“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
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

Assumptions for workshop

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

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
Connecting to Data

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

- Connects to:
  - Tables
  - Queries
Connecting to Data

Connecting to Data

Connecting to Data
Connecting to Data

Connecting to Data
Connecting to Data

External Data Connections
Exercise 1.1

Data is connected

Now What?
Displaying Data – Pivot Tables

1. Get a data source ✓
2. Insert a pivot table ✓
3. Populate pivot table grid
Displaying Data – Pivot Tables

[Image of Pivot Table Fields]

[Image of Pivot Table with data]
Displaying Data – Pivot Tables

Drag fields between areas below:

FILTERS
Semester

ROWS
Program name

Move to Beginning
Move to End
Move to Report Filter
Move to Row Labels
Move to Column Labels
Move to Values
Remove Field

Value Field Settings:

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

Displaying Data – Pivot Tables

ROWS

College
Department
Program name

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>Fall</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Row Labels</td>
<td>College of Information Studies</td>
<td>Information Management</td>
<td>Information Management</td>
<td>Library Science</td>
</tr>
<tr>
<td>5</td>
<td>115</td>
<td>150</td>
<td>130</td>
<td>145</td>
</tr>
<tr>
<td>6</td>
<td>115</td>
<td>150</td>
<td>130</td>
<td>145</td>
</tr>
<tr>
<td>7</td>
<td>35</td>
<td>45</td>
<td>43</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>35</td>
<td>45</td>
<td>43</td>
<td>31</td>
</tr>
<tr>
<td>9</td>
<td>35</td>
<td>45</td>
<td>43</td>
<td>31</td>
</tr>
</tbody>
</table>
Displaying Data – Pivot Tables

Pivot Table Introduction
   Exercise 2.1

Structure, Features, and Deficiencies of Pivot Tables
   Exercise 2.2

Displaying Data – Power Pivot

New and improved Pivot Tables!
Displaying Data – Power Pivot

• Set-up

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

• Right-click on ribbon
• Customize the ribbon
• Select Developer
Displaying Data – Power Pivot

• The Power Pivot environment

Open Power Pivot

Displaying Data – Power Pivot

• The Power Pivot environment
Displaying Data – Power Pivot

• Import data

![Image of Table Import Wizard]

Choose How to Import the Data

- Select from a list of tables and views to choose the data to import

![Image of Table Import Wizard]
Displaying Data – Power Pivot

- Import data

Displaying Data – Power Pivot

- How the imported data look
Displaying Data – Power Pivot

• Bringing data into Excel

Displaying Data – Power Pivot

• PivotTable vs. Power Pivot PivotTable
Displaying Data – Power Pivot

Power Pivot Introduction
Exercise 3.1

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

Displaying Data – Power Pivot

• Adding a calculated column
**Displaying Data – Power Pivot**

- Adding a calculated column

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

<table>
<thead>
<tr>
<th>CalculatedColumn1</th>
<th>CalculatedColumn1</th>
</tr>
</thead>
<tbody>
<tr>
<td>930</td>
<td></td>
</tr>
<tr>
<td>930</td>
<td></td>
</tr>
<tr>
<td>1260</td>
<td></td>
</tr>
<tr>
<td>940</td>
<td></td>
</tr>
<tr>
<td>1260</td>
<td></td>
</tr>
</tbody>
</table>

---

**Displaying Data – Power Pivot**

- Adding a calculated column

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

<table>
<thead>
<tr>
<th>CalculatedColumn1</th>
<th>CalculatedColumn1</th>
</tr>
</thead>
<tbody>
<tr>
<td>930</td>
<td></td>
</tr>
<tr>
<td>930</td>
<td></td>
</tr>
<tr>
<td>1260</td>
<td></td>
</tr>
<tr>
<td>940</td>
<td></td>
</tr>
<tr>
<td>1260</td>
<td></td>
</tr>
</tbody>
</table>
Displaying Data – Power Pivot

