Using Network Analysis to Understand Student Learning in Linguistically Diverse Settings

Youth-Nex Works-In-Progress Meeting
April 17, 2014

Lauren Molloy, PhD
Amanda Kibler, PhD
University of Virginia
Our Study

“Influences of classroom-level social settings on language and content learning in linguistically diverse classrooms”

The Current Team:

Amanda Kibler, Lauren Molloy, Valerie Futch, Nancy Deutsch, Nikki Duval, Fares Karam, Paul Yoder, Rebecca Bergey, and Ayanna Egbarin
Study Rationale

- Growing population of students in US schools who speak languages other than or in addition to English at home
- Inclusion of “English language learners” (ELLs) in accountability and standards-based reform
- How best to design classroom settings (curriculum, instruction, etc.) so that they simultaneously support language and academic content development?
Study Rationale

- Second language acquisition theory: interaction is key

- A small set of studies have documented positive results of instructional programs integrating adolescent English language learners with fluent English speakers, but

- what are the mechanisms through which this learning is believed to occur?
Terminology

- English language learner (ELL)
- English learner (EL)
- English as a Second Language (ESL)
- English for Speakers of Other Languages (ESOL)
- Limited English Proficient (LEP)
- Second language (L2) speaker or learner
- Emergent bilingual
Study Overview

**Purpose:** to better understand the classroom-level, teacher-student, and peer interactions that account for ELLs’ linguistic and academic learning in mainstream classrooms

**Setting:** middle school (grade 6-8) classrooms in which both English language learners (ELLs) and non-ELLs are enrolled.

**Mixed-methods:** Social network analysis alongside qualitative methods

**Data:**
- Quantitative: CLASS-S observations, student and teacher surveys, classroom seating arrangements, student assessment data (SOLs, WIDA, MAP), GPAs
- Qualitative: observational fieldnotes, video- and audio-recordings, student and teacher interviews
Our Study

- Phase 1 piloting in 3 (8th grade) classrooms in Spring 2013
  - N of students = 27
  - N of ELLs = 13

- Phase 2 piloting in 11 (6th grade) classrooms in Fall 2013-Spring 2014
  - N of students = 118 (56% of all students in targeted classrooms)
  - N of ELLs = 37 (80% of all ELLs in targeted classrooms)

- Phase 3 study in 35 classrooms (6th, 7th, & 8th) from Fall 2014-Spring 2017
  - Funded by WT Grant Foundation
Our Research Questions

1) What classroom features support language learning and academic development?

2) How do classroom social networks influence language learning and academic development?

3) What classroom features help to support beneficial social network dynamics (e.g., social integration of ELL students)?
Diversity

Development

Power

Classroom practices
- Instructional support (feedback quality, instructional dialogue)
- Emotional support (climate, sensitivity, regard for adolescent perspective)
- Classroom organization (instructional learning formats)
- Student engagement
- Cultural norms & practices
- Planned & contingent scaffolding
- Teacher emphasis on cross-language peer interactions
- Classroom seating chart

Classroom peer network-level features
- Network cohesion
- Language-based network segregation
- Hierarchical status structure

Interviews & field-notes

Selected CLASS-S Features

Level 2: Classroom

Level 1: Individual

Youth outcomes
- Content learning
- Language proficiency/learning
- Semester grades
- Teacher perceptions of students’ academic functioning

Individual-level features
- Overall centrality
- Personal network diversity
- Language learners’ investment
- Language learners’ legitimacy as speakers
- Language learners’ resistance
Classroom peer network-level features
- Network cohesion
- Language-based network segregation
  - Hierarchical structure

Individual-level features
- Overall centrality
- Personal network diversity
  - Language learners’ investment
  - Language learners’ legitimacy as speakers
  - Language learners’ resistance

Youth outcomes
- Content learning
- Language proficiency/learning
- Teacher perceptions of students’ academic functioning
Social network analysis

- Set of statistical techniques for studying complex networks of relationships
- E.g., friendships in a classroom

Who are your friends in this class? (check one or more)

- Anusha
- Clare
- Diego
- Eva
- Emilia
- Hillary
- Jack
- Neggme
- Santino
- Syed

