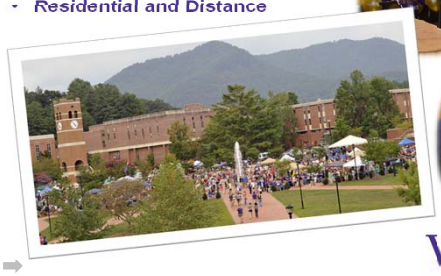
"Power" Tools for IR Reporting

David Onder and Alison Joseph

AIR Annual Forum 2014

- 10,107 students
- Master's Comprehensive
- Mountain location
- Residential and Distance



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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

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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

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Connecting to Data

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Connecting to Data

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

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Connecting to Data

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

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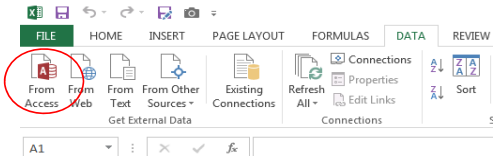
Connecting to Data



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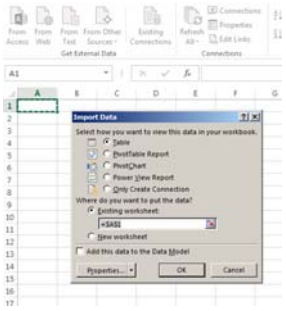
Connecting to Data



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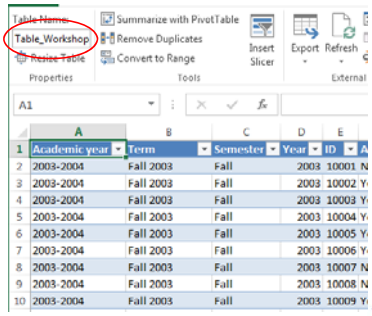
Connecting to Data



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Displaying Data –
Pivot Tables

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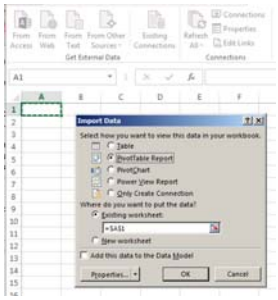
Connecting to Data



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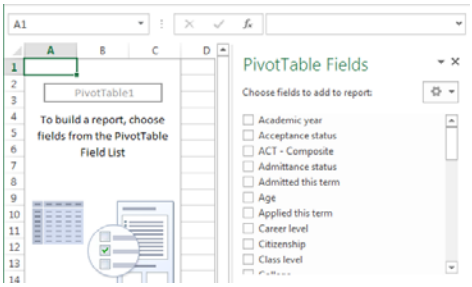
Connecting to Data



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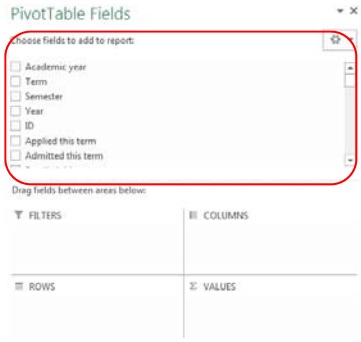
Displaying Data – Pivot Tables



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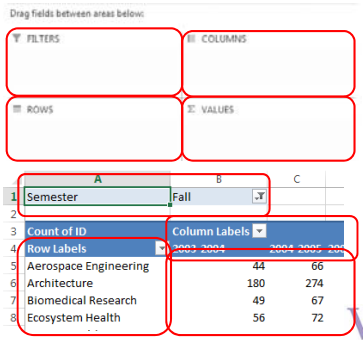
Displaying Data – Pivot Tables



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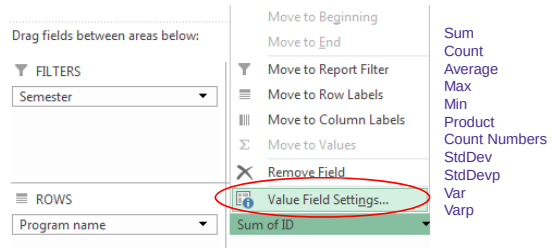
Displaying Data – Pivot Tables



