The tie that binds & loose ends: A social network analysis of graduate committee structure

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Abstract

The formation of a graduate committee is a critical point of a graduate student’s career. It is also a key component in the organizational structure of graduate programs. Understanding these committees can aid in the success of a graduate program. This study employs a social network analysis framework to study the organizational structure. The technique provides a visual mapping of the networks, along with key faculty in the network. It is illustrated that although faculty members in the department work with committees outside the department, this is not the standard. In addition, a few faculty members take on the bulk of the committee load. Findings support organizational decision making, which is key in a time of limited resources.
The tie that binds & loose ends: A social network analysis of doctoral committee structure

The formation of a doctoral committee is a critical point of a graduate student’s career. For many doctoral students, the committee they chose can have a profound impact on their research topic, type of research and job placement. While many students take great care in identifying which faculty members they want to work with on their doctoral committee individually, little attention is paid to deciding which combination of faculty members will work best with each other. These small networks of faculty members and graduate students can impact the flow of information through and the organization of the department.

The purposes of this study are to identify and display the networks of graduate committees for a specific department and to use social network analysis to examine the structure of these networks. Despite the popularity of social network analysis in fields such as sociology, anthropology, medicine and business, little educational research uses social network analysis.

The purpose of this study is to demonstrate a practical application of social network analysis for higher education. Here, a data set consisting of master and doctoral committees from 2004-2009 for a department housed in a College of Education is reviewed. Using social network analysis, the structure of the committees will be analyzed in a way that allows a view of networks created by these committees in a variety of different formats.

This study differs from both traditional social network analysis and research on higher education. Despite the ever growing popularity of social network analysis in fields such as medicine, sociology and business, very little research has been conducted on higher education (Borgatti et al., 2009) The only exception involves citation research studies, primarily done in schools of business. Also, unlike other social network analysis studies, the networks represented in this study were not chosen by members of the network, but rather by graduate students. However, committee chairs and other committee members can and do exhibit some control over
the selection of other members. Whereas most research in higher education examines individuals or departments, social network analysis focuses on the network as a whole, and then identifies key players in the network. This technique allows us to see a visual mapping of the networks as well as conduct social network analysis of committees.

Theoretical Framework

*Social Network Analysis*

The study of social networks is the actual study of the relationships between individuals and groups, rather than just the individuals themselves. Studying social networks enables researchers to study the different connections that make individuals effective, successful and happy. By studying social networks, the actual relationships an individual has with his or her contacts are studied in a way that previously could not have been. Prior research only allowed us to count the number of ties individuals had or to speculate the strength of these ties. Social network analysis allows researchers to view a mapping of the individual’s ties and the strength of these ties at the same time.

When social networks are analyzed on this level, the structure of a network can be viewed and substantive outcomes affected by the network structure can be determined. Social network analysis (SNA) shows the informal relationships within organizations that are often critical to understanding where the creative pockets and informal relationships reside. SNA can be very useful when changes are made within an organization and may allow us to track the diffusion of knowledge throughout a network.

Researchers have tried many different ways in the past to explain differences and outcomes in our society using social capital theory. Bourdieu (1972, 1977) writes that social
capital may otherwise be defined as ‘connections’ and that it is accumulated, transmitted and reproduced through clubs, families, and other sorts of interaction. Social network analysis is the physical representation, through maps and analyses, of social capital theory.

Methods

This study is exploratory uses existing data and a mixed methods design. It employs structural network analysis coupling empirical and theoretical research. Social Network Analysis is a way of quantitatively analyzing relationships between people and groups (Wasserman & Faust, 1999). A network is a set of ties among a set of actors. These ties represent some substantive relationship between those in the network (Knoke and Kuklinski 1982). For this study faculty members and departments are represented as actors, or nodes. A tie between two nodes indicates that either two faculty members serve on the same committee, or a faculty member serves on a committee outside their department. This example uses social network analysis to examine the relationships, or ties that occur between professors, or nodes within committees.

Data Source

For most social network analysis, surveys or questionnaires are given to the actors in the network to help identify the network. However, another technique used in social network analysis involves using archival records (Burt & Lin 1997). Data were collected from a College of Education department at a southeastern university. Using the graduate school data base, a data set was constructed to include all master and doctoral committees registered for a specific department over a 5year span. Data were comprised of listings of chair, co-chair, and other faculty members for the department committees. Also, faculty committee work in other departments is represented, as well as external faculty committee service in the department.
Graduate committee social network analysis

**Analysis**

Data were transferred and cleaned in Excel. The new Excel spreadsheets were then loaded into UCINET, a popular social network analysis software (Borgatti, et al 2002). At this stage, UCINET’s “symmetrize-addition” tool was used to make the spreadsheets symmetric. Data were then imputed into NetDraw a freeware social network visualizing program. In UCINET the relationships, or ties, that occur between professors, or nodes, within master or doctoral committees are being examined. Specifically, the measures that are examined in this study include centrality, an indication of how well a specific node connects with other nodes and tie strength, or frequency of the relationships, and density, a measure of the total connects compared to the possible connections within a network. These can all be performed in UCINET. The second stage involves using the network maps created by NetDraw to look for patterns that may emerge within the network.