- Used to quantify networks of relationships at network-level and the individual-level
Classroom network-level indices

Network Cohesion
a) Low Density
b) High Density

Language-based Network Segregation
e) High Network Segregation
f) Low Segregation (High Integration)
Individual student-level indices

a) High centrality

Overall Centrality

b) Low centrality

Indegree centrality = 5

Outdegree centrality = 2

Personal Network Diversity

c) High personal network diversity

d) Low personal network diversity
Social Network Measures

Who do you talk to when you’re trying to get work done in this class? (check one or more)

- [ ] Anusha
- [ ] Clare
- [ ] Diego
- [ ] Eva
- [ ] Hillary
- [ ] Jack
- [ ] Neggme
- [ ] Santino

Who are your closest friends in class?

<table>
<thead>
<tr>
<th></th>
<th>Not a friend at all</th>
<th>Know this person a little</th>
<th>Somewhat of a friend</th>
<th>Close friend</th>
<th>Very close friend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anusha</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clare</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diego</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Social Network Measures

Academic Help-Seeking Network

- **Source of help**
  - “Who do you talk to when you’re trying to get work done in this class?”

- **Help seekers**
  - “Who talks to YOU when THEY are trying to get work done in this class?”

Informal Social Interaction Network

- **Close friends**
- **Hang out in class**
- **Hang out outside of class**
  - “Who from your class do you hang out with most outside of class (like at lunch, in the library, or in the hallway between classes), before and after school, and on weekends?”

- **Comfort around**
- **Frequency of interaction**
  - Less than once a month
  - Once or twice a month
  - About once a week
  - A few times a week
  - Almost every day
Other Student-level Measures

- Student Demographics
  - Country of birth, other countries lived in, how long
  - Years in US
  - Language(s) most comfortable for: speaking, listening, reading, writing
  - Language(s) most often used outside of school to: read/write, watch TV, text/email/browse internet, speak with family, speak with friends

- Student Test Scores & Achievement
  - Language proficiency: WIDA
  - Academic competence: MAP scores, SOLs, GPAs
  - Teacher ratings of: academic effort, participation, topic comprehension, capacity to achieve, expected semester grade

- Classroom seating arrangements
Preliminary Results

- Variability in classroom density, ELL student centrality

Classroom A

- Indegree centrality: 6
- Cross-language centrality: 5

Density: 17%

Classroom B

- Indegree centrality: 1
- Cross-language centrality: 0

Density: 8%
Preliminary Results

- Variability in the extent of classroom-level segregation

Density of cross-language network: 4%

Density of cross-language network: 17%
Potential role of ELL concentration in shaping classroom peer dynamics?
Preliminary Results

- Variability in connectedness of ELLs within low-ELL-density classrooms

![Diagram showing network analysis with different indegree centralities](image-url)
Preliminary Results

- Moderate & higher-density classrooms

Avg indegree of ELLs: 4.5
Avg indegree of non-ELLs: 2.3

60% of ELLs’ ties are to other ELLs

Avg indegree of ELLs: 2.3
Avg indegree of non-ELLs: 1.75

68% of ELLs’ ties are to other ELLs
Preliminary Results

- Connectedness & clustering of ELLs within moderate and higher-ELL-density classrooms

- Avg indegree of ELLs: 3
  Avg indegree of non-ELLs: 3.7

- 31% of ELLs’ ties are to other ELLs

- 16% of ELLs’ ties are to other ELLs
Preliminary Results

- Just about maximizing connections to non-ELLs, or best to have some connections to both?