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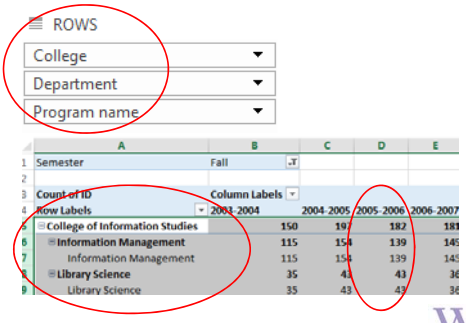
Displaying Data – Pivot Tables



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Displaying Data – Power Pivot

New and improved Pivot Tables!

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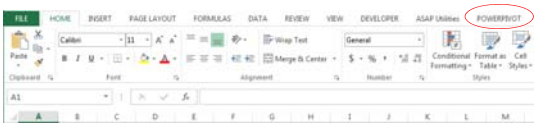
Displaying Data – Power Pivot

- **Set-up**



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

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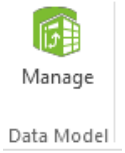
Displaying Data – Power Pivot

- **The Power Pivot environment**



Open Power Pivot

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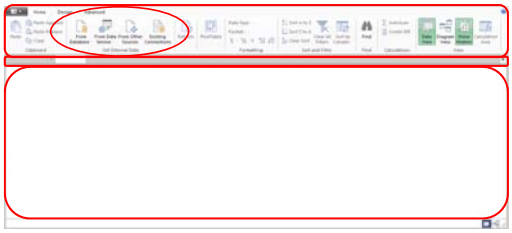
Displaying Data – Power Pivot

- **The Power Pivot environment**



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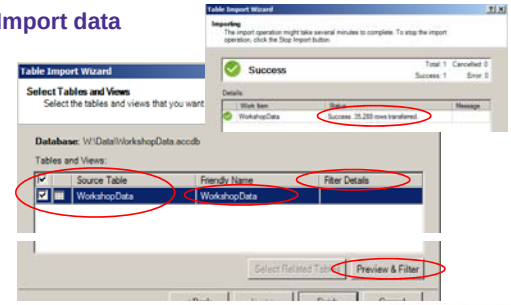
Displaying Data – Power Pivot

- Import data



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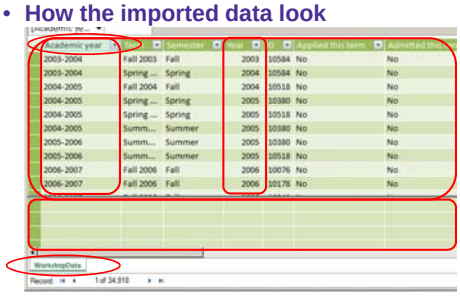
Displaying Data – Power Pivot

- How the imported data look



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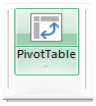
Displaying Data – Power Pivot

- Bringing data into Excel



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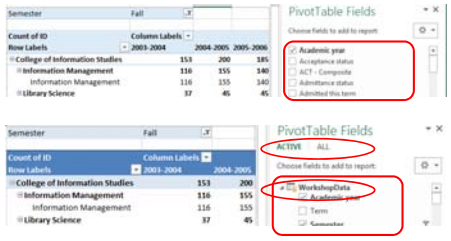
Displaying Data – Power Pivot

- **PivotTable vs. Power Pivot PivotTable**



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Displaying Data – Power Pivot

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

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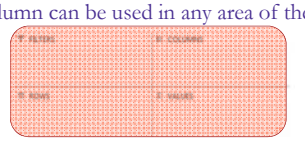
Displaying Data – Power Pivot

- **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



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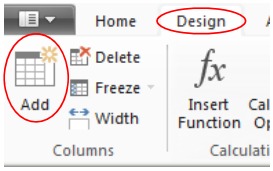
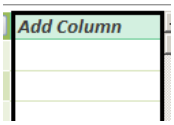
Displaying Data – Power Pivot

