

# Space: The Final Frontier for Institutional Research

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# Space: The Final Frontier for Institutional Research

## Introduction

- **1989 – Facilities information was in its infancy**
- **Until recently, facilities information relied on blue line drawings**
- **In 1989 it was considered cutting edge to use floor plans to gather information.**
- **In today's world geospatial information systems (GIS) and computer aided drafting (CAD) have become a standard for electronic floor plans**
- **With the newer facility information systems, new opportunities exist to coordinate information among a variety of units at an institution.**
- **New issues are bringing facilities information to the forefront of more IR offices (e.g., space projection models)**

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## Chapter 1 – Why are Data on Facilities Important?

- **Facilities are a permanent resource on campus**
- **Institutional researchers can assist senior administrators in managing these complex enterprises**
- **Compliance issues**
- **Increase in accountability issues**
- **\$15.1 billion spent by universities and colleges on new construction and renovations in 2006**
- **\$290 per square foot for a specialized science building in 2006**

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## Chapter 1 (Continued)

- **Easier to get Funds for new construction vs. for maintenance.**
- **There is no metric on how well space is used by function.**
- **Investment in a specialized field for a new faculty member can cost an \$1 million.**
- **Facility inventories lack information on movable assets (i.e. equipment and personnel) and function of space.**
- **Institutional researchers typically have intricate knowledge of the databases on campus and have a global perspective in regard to their institution. This makes them valuable for determining what information is needed on facilities and how that information should be combined with other data.**

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## Chapter 2 – Where to Start When Facilities Information is Questionable

- NSF has stated that research space will be even more important in the future.
- Clemson – Turnover with faculty members retiring and new research coming online caused for a re-evaluation of space.
- Clemson – 15 research buildings and the inventory had become woefully out of date. To rectify the situation, Clemson decided to use an open source system from Medical University of South Carolina (MUSC).
- Clemson – First priority was getting buy in from university stakeholders.
- Clemson – Once the errors were corrected in the facility database, the Vice President of Research used the information to hold his deans accountable for empty laboratory space. The Project was considered successful.

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## Chapter 2 (Continued)

- MUSC – Before 1990, the Physical Plant was the sole information on facility space.
- MUSC – 1980's began to assign space to different colleges at the institution.
- MUSC – There were several shortcomings to correct; the accuracy of the information, additional fields needed to be added to get the required information for each room (multi-functional areas) and development of a web based database system for facility information.
- MUSC – The real issues to resolving the facility inventory were not the technical issues, but were the cultural issues.

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## Chapter 2 (Continued)

- UTD – THECB mandatory facility inventory report and the federal indirect cost recovery projects caused OSPA to become involved in getting the facility inventory cleaned up and accurate.
- UTD – Started life in 1962 as the Graduate Research Center of the Southwest as a private research “think tank” for cold war research. Sponsored by the founders of Texas Instruments.
- UTD – 1969 became UT-Dallas and began expanding facilities rapidly. 1997 the facility inventory was inaccurate and thus began development of the Logistical Tracking System in 2001 – present to correct the problems found in measurements by using GIS.
- UTD – Initially compared data that was in the mainframe to CAD floor plans or blue line drawings for a starting point to resolve out differences.
- UTD – Discovered that the CAD plans and blue line drawings were out of date due to renovations or were as designed plans instead of as built.

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## Chapter 2 (Continued)

- **UTD – Used GIS to get accurate floor plans from the previous information that was gathered and used LTS to interface with those floor plans.**
- **UTD – Geoscience department had students get GPS data on facilities for OSPA's mapping down of facilities process for state and federal reports.**
- **UTD – Did random spot measurements to make sure GIS shape files were accurate.**
- **Conclusion – processes to succeed must be adopted by institutional culture.**

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## Chapter 3 - Recommendations to Improve Space Projection Models and University Space Usage

- THECB – Space Projection Models does not take into account such things as fire codes, American with Disabilities Act (ADA), auditorium layouts, volume dimensions, student stations, true utilization of rooms and a provision for high technology equipment in classrooms.
- THECB – Does not take advantage of modern reporting capabilities to get an increase in accuracy for forecasting purposes and analysis.
- THECB – Did not state how the base numbers for the space projection model were arrived at for the calculations.
- THECB – Uses Full Time Student Equivalent (FTSE) instead of Semester Credit Hour (SCH) to determine need for various academic areas.
- THECB – Utilization guidelines does not take into account non-traditional commuter schools.

