



“Irrational” Vs. “Rational” Behavior: Using Evolutionary Theory & Comprehensive Evaluations to Ensure Building Performance Meets Design Intent

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SLOW FLOW OF PROGRESS IN AEC INDUSTRY

62%+

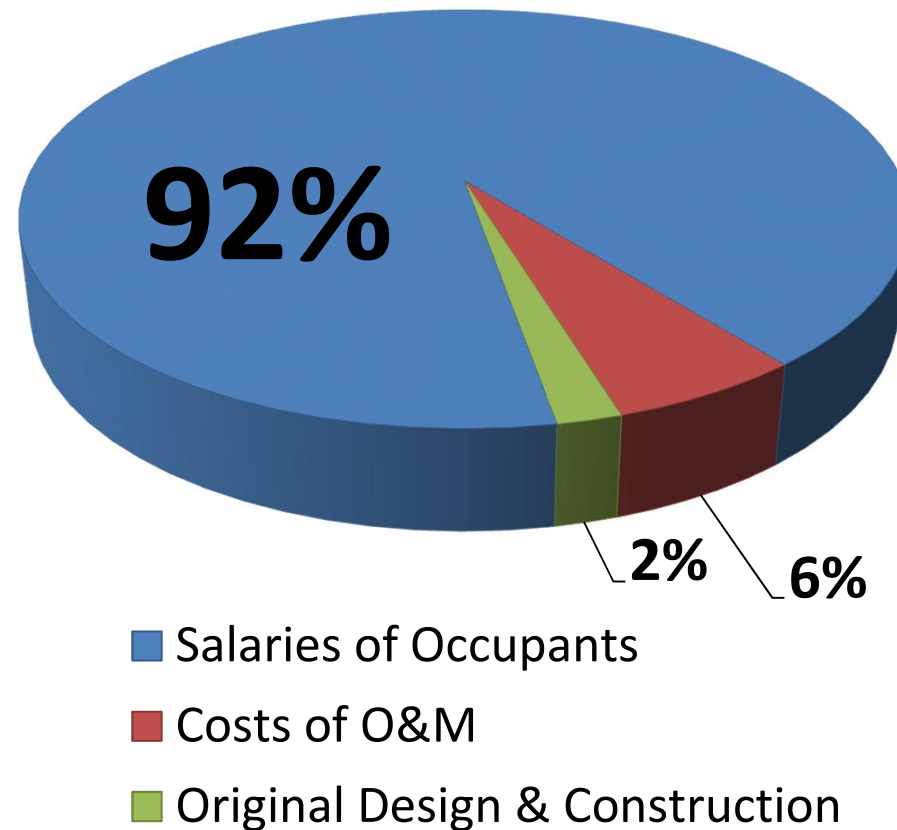
The 2012 global average share of *non-green* building activity.

Source: [McGraw Hill Construction. 2013. *World Green Building Trends: Business Benefits Driving New and Retrofit Market Opportunities in Over 60 Countries*. A SmartMarket Report.](#)



SLOW FLOW OF PROGRESS IN AEC INDUSTRY

Life Cycle Costs of a Facility



Sources: *Cotts, D.G., The Facility Management Handbook, Second Edition, 1999*

Sapp, D. Facilities Operations & Maintenance. Updated by the Facilities O&M Committee. Last updated: 11-09-2011. <http://www.wbdg.org/om/om.php>.



SLOW FLOW OF PROGRESS IN AEC INDUSTRY

50% - 80%

The percentage of high performance buildings with actual energy consumption found to exceed predicted consumption.

Sources: [Burman, E., D. Mumovic, and J. Kimpian. 2014. Towards measurement and verification of energy performance under the framework of the European directive for energy performance of buildings. *Energy*: 77\(1\):153–163.](#)

Carbon Trust. *Closing the Gap – Lessons Learned on Realising the Potential of Low Carbon Building Design*. Carbon Trust, London.

Pegg, A. C., M. Kolokotroni. 2007. Post-Occupancy Performance of Five Low-Energy Schools in the UK. *ASHRAE Transactions*, 113 (Part 2).

[Turner, C. and M. Frankel. 2008. *Energy Performance of LEED® for New Construction Buildings*. Report Prepared by New Buildings Institute for the U.S. Green Building Council.](#)