- Adding a calculated column





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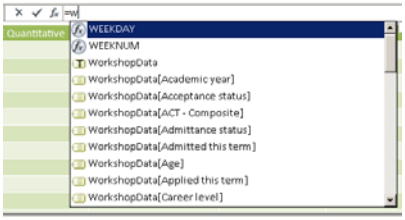
Displaying Data – Power Pivot

- Adding a calculated column



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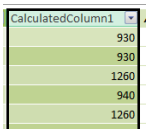
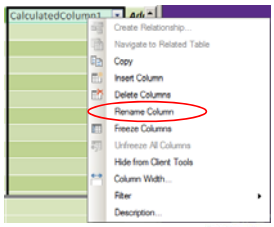
Displaying Data – Power Pivot

- Adding a calculated column

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





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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	

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Evaluation Contexts

- Row context
- Filter context

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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

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Row Context

=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	

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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

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Filter Context

Semester: Fall

Row Labels	Column Labels: 2003-2004 Count of ID	Average SAT	2004 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	

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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

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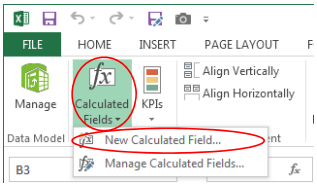
Displaying Data – Power Pivot

- **Adding a Calculated Field**



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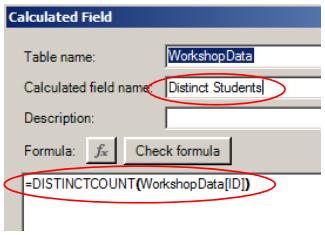
Displaying Data – Power Pivot

- **Adding a Calculated Field**



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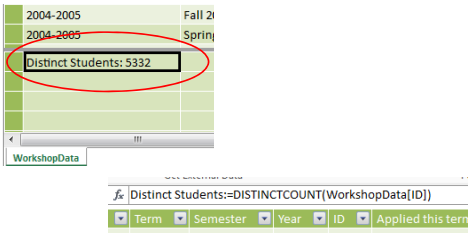
Displaying Data – Power Pivot

- **Calculated Field in Power Pivot**



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Displaying Data –
Power Pivot

DAX

ALL, ALLEXCEPT, CALCULATE, DISTINCTCOUNT, DIVIDE, FILTER

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Displaying Data – Power Pivot

- **DISTINCTCOUNT**

  DISTINCTCOUNT(<column>)

  – Counts unique values in column

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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

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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

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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"
    )
```

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Displaying Data – Power Pivot: DAX CALCULATE

Row Labels	Column Labels 2003-2004 Distinct Enrolled Students	First-time Freshmen Distinct Students	First-
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	

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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

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Displaying Data – Power Pivot: DAX ALL

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

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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

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Displaying Data – Power Pivot: DAX ALL

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

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Displaying Data – Power Pivot

- **DIVIDE**

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

  – "Safe" divide
  – Can specify alternate result for divide by zero

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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 %	

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Displaying Data – Power Pivot: DAX FILTER

- **FILTER**

FILTER(TableToFilter, FilterExpression)

– Returns a table filtered by FilterExpression

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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]
         )
   )
```

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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 %	

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Displaying Data – Power Pivot: DAX FILTER

- **ALLEXCEPT**

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

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

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Displaying Data –
Power Map & Power View

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Displaying Data – Power Map and Power View

- **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

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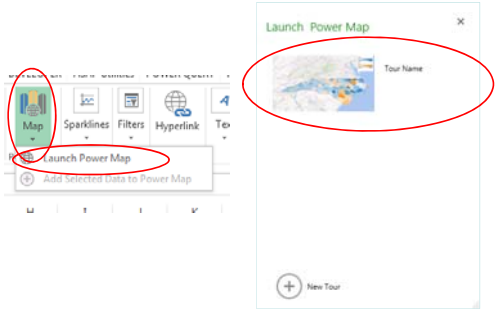
Displaying Data – Power Map and Power View