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## Chapter 3 (Continued)

- **THECB – Utilization guidelines do not take into account when all rooms across campus is utilized, thus restricting growth of a segment of course offerings if academic space is not available during a certain time slot.**
- **Suggested Improvements – Form a university space committee to improve space utilization.**
- **Suggested Improvements – Space should be surveyed annually.**
- **Suggested Improvements – Blocks of rooms should be assigned to academic areas by required needs of the department.**
- **Suggested Improvements – Have one database source for the facilities inventory. Avoid shadow databases.**
- **Conclusion – The traditional university structure has changed over the years and the THECB space projection model needs to reflect institutions with non-traditional students and different needs.**

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## Chapter 4: The Logistical Tracking System (LTS) Five Years Later: What Has Been Accomplished?

- LTS – Software application designed to not only track facility information but also track assets and personnel assignments within the facilities.
- Decentralized data streams and empowered users.
- New platforms allows use of new technology.
- Improvement in processes through using GIS.
- Advantages to developing an in-house system.
- Training students to work with LTS.
- Intellectual Property Rights

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## Chapter 4 (Continued)

- Understanding the data streams.
- Challenges in developing an in-house software system.
- Issues of Resources.
- Conclusion – What have we learned?

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## Chapter 5: Indirect Costs and Other Uses of Facility Data at Institutions

- Focus of chapter is to discuss how institutions are evolving in their use, and as a result, their collection and storage of facility data and to examine possible uses for facilities data as they relate to three academic issues:
  - Classroom management
  - Personnel management
  - Research activity

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## Chapter 5: Indirect Costs and Other Uses of Facility Data at Institutions

- Leaders are beginning to acknowledge that facilities are intricately linked to faculty recruitment and retention.
- In addition, the following challenges are gaining their attention:
  - the growing complexity of sponsored awards
  - Burgeoning deferred maintenance
  - Pressure to decrease state investment in facilities
  - Length of time need to build and renovate buildings

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## Chapter 5: Indirect Costs and Other Uses of Facility Data at Institutions

- These escalating costs combined with the accountability and budget constraints facing most public institutions once again bring space planning to the fore of higher education interests.

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## Chapter 5: Indirect Costs and Other Uses of Facility Data at Institutions

- The authors use the term *academic space management* to refer to facilities –based data that can address such issues as academic space allocation, development of benchmarks relative to program needs, and using the benchmarks as a foundation for setting expectations and making decisions.
- To make use of a space database for planning and operational decision-making, it is necessary to construct it so as to enable data on space to be linked with other institutional information.

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## Chapter 6

### The Impact of Facilities on Recruitment and Satisfaction of Students

- Project was designed to identify physical campus characteristics that may influence student recruitment and satisfaction of enrolled students
- Online questionnaire survey collected non-randomized data from 13,782 students at 27 mostly public institutions in the U.S. (86%) and Canada (14%)
  - 68% female
  - 85% non-Hispanic white
  - 65% urban or suburban
  - 21% freshmen, 20% sophomores, 23% juniors, 25% seniors, 11% grads
  - 78% w/ GPA  $\geq$  3.0
  - 69% lived on-campus, 11.5% at home
  - 60% visited campus prior to enrollment

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- Essential or very important institutional characteristics:
  1. Academic quality (major, faculty, career preparation)
  2. Overall quality of campus facilities
  3. Location
  4. Extra-curricular activities
  
- Facilities looming large in the selection of the institution:
  1. Academic facilities (major, library, classrooms, technology)
  2. Residence halls
  3. Recreation areas
  4. Student union
  
- Facilities important to see during pre-enrollment visit:
  1. Related to major
  2. Residence halls
  3. Library
  4. Classrooms

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- Facilities missing, inadequate, or poorly maintained at rejected institutions:
  1. Residence halls
  2. Related to major
  3. Classrooms
  4. Open space
- Characteristics considered more important by gender
  - *Women:* Academic-related (career/grad-school prep., major, faculty, advising, challenging courses)
  - *Men:* Sports and technology related (recreation, science & engineering, varsity & intramural)
- Importance of facilities by institutional control and level
  - Students at private institutions are more picky than those at publics about the quality and maintenance of facilities
  - Off-campus facilities are more important to students at public institutions
  - Upper-division students are less satisfied than lower-division ones