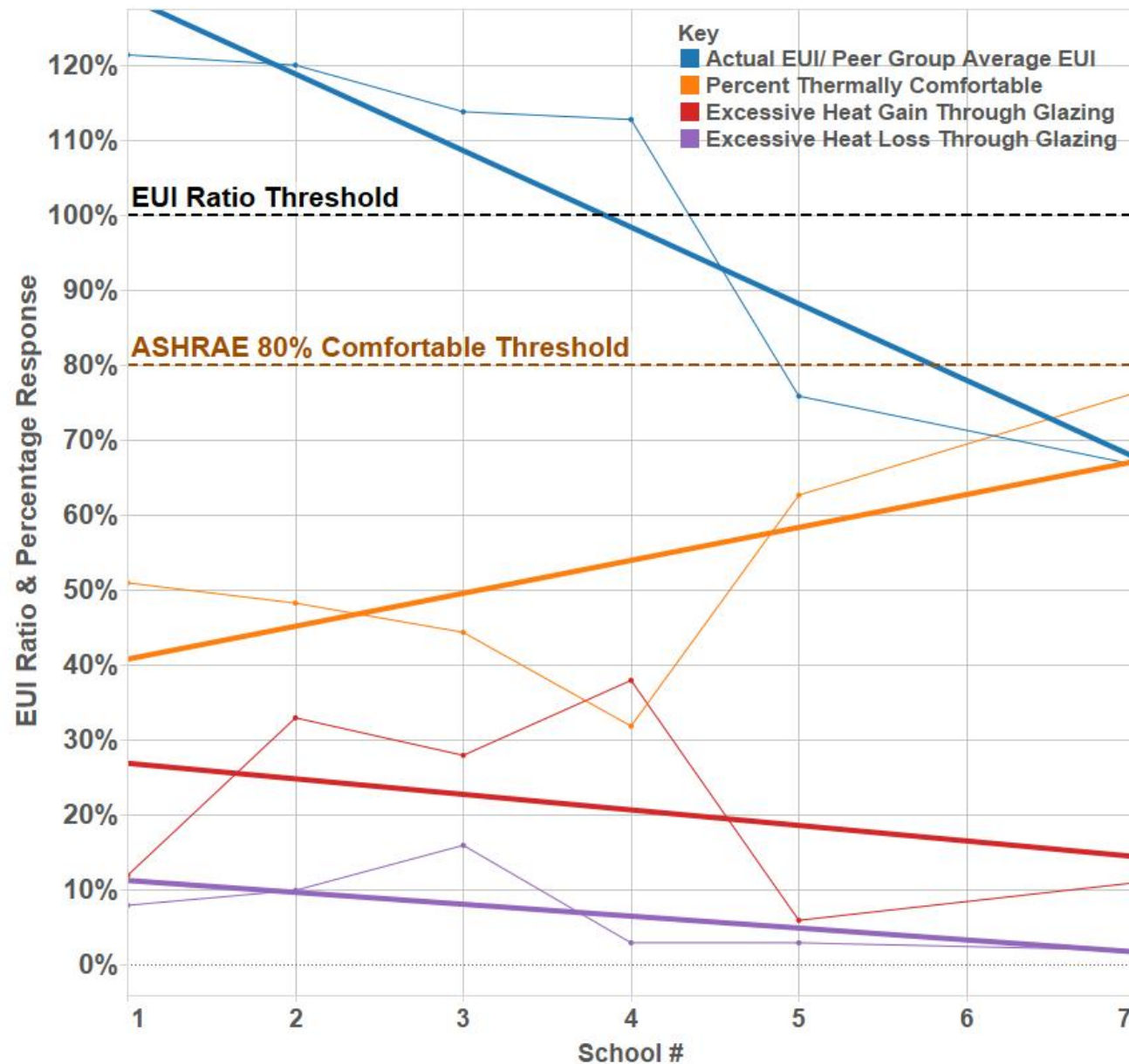
LACK OF PERSONAL CONTROL, FRUSTRATION & IMPACT ON PERFORMANCE



*Leaving lights on as a sign of protest & statement of
personal control*

New Mexico Elementary School

LINK BETWEEN ENERGY & OCC. EXPERIENCE



Comparison of EUI Ratios to Temperature Responses

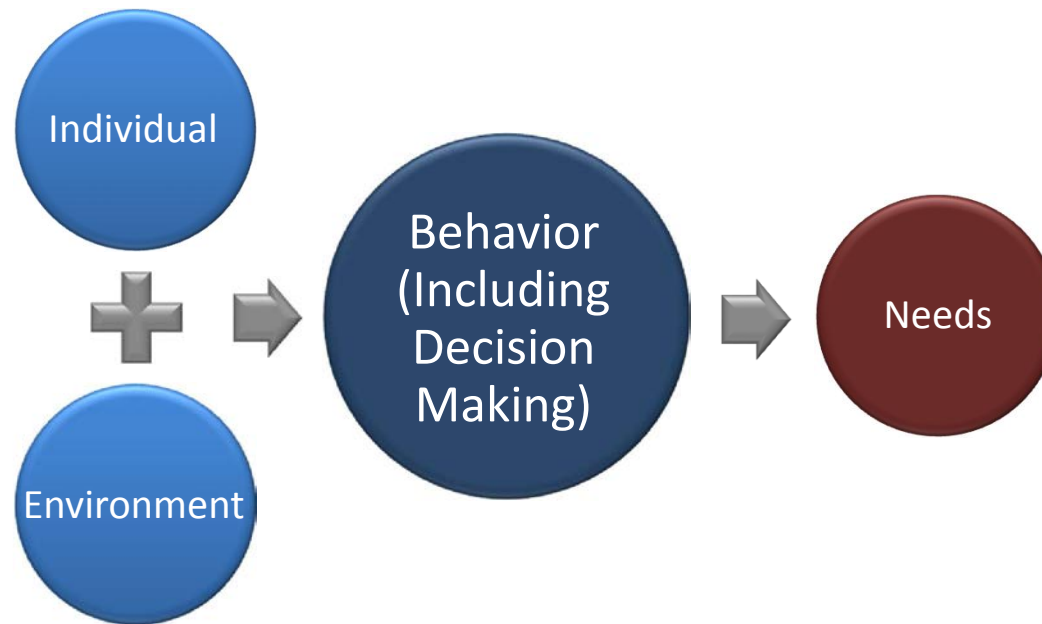


KEY TAKEAWAYS

- Recognize that **BEHAVIOR JUDGEMENTS** are a matter of perspective
- Improve **ALIGNMENT**
- Account for **PRODUCTIVITY/PERFORMANCE** and **HEALTH** impacts
- Increase number of **DECISION MAKERS** and **GROUP UNITY**