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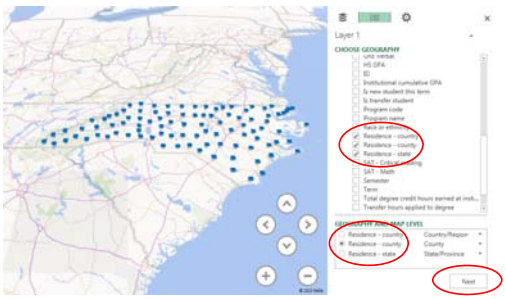
Displaying Data – Power Map and Power View



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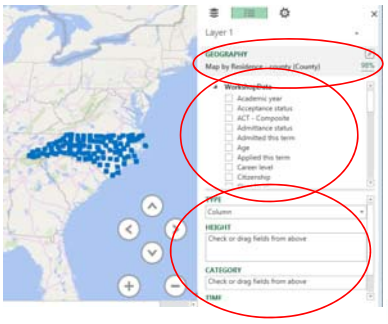
Displaying Data – Power Map and Power View



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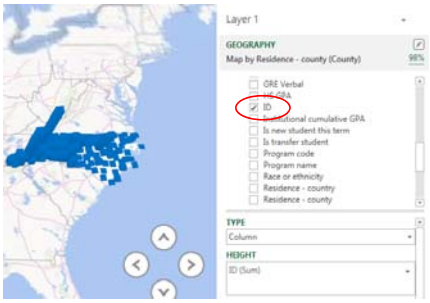
Displaying Data – Power Map and Power View



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Displaying Data – Power Map and Power View

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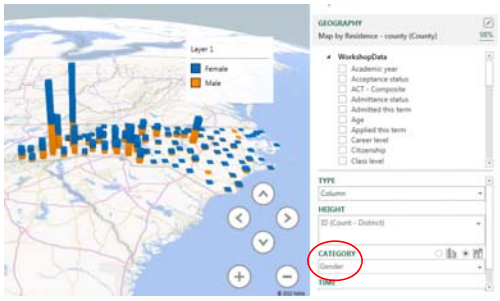
Displaying Data – Power Map and Power View



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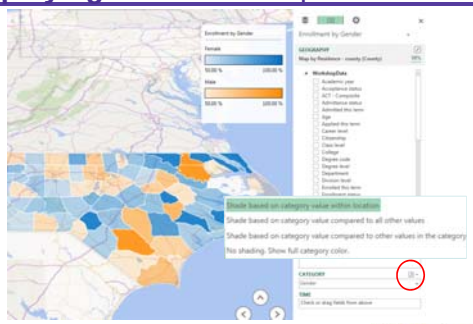
Displaying Data – Power Map and Power View



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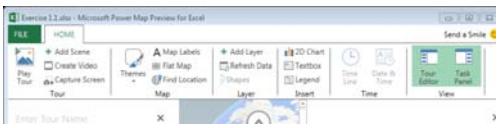
Displaying Data – Power Map and Power View



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Displaying Data – Power Map and Power View

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

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Displaying Data – Power Map and Power View

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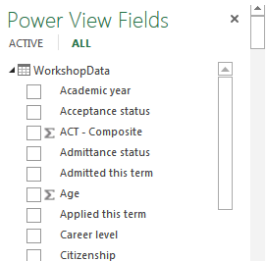
Displaying Data – Power Map and Power View



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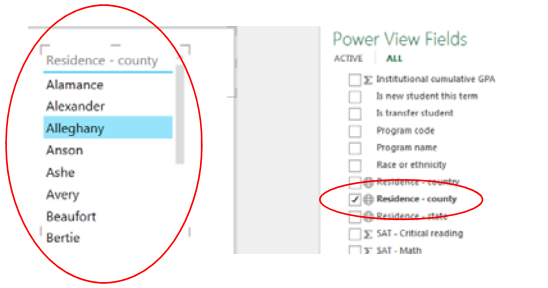

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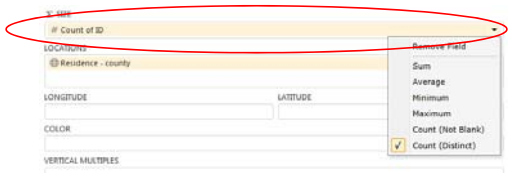
Displaying Data – Power Map and Power View



