Studying a Math Help Center using Organizational Development and Change Theory

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Math Centers: Names and General Goal

- Math help centers, math learning centers, math support centers, math tutoring centers

- **Goal**: To provide support services (usually tutoring) to undergraduate students in math courses, often focusing on the math courses students take during their freshman and sophomore years
Math Centers: Common Fixtures

- Math Centers rather common entities in postsecondary education - Recent MAA study conducted shared that >70% of calculus course coordinators surveyed reported their institutions had Math Centers (Johnson & Hanson, 2015).

- Recent handbook for Math Center directors (Coulombe, O’Neill & Shuckers, 2016) with contributors from 31 various institutions ranging from two-year community colleges to liberal arts institutions to large research universities.

- Students typically receive tutoring services from peer tutors (Rickard & Mills, 2018)

- Tutoring is usually on a drop-in basis (Byerley et al., 2019)
Math Center Tutoring: Different but Beneficial

- Tutoring at drop-in Math Centers differs significantly from traditional tutoring and needs more research (Cooper, 2010)
- Attending Math Center tutoring has more of an impact on lower-achieving students’ grades; students’ final course grades increase by one percent with every three visits per semester to a Math Center (Rickard & Mills, 2018)
- In a meta-analysis across content areas, positive correlation between students’ attendance in tutoring programs and course outcomes; benefit of tutoring centers more pronounced with mathematics tutoring than other content areas (Cohen, Kulik & Kulik, 1982)
Math Centers: Attendance Common in Existing Research

- Studies on often focus on sign-in data.
- High-risk and underprepared university students less likely to attend Math Center to seek out tutoring, even when explicitly encouraged to do so (Hodges & White, 2001, Rogers, 2010).
- Bannier (2007) used correlational analyses and reported:
  - Confidence in mathematics negatively correlated with attendance
  - Young, inexperienced students least likely to visit math center
  - Academic and life experience (i.e., years in college and since high school graduation) both positively correlated with attendance
Math Centers: Attendance (similar findings in UK)

- Mac an Bhaird and colleagues (2009) reported that math center attendance had a positive effect on students’ grades, and this was particularly beneficial for students whose mathematical backgrounds were weaker.

- Halcrow and liams (2011) found that lower ability students were less likely to attend a math center, and that there was a correlation between the time spent in a math center and course grades.
Math Center: Existing Corpus of Research

- Little is known about:
  - How math help centers come into existence
  - How they operate
  - What specific services they offer and how these change over time
  - What challenges they face

- Budding research group
  - Summer workshop
  - Weekly telecons
  - RUME working group
Framing Theories from Weisbord & Lewin

Marvin Weisbord’s six-box model

Kurt Lewin’s ideas on organizational culture and evolution
Weisbord’s Model for Understanding Organizations

- **Purpose**: What is the primary goal of the organization? What business are we in?
- **Structure**: How is work divided up?
- **Relationships**: How is conflict managed?
- **Rewards**: What incentives are offered?
- **Mechanisms**: What means/technologies are used to help the organization?
- **Leadership** (should coordinate other 5 boxes): Who makes sure the above are kept in sync?
Organizational Fit: Individual-Organization-Environment

- **Fit between the organization and environment**
  extent to which purposes and structure support 1) high performance and 2) ability to change with conditions

- **Fit between individual and organization**
  extent to which people 1) support or 2) subvert formal mechanisms intended to carry out an organization’s purposes
Kurt Lewin: Father of Modern Social Psychology

- Often noted for:
  - Idea that behavior is a function of person and situation.
  - Organizational change theory
  - Quote: *If you want to truly understand something, try to change it.*
Lewin’s Change Theory: Need for reflection (short & long term)

- **Unfreeze**
  - Status quo with some motivation for change
  - Need to build trust and recognition of need for change (i.e., status quo is not beneficial)

- **Change**
  - Movement stage where target is new equilibrium
  - Carry out plans; execute change actions

- **Refreeze**
  - Stabilization stage to ensure new equilibrium “sticks”
  - Must find mechanisms to ensure new values, practices
Lewin’s Force Field Analysis: Restraining and Driving Forces

Status Quo

Desired State
Evolution of the OU Math Center
OU’s Math Center: Humble Beginning in 2001

Purpose:
- Drop-in tutoring for Business, Life and Social Science Calculus 1 & 2

Structure:
- 4 graduate assistants serving as tutors, one tutor per shift
- Hours of operation: MTWRF, 1 pm – 5 pm

Relationships:
- Math Center receptionist checked in hourly

Rewards:
- Quarter of each GA’s assignment (some stipend/tuition monies)

Mechanisms:
- Math Center housed just across from Math Dept office in 713 ft$^2$ room with tables and chairs

Leadership: Receptionist or tutors reported to Math Dept chair, if issues
OU’s Math Center:
Understanding the Changes in 2001

Reasons for change from status quo:
- new textbook
- calculators were adopted in the course
- large sections being taught

Buy-in:
- Help for those teaching the courses
- Benefit for students in those courses
- Relatively little expense

Mechanism for ensuring change:
- Course fee added to those courses
OU’s Math Center: Growth by 2004

Structure:
- Maintained with additional graduate assistants serving as tutors
- Hours of operation extended: 9:30 am - 5:30 pm MWF and 9 am - 5pm TR

