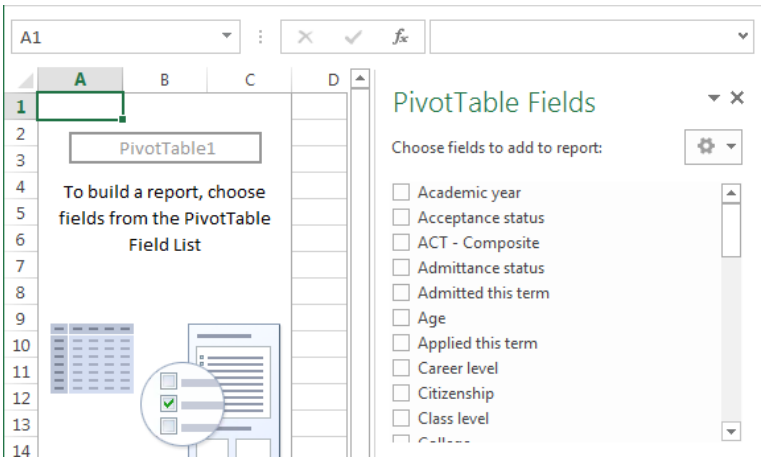
12

Connecting to Data



13

Connecting to Data



14

Connecting to Data

External Data Connections

Exercise 1.1

15

Connecting to Data

Data is connected

Now What?

16

Displaying Data –
Pivot Tables

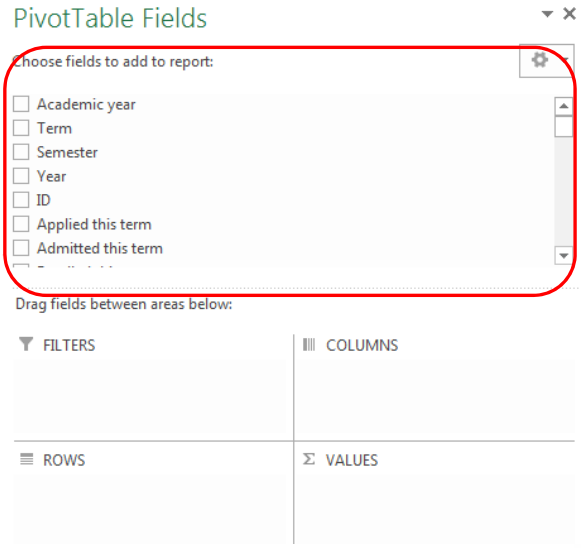
17

Displaying Data – Pivot Tables

1. Get a data source ✔
2. Insert a pivot table ✔
3. Populate pivot table grid

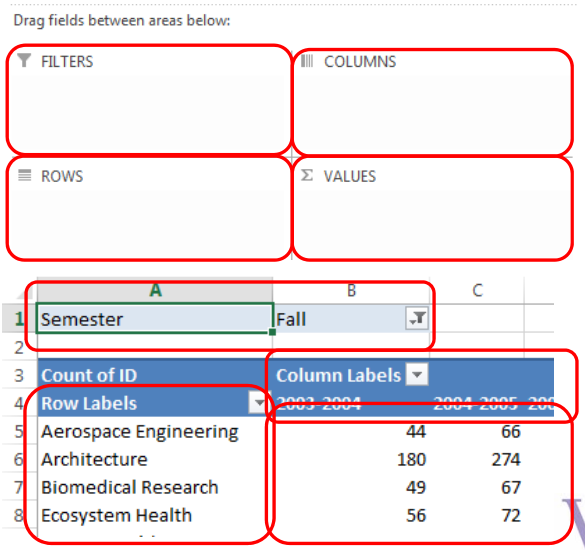
18

Displaying Data – Pivot Tables



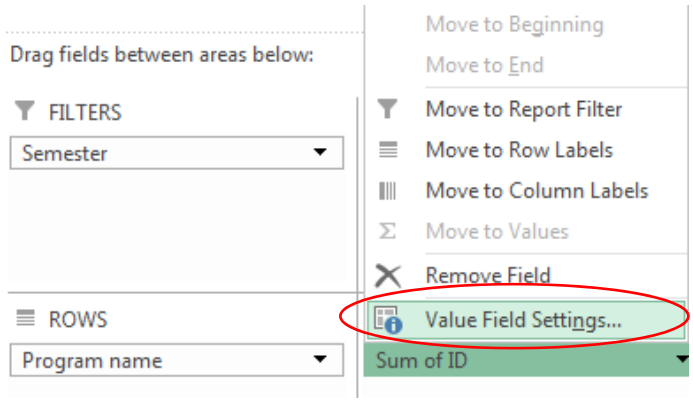
19

Displaying Data – Pivot Tables



20

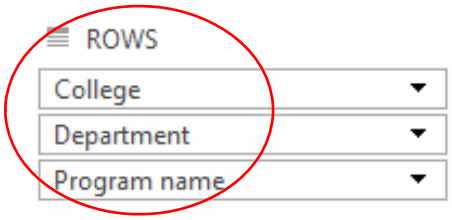
Displaying Data – Pivot Tables



Sum
Count
Average
Max
Min
Product
Count Numbers
StdDev
StdDevp
Var
Varp

21

Displaying Data – Pivot Tables



	A	B	C	D	E
1	Semester	Fall			
2					
3	Count of ID	Column Labels			
4	Row Labels	2003-2004	2004-2005	2005-2006	2006-2007
5	College of Information Studies	150	197	182	181
6	Information Management	115	154	139	145
7	Information Management	115	154	139	145
8	Library Science	35	43	43	36
9	Library Science	35	43	43	36

22

Displaying Data – Pivot Tables

Pivot Table Introduction

Exercise 2.1

Structure, Features, and Deficiencies of Pivot Tables

Exercise 2.2

23

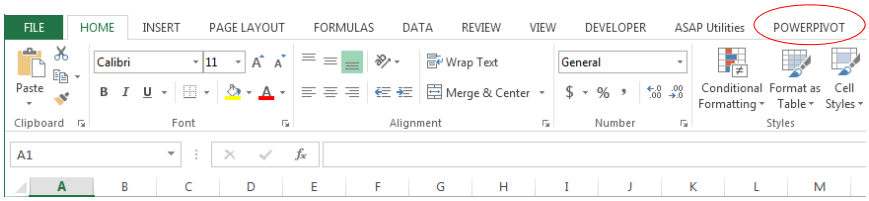
Displaying Data – Power Pivot

New and improved Pivot Tables!

24

Displaying Data – Power Pivot

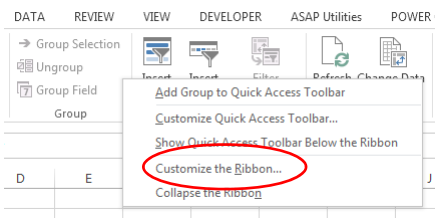
- **Set-up**

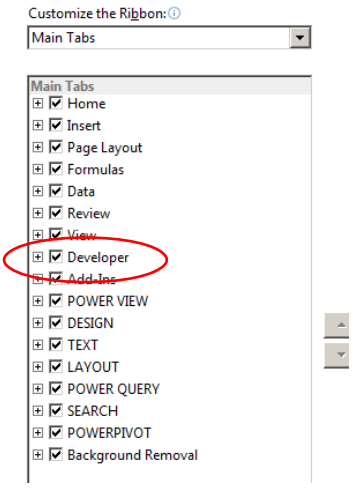


- Installed with Excel 2013
- Downloadable add-in for Excel 2010
- **Not available prior to Excel 2010**