Engages in help-seeking interactions with 7 non-ELL peers as well as 3 ELL peers.
Differences by type of social tie under consideration?
Preliminary Results

Classroom 1
- 75% same-language
- 62% same-language

Classroom 2
- 93% same-language
- 71% same-language
**Preliminary Results**

- Varied patterns of academic/social overlaps across classes and students

83% of peers who “hang out” with each other in this classroom also seek help from each other

63% of helping relationships are also social

66% of peers who “hang out” with each other in this classroom also seek help from each other

57% of helping relationships are also social
## Correlations with Academic Functioning

<table>
<thead>
<tr>
<th></th>
<th>Capacity to Achieve</th>
<th>Class Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help-seeking relationships</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-ELLs chosen (proportion outdegree)</td>
<td>0.45*</td>
<td></td>
</tr>
<tr>
<td>Chosen by ELLs (# indegree)</td>
<td>-0.48**</td>
<td></td>
</tr>
<tr>
<td>Hang out at least once a week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chosen by non-ELLs (proportion indegree)</td>
<td>0.54**</td>
<td></td>
</tr>
<tr>
<td>Friendships</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chosen by non-ELLs (proportion indegree)</td>
<td>0.32+</td>
<td></td>
</tr>
<tr>
<td>Chosen by ELLs (# indegree)</td>
<td>-0.48**</td>
<td></td>
</tr>
<tr>
<td>Any peers chosen (# outdegree)</td>
<td>0.38*</td>
<td></td>
</tr>
<tr>
<td>Comfort around peers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-ELLs chosen (# outdegree)</td>
<td>0.36*</td>
<td>0.49*</td>
</tr>
<tr>
<td>ELLs chosen (# outdegree)</td>
<td></td>
<td>0.35+</td>
</tr>
<tr>
<td>Any peers chosen (# outdegree)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Correlations with changes in test scores

- Preliminary evidence that differences in peer network position matter for student learning

<table>
<thead>
<tr>
<th></th>
<th>Changes in standardized test scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>&quot;Source of help&quot; indegree centrality</strong></td>
<td></td>
</tr>
<tr>
<td>a) # times chosen by any peers</td>
<td>.51**</td>
</tr>
<tr>
<td>b) # times chosen by cross-language-status peers</td>
<td>.59**</td>
</tr>
<tr>
<td>c) # times chosen by same-language-status peers</td>
<td>.31</td>
</tr>
<tr>
<td><strong>&quot;Help seeker&quot; indegree centrality</strong></td>
<td></td>
</tr>
<tr>
<td>a) # times chosen by any peers</td>
<td>.54**</td>
</tr>
<tr>
<td>b) # times chosen by cross-language-status peers</td>
<td>.55**</td>
</tr>
<tr>
<td>c) # times chosen by same-language-status peers</td>
<td>.20</td>
</tr>
<tr>
<td><strong>&quot;Hang out&quot; indegree centrality</strong></td>
<td></td>
</tr>
<tr>
<td>a) # times chosen by any peers</td>
<td>.50**</td>
</tr>
<tr>
<td>b) # times chosen by cross-language-status peers</td>
<td>.47*</td>
</tr>
<tr>
<td>c) # times chosen by same-language-status peers</td>
<td>.34</td>
</tr>
</tbody>
</table>
Teacher Strategies

Please rate how frequently you use each strategy (1=never to 5=very often)

- Creating opportunities for ELLs to have positive social experiences with non-ELLs
- Pairing ELLs with other ELLs (e.g., to decrease stress from interacting across languages)
- Creating general opportunities for ELLs’ social integration (e.g., providing opps for social interactions in class, allowing students to choose their own workgroups)
- Emphasizing to students the importance of social acceptance among peers in the classroom
- Creating extra opportunities for ELLs to receive recognition (e.g., assigning them leadership roles, giving them positive recognition)
- Use group activities or assignments in your classroom
- When using groups, structure groups so as to deliberately put ELLs and non-ELLs together
- When assigning seats, deliberately put ELLs and non-ELLs together
Preliminary findings

- Teachers differ in their strategies and emphasis on ELLs’ social integration

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>Create opportunities for positive social experiences btwn ELLs &amp; non-ELLs</th>
<th>Pair ELLs with other ELLs</th>
<th>Create extra opportunities for ELL recognition</th>
<th>Use group activities or assignments</th>
<th>In group activities, deliberately pair ELLs and non-ELLs</th>
<th>In assigning seats, deliberately pair ELLs and non-ELLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>5</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>6</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
Teacher Rationale for Strategies

There are many reasons that teachers may choose not to get involved in managing ELLs’ relationships with non-ELL peers. Please rate how much you agree or disagree with each reason below, on a scale of 1=strongly disagree to 5=strongly agree.

