A CASE STUDY

To determine if improving certain district operational activities correlates with improved student achievement

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Study Background
• APS Maintenance and Operations
• Demographics
• Significance of Study

Study Details
• Study Format
• Research Review
• Key Performance Indicators (KPIs)
• Raw Data Input

Study Conduct
• Preliminary Timeline
• Analysis Approach

Study Results
• Presentation of Results at Future CGCS Conference
• Can improvement in CGCS KPIs be correlated to improved student achievement?
APS Maintenance and Operations Structure

- Employees: ~265
- Students served: ~89,000
- Schools served: 141 traditional plus 4 charters
- Square feet schools served: ~14.5 Million square feet
- Square miles served: 123
- Budget:

Past 3 Years - APS:
Cut: ~$100M; Lost: ~ 1,000 positions
⇒ Lots in M&O area
STUDY BACKGROUND, con’t

Maintenance and Operations Trends

- Positions cut
- Square footage to maintain increased
- Number of work orders increased
- Available dollars focused in classrooms
- Food Service has more federal mandates
- Fewer buses to transport students

M&O Past 5 Years:
- New Schools: 5ES, 1MS, 2HS
- Replacements: 2ES
- New Sq Ft: 2.5M
- Renovated Sq Ft: 5M

<table>
<thead>
<tr>
<th>Fiscal Years</th>
<th>Work Orders</th>
<th>Square Feet</th>
<th>M &amp; O Budget</th>
<th>Operational Budget</th>
<th>SB-9 Budget</th>
<th>Salaries OT &amp; Benefits</th>
<th>School FTE's</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>57,760</td>
<td>12,003,465</td>
<td>$48,342,400.00</td>
<td>$2,903,213.00</td>
<td>$31,393,556.00</td>
<td>$14,045,631.00</td>
<td>136</td>
<td>330.5</td>
</tr>
<tr>
<td>2008</td>
<td>63,476</td>
<td>12,008,841</td>
<td>$55,391,208.00</td>
<td>$2,629,799.00</td>
<td>$37,165,908.00</td>
<td>$15,595,501.00</td>
<td>137</td>
<td>320.5</td>
</tr>
<tr>
<td>2009</td>
<td>68,155</td>
<td>12,703,152</td>
<td>$48,564,786.00</td>
<td>$2,066,226.00</td>
<td>$30,832,290.00</td>
<td>$15,666,270.00</td>
<td>139</td>
<td>310</td>
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<tr>
<td>2010</td>
<td>68,372</td>
<td>14,207,533</td>
<td>$41,227,836.00</td>
<td>$1,329,653.00</td>
<td>$25,350,736.00</td>
<td>$14,547,447.00</td>
<td>141</td>
<td>285.5</td>
</tr>
<tr>
<td>2011</td>
<td>74,546</td>
<td>14,207,533</td>
<td>$30,237,780.00</td>
<td>$909,154.00</td>
<td>$14,776,670.00</td>
<td>$14,551,956.00</td>
<td>142</td>
<td>265</td>
</tr>
</tbody>
</table>

If M&O operations correlate with improved student achievement – why cut?

Georgia O’Keefe ES
Hypothesis

- Certain Maintenance and Operations functions directly correlate with student achievement

Study Significance

- By provided research evidence of whether (and by how much) certain M&O improvements (or cuts) impact student achievement, a more realistic approach to prioritizing and funding M&O functions can be achieved

If M&O operations do correlate with student achievement, then we may be indirectly reducing student achievement by cutting M&O functions, or perhaps by distributing our limited M&O funding in a non-optimum way.
How the study will be formulated

• Use CGCS KPIs as a basis for potential Maintenance and Operations areas of improvement

• Obtain raw input suggestions from Maintenance and Operations staff – what activities do staff feel directly affect student achievement?

• Select certain areas (Maintenance and Operations KPIs and student achievement) where a controlled design of experiment can be conducted

• Establish a controlled design of experiment to determine if improved effectiveness and/or efficiency of the selected areas has any correlation to improvement in selected student achievement areas
Research review

- Preliminary review indicates there is only limited research

- Some research results do show positive correlation between school facilities and student achievement and to some extent transportation funding and student success on SATs

- Additional research will be conducted to determine what research evidence may be available in any of the study selected areas
### Key Performance Indicators (KPIs) and M&O Relationships