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Displaying Data – Power Map and Power View

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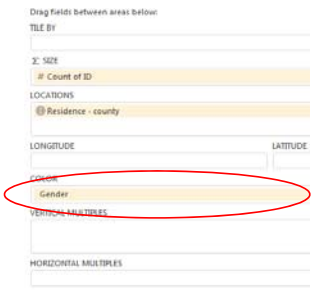
Displaying Data – Power Map and Power View



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Displaying Data – Power Map and Power View

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Displaying Data – Power Map and Power View

College	Count of ID
College of Information Studies	1,301
College of Journalism	516
College of Veterinary Medicine	3,061
No college	2,150
School of Architecture	1,783
School of Engineering	658
Total	**5,332**

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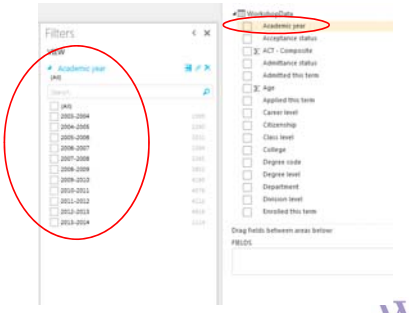
Displaying Data – Power Map and Power View



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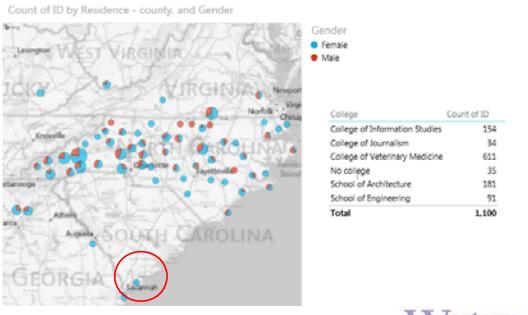
Displaying Data – Power Map and Power View



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**

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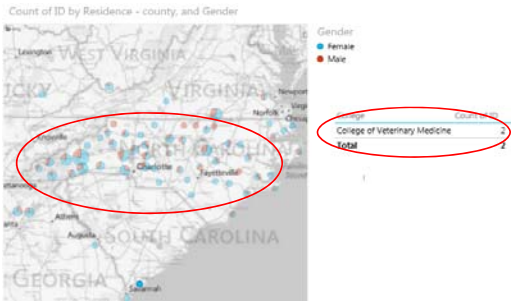
Displaying Data – Power Map and Power View



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

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Power Query –
Advanced

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Power Query – Advanced

- Retrieve data from a variety of external sources
  - Pull in external data from the Internet
- Limit the data you bring into your model (filter on rows and columns)
  - Keep you model to a reasonable size (< 1M records) to prevent processing problems
  - Bring in only what you need

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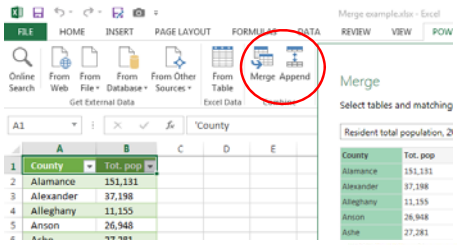
Power Query – Advanced

- **Consolidate multiple tables into one**



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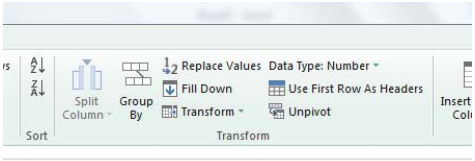
Power Query – Advanced

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



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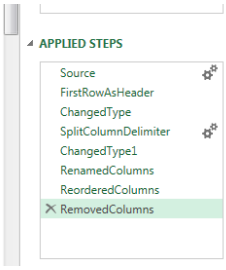
Power Query – Advanced

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



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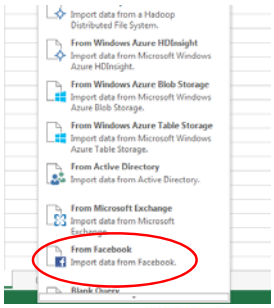
Power Query – Advanced