25

Displaying Data – Power Pivot

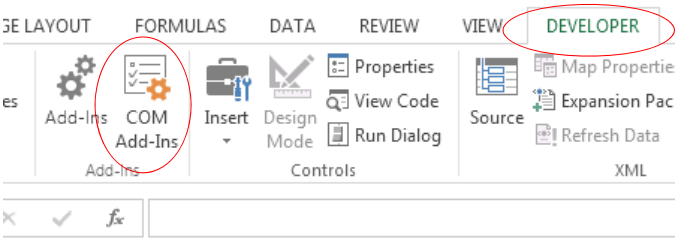




- Right-click on ribbon
- *Customize the ribbon*
- Select *Developer*

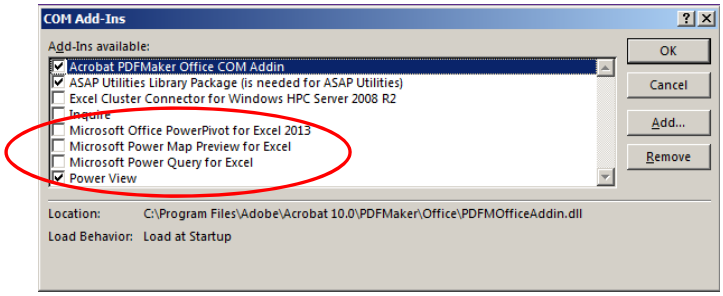
26

Displaying Data – Power Pivot



27

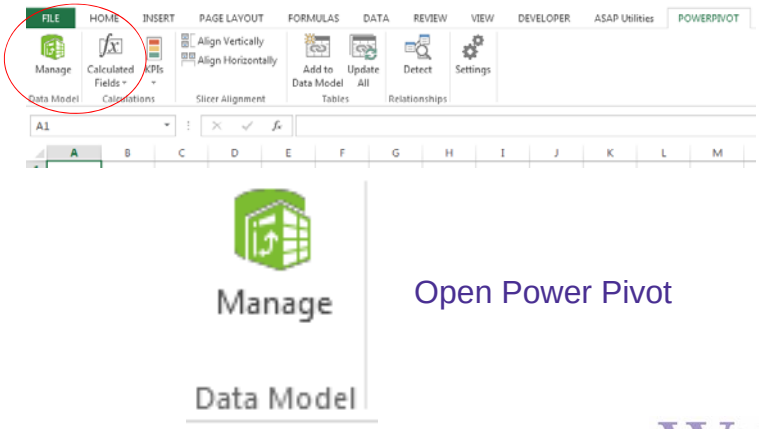
Displaying Data – Power Pivot



28

Displaying Data – Power Pivot

- **The Power Pivot environment**

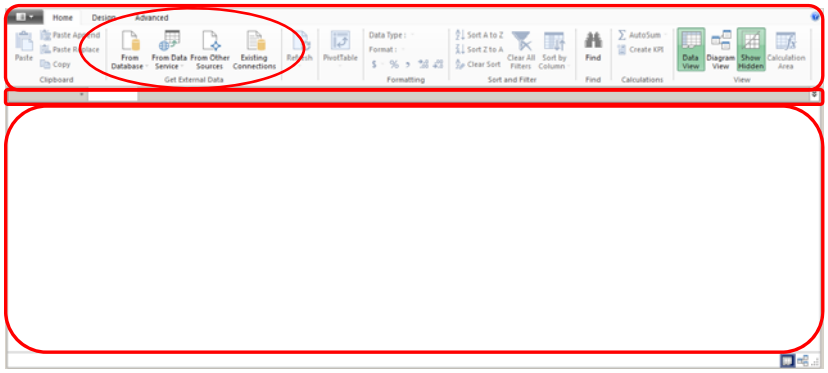


Open Power Pivot

29

Displaying Data – Power Pivot

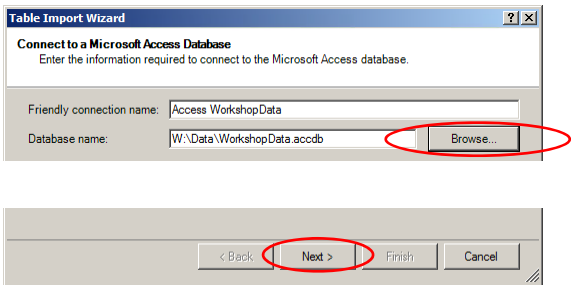
- **The Power Pivot environment**



30

Displaying Data – Power Pivot

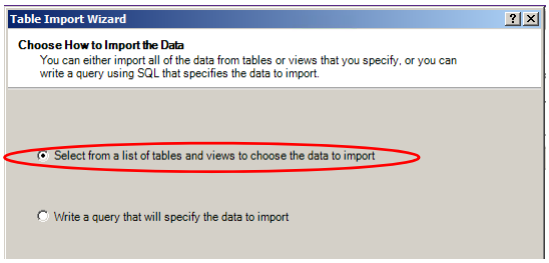
- Import data



31

Displaying Data – Power Pivot

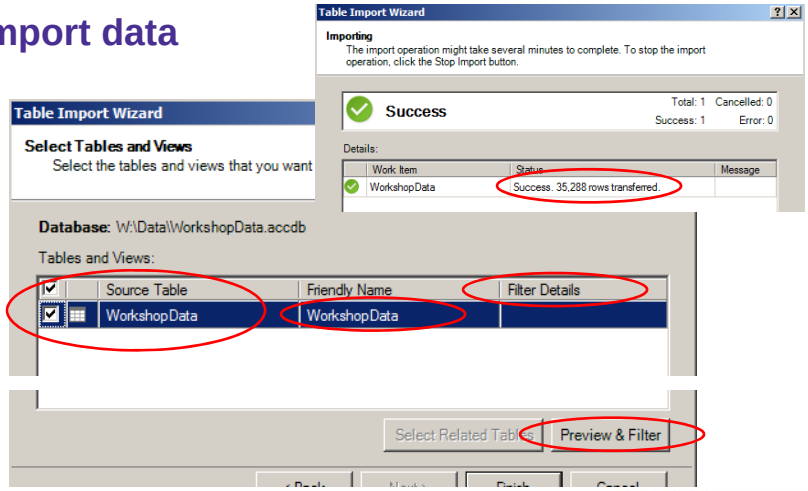
- Import data



32

Displaying Data – Power Pivot

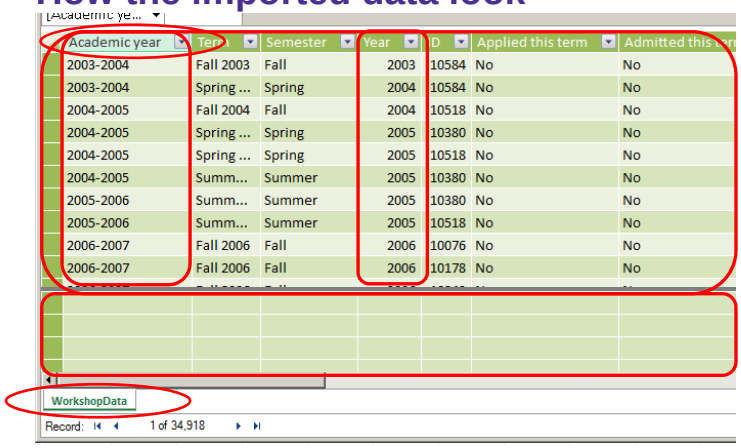
- Import data



33

Displaying Data – Power Pivot

- How the imported data look

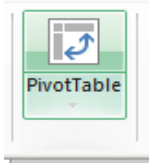


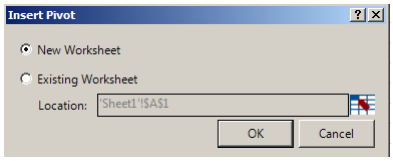
Academic year	Term	Semester	Year	ID	Applied this term	Admitted this term
2003-2004	Fall 2003	Fall	2003	10584	No	No
2003-2004	Spring ...	Spring	2004	10584	No	No
2004-2005	Fall 2004	Fall	2004	10518	No	No
2004-2005	Spring ...	Spring	2005	10380	No	No
2004-2005	Spring ...	Spring	2005	10518	No	No
2004-2005	Summ...	Summer	2005	10380	No	No
2005-2006	Summ...	Summer	2005	10380	No	No
2005-2006	Summ...	Summer	2005	10518	No	No
2006-2007	Fall 2006	Fall	2006	10076	No	No
2006-2007	Fall 2006	Fall	2006	10178	No	No

34

Displaying Data – Power Pivot

- **Bringing data into Excel**

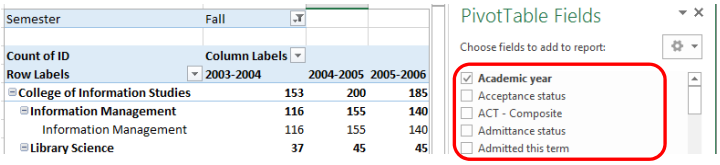


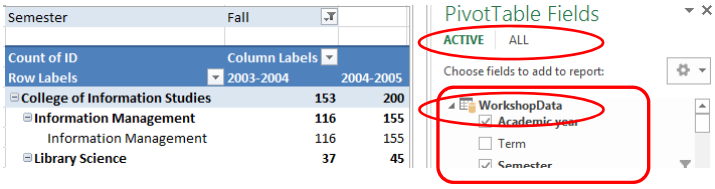


35

Displaying Data – Power Pivot

- **PivotTable vs. Power Pivot PivotTable**





36

Displaying Data – Power Pivot

Power Pivot Introduction

Exercise 3.1

37

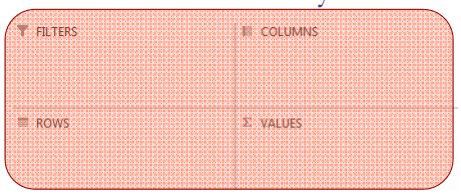
Displaying Data – Power Pivot

- **DAX**
  - Data Analysis Expressions (DAX)
  - Formula language for Power Pivot
  - Used to create **Calculated Columns** and **Calculated Fields**

38

Displaying Data – Power Pivot

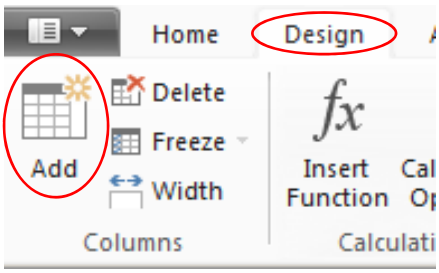
- **Calculated Columns**
  - Used to add an additional column to data table
  - Can be a column added from a related table (like a VLOOKUP) or new data, derived from existing data (sum to combined SAT, length of name, substring of longer string, etc.)
  - Column can be used in any area of the pivot