BEHAVIOR JUDGEMENTS



Based on research spanning from:

Kurt Lewin, 1936 *Principles of Topological Psychology*
to

Elliott Sober & David Sloan Wilson, 1999

Unto Others: The Evolution and Psychology of Unselfish Behavior



BEHAVIOR JUDGEMENTS

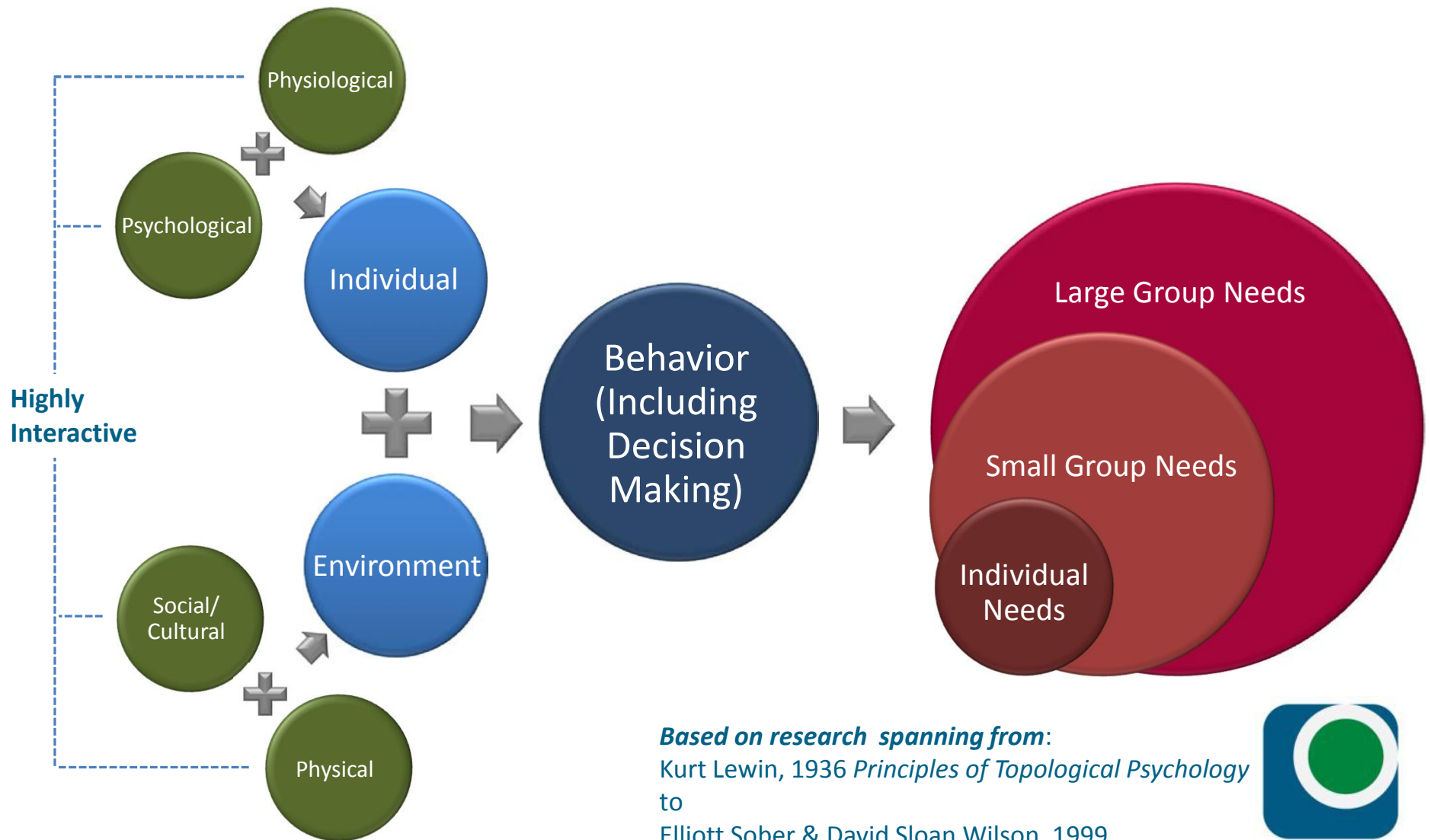
Clothing Variability, Thermal Comfort & Energy Consumption



Space Heater



BEHAVIOR JUDGEMENTS



Based on research spanning from:

Kurt Lewin, 1936 *Principles of Topological Psychology* to

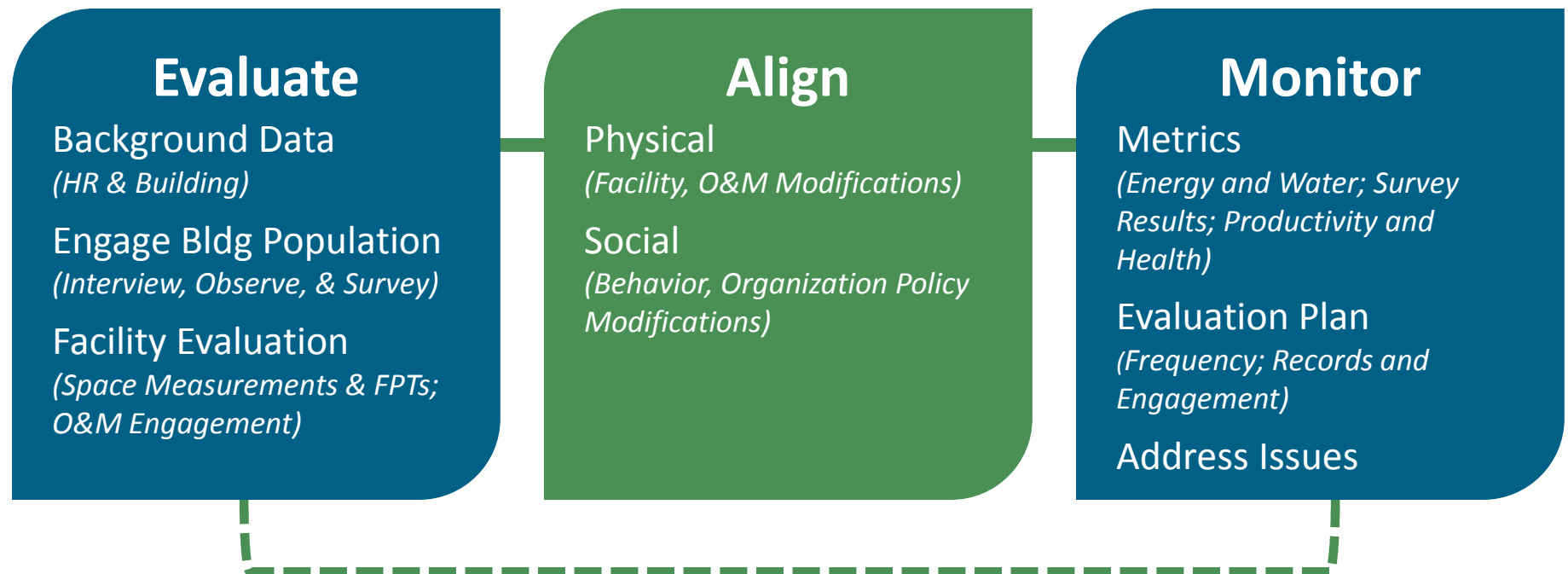
Elliott Sober & David Sloan Wilson, 1999

