Summer Research proposal

**Succinct review of prior work**

Prior evidence suggests that youth who report higher belonging in a program are more likely to have more expressed satisfaction with their relationships (Marsh, 2009). Baunmeister & Leary (1995) have discussed the importance of belongingness during the adolescent time period and explain that it is a fundamental part of forming relationships with adolescent peers. Additionally, promoting positive social bonds between youth is an essential component to reducing delinquent behavior (Hirschi, 2002). Therefore, it is important to look at both a youth’s feeling of belongingness and the social bonds they form while participating in a social program focused on building positive friendships between adolescent peers.

A method for understanding outcomes in scientific literature is analyzing the social network. Furthermore, the concept of social capital and the relation with health outcomes is also of great interest to the research community and has been used in several research articles (Barman-Adhikari & Rice, 2014; Szreter & Woolcock, 2004). Campus Connections has the unique aspect of being a controlled environment in which adolescent peers have the chance to interact with one another once a week with the presence of paired mentors and trained program staff. By measuring the changing social networks throughout the course of the 12-week program we are able to track the youth’s social capital and see its relationship with program belongingness.

To properly assess questions regarding social networks of individuals (in this case, adolescent friendship groups) it is important to properly control for network dynamics which will help to properly assess the association between variables of interest and relationships formed. Using methods proposed by Veenstra et al (2013), a stochastic actor-based model serves as a great specification in assess naturally occurring network processes as covariates (i.e triadic closure, transitivity etc.). These methods are imperative to the research process as to avoid pseudo-likelihood estimates, which result in a biased estimation of our effects (Robins et al, 2007; Wasserman & Pattison, 1996). Additionally, a large amount of research uses these stochastic actor-based models to analyze network dynamics in adolescent networks (Burk, Steglich, & Snijders, 2007; Dijkstra, Berger, & Lindenberg, 2011).

**Approach**

**Data Collection**

The Campus Connections Program (CC) has collected data using a measure of belongingness (Youth Development Strategies, Inc.) that was assessed prior to Campus Connections (Baseline) and assessed program belongingness in the *future* (i.e. I feel like I will belong at Campus Connections).Next, it was assessed in the present tense at all other survey time points during the 12 week program (weeks 3, 6, 9, & 11). At the same rate, the growing social network was assessed, which mentees had the ability to choose all individuals within the program and assessed their overall relationship with others.

**Goals**

A major goal of this research project is to track and analyze the changing social network for the youth and analyze their social capital and understand its relationship with program belongingness. Using the belonging measure, adapted by *Youth Development Strategies, inc* the goal is understand if this concept of social capital within the campus connections has a relationship to belongingness. Additionally, using the Mentor Alliance scale, it would be interesting to understand how the social bonds that mentees feel with their paired mentor have are related with the relationship they report on the youth version of the mentor alliance scale. Additionally, how does the reciprocated relationship of the mentor relate to the outcome of this mentor alliance measure? The point in this project is to understand how these validated measures related to an individual social embeddedness in the program. It will be interesting to utilize the fact that we have both social network data as well as these measures tracked throughout the program so we can see how predictive they are of eachother.

~~Using this data, the overarching plan is to assess the changing network across the 12 weeks and view the mentees sense of belongingness in the program across the time span and understand its relationship with the dyadic formation in the overall network. It is theorized that embeddedness in the social network and the sense of belonging in the program will be inexplicably linked with one another. Using stochastic actor-based modeling this study will build a regression model using parameter estimate methods to control for important confounding variables associated with social network characteristics. Building off previous literature that encompasses the importance of belongingness and positive outcomes (Hirschi, 2002; Marsh & Evans, 2009) the goal is to understand how belongingness and the growing social network relate with each other.~~

**Analysis Method**

~~Using~~ *~~Simulation Investigation for Empirical Network Analysis (SIENA;~~* ~~Ripley et al, 2017~~*~~)~~*~~for a longitudinal aspect of a given network and~~ *~~Exponential Random Graphing Models (ERGM~~*~~; Handcock et al, 2003; also known as p\* models) for viewing the data in a cross sectional way, we can understand how the dyadic process of relationship formation works within the CC program while appropriately controlling for network relationship formation. Both of these models run simulated networks with the given observed network derived from Monte-Carlo statistics and build predictive models with less bias than a regular regression based model. By inputting the correct parameter estimates these unique simulation-based models build theta parameter estimates (analogous to Beta estimates in normal regression modeling) to accurately predict the observed network. Using the parameter estimates from these models we are able to make inferences about a mentees perceived belongingness in the program. These analysis methods give us the proper ability to control for the network formations and understand how program belongingness is predictive of dyadic formation within the Campus Connections networks. Which are used to understand the micro-processes that helped to form the overall network.~~

Using multivariate regression, I plan to use our validated measure scores (belongingness & Mentor Alliance) as the outcome variables. Next, while controlling for several important demographic variables, such as age, ethnicity, sex, and other important variables, we can assess how a mentees embeddedness in the program, or in other words, a mentees social capital, using measures controlled measures of centrality as well as their reciprocity with others in the program.

It is important to use standardized measures of centrality that control for multiple aspects of the social network of the program. A particular centrality measure of interest is the Eigenvector centrality measure. Using the SNA package in R we are able to obtain these values for all mentees within the program. The eigenvector centrality measure is standardized measure that understands how others are connected within the program based on both their centrality score as well as others around them. Therefore, the Eigenvector centrality score takes into account the individuals inbound and outbound connections while also taking into account the centrality of scores of those around them. A higher Eigenvector Centrality score is associated with better social capital and more social embeddedness within the program. It is also appropriate to measure just the individual mentees eigenvector with other mentees in the program, or assess the entire network. Thus allowing us to create Hierarchical models in predicting program belongingness.