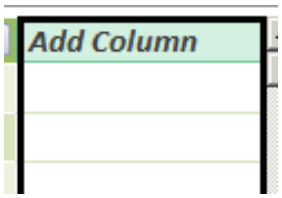


39

Displaying Data – Power Pivot

- **Adding a calculated column**

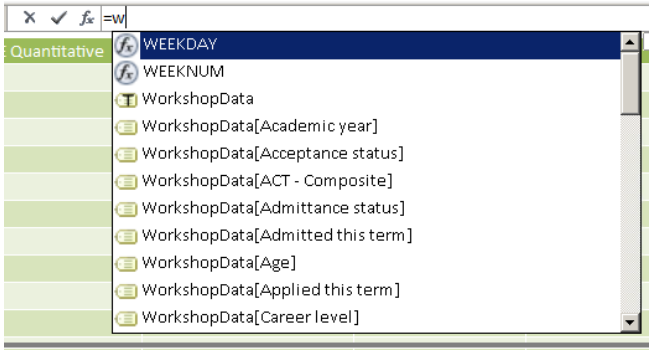




40

Displaying Data – Power Pivot

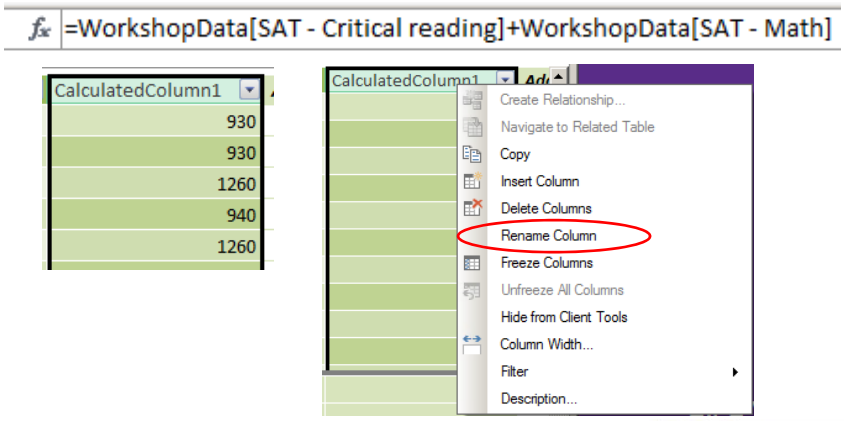
- **Adding a calculated column**



41

Displaying Data – Power Pivot

- **Adding a calculated column**



42

Displaying Data – Power Pivot

- **Adding a calculated column to pivot table**

	Column Labels		
	2003-2004		2004-20
Row Labels	Count of ID	Average SAT	Count o
College of Information Studies	**153**	**1062.592593**	
Information Management	**116**	**1081.188119**	
Information Management	116	1081.188119	
Library Science	**37**	**1007.352941**	
Library Science	37	1007.352941	
College of Journalism	**67**	**1045.5**	
Journalism	**67**	**1045.5**	
Journalism	67	1045.5	

43

Evaluation Contexts

- Row context
- Filter context

44

Evaluation Contexts

- Row context
  - The one row being evaluated
  - Automatic for calculated columns
  - Can be created in other ways as well (SUMX, AVERAGEX, etc.)
- Filter context

45

Row Context

fx =WorkshopData[SAT - Critical reading]+WorkshopData[SAT - Math]

mulative GPA	HS GPA	SAT - Critical reading	SAT - Math	SAT - Total	AC
3.13800001144409	3.150000...	540	390	930	
3.17499995231628	3.150000...	540	390	930	
3.53699994087219	4.559999...	520	740	1260	
1.8289999961853	3.25	510	430	940	
3.58999991416931	4.559999...	520	740	1260	
1.94900000095367	3.25	510	430	940	

46

Evaluation Contexts

- Row context
  - The one row being evaluated
  - Automatic for calculated columns
  - Can be created in other ways as well (SUMX, AVERAGEX, etc.)
- Filter context
  - The filters being applied by the pivot table
  - Filters can be explicit or implicit
  - Can add additional filters only with CALCULATE

47

Filter Context

Semester	Fall	
	Column Labels	
	2003-2004	200
Row Labels	Count of ID	Average SAT Cou
College of Information Studies	153	1062.592593
Information Management	116	1081.188119
Information Management	116	1081.188119
Library Science	37	1007.352941
Library Science	37	1007.352941
College of Journalism	67	1045.5

48

Displaying Data – Power Pivot

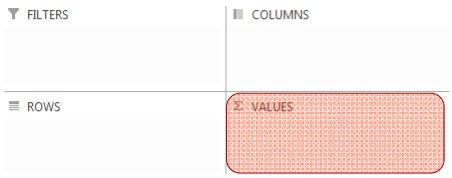
DAX & Calculated Columns Introduction

Exercise 3.2

49

Displaying Data – Power Pivot

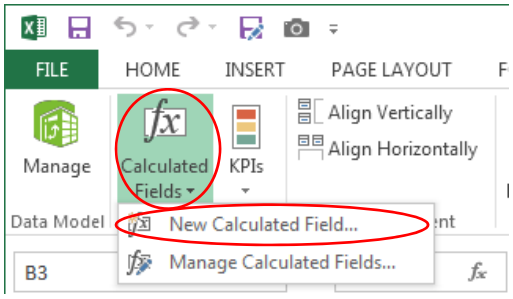
- **Calculated Fields**
  - Used to add a calculated element
  - Aggregate function that applies to whole table, column, or range
  - Something that needs to be recalculated
  - Fields can only be used in the VALUES section



50

Displaying Data – Power Pivot

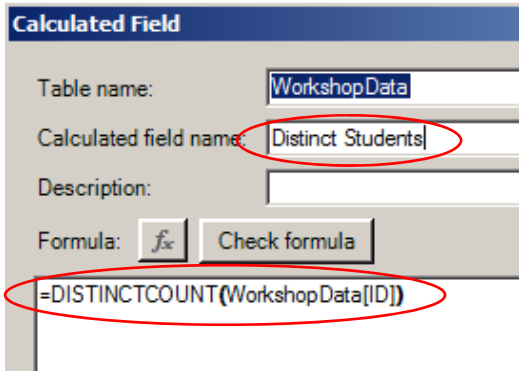
- **Adding a Calculated Field**



51

Displaying Data – Power Pivot

- **Adding a Calculated Field**



52

Displaying Data – Power Pivot

- **DISTINCTCOUNT**

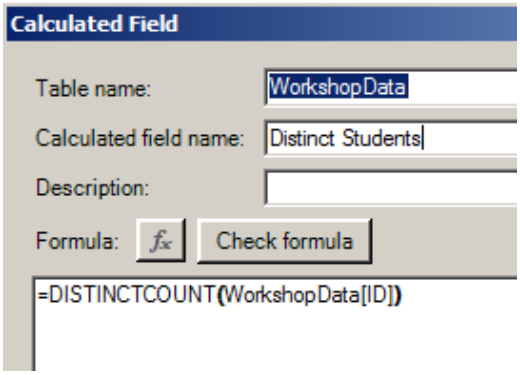
  DISTINCTCOUNT(<column>)

  – Counts unique values in column

53

Displaying Data – Power Pivot

- **Adding a Calculated Field**



54

Displaying Data – Power Pivot

- **Adding a Calculated Field**

Row Labels	Column Labels 2003-2004 Count of ID	Distinct Students
College of Information Studies	153	152
Information Management	116	116
Information Management	116	116
Library Science	37	37

55

Displaying Data – Power Pivot

- **Calculated Field in Power Pivot**

2004-2005	Fall 2
2004-2005	Sprin
Distinct Students: 5332	

WorkshopData

Distinct Students:=DISTINCTCOUNT(WorkshopData[ID])

Term	Semester	Year	ID	Applied this tern

56

Displaying Data – Power Pivot

DAX & Calculated Fields Introduction

Exercise 3.3

57

Displaying Data –
Power Pivot

DAX
CALCULATE, ALL, FILTER

58

Displaying Data – Power Pivot: DAX CALCULATE

- **CALCULATE**

CALCULATE(expression, <filter1>, <filter2>…)

- Supercharged SUMIFS
- Allows filtering (IFs) on any aggregate function (imagine "MAXIFS", "MEDIANIFS", etc.)
- Operators for filters: =, <, >, <=, >=, <>
- Can also use || in filter on same column

59

Displaying Data – Power Pivot: DAX CALCULATE

```
First-time Freshmen Distinct Students:=
    CALCULATE(
      [Distinct Students],
      WorkshopData[Class level]="Freshman",
      WorkshopData[Is new student this term]="Yes"
    )
```

60

Displaying Data – Power Pivot: DAX CALCULATE

Row Labels	Column Labels 2003-2004 Distinct Enrolled Students	First-time Freshmen Distinct Students	First-t
Aerospace Engineering	**44**	**10**	
Freshman	**12**	**10**	
No	2	10	
Yes	10	10	
Sophomore	**15**	**10**	
No	12	10	
Yes	3	10	
Junior	**9**	**10**	
No	6	10	

61

Displaying Data – Power Pivot: DAX CALCULATE

DAX - CALCULATE

Exercise 3.4

62

Displaying Data – Power Pivot: DAX ALL

- **ALL**

ALL(table_or_column, <column1>, <column2>, …)

– Returns all the rows in a table, or all the values in a column, removing any filters that might have been applied

63

Displaying Data – Power Pivot: DAX ALL

```
All Distinct Enrolled Students:=
  CALCULATE(
    [Distinct Enrolled Students],
    ALL( WorkshopData[Class level] )
  )
```

64

Displaying Data – Power Pivot: DAX ALL

Row Labels	2009-2010 Distinct Enrolled Students	All Distinct Enrolled Students
Aerospace Engineering	**107**	**107**
Freshman	18	107
Sophomore	13	107
Junior	37	107
Senior	39	107
Architecture	**276**	**276**
Freshman	40	276