- Consolidate multiple tables into one
- In-line data transformations
- All transformation steps are listed, and reversible
- **Access to sources of data not readily available to Power Pivot**



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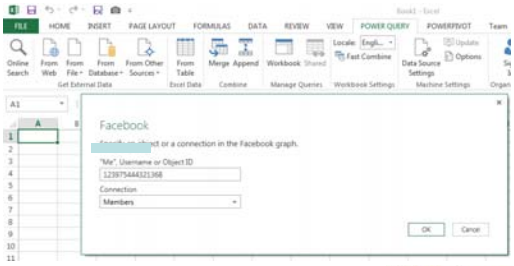
Power Query – Advanced

- Facebook pages and groups



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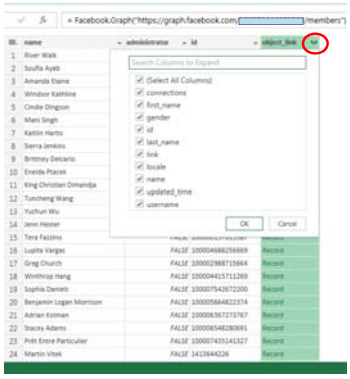
Power Query – Advanced

- Drill down for additional data fields in facebook records
- Availability of data fields depends on your personal status with the group/page, and facebook data fields completed and available



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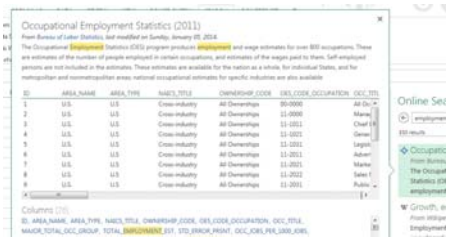
Power Query – Advanced

- Employment data



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Power Query – Advanced

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

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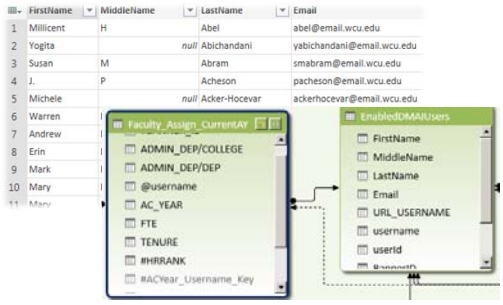
Power Query – Advanced



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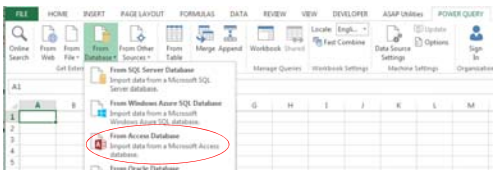
Power Query – Advanced

- **Microsoft SQL Server and Access**



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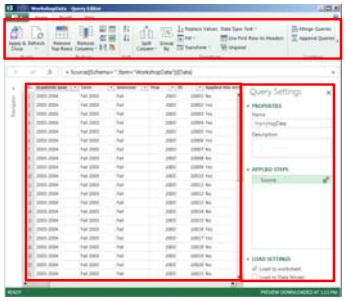
Power Query – Advanced



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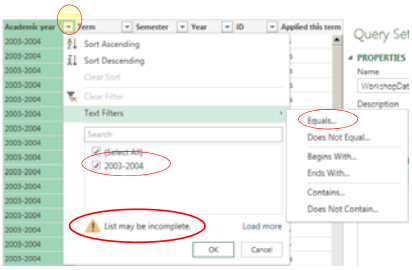
Power Query – Advanced



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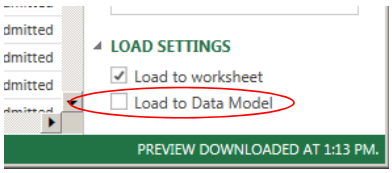
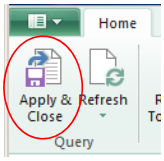
Power Query – Advanced





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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/)**

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Contact Information

David Onder, Director of Assessment
dmonder@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 Tim Metz, Elizabeth Snyder, Billy Hutchings, and Henson Sturgill

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