Unto Others: The Evolution and Psychology of Unselfish Behavior



IMPROVE ALIGNMENT

EAM PROCESS: For Building & Occupant Alignment

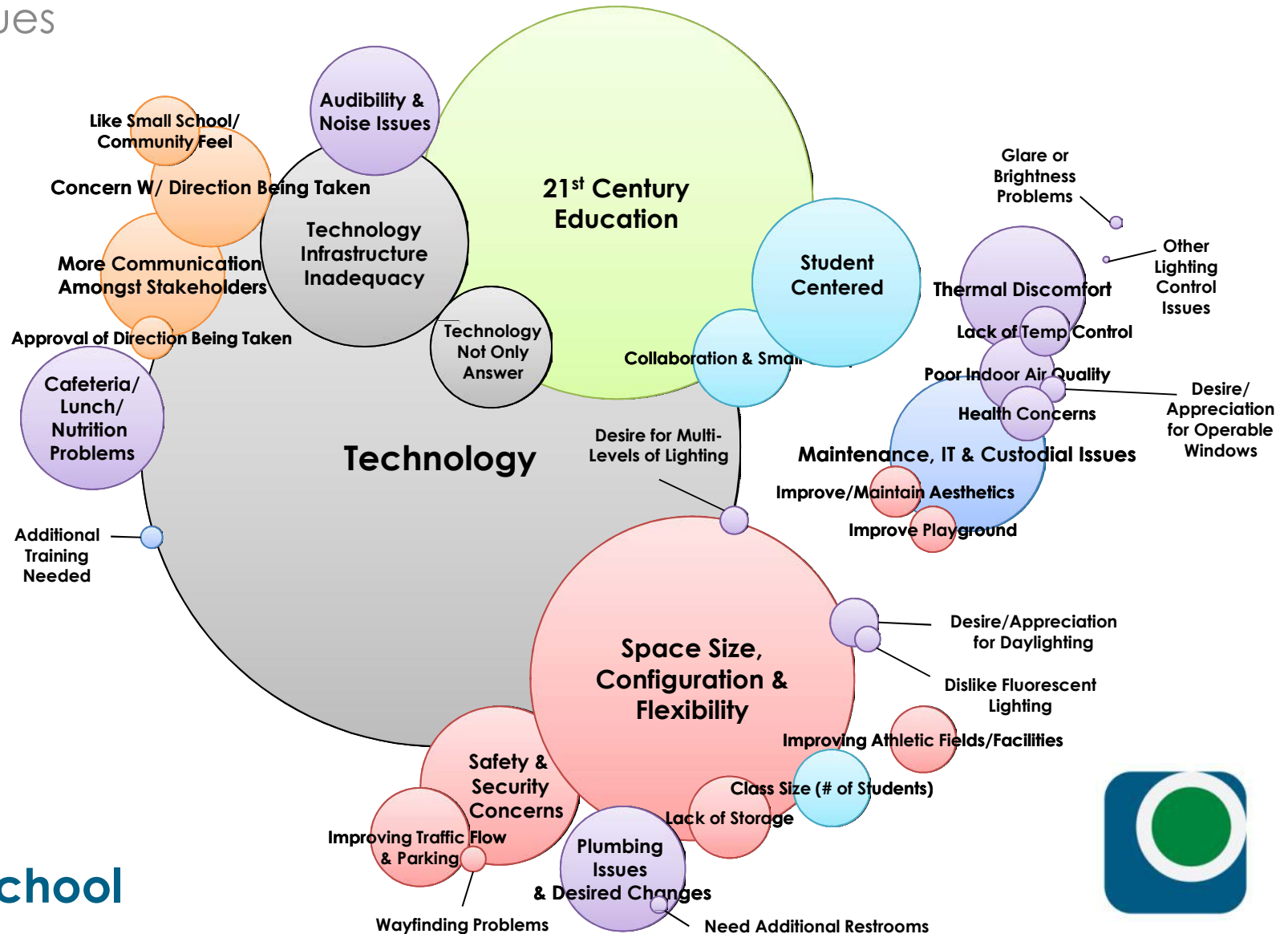


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IMPROVE ALIGNMENT

Deep key stakeholder engagement needed to assess varying wants/needs/values



IMPROVE ALIGNMENT

Personal Control, Occupant Inertia &
Ease of Blind Control Access