65

Displaying Data – Power Pivot: DAX ALL

```
% of All Distinct Enrolled Students:=
  DIVIDE([Distinct Enrolled Students],
     [All Distinct Enrolled Students] )
```

66

Displaying Data – Power Pivot

- **DIVIDE**

  DIVIDE(<num>, <den>, [<alt>])

  – "Safe" divide

  – Can specify alternate result for divide by zero

67

Displaying Data – Power Pivot

Row Labels	2009-2010 Distinct Enrolled Students	% of All Distinct Enrolled Students	2010 Dist
Aerospace Engineering	**107**	**100.00 %**	
Freshman	18	16.82 %	
Sophomore	13	12.15 %	
Junior	37	34.58 %	
Senior	39	36.45 %	
Architecture	**276**	**100.00 %**	
Freshman	40	14.49 %	

68

Displaying Data – Power Pivot: DAX ALL

DAX - ALL

Exercise 3.5

69

Displaying Data – Power Pivot: DAX FILTER

- **FILTER**

FILTER(TableToFilter, FilterExpression)

– Returns a table filtered by FilterExpression

70

Displaying Data – Power Pivot: DAX CALCULATE

```
Above Average GPA Enrolled Undergraduates:=

   CALCULATE(

      [Distinct Enrolled Students],

      FILTER(

         WorkshopData,

         WorkshopData[Institutional cumulative GPA] >
               [Average GPA Enrolled Undergraduates]
         )

   )
```

71

Displaying Data – Power Pivot: DAX CALCULATE

Row Labels	2003-2004 Distinct Enrolled Students	Average GPA Enrolled Undergraduates
College of Information Studies	152	2.922505829
Information Management	116	2.922505829
Information Management	116	2.922505829
Library Science	37	2.922505829
Library Science	37	2.922505829
College of Journalism	66	2.922505829
Journalism	66	2.922505829

72

Displaying Data – Power Pivot: DAX FILTER

Row Labels	Column Labels 2003-2004 Distinct Enrolled Students	% Above Average GPA Enrolled Undergraduates	2004-: Distin
College of Information Studies	**152**	**42.11 %**	
Information Management	**116**	**44.83 %**	
Information Management	116	44.83 %	
Library Science	**37**	**32.43 %**	
Library Science	37	32.43 %	
College of Journalism	**66**	**45.45 %**	
Journalism	**66**	**45.45 %**	
Journalism	66	45.45 %	

73

Displaying Data – Power Pivot: DAX FILTER

- **ALLEXCEPT**

ALLEXCEPT(<table>, <column>[, <column>…])

– Similar to ALL function, but excludes the column(s) specified from the ALL

74

Displaying Data – Power Pivot: DAX FILTER

```
=CALCULATE(
  AVERAGE( WorkshopData[Institutional cumulative GPA] ),
  ALLEXCEPT( WorkshopData, WorkshopData[Semester] ),
  WorkshopData[Career level]="Undergraduate",
  WorkshopData[Enrolled this term]="Yes“
)
```

75

Displaying Data – Power Pivot: DAX FILTER

DAX - FILTER

Exercise 3.6

76

Displaying Data –
Power Map &
Power View

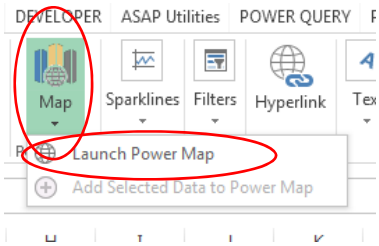
77

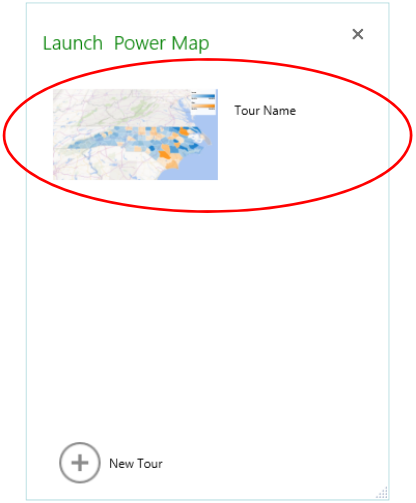
Displaying Data – Power Map

- **Power Map**
  - Automated way to map geographic data
  - Doesn't require geo-location information like longitude and latitude (just country, state, or county names)
  - Can add elements to look at aggregate function on variables across physical space

