# Organizing for instruction in education systems and school organizations: how the subject matters

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Presented by:

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# Overview

- Motivation for paper
- Previous Work
- Data
- Methods
- Results

# Aims of paper

- Paper explores the advice relationships among different elementary schools at "Auburn Park"
  - Questions whether there are different effects for varying school subjects
  - Aims to see whether leadership positions impact advice connections
- Use social network analysis to evaluate these questions

# Motivated and framed by two empirical and theoretical anchors

- 1.) Anchored in research that points to the importance of teachers' interactions with peers for their learning and development, and how the organizational infrastructure influences or structures these interactions
- 2.) Motivates and frames work with research on how school subjects matter in classroom, school, and institutional work related to teaching

# Teacher learning from peer interactions

- Recent work has highlighted the benefits of teachers' learning for students, where higher levels of teacher collaboration were associated with high student achievement on high-stakes test in both math and reading
  - Goddard et al. 2007
- Social interactions, advice-seeking interactions specifically, are associated with the transfer of information in the classroom
  - Frank et al. 2004, Reagans and McEvily 2003

# School subjects and organizing for instruction

- Research suggests that school subjects and teachers' perceptions of these subjects shape teachers' work and their response to efforts at reforming their practice
  - Ball 1981, Ball and Lacey 2012, Grossman and Stodolsky 1994, Little 1993, McLaughlin and Talbert 1993, Siskin 1991,1994
- Elementary or primary school teachers are typically generalists, with no specific subject specialty
  - Stodolsky 1988
- Institutional sector treats school subjects differently. Mathematics and literacy receive more attention from policy makers
  - Burch and Spillane 2005

# Outline of Methods

- Social network survey
- Social network measures used
- Formal system and organizational infrastructure measures
- Social network data analysis

# Quick overview of the data

- Data from social network survey collected over three years in a Midwestern school district-Auburn Park
- School Staff Questionnaire administered every spring from 2010 to 2012 to all teaching and admin staff in district's elementary schools
- 2012- 5786 students were present in Auburn Park's 14 elementary schools
- Schools served predominantly white student populations
  - Socioeconomic makeup varied from 5 to 58% of a school's students receiving free or reduced-price lunches

# School by school summary

**Table 1. Elementary school demographics, Auburn Park School District, 2012.**

| School | Students enrolled | White (%) | African American (%) | Latino (%) | English learner (%) | Free/ reduced lunch (%) | Staff in network |
|---|---|---|---|---|---|---|---|
| *Kingsley* | 564 | 89 | 2 | 4 | – | 7 | 32 |
| *Chamberlain* | 528 | 91 | 3 | 3 | – | 5 | 30 |
| *Ashton* | 484 | 74 | 5 | 12 | 7 | 40 | 31 |
| Ashe | 464 | 88 | 2 | 5 | – | 7 | 27 |
| Warner | 446 | 84 | 7 | 2 | 4 | 18 | 27 |
| Abbott | 441 | 93 | 1 | 4 | – | 23 | 24 |
| *Bryant* | 436 | 81 | 6 | 8 | – | 39 | 34 |
| Riley | 403 | 89 | 4 | 3 | – | 28 | 26 |
| Northvale | 395 | 86 | 4 | 5 | – | 14 | 22 |
| Torres | 393 | 76 | 9 | 8 | 9 | 44 | 29 |
| Cisneros | 353 | 88 | 3 | 4 | – | 16 | 22 |
| *Chavez* | 343 | 71 | 11 | 11 | 8 | 58 | 28 |
| Stevenson | 277 | 69 | 10 | 10 | 9 | 48 | 22 |
| Easton | 259 | 83 | 3 | 5 | – | 10 | 17 |

*Notes.* A missing value indicates that data were masked to protect student identity, as fewer than 10 students were reported in the subgroup. Schools in italics were interview sites.

# Methods - Social network survey

- Surveys to measure the advice and information-seeking interactions among staff in three core elementary subjects: literacy, mathematics, and science
- 2010 Survey
  - 331 staff members responded to the survey
  - Average response rate of 81%
- 2012 Survey
  - Overall response rate of 94% of 371 staff member responses
- "During the school year, to whom have you turned to for advice and/or information about curriculum, teaching, and student learning?"
  - Listed up to 12 individuals and the content area for which they sought advice

# Methods- Social network measures

- Gini coefficient: extent actors are part of network's core versus periphery
  - Indicates amount of inequality in network
- Network density: measure of proportion of potential ties between actors in network that are acutalized
- Degree Centrality: measures network activity and centralization
- Betweenness: measure of brokering
  - Extent to which an actor links two other actors in a network