• Adding a calculated column to pivot table

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>Column Labels</th>
<th>2003-2004</th>
<th>2004-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Information Studies</td>
<td>Count of ID</td>
<td>151</td>
<td>1062.502593</td>
</tr>
<tr>
<td>Information Management</td>
<td>Count of ID</td>
<td>116</td>
<td>1081.188119</td>
</tr>
<tr>
<td>Information Management</td>
<td></td>
<td>116</td>
<td>1081.188119</td>
</tr>
<tr>
<td>Library Science</td>
<td>Count of ID</td>
<td>37</td>
<td>1007.352941</td>
</tr>
<tr>
<td>Library Science</td>
<td></td>
<td>37</td>
<td>1007.352941</td>
</tr>
<tr>
<td>College of Journalism</td>
<td>Count of ID</td>
<td>67</td>
<td>1045.5</td>
</tr>
<tr>
<td>Journalism</td>
<td></td>
<td>67</td>
<td>1045.5</td>
</tr>
<tr>
<td>Journalism</td>
<td></td>
<td>67</td>
<td>1045.5</td>
</tr>
</tbody>
</table>

Evaluation Contexts

• Row context

• Filter context
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

Row Context
### 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

<table>
<thead>
<tr>
<th>Semester</th>
<th>Fall</th>
<th>2003-2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count of ID</td>
<td>Average SAT</td>
<td>Count of ID</td>
</tr>
<tr>
<td>College of Information Studies</td>
<td>153</td>
<td>1062.592593</td>
</tr>
<tr>
<td>Information Management</td>
<td>116</td>
<td>1081.188119</td>
</tr>
<tr>
<td>Information Management</td>
<td>116</td>
<td>1081.188119</td>
</tr>
<tr>
<td>Library Science</td>
<td>37</td>
<td>1007.352941</td>
</tr>
<tr>
<td>Library Science</td>
<td>37</td>
<td>1007.352941</td>
</tr>
<tr>
<td>College of Journalism</td>
<td>67</td>
<td>1015.5...</td>
</tr>
</tbody>
</table>
Displaying Data – Power Pivot

DAX & Calculated Columns Introduction

Exercise 3.2

• 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
Displaying Data – Power Pivot

• Adding a Calculated Field

![Image of Excel Power Pivot interface showing how to add a calculated field](image-url)

**Formula:**

```
=DISTINCTCOUNT(WorkshopData[ID])
```
Displaying Data – Power Pivot

• DISTINCTCOUNT

    DISTINCTCOUNT( <column> )

    – Counts unique values in column

Displaying Data – Power Pivot

• Adding a Calculated Field

    ![Calculated Field]

    Formula: =DISTINCTCOUNT(WorkshopData[ID])
Displaying Data – Power Pivot

• Adding a Calculated Field

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>Column Labels</th>
<th>Count of ID</th>
<th>Distinct Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Information Studies</td>
<td>2003-2004</td>
<td>153</td>
<td>152</td>
</tr>
<tr>
<td>Information Management</td>
<td>116</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Information Management</td>
<td>116</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Library Science</td>
<td>37</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Displaying Data – Power Pivot

• Calculated Field in Power Pivot

```
Distinct Students: 5332
```

Distinct Students:=DISTINCTCOUNT(WorkshopData[ID])
Displaying Data – Power Pivot

DAX & Calculated Fields Introduction
Exercise 3.3

Displaying Data – Power Pivot

DAX
CALCULATE, ALL, FILTER
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

First-time Freshmen Distinct Students:=

CALCULATE(
    [Distinct Students],
    WorkshopData[Class level]="Freshman",
    WorkshopData[Is new student this term]="Yes"
)
Displaying Data – Power Pivot: DAX CALCULATE

DAX - CALCULATE

Exercise 3.4
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

All Distinct Enrolled Students:=

CALCULATE(

[Distinct Enrolled Students],

ALL( WorkshopData[Class level] )
)


% of All Distinct Enrolled Students :=

\[
\text{DIVIDE}([\text{Distinct Enrolled Students}], [\text{All Distinct Enrolled Students}])
\]
Displaying Data – Power Pivot

• **DIVIDE**

\[
\text{DIVIDE( <num>, <den>, [<alt>] )}
\]