78

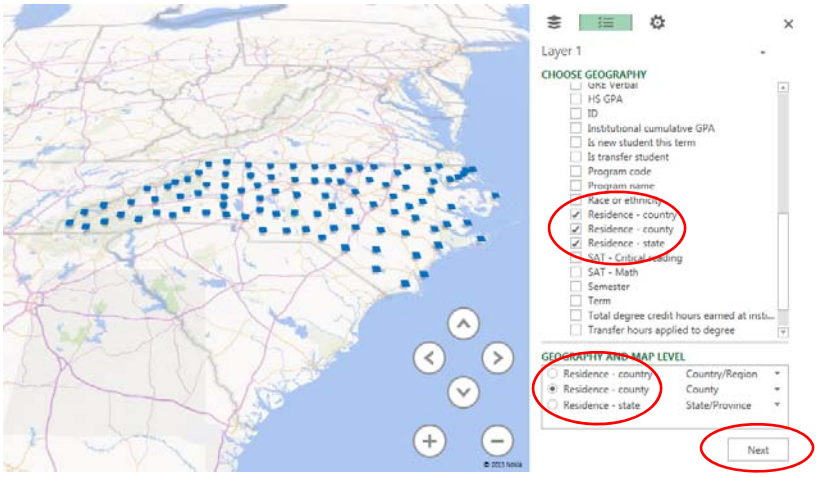
Displaying Data – Power Map





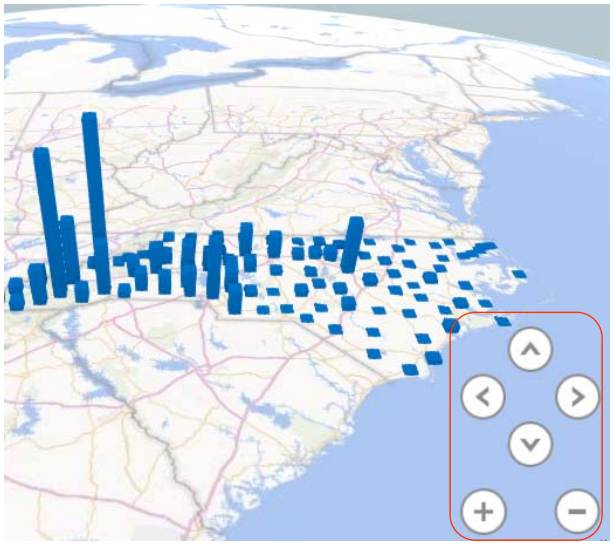
79

Displaying Data – Power Map



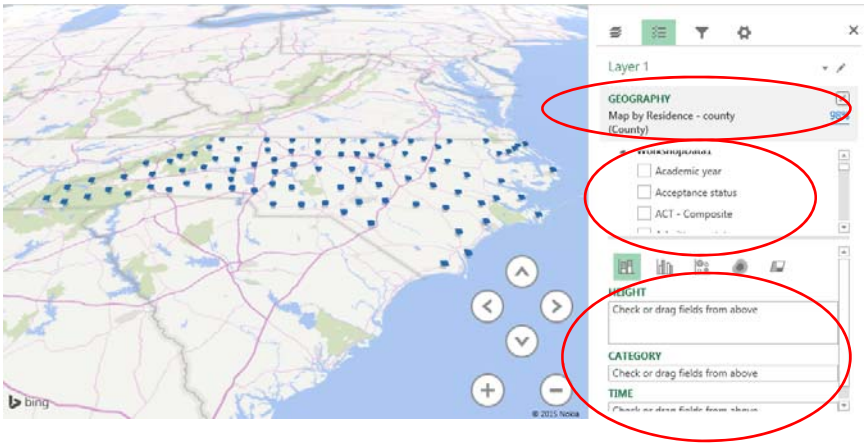
80

Displaying Data – Power Map



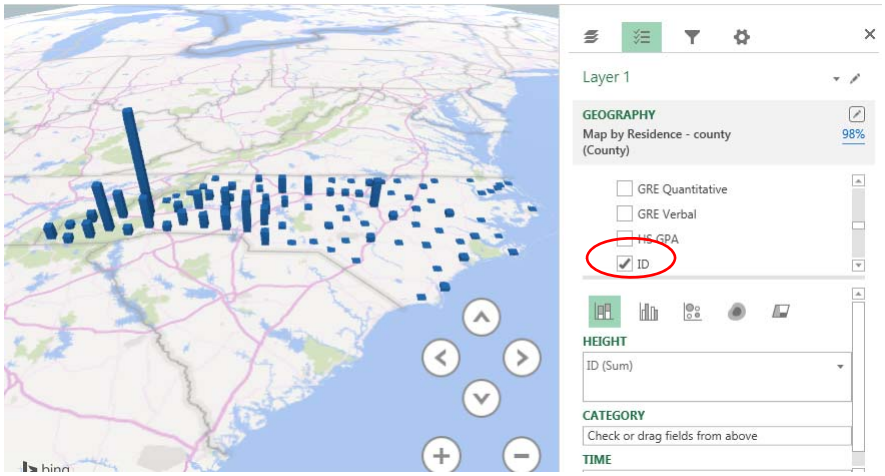
81

Displaying Data – Power Map



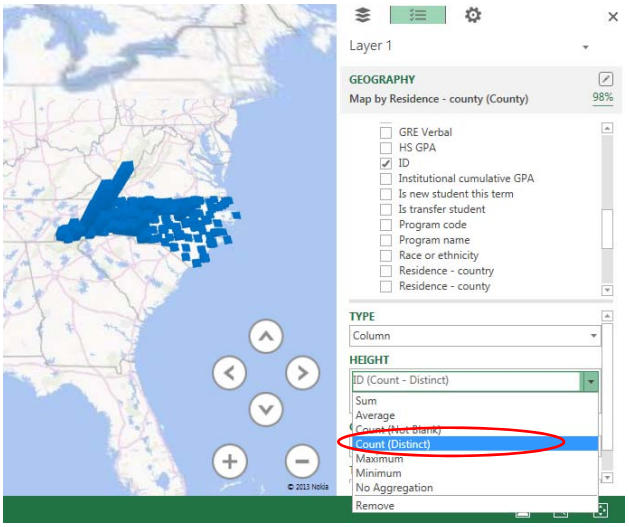
82

Displaying Data – Power Map



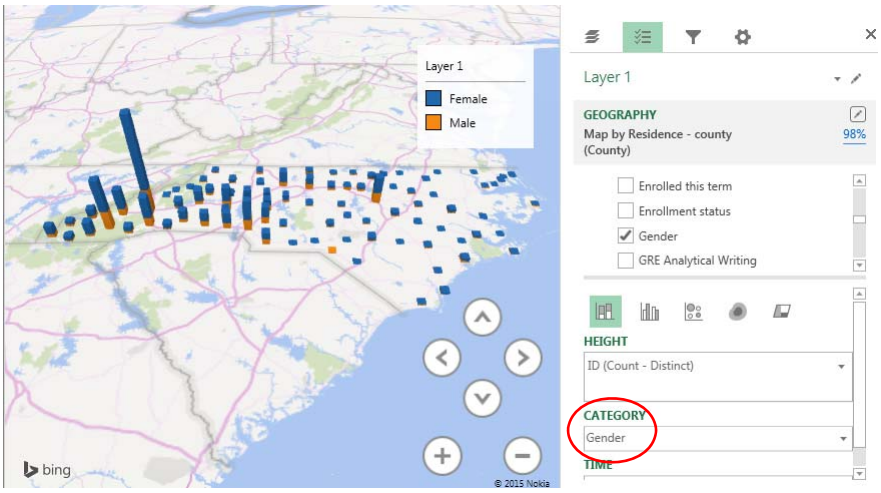
83

Displaying Data – Power Map



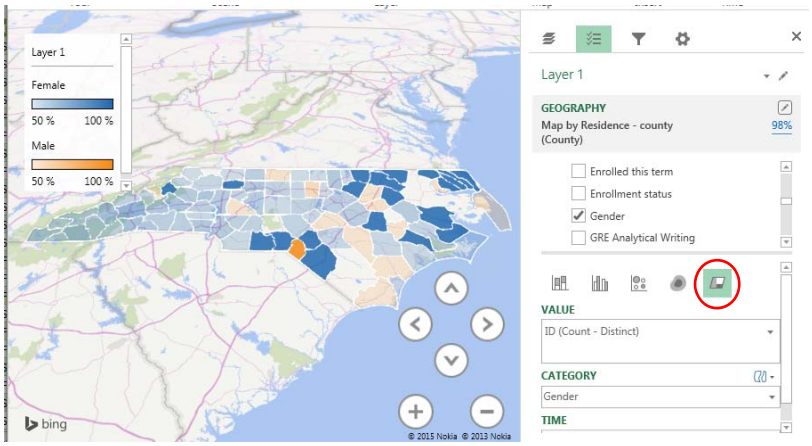
84

Displaying Data – Power Map



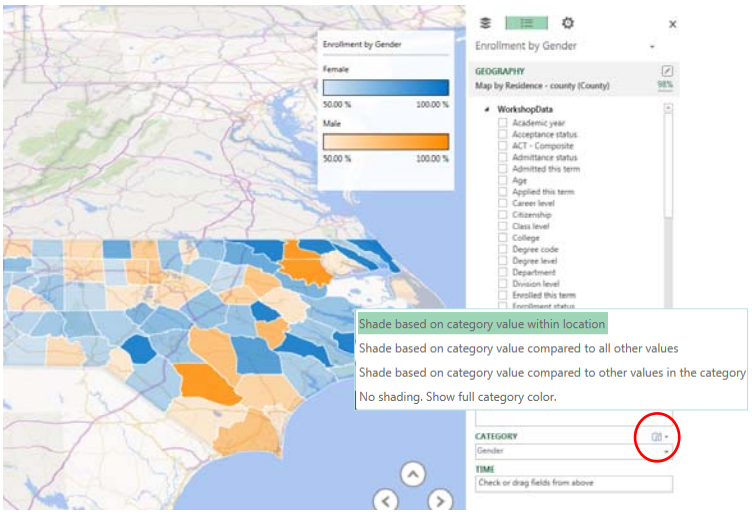
85

Displaying Data – Power Map



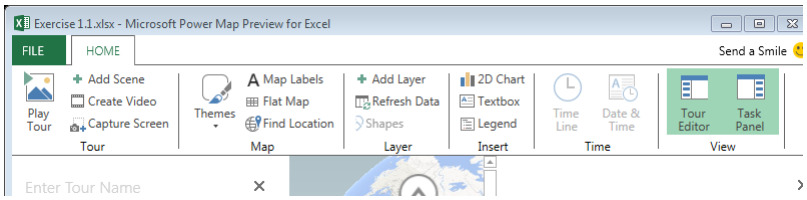
86

Displaying Data – Power Map



87

Displaying Data – Power Map



88

Displaying Data – Power Map

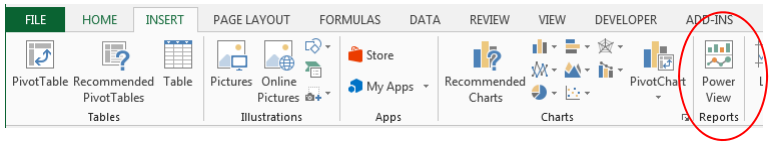
Power Map

Exercise 4.1

89

Displaying Data – Power View

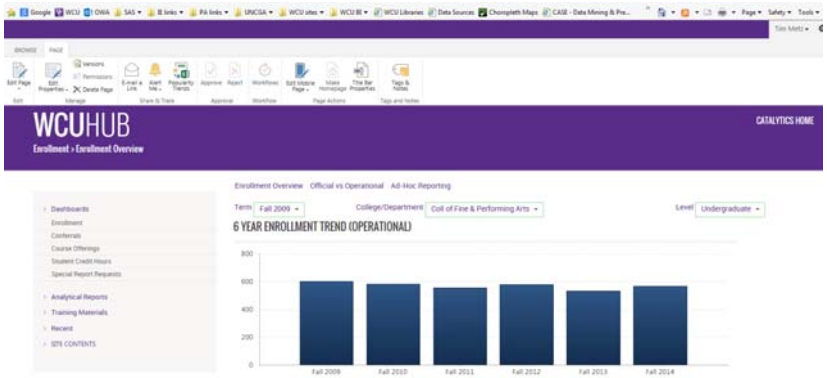
- **Power View**
  - Dashboard builder
  - Allows synchronized filtering
  - Bring together tables, graphs, maps



90

Displaying Data – Power View

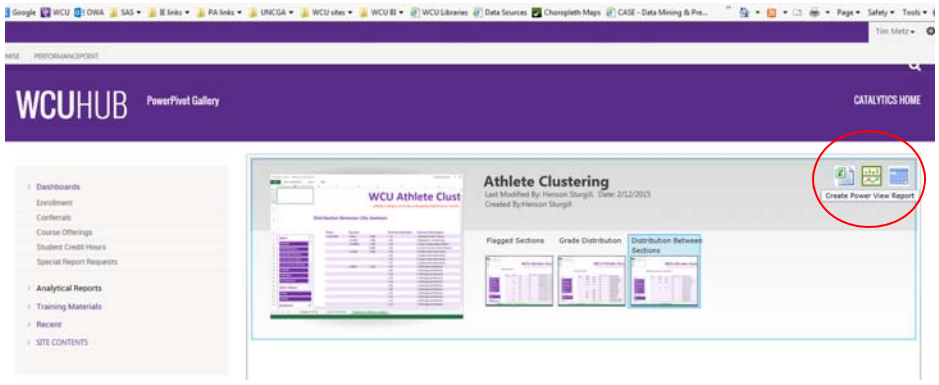
- **Use in conjunction with Power Pivot to create a self-service BI tool in SharePoint**