# Methods- Formal system and organizational infrastructure measures

- Full-time leadership or specialist positions
  - Aka school principals, literacy facilitators (14), reading specialists (5), math facilitators (2)
- Teacher leaders
  - Such as program coordinator, grade-level team leader, mentor teach, or district curriculum committee member
- Full time teachers with no leadership designation

# Methods- social network data analysis

- Calculated gini coefficients and densities for schools' literacy, math, and science networks in 2012
- Found centrality measures for all survey respondents in 2012
  - Calculated averages across district
  - Examined these for each school subject by position type
  - Compared average centrality measures between these groups using one-way ANOVA with permutation tests
  - Permutation tests to replicate randomly 5000 times and calculate significance levels – allow assumption of independence

# Walk through the findings

1. Advice interactions about teaching and learning in Auburn Park elementary schools differed by school subjects
2. Organizational infrastructure (designated leadership positions) is associated with advice interactions by school subject
3. Examined whether or how adding facilitators were associated with changes in advice interactions (implementation of math facilitators in 2011)

# Subject matters for advice seeking

- Kingsley Elementary School in 2012

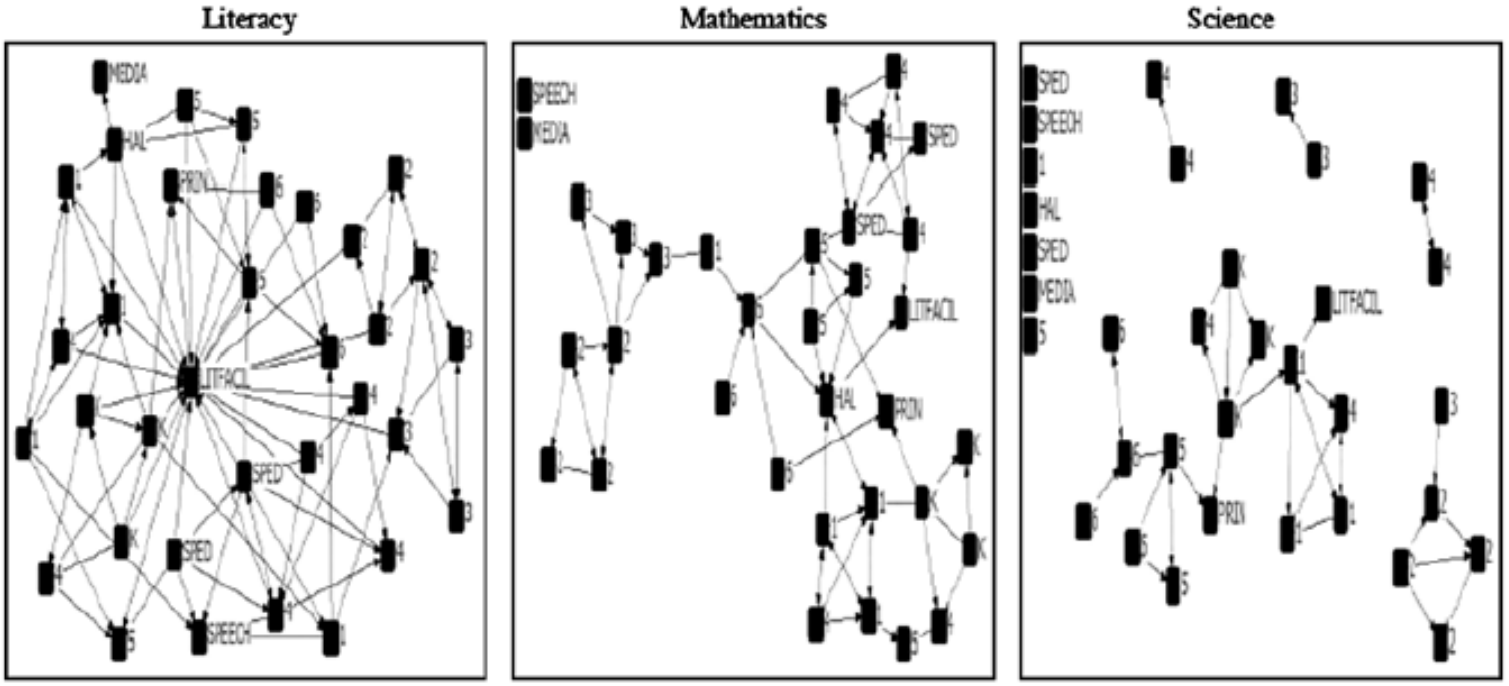


**Figure 1. Kingsley elementary school (no mathematics facilitator) social network diagrams by subject, 2012.**

# More formal statistics by subject

- Literacy networks on average 50% denser than math,150% denser than science, and math is 66% denser than science
  - Percentages varied by school
    - Literacy > math : 8 to 92% denser
    - Math > science: 17 to 136% denser
- Gini coefficients show literacy has more teachers acting as central advice providers
  - Average gini coefficient was 0.54 for literacy, 0.69 for mathematics, and 0.80 for science