New Mexico
Elementary School



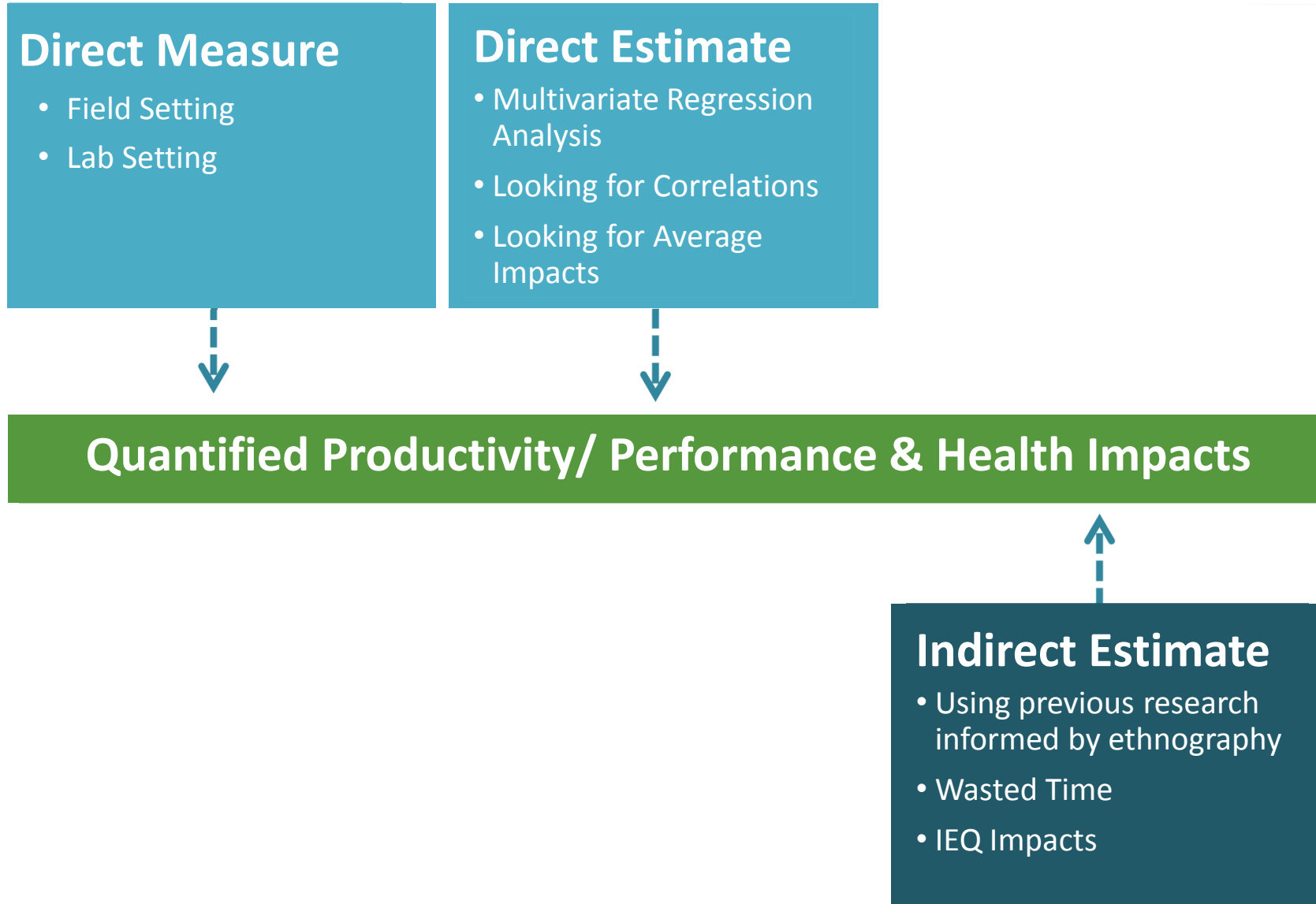
IMPROVE ALIGNMENT



New Mexico
Elementary School

Technology's perspective
from a child

QUANTIFY PRODUCTIVITY/HEALTH IMPACTS

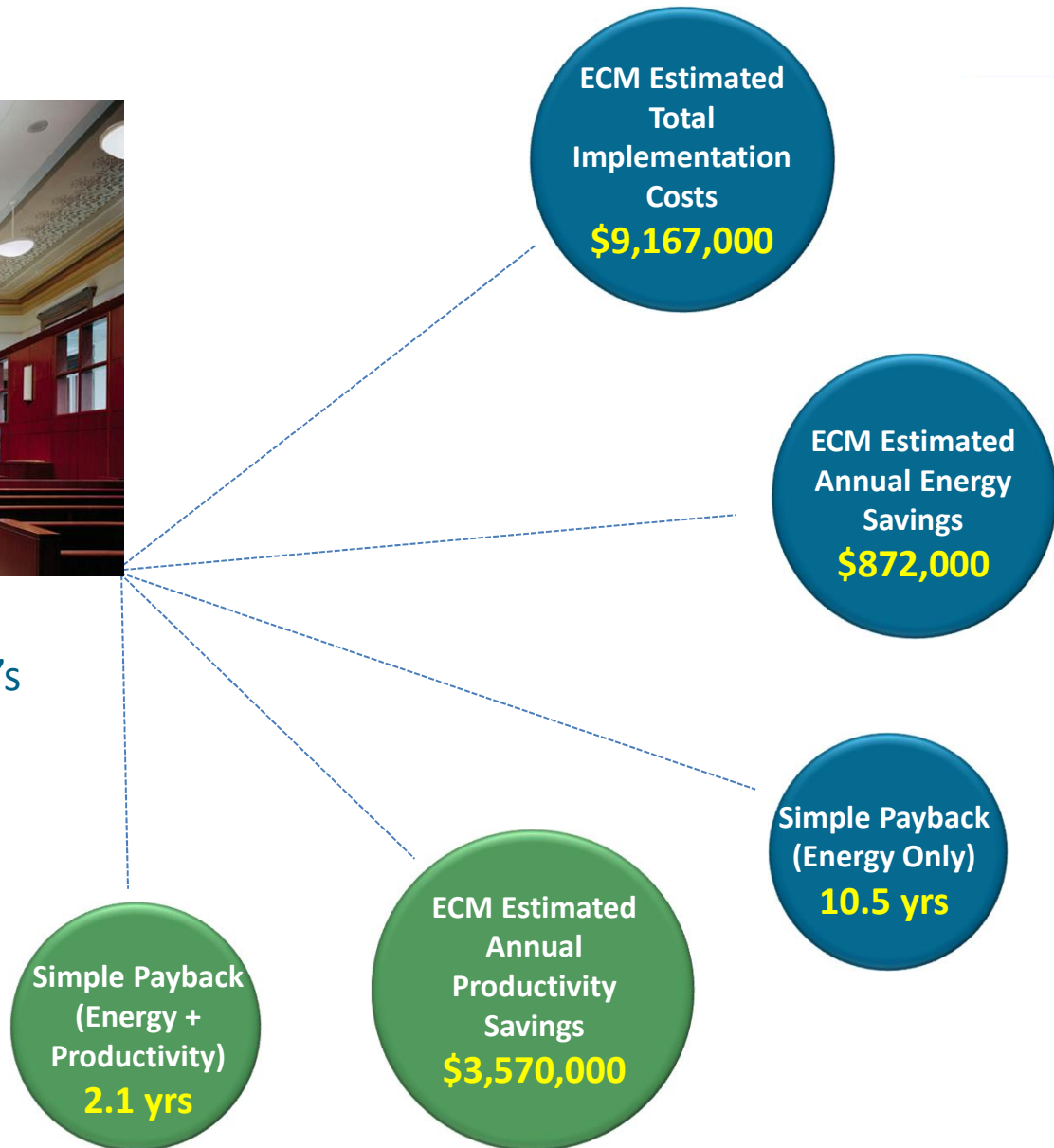


QUANTIFY PRODUCTIVITY/HEALTH IMPACTS



Conrad Duberstein U.S.
Courthouse and Post Office's
Energy Conservation
Measure (ECM) Total Cost
and Estimated Payback