91

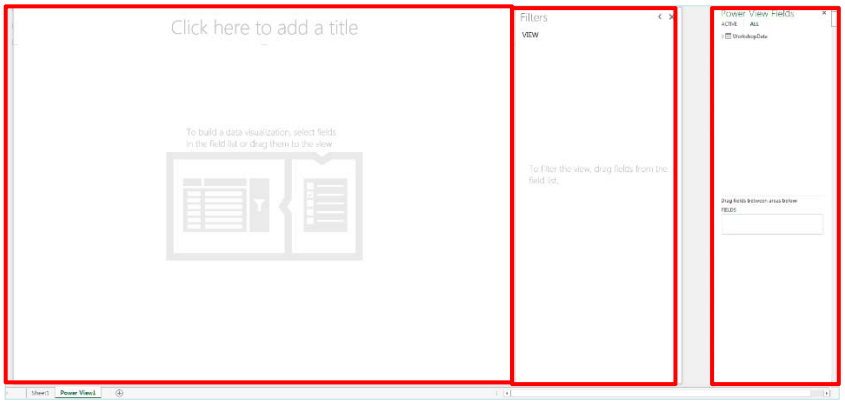
Displaying Data – Power View

- **Create Power View reports directly in Share Point Server as well as in Excel**



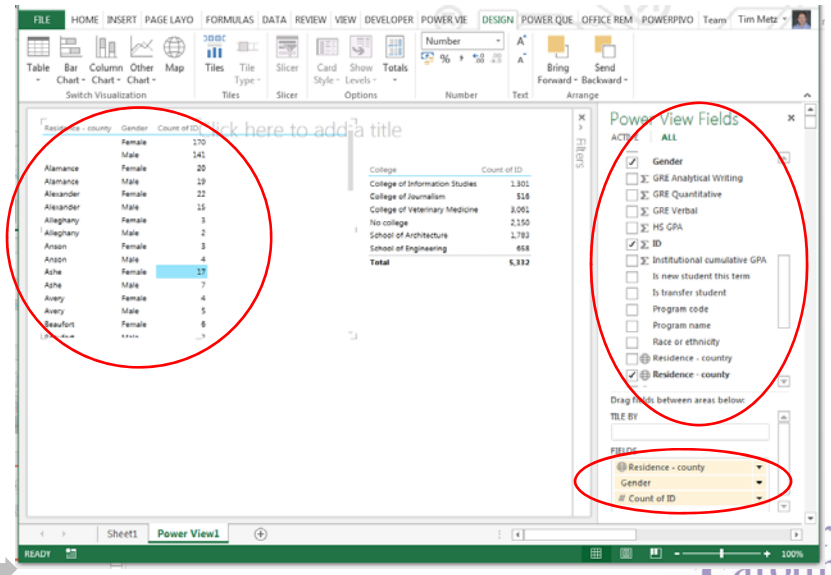
92

Displaying Data – Power View



93

Displaying Data – Power View

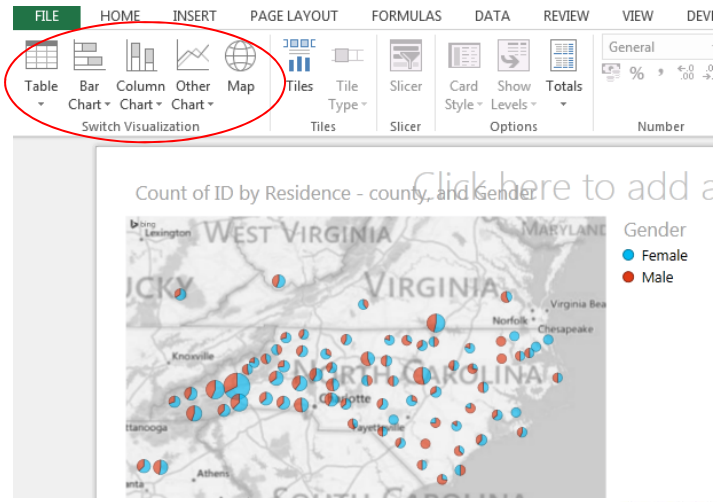


94

Displaying Data – Power View

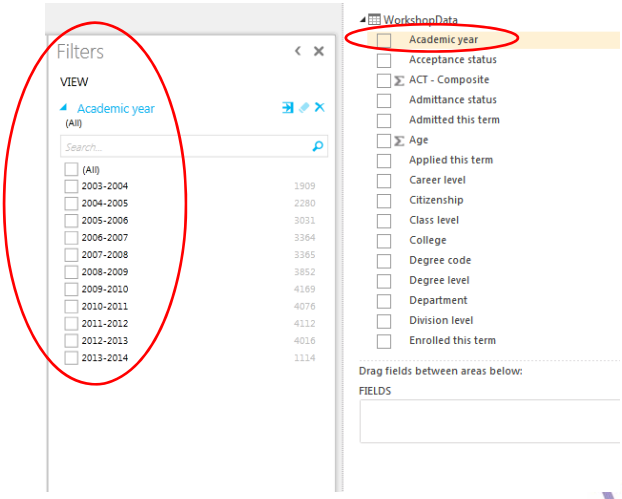
95

Displaying Data – Power View



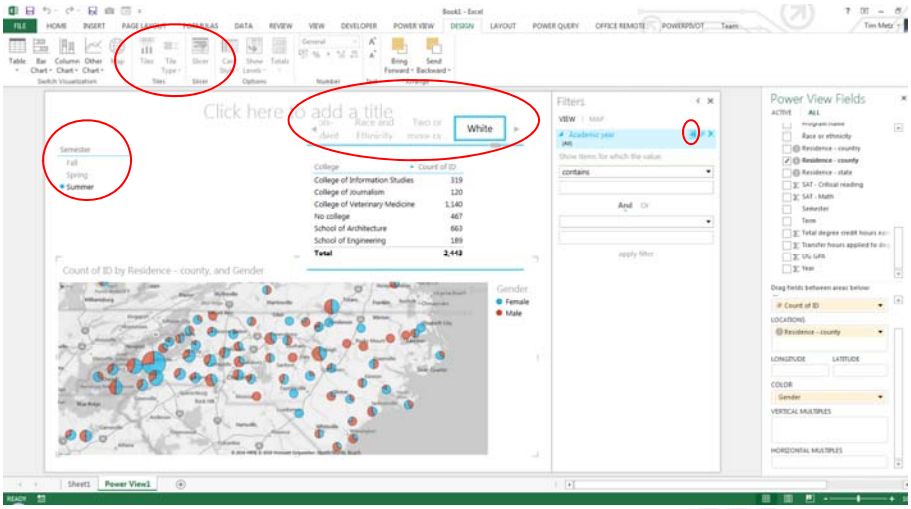
96

Displaying Data – Power View



97

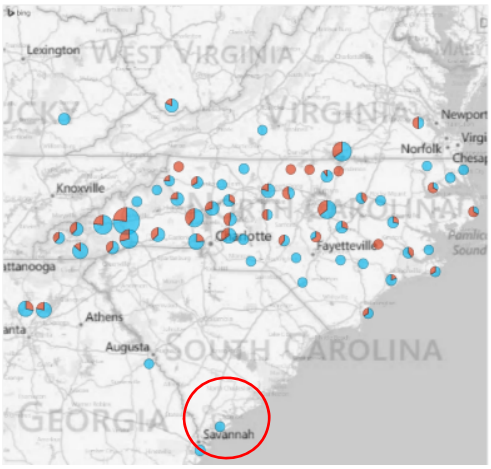
Displaying Data – Power View



98

Displaying Data – Power View

Count of ID by Residence - county, and Gender



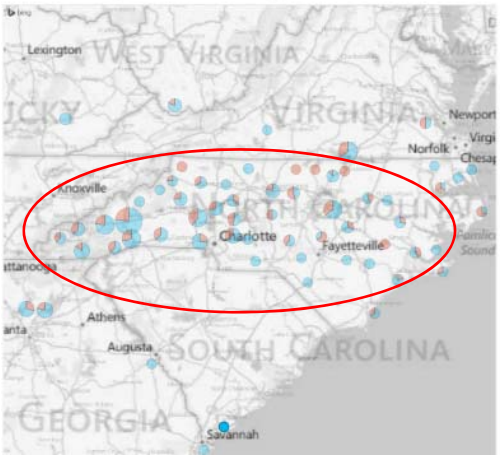
Gender
- Female
- Male

College	Count of ID
College of Information Studies	154
College of Journalism	34
College of Veterinary Medicine	611
No college	35
School of Architecture	181
School of Engineering	91
Total	**1,100**

99

Displaying Data – Power View

Count of ID by Residence - county, and Gender

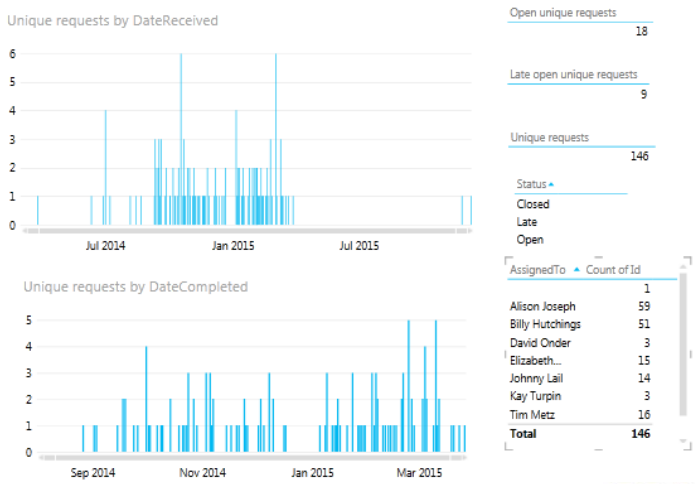


Gender
- Female
- Male

College	Count of ID
College of Veterinary Medicine	2
Total	**2**

100

Displaying Data – Power View (Example)