# Summary of the centrality measures and betweenness

**Table 2. Average centrality measures in subject matter networks, 2012.**

| | Literacy | Mathematics | Science | Change from math to literacy (%) | Change from science to math (%) |
|---|---|---|---|---|---|
| In-degree | 2.93 | 2.02 | 1.19 | +45.0 | +69.7 |
| Out-degree | 3.63 | 2.41 | 1.40 | +50.6 | +72.1 |
| Betweenness | 38.08 | 21.94 | 2.52 | +73.6 | +770.6 |

Still, propensity of elementary teachers and school leaders to seek, give, or broker teaching advice is likely a function of leaders available to provide such advice

# Infrastructure, instructional interactions and subject matters

- Prior work shows infrastructure for supporting teaching and its improvement differs by school subjects
  - Many formal leadership positions or specialists often are assigned to literacy rather than math or science
- This analysis suggests Auburn Park's infrastructure differs by subject
- School leaders with no subject assignment more central in some subject advice networks than others
- Formally designated school leaders were most central advice givers in subject area

# Numbers to support these findings

**Table 3. Mean (and Standard Deviation) comparisons for centrality measures, 2012, Based on one-way analysis of variances, with permutation-based standard errors and tests ($n = 371$).**

| | | Literacy | | | Mathematics | | | Science | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | In-deg. | Out-deg. | Between | In-deg. | Out-deg. | Between | In-deg. | Out-deg. | Between |
| Principals | 14 | 5.7 (3.3) | 4.9(3.6) | 137.4(65.8) | 4.1(3.3) | 3.6(2.9) | 53.7(52.1) | 1.7(1.8) | 1.8(2.3) | 10.0(18.6) |
| Literacy Facilitators | 14 | 16.1 (4.7) | 5.9(3.2) | 214.9(177.2) | 0.7(0.8) | 1.1(1.1) | 2.7(10.0) | 1.1(0.9) | 1.0(1.8) | 0.0(0.0) |
| Reading Specialists | 6 | 5.8(3.2) | 6.3(4.0) | 140.9(93.7) | 0.0(0.0) | 0.0(0.0) | 0.0(0.0) | 0.0(0.0) | 0.0(0.0) | 0.0(0.0) |
| Math Facilitators | 2 | 1.5(0.7) | 1.5(0.7) | 3.8(5.4) | 19.5(0.7) | 8.5(4.9) | 285.0(249.0) | 0.5(0.7) | 0.0(0.0) | 1.57(5.9) |
| Teacher Leaders | 96 | 2.8(1.7) | 3.1(1.9) | 31.3(44.9) | 2.6(2.6) | 2.4(1.8) | 28.5(62.6) | 1.5(1.2) | 1.3(1.5) | 3.3(8.1) |
| Teachers | 239 | 2.0(1.4) | 3.6(2.4) | 22.4(39.4) | 1.6(1.2) | 2.4(1.9) | 16.9(37.5) | 1.1(0.9) | 1.5(1.5) | 1.9(5.4) |
| *F* | | 164.3 | 5.9 | 38.5 | 50.6 | 8.4 | 15.5 | 7.4 | 1.7 | 4.0 |
| d.f. | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| *p* | | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0004 | 0.0006 | 0.0002 | 0.1248 | 0.0224 |

*Note.* Random replications are applied because our observations are not independent. Tests of significance are based on 5000 permutations.

- Used random replications because observations not independent
- Significance tests are based on 5000 permutations

# How did adding math facilitators change the network?

- Focused on 2 of 14 elementary schools
  - Kingsley – no math facilitator
  - Chamberlain – full time math facilitator position created in 2011
- Compared changes in 2010 and 2012 school years

Chamberlain Elementary School

Difference in network density between literacy and math 40% in 2010, decreased to 8% in 2012