- It is better for students to work out their peer relationships on their own
- It is not clear what a teacher could do to affect ELL students’ peer relationships
- I don’t want to create additional stress for ELL students by forcing them to interact with non-ELL peers
- I think ELL students benefit more from relationships to peers in their own language community than from cross-language-status peer relationships
- It’s better to let students decide on their own how much they want to interact with those outside of their language community
- Issues related to language learning should occur outside of the classroom (e.g., in other classes or through informal social interactions)
- A teacher’s job is to stay focused on academic instruction
- These issues do not affect what happens in the classroom
- If teachers spent time on these issues, they would never get any teaching done
- When concerns arise regarding the language or social development of ELL students, it is better to make a referral to the appropriate school personnel
## Preliminary findings

- Teachers differ in their hesitations about getting involved in managing ELLs’ peer relationships

<table>
<thead>
<tr>
<th>ID</th>
<th>Better for students to work out peer relationships on their own</th>
<th>Don't want to create additional stress for ELL students</th>
<th>Better to let students decide how much cross-language interaction they want</th>
<th>Language learning should occur outside of the classroom</th>
<th>When concerns arise, better to make referral to the school support personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Planned analyses with network data

- Student-level peer network positions (e.g., centrality, connectedness to cross-language-status peers) $\rightarrow$ changes in language proficiency & academic functioning

- Classroom-level peer network features (e.g., language-based segregation of peer network) $\rightarrow$ changes in language proficiency & academic functioning

- Teacher attitudes / practices & CLASS-S scores $\rightarrow$ changes in peer network features & ELLs’ positions in network

- Relations between seating arrangements, peer network features, & students’ language learning / academic development
Remaining Questions

- Benefits to ELLs of maintaining ties within own language community, and/ or with ELLs of other languages?

- Why differences across classrooms in the amount of overlap between the academic and social relationships?
  - What might predict this, or what might this predict?

- If or how best to aggregate across relationship types?

- Changes in teacher attitudes / practices across school year?

- Accounting for different sources of variability – class size, # of ELLs in class, course subject and level?

- Other comments/ questions from you??
Qualitative Methods

- Classrooms selected by CLASS-S scores, percentage of ELLs per class, and content area
- Audio- and video-recorded classroom observations (10/year)
- Observational fieldnotes
- Teacher interview
- Student interviews with 4 focal students, selected by language background (ELL vs. non-ELL) and social network results
Diversity

Classroom practices:
- Instructional support (feedback quality, instructional dialogue)
- Emotional support (climate, sensitivity, regard for adolescent perspective)
- Classroom organization (instructional learning formats)
- Student engagement
- Cultural norms & practices
- Planned & contingent scaffolding
- Teacher emphasis on cross-language peer interactions
- Classroom seating chart

Development

Selected CLASS-S Features

Interviews & field-notes

Power

Classroom peer network-level features:
- Network cohesion
- Language-based network segregation
- Hierarchical status structure

Youth outcomes:
- Content learning
- Language proficiency/learning
- Semester grades
- Teacher perceptions of students’ academic functioning

Individual-level features:
- Overall centrality
- Personal network diversity
- Language learners’ investment
- Language learners’ legitimacy as speakers
- Language learners’ resistance
Classroom practices

- Instructional support (feedback quality, instructional dialogue)
- Emotional support (climate, sensitivity, regard for adolescent perspective)
- Classroom organization (instructional learning formats)
- Student engagement
- Cultural norms & practices
- Planned & contingent scaffolding
- Teacher emphasis on cross-language peer interactions
- Classroom seating chart
Teacher cultural openness responsiveness:

“Mrs. Griffith then starts to take students through all four types of character conflict they are studying. She asks which students watch wrestling or boxing. Several boys, including Miguel, raise their hands, and Mrs. Griffith asks what the names of some wrestlers are. Miguel immediately calls out “John Cena” and Anthony and Xavier repeat it enthusiastically and also shout out “the Rock”! Mrs. Griffith then goes on to explain that the “vs.” in the titles of wrestling matches is like the “vs.” they’ll see with character conflict (e.g., character vs. character; character vs. society).
Student-student peer culture:

- As Mrs. Griffith is giving instructions and passing out papers to students according to their “expert” group for the jigsaw, Miguel is standing by Xavier, and Xavier, smiling, is retelling a story with gestures, then a gestured big explosion. I move closer because they’re whispering, and I overhear Miguel talking about his computer crashing, and PS3 games. Xavier is describing some sort of videogame characters, but doesn’t seem to remember their names. “Zombies?” Miguel suggests, and Xavier nods and also says, “Creepers?” Miguel says, “Oh, yeah,” and they continue to whisper in quiet but excited voices. Anthony comes over to the group, puts his hand on Miguel’s shoulder, and they continue talking games.
Planned and contingent scaffolding

- Planned scaffolding
  - Jigsaw structure with pre-planned groups
  - Extension activities
Directions for small group:

1. Discuss the definition of the type of figurative language that is assigned to your group. (Hint: Check the white board.)
2. On your own: find an example of that type of figurative language in your copy of *The One and Only Ivan*.
3. Write that example and explanation of what the author is really saying in your section of the chart paper.
4. When everyone in your group is finished, take turns sharing your work. Let your group members know if you agree with their example and explanation.
5. Make any necessary changes on the chart paper.
6. Record your example with explanation and one other from your group on the chart on the back of this page.

When you return to your home team:

1. Your purpose is to share your examples and get examples of the other types of figurative language from your home team members.
2. Share in this order:
   a. Simile
   b. Metaphor
   c. Hyperbole
   d. Personification
3. If you have extra time, create an example for one of the other types of figurative language.
Mrs. Griffith is sitting with Miguel in student desks at the middle-back table. Miguel is filling in a rhyme example from one of the poems. Mrs. Griffith asks Miguel if he found any alliteration. She points to a part and asks him if it sounds like a tongue-twister. He smiles and says “a-a-a-a-a-“. Mrs. Griffith looks at the paper and says it’s not the same sounds. She asks if “wood wood wood” would be alliteration, and Miguel loudly replies, with emphatic gestures, “but I don’t know what alliteration IS!”. Mrs. Griffith pauses, says “oh, ok” and asks him to get out his “cards” – these are flip-up vocabulary pages with the word, a picture, a sentence, and then a space where students wrote an example. Miguel brings over his cards, and Mrs. Griffith reads aloud the one for alliteration and explains it. She then asks again if there’s alliteration, and he says, “a-a-a-, yes, maybe” and Mrs. Griffith says it isn’t, pointing out that alliteration is the words together, rather than just first sounds in each row.
Planned and contingent scaffolding

Contingent scaffolding (peer):

Miguel is still seated with Mrs. Griffith. Isabella is now standing by Mrs. Griffith too, though she is waiting silently. Mrs. Griffith says to Isabella: you worked on alliteration; do you have a suggestion for Miguel? She tells Miguel the title of the poem she found alliteration in, and he starts reading it. Miguel leans back so he can see Isabella, points to a part of the poem, and says “here?” Isabella tells him yes, and on the next page of the poem there is a second one, which she then recites. Mrs. Griffith agrees with Isabella and tells Miguel to write them down...Mrs. Griffith and Isabella begin to discuss the poem she’s working on, and Mrs. Griffith mentions that it was published after the author died. Mrs. Griffith turns so she’s facing both Isabella and Miguel and makes a comment about the poems. Miguel asks, “How did he [the author] die?” and Mrs. Griffith says she doesn’t know, but Isabella tells him he died of a heart attack.
Teacher emphasis on cross-language interactions

For a final example of figurative language, Mrs. Griffith reads, “My desk looks like it needs a little cleaning”, and calls on Daisy, who doesn’t have her hand up, though Daphne and Anthony do. Daisy says she doesn't know, and Mrs. Griffith asks students to turn to their shoulder-partners to talk about it. Mrs. Griffith points to pairs to work together, pairing up students who are sitting close together. Mrs. Griffith sits with Liam and Miguel and brokers their conversation, and they respond, but they do so more to her rather than to each other.