101

Displaying Data – Power Map and Power View

Power View

Exercise 4.2

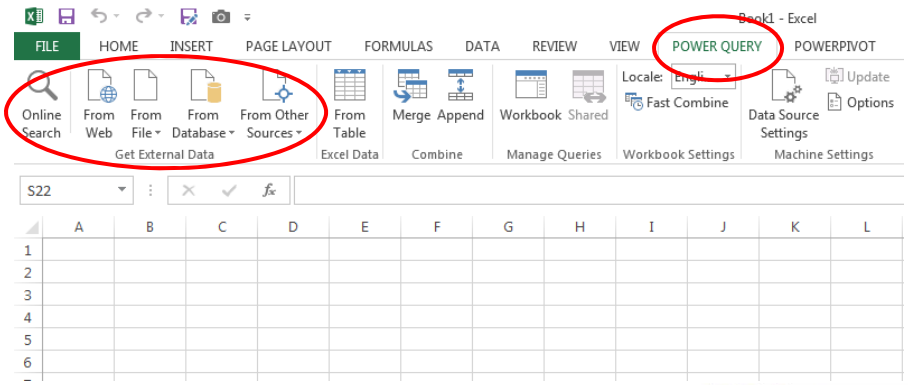
102

Power Query

103

Power Query data sources

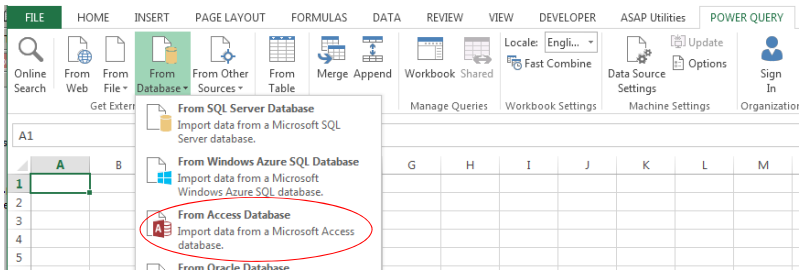
- Retrieve data from a variety of external sources (web searches, webpages, files, databases, and more)



104

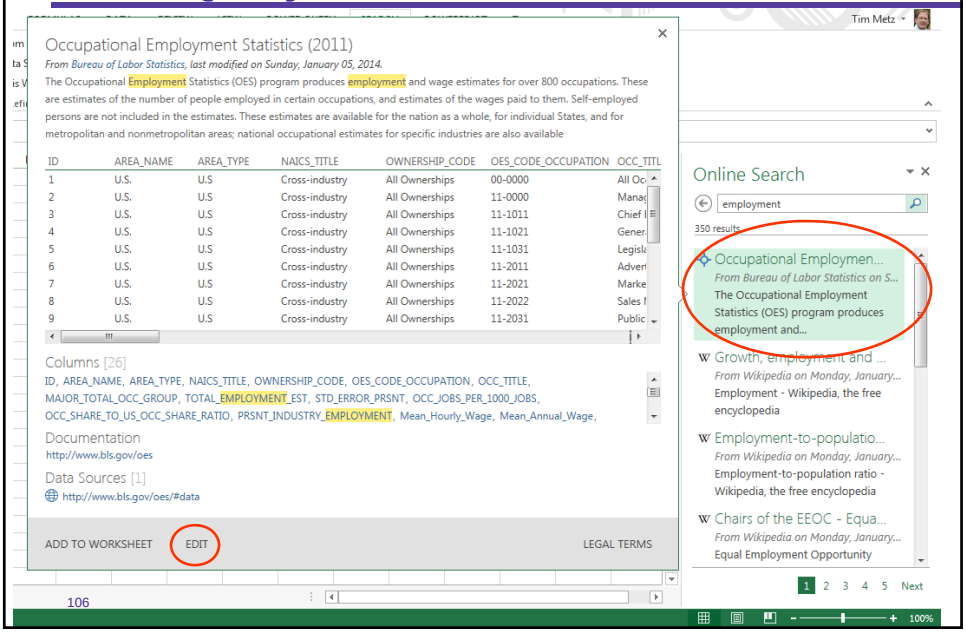
Power Query data sources

- **Microsoft SQL Server and Access**



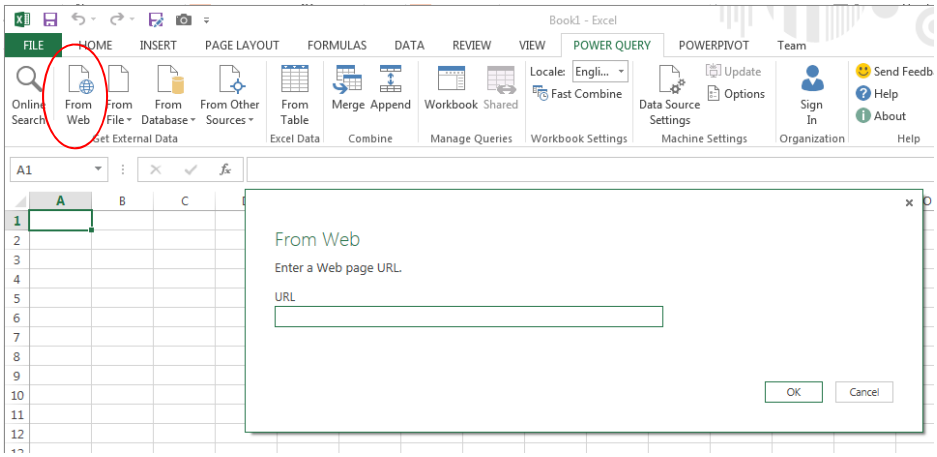
105

Power Query data sources: Online Search



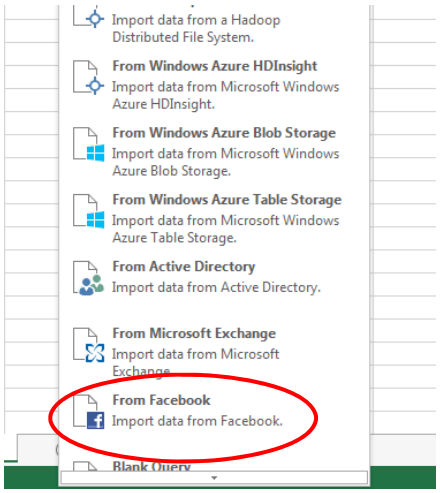
106

Power Query data sources: Web page URLs



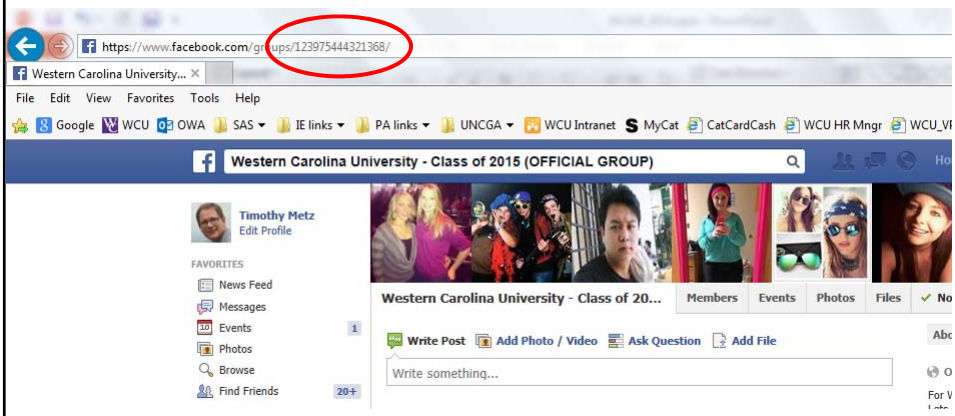
Power Query data sources

- **Access to sources of data not readily available to Power Pivot**



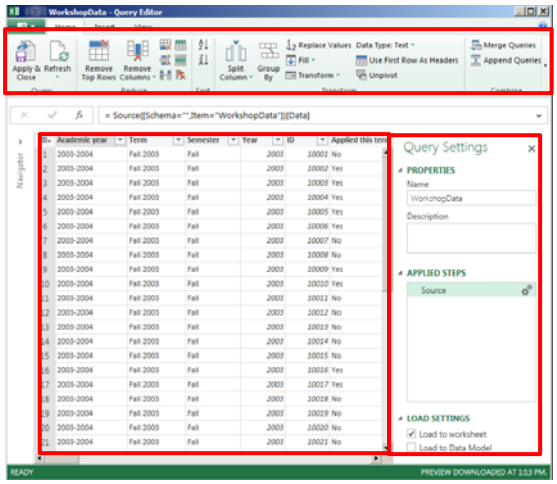
Power Query data sources

- **Facebook pages and groups**



109

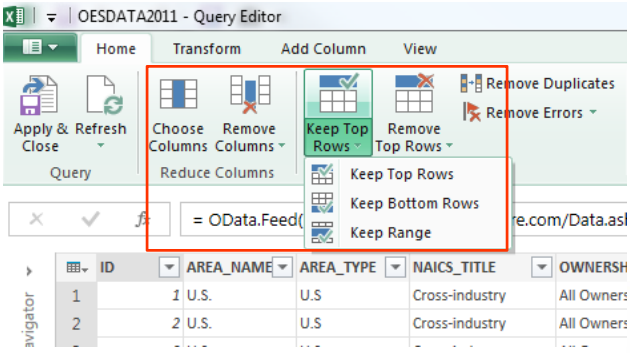
Power Query preview (Query Editor)