Reaching network equality in Chamberlain

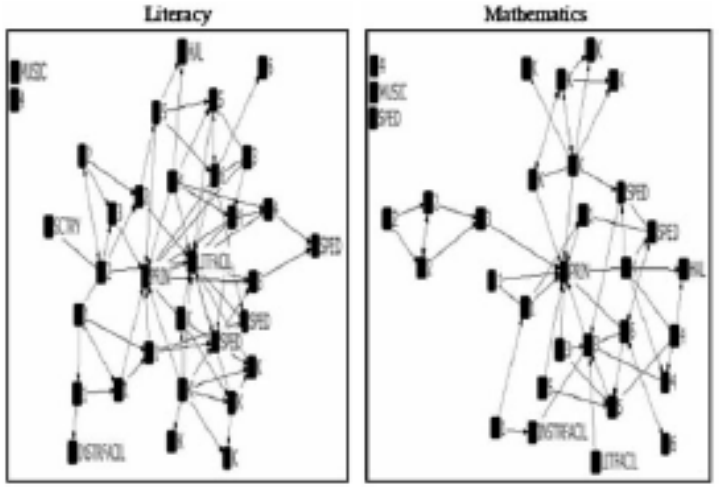


**Figure 3. Chamberlain elementary school (prior to mathematics facilitator) social network diagrams by subject, 2010.**

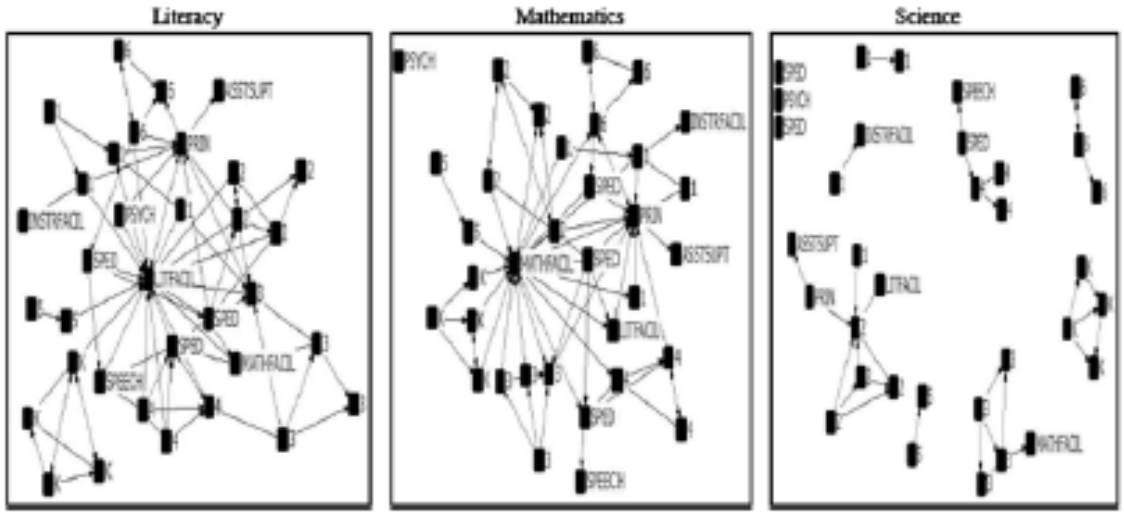


**Figure 2. Chamberlain elementary school (with mathematics facilitator) social network diagram by subject, 2012.**

# Compare results to Kingsley with no facilitators

**Table 4. Social network measures for case study schools, 2010 and 2012.**

| | Kingsley (no facilitator) | | | | | | Chamberlain (facilitator) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | | | 2012 | | | 2010 | | | 2012 | | |
| | Lit. | Math | Change from math to literacy (%) | Lit. | Math | Change from math to literacy (%) | Lit. | Math | Change from math to literacy (%) | Lit. | Math | Change from math to literacy |
| Density | 0.104 | 0.060 | +73 | 0.094 | 0.062 | +52 | 0.077 | 0.055 | +40 | 0.077 | 0.071 | +8% |
| Gini | 0.614 | 0.784 | −22 | 0.482 | 0.815 | −41 | 0.701 | 0.780 | −10 | 0.549 | 0.566 | −3% |
| In-degree | 3.43 | 2.05 | +67 | 3.09 | 2.19 | +41 | 2.73 | 1.73 | +58 | 2.67 | 2.57 | +4% |
| Out-degree | 3.86 | 2.24 | +72 | 3.44 | 2.38 | +45 | 3.21 | 1.91 | +68 | 3.10 | 2.87 | +8% |
| Triads (open and closed) | 674 | 181 | +272 | 447 | 111 | +303 | 306 | 171 | +79 | 342 | 316 | +8 |

- Adding subject specific leadership for mathematics facilitates more interactions and promotes overall network activity in the subject

# Concluding remarks

1. Show that elementary school staff members organize for instruction differently per subject
2. Subject matter differences in advice interactions are related to subject-specific differences in organizational infrastructures
3. Infrastructural changes can work to better subject-specific staff interactions

What this means?

Teacher learning is essential for improving education. This may be more of a challenge in certain subjects due to infrastructural restrictions

# Thank you. Questions?