
Appendix B: Glossary of Network Structure and Composition Measurements

Size

Size is the total number of network contacts, excluding the early career PT faculty member whose network is shown (“owner”).¹⁴

Calculation – total number of contacts minus the network “owner”

Example:

Size: 16 – 1 = 15 total contacts

Density

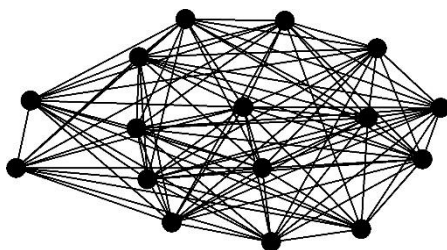
Density is a measure of interconnectedness between the contacts in one’s professional network. A connection between two individuals is called a tie. **The more ties between network contacts, the higher the density and more interconnected the network becomes.** Density is calculated as the proportion of a network’s actual ties out of the number of possible ties among network contacts.³⁵ **The ties are considered ordered ties so that AB and BA are two distinct ties where A can know B or B can know A without them knowing each other.**

$$\text{Density Calculation} = \frac{\text{total number of network ties between contacts}}{\text{total number of possible network ties between contacts}}$$

Example Application for Network Density

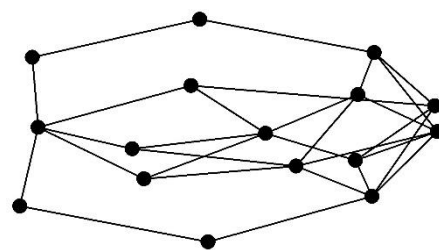
High Density
highly interconnected, closed network

$$\text{Density} = \frac{178}{210} = 85\%$$



Low Density
less interconnected, open network

$$\text{Density} = \frac{47}{210} = 22\%$$



Appendix Continued

Homophily

Homophily is quantifying similarity of network contacts to the early career PT faculty member. The EI Index measures the total number of ties one has to contacts in a category external (E) from their own (e.g. academic rank) and the total number of ties with contacts in the same category, internal ties (I).³⁵ For this study there are seven categories of characteristics measured for homophily, shown in Table 4.

The homophily EI Index range is from -1 to +1. An EI Index of -1 indicates that the early career faculty member has a network of ties with contacts only in the same category as themselves, named perfect homophily. A score of +1 means the early career faculty only has ties to contacts from different categories from themselves, which is perfect heterophily.³⁵

$$\text{Calculation: } EI = \frac{E-I}{E+I}$$

Example Application of Homophily for Academic Rank:

Network for an early career PT faculty member who is an assistant professor with ties to 15 contacts.

Internal Ties (I): 3 contacts are assistant professors

External Ties (E): 3 contacts are instructors, 4 contacts are associate professors, 5 contacts are professors

$$\text{EI index: } I = 3, E = 12 \rightarrow \frac{(12-3)}{(12+3)} = 0.60.$$

This number indicates a high degree of heterophily. In other words, the network consists of ties to contacts different from the early career faculty member, who is an assistant professor.

Heterogeneity

Heterogeneity is quantifying the network diversity in terms of the variety of characteristics each network contact brings. Agresti's IQV (Index of Qualitative Variation) indicates the amount of diversity over a number of categories. Networks without diversity have a heterogeneity **value equal to 0**. This occurs when an early career faculty is connected only to those in one group or with one characteristic (**e.g., all with same academic rank**). An early career faculty member with a network of maximum heterogeneity (i.e., equal to $1-1/r$, where r is the number of different relational types) has the same number of connections to those in each group or with each characteristic (e.g., an equal number **of contacts among different academic ranks**).³⁵

Calculation:

Let P_1, P_2, \dots, P_r be the proportions of network ties within each category for a characteristic with r categories. Then:

$$H = 1 - P_1^2 - P_2^2 - P_3^2 \dots - P_r^2 \text{ and } IQV = H/(1-1/r).$$

Example Application of Heterogeneity for Academic Rank:

Network for an early career PT faculty member with ties to 15 contacts. Academic rank is defined with five categories: clinician with no rank, instructor, assistant professor, associate professor, and professor

Proportion (P) of contacts within each of the five academic rank categories ($r=5$).

0 contacts are clinicians with no rank: $P_1 = 0/15 = 0$

3 contacts are instructors: $P_2 = 3/15 = .20$

4 contacts are assistant professors: $P_3 = 4/15 = .27$

5 contacts are associate professors: $P_4 = 5/15 = .33$

3 contacts are professors: $P_5 = 3/15 = .20$

$$H = 1 - 0^2 - .20^2 - .27^2 - .33^2 - .20^2 = .7382$$

$$IQV = .7382 / (1-1/5) = .92$$

This number indicates diversity. In other words, there is diversity in academic rank among contacts in this network.