110

Power Query features

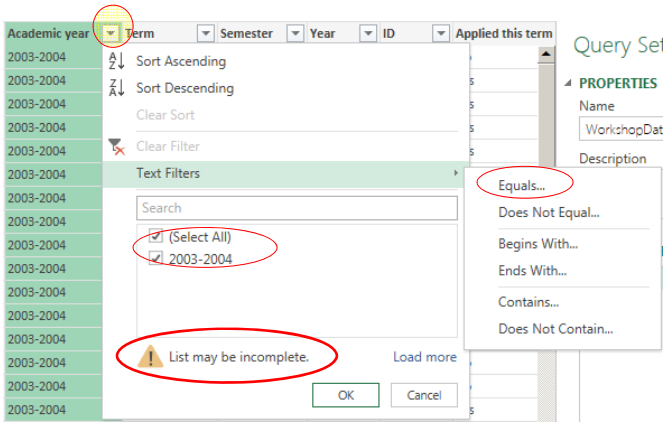
- Limit the data you bring into your model
  - Keep you model to a reasonable size (< 1M records) to prevent processing problems
  - Bring in only what you need



111

Power Query features

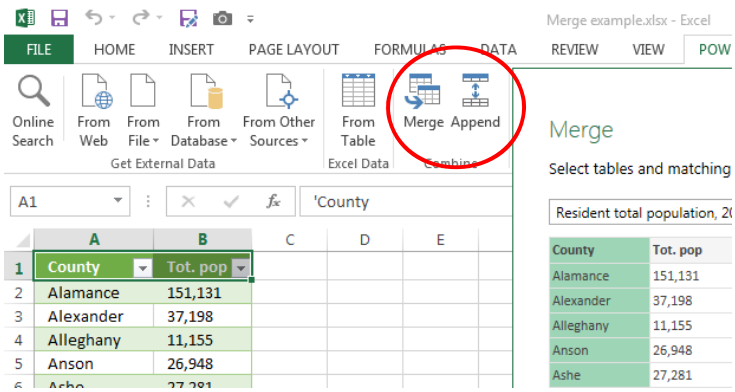
- Filter on rows and columns



112

Power Query features

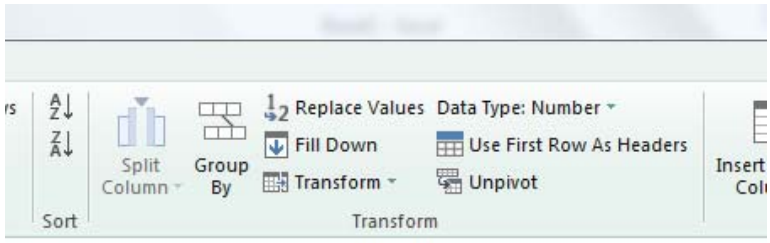
- **Consolidate multiple tables into one**



113

Power Query features

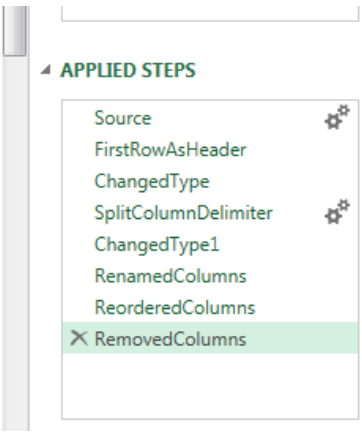
- Consolidate multiple tables into one
- **In-line data transformations**



114

Power Query features

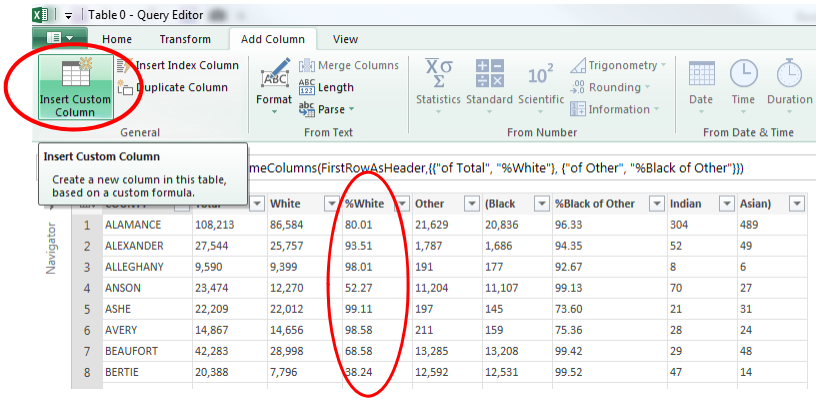
- Consolidate multiple tables into one
- In-line data transformations
- **All transformation steps are listed, and reversible**



115

Power Query features

- **Insert custom formula-based columns**

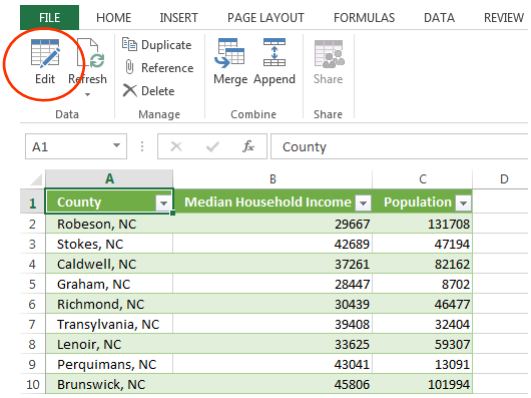


			White	%White	Other	(Black	%Black of Other	Indian	Asian)
1	ALAMANCE	108,213	86,584	80.01	21,629	20,836	96.33	304	489
2	ALEXANDER	27,544	25,757	93.51	1,787	1,686	94.35	52	49
3	ALLEGHANY	9,590	9,399	98.01	191	177	92.67	8	6
4	ANSON	23,474	12,270	52.27	11,204	11,107	99.13	70	27
5	ASHE	22,209	22,012	99.11	197	145	73.60	21	31
6	AVERY	14,867	14,656	98.58	211	159	75.36	28	24
7	BEAUFORT	42,283	28,998	68.58	13,285	13,208	99.42	29	48
8	BERTIE	20,388	7,796	38.24	12,592	12,531	99.52	47	14

116

Power Query features

- **Queries can be re-edited, merged and appended as needed**



	A	B	C	D
1	County	Median Household Income	Population	
2	Robeson, NC	29667	131708	
3	Stokes, NC	42689	47194	
4	Caldwell, NC	37261	82162	
5	Graham, NC	28447	8702	
6	Richmond, NC	30439	46477	
7	Transylvania, NC	39408	32404	
8	Lenoir, NC	33625	59307	
9	Perquimans, NC	43041	13091	
10	Brunswick, NC	45806	101994	

117

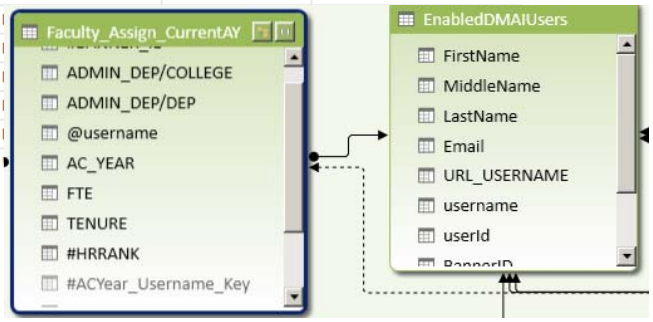
Power Query – Example

- **Connect to online faculty database**
  - Import active users from Digital Measures
  - Merge with local data
  - Export updated data to Digital Measures

118

Power Query – Example

	FirstName	MiddleName	LastName	Email
1	Millicent	H	Abel	abel@email.wcu.edu
2	Yogita	null	Abichandani	yabichandani@email.wcu.edu
3	Susan	M	Abram	smabram@email.wcu.edu
4	J.	P	Acheson	pacheson@email.wcu.edu
5	Michele	null	Acker-Hocevar	ackerhocevar@email.wcu.edu
6	Warren			
7	Andrew			
8	Erin			
9	Mark			
10	Mary			
11	Mary			



119

Power Query – Advanced

Power Query

Exercise 5.1

120

Resources

- **Rob Collie (http://powerpivotpro)**
  - DAX Formulas for PowerPivot, 2013
- **Bill Jelen (http://mrexcel.com)**
  - PowerPivot for the Data Analyst: Microsoft Excel 2010, 2010
- **Alberto Ferrari and Marco Russo**
  - Microsoft Excel 2013: Building Data Models with PowerPivot
- **Chris Webb (http://cwebbbi.wordpress.com)**
- **Kasper de Jonge (http://www.powerpivotblog.nl)**
- **Purna Duggirala (http://www.chandoo.org/)**

121

Contact Information

Tim Metz, Assistant Vice Chancellor for Institutional Planning & Effectiveness
tdmetz@wcu.edu

Alison Joseph, Business and Technology Applications Analyst
ajoseph@wcu.edu

Office of Institutional Planning and Effectiveness
oipe.wcu.edu, (828) 227-7239

With the help of David Onder, Elizabeth Snyder, Billy Hutchings, and Henson Sturgill

122