<table>
<thead>
<tr>
<th>APS M&amp;O Divisions</th>
<th>APS M&amp; O activities</th>
<th>CGCS Business Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>Metal Ship, Locker Repair, HVAC, Plumbing</td>
<td>M&amp;O</td>
</tr>
<tr>
<td>Grounds</td>
<td>Equipment Operators, Landscaping, Irrigation, Playground Repair, Playground</td>
<td>M&amp;O</td>
</tr>
<tr>
<td></td>
<td>Maintenance &amp; Fix Portables</td>
<td></td>
</tr>
<tr>
<td>Structural</td>
<td>Furniture Repair, Glaziers, Locksmiths, Masons, Paint Ship, Welding, Roofing</td>
<td>M&amp;O</td>
</tr>
<tr>
<td></td>
<td>Repair</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td>Electricians, Audio Visual, Fire Ext Service, Telecommunications</td>
<td>M&amp;O</td>
</tr>
<tr>
<td>Building Services</td>
<td>Custodian Supervisors, Interior Pest Control, Carpet Cleaners, Specialty Cleaning,</td>
<td>M&amp;O</td>
</tr>
<tr>
<td></td>
<td>Small Appliance Repair, Procurement Specialist, M&amp;O Warehouse</td>
<td></td>
</tr>
<tr>
<td>Fleet Maintenance</td>
<td>Tire Shop, Specialty Equipment Maintenance, Vehicle Maintenance, Fueling Station</td>
<td>Transportation</td>
</tr>
<tr>
<td>Environmental</td>
<td>Environmental Inspectors</td>
<td>M&amp;O</td>
</tr>
<tr>
<td>Support Services</td>
<td>Utilities, Wireless</td>
<td>M&amp;O</td>
</tr>
<tr>
<td>Computer Network</td>
<td>Central Office Network; District-wide Network</td>
<td>Information Technology</td>
</tr>
<tr>
<td>Energy Conservation</td>
<td>Energy Efficiency; LEEDS Certification</td>
<td>M&amp;O</td>
</tr>
<tr>
<td>Technology Support</td>
<td>Technology Repair &amp; Service</td>
<td>Information Technology</td>
</tr>
<tr>
<td>Food Services</td>
<td>FRL; Breakfast, Lunch</td>
<td>Food Services</td>
</tr>
<tr>
<td>Safety and Security</td>
<td>School Resource Officers, APS Police Officers</td>
<td>Safety and Security</td>
</tr>
</tbody>
</table>

### Potential Study Parameters
- Current APS KPI Ranking
- Description of Key KPI Activities to Consider
- Pilot Program Key Focus Areas
- Expected Outcomes Influencing Student Achievement
Input (the raw data – already initiated)

- Operations department
- Managers and staff
- Areas and activities that staff believe might directly impact student achievement – and how!

Link to matrix of potential Maintenance and Operations activities as defined by M&O staff.

Examples from Transportation:

- Buses late to school in morning
- Buses not showing up in morning
- Bus driver attitude
- Bullying on bus
- Overcrowded buses
- Lack of special education equipment on buses
Design of Experiment (DOE)

What is DOE?
- DOE refers to an experiment where one or more variables believed to have an effect on an experimental outcome are identified and manipulated according to a plan.

How would DOE be used?
The key elements of the experiment are:
1. Response Variable: The outcome variable being investigated. Also called independent variable.
2. Primary Variables: The controlled variables believed most likely to have an effect on the response variable.
3. Background Variables: Variables which may have an effect but cannot or will not be deliberately manipulated or held constant.
4. Common causes or experimental error: This is the “noise” measurement for the experiment.
5. Interaction: A condition where the effect of one factor depends on the level of another factor.

Some thoughts on the APS DOE strategy
The APS DOE strategy would be to select student achievement parameter(s) as the Response Variable(s); specify M&O area KPI/activities as Primary Variables; define student/school socioeconomic/disaggregated information as Background Variables. Data collected in accordance with the DOE model would then be analyzed for statistical significance, interaction, and effects of the Primary Variables on the Response Variable(s). In addition, analysis to understand the “unknown” error in the experiment and whether that is significant is important.
Analysis Expectations Using DOE

- DOE Model dictates whether replication or randomization is appropriate

- Potential Experimental Models and Analysis
  - Fixed effects model; random effects model; mixed model
  - Completely randomized design; balanced design; unbalanced design
  - Randomized block design (probably more suitable for APS DOE effects)

- Expected Results of Analysis
  - There will be statistical correlation between selected Maintenance and Operations activities and specified student achievement parameters
  - The block effects of socioeconomic/disaggregated groups (e.g., race, ELL, poverty, statistical peer groups) will be Background Variables that are influential in the correlation results.
PRELIMINARY TIMELINE

• 11/30/11: Research Review
  • Literature
  • Raw data staff input

• 01/31/12: Selection of DOE parameters
  • Select Maintenance and Operations parameters
  • Select student achievement parameters

• 02/29/12: Define expected outcomes and relationship to the CGCS KPIs
  • Yes, it is Leap Year!

• 07/31/12: Gather Maintenance and Operations and student achievement parameter data

• 08/31/12: Conduct DOE analysis of the data

• 09/30/12: Write preliminary report of results
  • Prepare presentation for future CGCS conference

• 10/31/12: Define follow-on strategy
FUTURE PRESENTATION OF THE RESULTS

CGCS Fall 2012 – Indianapolis
Preliminary Results

CGCS Fall 2013 – Albuquerque!
More detailed results
For more information, visit [www.aps.edu](http://www.aps.edu)
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Peercy_d@aps.edu