Photo Rights: Cervin Robinson, Richard McElhiney
Architects LLC



QUANTIFY PRODUCTIVITY/HEALTH IMPACTS

Evaluation of Design Daylighting Options Using Productivity Impacts

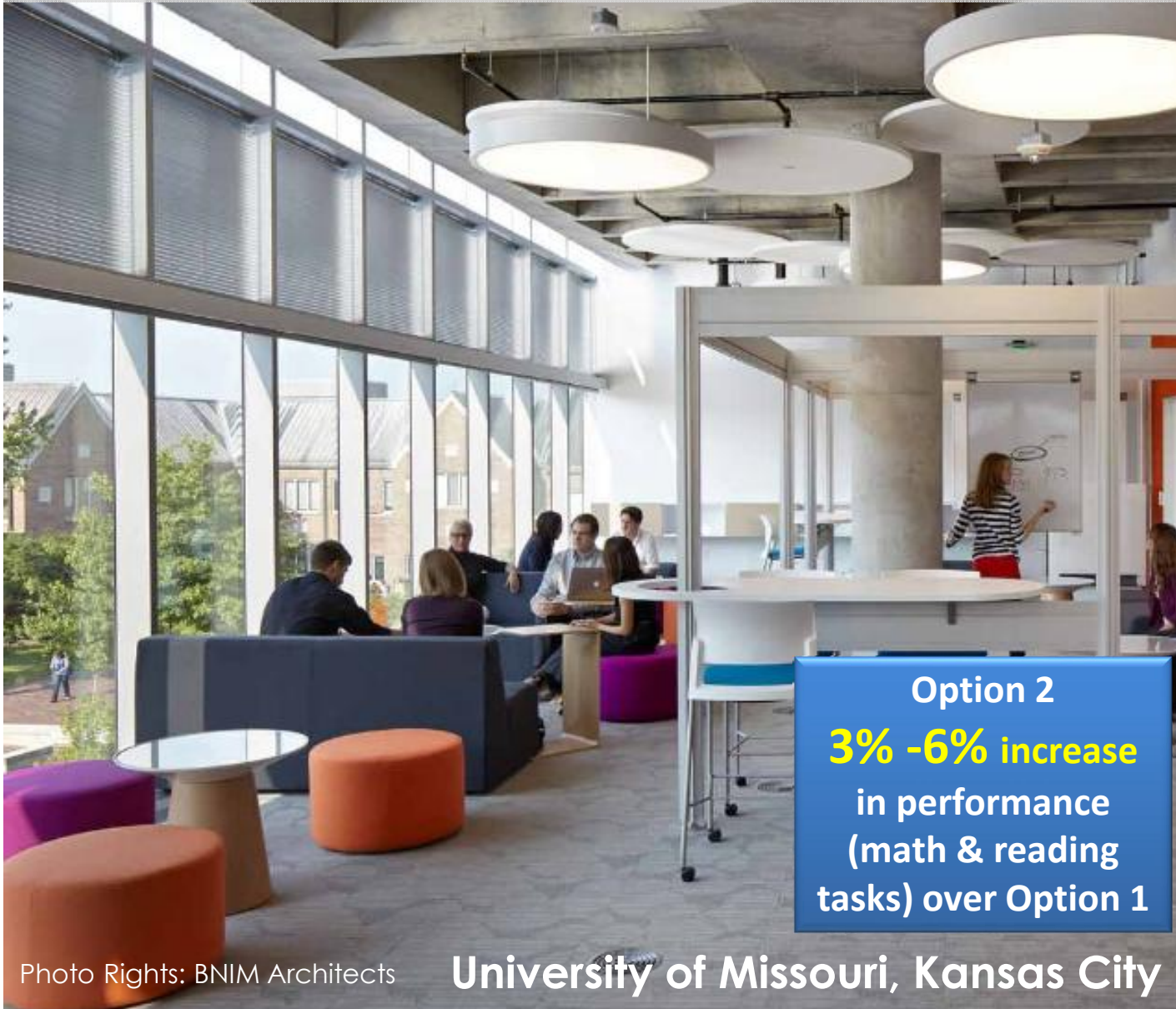







Photo Rights: BNIM Architects

University of Missouri, Kansas City

	50%	11
	25%	8
	0%	3
	25%	0
	50%	

Option 1: Frit Glazing

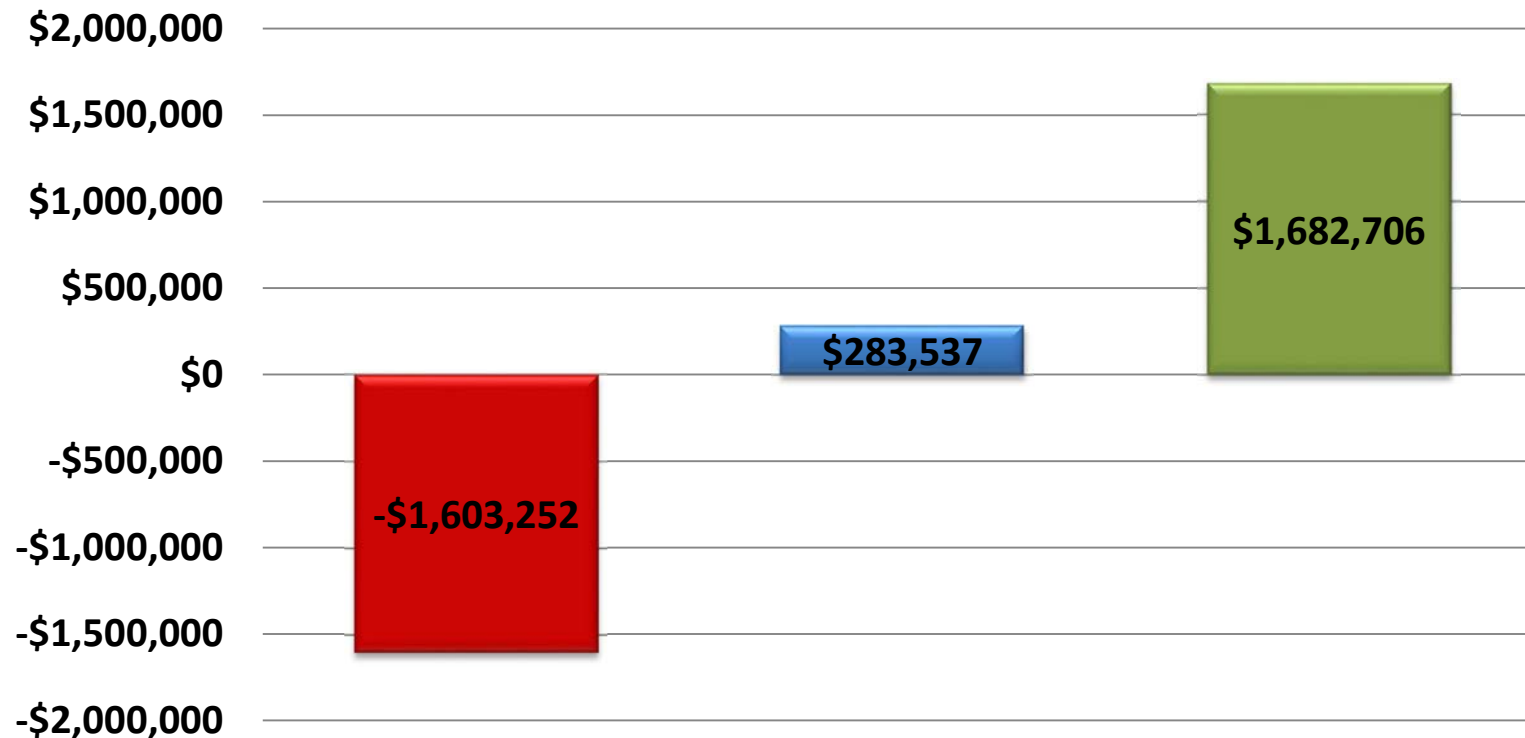


Option 2: LightLouver
+ Blinds/Shades

INCREASE NUMBER OF DECISION MAKERS

As well as GROUP UNITY

Utility & Productivity Impacts



■ 2011-2012 Utility Costs

■ Estimated Annual Utility Savings

■ Estimated Annual Productivity Improvement (Dollar Equivalent)



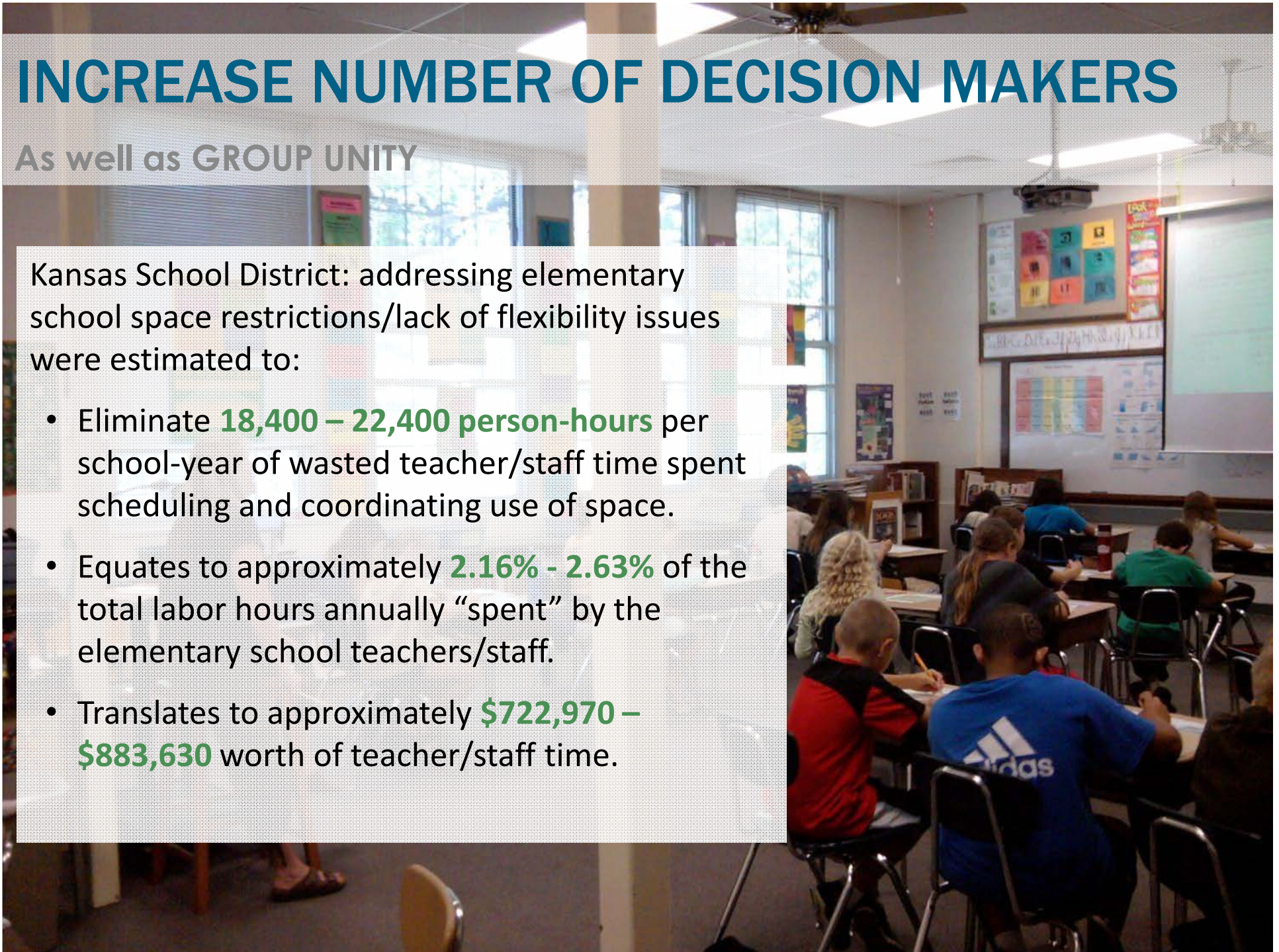
Kansas School District

INCREASE NUMBER OF DECISION MAKERS

As well as GROUP UNITY

Kansas School District: addressing elementary school space restrictions/lack of flexibility issues were estimated to:

- Eliminate **18,400 – 22,400 person-hours** per school-year of wasted teacher/staff time spent scheduling and coordinating use of space.
- Equates to approximately **2.16% - 2.63%** of the total labor hours annually “spent” by the elementary school teachers/staff.
- Translates to approximately **\$722,970 – \$883,630** worth of teacher/staff time.



INCREASE NUMBER OF DECISION MAKERS

As well as GROUP UNITY




- 
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Image Source:
http://surveyingproperty.blogspot.com/2013/03/climate-change-and-built-environment_11.html



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