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## Chapter 7

### The Ecology of Learning: The Impact of Classroom Features and Utilization on Student Academic Success

- Estimate the impact of physical classroom attributes
  - Natural lighting (i.e., presence of windows)
  - Room size (i.e., square footage/meters)
  - Class size (i.e., number of students in room)
  - Classroom density (sq. ft/m per student)
- Estimate the impact of classroom utilization
  - Time of class attendance (e.g. morning vs. afternoon)
- ...on student academic success in terms of
  - First-year cumulative grades/marks received
  - Second-year retention (subsequent re-enrollment)

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## Research on the Ecology of Learning in Higher Education

- A few studies on class size (Pascarella & Terenzini, 2005)
- No studies in the past 15 years on the influence of classroom physical attributes or class timing/scheduling
- More developed research at the primary/secondary school level (e.g., class size, density)

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## Conceptual Approach

- Input-environment-output (I-E-O) model based on Astin (1993)
- Statistical control of covariates for
  - Student demographic background
  - Pre-university academic preparation
  - First-year university experience
  - First-year curricular experience (special focus on math and English)
- Gauging first-year cognitive growth via
  - Standardized university entry tests
  - Cumulative first-year grades/marks

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## Control Variables

- *Demographic*

- Gender
- Ethnicity/race
- Age
- Parent income
- Residency

- *Academic Preparation*

- Entry test scores (ACT/SAT)
- AP credits (y/n)
- Preparation index

- *Campus Experience*

- On-campus living (y/n)
- Varsity athlete (y/n)

- *Financial aid*

- Remaining first-year financial need (\$1K, constant 2005)
- Pell grant 2<sup>nd</sup> year offer
- Inst'l aid 2<sup>nd</sup> year offer

- *Academic Experience*

- Course load (credits)
- Number of science classes
- Average grade awarded in classes taken

- *Core Curricular Exp.*

- English/math highest course completed and grade/mark received in first year

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## Statistical Methods and Cohorts

- Influence on first-year grades/marks (GPA): *OLS regression with covariate block entry (mediated eff.)*
- Influence on second-year retention: *binary logistic regression with covariate block entry (mediated eff.)*
- Data quality confirmed via:
  - Collinearity diagnostics ( $VIF < 3$ , VD matrix  $< 0.8$ )
  - Regression diagnostics (std residuals  $< 3$ , Cook's  $D$  no visual separation, Mahalanobis distance)
  - Cross-tabulation with program major variable to obviate data sparseness in logit models
- Student cohorts: 2001-2005 new first-year students, i.e. ~9,100 cases (or 95% of total first-year population net of outliers/listwise deletion of missing cases)

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## Findings

- *Natural lighting* (windows) of classrooms shows significant correlation with academic performance, but no consistency in results (Collins, 1975, found no connection)
- *Room size* is negatively correlated with academic performance (cognitive gain), but of small effect size (corroborating evidence in Becker et al., 1973)
- Taking classes in the *afternoon*, as opposed to in the morning, shows negative correlation with academic performance

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## Findings

- No significant correlation, associated with *class size* or *classroom density* in estimating academic performance or second-year return (corroborated by Holliman & Anderson, 1986)
- Physical attributes of classrooms and timing of classes do not correlate with first-year student retention
- Academic experience in core courses are key indicators of cumulative cognitive gain
- Cumulative cognitive gain is key to student persistence in higher education, overriding financial need and socio-demographic background

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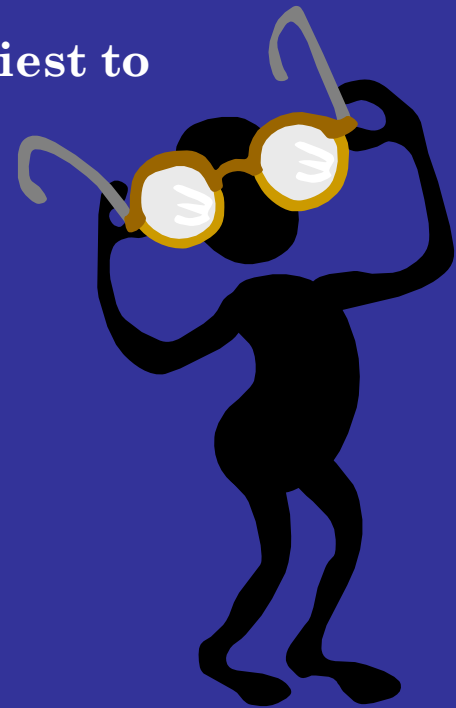
## Chapter 8

### Taking a Fresh Look at Facilities Data: Lessons Learned

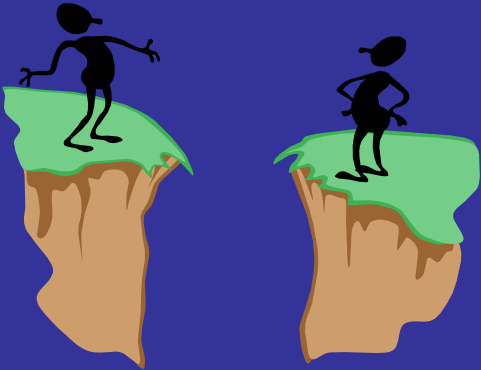
#### ➤ Lesson One: What You Don't Know *Can* Hurt You.