Rewards:
- Seen as easy assignment, GAs often able to do own work in Math Center

Reason for change:
- Volume of students wanting tutoring
- Hours more amenable to student schedules
- Abundance of GAs who needed assignments
OU’s Math Center: Gradual changes to 2011

Purpose
Drop-in tutoring for most courses taken by students in their first year

Structure:
- Additional courses added
- A few undergraduate tutors added for courses less familiar to GAs (Critical Thinking, gen-ed math course)

Reason for change:
- Students in many first year math courses struggling (high DFW rates)
- Good PR for Math Department (seen as being responsive to students’ needs)
  - In College of Arts and Sciences
  - Across campus
- Abundance of GAs needing assignments
OU’s Math Center: Major Changes in 2012

Purpose
- Support for all math courses up to multivariable calc (Calc 3 & 4)

Structure:
- Hours of operation: 9:30am-5:30pm MTWR and 9:30am – 3:30pm F
- Maintained GAs and added more undergrad tutors (because of demand)

Relationships:
- Math Center Director was hired to oversee GAs

Mechanisms:
- Math Center on different floor but same building in new location that seated 65 students in 1,877 ft²

Leadership:
- Math Center Director reported to Math Dept chair, tutors reported to Math Center Director
OU’s Math Center: Understanding the Changes in 2012

Reasons for change:
- Volume issues, too many students for space
- Too big of enterprise not to have direct oversight
- Students past Calc 1 & 2 were still coming to Math Center, even though their courses were not “covered”

Buy-in:
- College of Arts and Sciences saw the benefit
- Above show of support well received by the math faculty
- Appreciation of earlier closing on Fri and late opening on Tues/Thurs

Mechanism for ensuring change:
- CAS and put up space for the Math Center, money for undergraduate tutors, and money for the Director position
OU’s Math Center: Organizational Efficiency Efforts

By 2014

Structure:
- Evening review sessions for coordinated Precalculus exams
- Tutoring available during finals week

Mechanisms:
- Specific areas assigned for different courses with color coded signage and hand raising systems

Mechanisms/Rewards:
- Tutor training for Calc 3 & 4 and for Business, Life, and Social Science Calculus 1 & 2; certification in areas made available to tutors
OU’s Math Center: Understanding the Changes in 2012

Reasons for change:
- Volume issues, too many students for space on Precalculus exam nights
- Pushback from students on not offering help during finals week
- Grouping students in areas helped tutors meet students’ needs and helped students work collaboratively

Buy-in:
- Tutors saw changes as leading to more order/less confusion in Math Center

Mechanism for ensuring change:
- Recruited faculty to help with evening review sessions (which helped them with overcrowded office hours)
So, what about the Math Center today?
OU’s Math Center: Details as of Fall 2018

- Expanded the center to include 5 color-coded areas that seat 200 students in 4,723 ft\(^2\) with 3 entrances all with swipe entry system
- Maintain both graduate and undergraduate tutors
  - 303 hrs/wk for UG tutors, 230 hr/wk for GA tutors, 69+ hrs/wk for front desk assistants
- Hours of operation: 9:30 am – 7pm MT, 9:30 am – 5:30 pm WR and 9:30 am – 3:30 pm F, 3:00 – 7:00 pm Sundays (in dorms) & After Darks
- On target to have about 30,000 visits to the center this fall, average weekly number of visits 1,770 with about half of all students eligible attending
- Training for Business, Life, Social Sci Calc 1 & 2; Calc 1 & 2; Calc 3 & 4; Precalculus, Critical Thinking (flex tutors: pay scale for undergrads)
Six-Box Model

- Purposes
- Structure
- Leadership
- Mechanisms
- Rewards
- Relationships
- Environment
Freshman Enrollment (First-Time, Full-time Students)

- 2001: 3,748 Math Center opens
- 2002: 3,833
- 2003: 3,808
- 2004: 3,614 More tutors, extended hours
- 2005: 3,245
- 2006: 3,342
- 2007: 3,883 Increase in number of courses served
- 2008: 3,803
- 2009: 3,760
- 2010: 3,724
- 2011: 4,053
- 2012: 4,138 Math Center opens in new larger space
- 2013: 4,138
- 2014: 4,052
- 2015: 4,176
- 2016: 4,200 Math Center introduced After Dark events
- 2017: 4,198
- 2018: 4,473 Math Center expands to much larger space
Bigger Picture: Individual-Organization-Environment

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GA salaries stagnant
GA #s drop about 20%
Math Center: Incredible Growth in Visits

As of Fall 2017, almost half of the students in courses served by the Math Center visited it at least once. (2,671 unique student visitors)
Individuals – Organizations – Environment

- Support or subvert mechanisms to carry out organization’s purposes
- Purposes and structure support performance and ability to change
Math Center’s Future: Challenges and Changes

- Many FYM instructors holding some office hours in Math Center
- Work with the Graduate Student Advisory Council on tutor handbook (clear expectations, university resources) and to keep them informed of the situation
- Considerations to having more (or only) undergraduate tutors in Math Center (only UG tutors for After Darks starting this spring)
- Poorer tutor performance from graduate tutors (sparked a triggered inquiry and positive report system)