– “Safe” divide
– Can specify alternate result for divide by zero

---

**Displaying Data – Power Pivot**

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>2009-2010</th>
<th>% of All Distinct Enrolled Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering</td>
<td>107</td>
<td>100.00 %</td>
</tr>
<tr>
<td>Freshman</td>
<td>18</td>
<td>16.82 %</td>
</tr>
<tr>
<td>Sophomore</td>
<td>13</td>
<td>12.15 %</td>
</tr>
<tr>
<td>Junior</td>
<td>37</td>
<td>34.58 %</td>
</tr>
<tr>
<td>Senior</td>
<td>39</td>
<td>36.45 %</td>
</tr>
<tr>
<td>Architecture</td>
<td>276</td>
<td>100.00 %</td>
</tr>
<tr>
<td>Freshman</td>
<td>40</td>
<td>14.49 %</td>
</tr>
</tbody>
</table>
Displaying Data – Power Pivot: DAX ALL

DAX - ALL
Exercise 3.5

Displaying Data – Power Pivot: DAX FILTER

• FILTER

FILTER( TableToFilter, FilterExpression )

– Returns a table filtered by FilterExpression
Above Average GPA Enrolled Undergraduates:

\[
\text{CALCULATE(}
\text{Distinct Enrolled Students,}
\text{FILTER(WorkshopData,}
\text{WorkshopData[Institutional cumulative GPA] > Average GPA Enrolled Undergraduates})
\text{)}
\]
Displaying Data – Power Pivot: DAX FILTER

• ALLEXCEPT

\[ \text{ALLEXCEPT( <table>, <column>[, <column>…])} \]

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

)
Displaying Data – Power Map & 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
Displaying Data – Power Map

Launch Power Map

Displaying Data – Power Map

Next
Displaying Data – Power Map

Displaying Data – Power Map
Displaying Data – Power Map

Displaying Data – Power Map
Displaying Data – Power Map

[Map showing gender distribution with related filters and settings]
Displaying Data – Power Map

Shade based on category value within location
Shade based on category value compared to all other values
Shade based on category value compared to other values in the category
No shading. Show full category color.

Displaying Data – Power Map
Displaying Data – Power Map

Power Map
Exercise 4.1

Displaying Data – Power View

• Power View
  – Dashboard builder
  – Allows synchronized filtering
  – Bring together tables, graphs, maps
Displaying Data – Power View

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

Displaying Data – Power View

• Create Power View reports directly in SharePoint Server as well as in Excel
Displaying Data – Power View

Displaying Data – Power View
Displaying Data – Power View

[Image of a slide showing a Power View interface with a map and a data table.]

Displaying Data – Power View

[Image of a slide showing a different Power View interface with a map.]
Displaying Data – Power View

Count of ID by Residence - county, and Gender

<table>
<thead>
<tr>
<th>College</th>
<th>Count of ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Information Studies</td>
<td>154</td>
</tr>
<tr>
<td>College of Journalism</td>
<td>54</td>
</tr>
<tr>
<td>College of Veterinary Medicine</td>
<td>611</td>
</tr>
<tr>
<td>No college</td>
<td>35</td>
</tr>
<tr>
<td>School of Architecture</td>
<td>381</td>
</tr>
<tr>
<td>School of Engineering</td>
<td>91</td>
</tr>
<tr>
<td>Total</td>
<td>1,190</td>
</tr>
</tbody>
</table>

Displaying Data – Power View

Count of ID by Residence - county, and Gender

<table>
<thead>
<tr>
<th>College</th>
<th>Count of ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Veterinary Medicine</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>1,190</td>
</tr>
</tbody>
</table>
Displaying Data – Power View (Example)

Displaying Data – Power Map and Power View

Power View
Exercise 4.2
Power Query

Power Query data sources

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

- Microsoft SQL Server and Access

Power Query data sources: Online Search
Power Query data sources: Web page URLs

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

• Facebook pages and groups

Power Query preview (Query Editor)
Power Query features

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

Power Query features

- Filter on rows and columns
Power Query features

- Consolidate multiple tables into one

- In-line data transformations
Power Query features

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

Power Query features

- Insert custom formula-based columns
Power Query features

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

Power Query – Example

• Connect to online faculty database
  – Import active users from Digital Measures
  – Merge with local data
  – Export updated data to Digital Measures
Power Query – Example

Power Query – Advanced

Power Query

Exercise 5.1
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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