➤ If we limit our analyses to those data that are easiest to access or most familiar to us, we run the risk of overlooking data resources with which we are less familiar.

➤ Organizational structures can be developed that leverage institutional knowledge, e.g., a data governance group.



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## Chapter 8 Lessons Learned

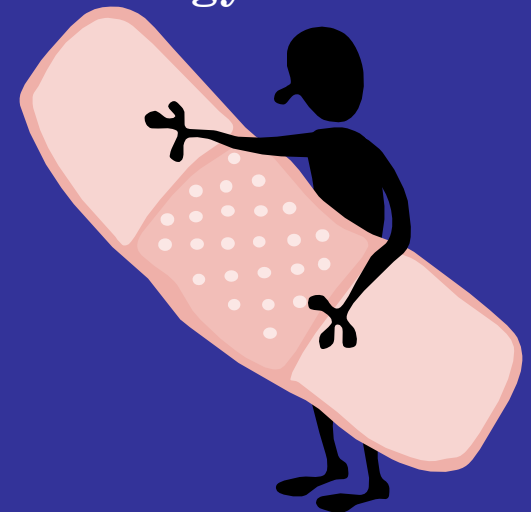
### Lesson Two: Operational Systems Are Not Designed to Support Ad Hoc Studies

- **Inventories are operational systems: they have a narrowly defined purpose, with data redundancies and inconsistencies, a small set of users, lengthy data collection and reporting procedures, and difficult to access**
- **Facilities inventories must be redesigned and integrated with other campus data to create data that can be used for broad-based decision support**

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## Chapter 8 Lessons Learned

- **Lesson Three: Data First, Technology Second.**
  - In the context of developing or purchasing a new facilities management system, clearly identify the purpose, the data needed, and the business processes that originate the data before beginning the transition to a new technology.
  - New technologies should not lead the conversion process: “paving over the cow path”.



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## Chapter 8 Lessons Learned

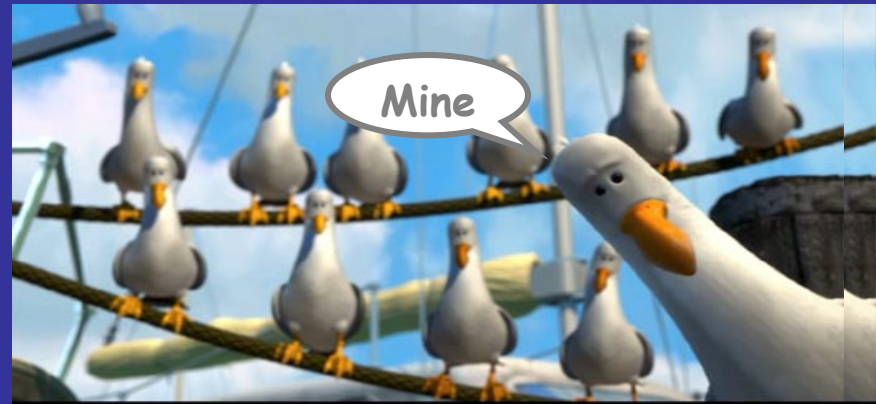
- **Lesson Four: Sharing Your Data Makes It Better.**
  - **Facilities inventories were developed for a narrow audience and therefore it is not surprising that they are seldom updated or improved.**
  - **Expanding the audience will place it under the scrutiny of those individuals who know most about it locally**
  - **Expanding the audience will increase the sophistication of the inquiries and analyses involving the data.**

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## Chapter 8

### Lessons Learned

- **Lesson Five: It Takes Skill and Time to Teach Old Dogs New Tricks.**
  - There are a number of tensions created when an institution attempts to expand the boundaries of well-established roles and decision processes.
  - The propriety nature of data, especially facilities data, increases this tension.
  - Treat it as a cultural change, and proceed accordingly.



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Questions?

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**End of Presentation**