It is also important to understand an individual’s reciprocity within the network. Based on my own past research of relating the social network of a program to program outcomes, it seems as though reciprocity is also a very important aspect to the success of a mentee with in the program. For the purpose of this study, we need to make a decision on how to handle the weighted network in terms of viewing reciprocity. There are methods available in order to properly symmetrize networks within the sna packages in R. Squartini et al. (2013) have a report indicating the limitations in symmetrizing a reciprocated network. However, it appears that, although there are limitations, it is important to use the higher weighted value when there are differences in the reciprocity scores between two actors (i.e. if there is a tie of 2 and a tie of 5 being reciprocated, it is better to take the higher value of 5 to indicate the strength of reciprocity between actors). Of course, analyzing the reciprcocity at the unweighted level is also a possibility to be taken into account.

Next, in order to assess the relation towards mentor alliance, we can correlate the strength of a tie from a mentee to their paired mentee (that is where the mentor and mentee id’s are equivalent in the edgelist). Using the strength of these ties, and controlling for other important factors, similar to the belongingness assessment, we can just look at the strength a mentee has with their mentor and use that in a predictive model in order to assess mentor alliance. Additionally, it would be interesting to see if the mentors returned relationship and mentee alliance is in anyway associated with that as well using a linear regression hierarchical modeling.

**Data Set-up**

~~To properly assess for these models, it is required to properly set-up our data in a unique way. All data will be organized into adjacency tables with indicators if relationships were formed for the social network indicators. Additionally, actor attributes will be set-up in an additional file. Both SIENA and ERGM program allow for these attributes to be accounted for and matched appropriately to the adjacency tables that indicate the network connections. Therefore, we are able to control for both for network formation characteristics and actor attributes (such as program belongingness) and predict the probability of tie formations between actors and alters – which serves as a predictive model for the overall network formation.~~

**Research questions**

Using these analysis methods, the following research questions can be formed:

1. How is a mentees embeddedness in the Campus Connections associated with their feelings of belongings in the program?
   1. Is the network embeddedness in the Campus Connections program a predicted by a mentees feeling of belongingness within the program?
2. **~~How does perceived belongingness in the program impact a mentees ability to create ties within the program?~~**

**~~In a different analysis:~~**

1. **~~Additionally, do mentees have a tendency to form more ties with each other, or staff members? And what does this say about their feelings of belongingness in the program~~?**

**Hypotheses:**

~~Based off these research questions, we can form a main hypothesis:~~

**Hypothesis:**

* + - 1. Youth that are more embedded (measured through special measures of centrality) in the social network are more likely to have a better sense of belonging in the Campus Connections program.
      2. Youth that show a stronger connection with their paired mentor are more likely to have a higher sense of mentor alliance.

Hypotheses:

1. ~~After controlling for important network factors (centrality, reciprocity, triangle formation, cyclical triangle structures), mentees that have higher feelings of belonging will have a higher propensity to build ties with others in the program.~~
2. ~~Additionally, mentees will tend to have a stronger relationship with their paired mentor than compared to others within the program.~~
3. When you say embeddedness, what specifically do you mean - with mentees, with mentors, with mentor families.; number of outgoing connections, inbound connections, reciprocated connections; and is it just number of connections, or strength of connections. I think we need an exposition of what factors will be test here.

**Embeddedness:**

Embeddedness within the program will be a measure of multiple connection measures. The model allows for control of multiple network connections. Seeing as this is a directed network, we have multiple options. There are several components to consider when defining a mentees social embeddedness in the program. There are several ways in order to define this:

1. **Popularity:** Through inbound 2-star formations. This is a more direct measure of popularity rather than the general inbound relationships.
2. **Expansiveness: Measured through *outbound* 2-star formations. This controls the overarching**
3. **Overall Centrality:** Literally the count of connections in and out of the individual overall.
4. **Reciprocity:** The actual count of shared inbound & and outbound relationships between individuals. That is, the number of reciprocated relationships. This serves as a very powerful measure for embeddedness in the program as well. Especially when indicating the relationship with mentor and their paired mentee.
   1. When thinking of reciprocity, it is important to think of how this should be analyzed. Especially when considering a weighted matrix.
   2. It, honestly, makes the most sense to work with an unweighted matrix, but there are strategies developed in a weighted matrix. For example, 1.) Taking the difference of the 2 reciprocity scores between the two actors. 2.) Taking the lowest reciprocity score between the 2 actors. And 3.) Taking the highest reciprocity score between the 2 actors. However, the interpretation may be biased and less trustworthy than when analyzing an unweighted matrix.

Looking at overall centrality may serve as an important factor when analyzing the embeddedness in the program. In this instance, we may view the

1. I think we need to describe how the specific relationship with the mentor will be modeled, and what role does this key relationship play in the hypotheses.

In order to assess this aspect of the relationship

1. What are the confounders, and how will these be managed?

**Confounders:**

**Age**

**Sex**

**Room**

**Ethnicity**

**Baseline [Future tense] belonging**

**Controlling in the network:**

**Role**

**Triadic Closure**

**Cyclical formations**

**Potential Journal submissions:**

1. **Journal of Research on Adolescence:** <http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1532-7795>
2. **Social Networks:** <https://www.journals.elsevier.com/social-networks/>
3. **International Journal of Behavioral Development:** <http://journals.sagepub.com/home/jbd>

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MAT: 970-498-9070

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