**Results & Discussion**

In preliminary analysis, three different network mappings were identified. To simply the maps, departments outside the home department are labeled “outside”. Departments within the same college are labeled “inside”. To ensure confidentiality, faculty were also coded. The name used indicates a measure of faculty status in the department. The shape of the node indicates whether the node represents a faculty member (square) or a department (circle). The width of the tie connecting two nodes is a measure of the frequency of the relationship. For example, the more times two faculty members serve on the same committee, the thicker the tie between them. On the other hand, the faculty that only serve on the same committee once have the thinnest ties, with thickness of the ties range on a scale from 1 to 5.

*Network Visualization*
The first step to begin a social network analysis is to create visual mappings in Netdraw of the social networks created using Excel and UCINET. The following figures are social network mappings of the department. Figure 1 consists of faculty in the department, their ties with one another, as well as their ties with faculty on other committees. Figure 2 consists solely of committees within the home department.

Figure 1. Department faculty ties
In addition to visualizing the connections between faculty members, the first two mappings are valued graphs, or a graph where each line carries a value (Wasserman & Faust, 1994). These maps were created using NetDraw with the option to have the width of the line connecting nodes to be proportional to the number of ties between the nodes. The thicker, or wider, the line the more common committees the faculty serve on together. In the case of the Figure 2, department faculty ties, a thicker tie between a faculty member and another department indicates that faculty member serves on more committees with that outside department than other faculty members or departments with thinner lines.

These first two mappings indicate a solid network structure, both inside and outside the department. The high percentage of thin lines between faculty members and other departments in Figure 1 indicate that most faculty only serve a few times with one another on committees outside the department. Whereas thicker lines, occurring mainly between faculty members on
both Figure 1 and Figure 2 indicate that faculty tend to serve on committees with the same faculty members, during this 5 year time period.

One interesting finding of the first mapping is where the thickest tie, indicating the most frequent tie, occurs. This “strongest tie” occurs between T1a and Inside 5. Therefore, faculty member T1a serves on more graduate committees with faculty members in some department outside their home department but within the college of education than any other faculty members. For this particular faculty member, it is important to note that this faculty member also serves on more committees than any other faculty member in the department. Department inside 5 also happens to be a related department in which the faculty T1a holds expertise. Therefore, this relationship is expected, as this faculty member often serves as an “outside” person on committees for department inside 5. Faculty T1a will be discussed extensively later in this paper.

In figure 2 the majority of ties are weak, as demonstrated by the thin line between them. Some faculty (BA, T1a, A1, J1 and B1a) do appear to serve on more committees with each other. This pattern, contrasted with the thin lines elsewhere in the mapping, indicate that while this group of faculty serve on committees with one another repeatedly. The majority of these professors are tenured faculty member, but not all tenured faculty members are included in this group. Identifying this center group of faculty members indicates that there may be a fairly solid “core group” of faculty members that frequently serve on committees together. Other faculty in the department serve on fewer committees and do not repeatedly serve on committees with anyone.

A third social network mapping was also created to visualize the relationships between committee chairs and their committees. Unlike the previous two mappings, this map is a valued directed graph; meaning the direction of the arrow indicates the direction of the relationship. In
other words, a committee chair will have an arrow coming out from them pointed towards other committee members. Again in this map, width of the tie indicates the frequency of the relationship.

Figure 3. Committee Chair Mapping

*Density*

Network density, simply put, is the number of ties divided by the number of possible ties. Although it may not make practical sense for everyone in the department to serve on a committee with every other person in the past five years we would expect a certain amount of inter-departmental collaboration. UCINET uses the following formula to determine the overall density of a network with undirected ties and no ties to oneself: $Density = \frac{T}{n(n-1)/2}$; where $T$ is equal to the number of ties in the network and $n$ is equal to the number of nodes.
To measure density, Figure 2 was used to ensure only faculty members in the department are being analyzed. The density function essentially uses the unvalued graph to evaluate the network saturation. This technique gives each line a value of one, regardless of its actual value from the valued graph. For faculty members that do not serve on the same committee, their relationship is valued a 0 (Wasserman & Faust, 1994). The density of Figure 2 is .4678, meaning that 46.78% of all possible committee relationships are established. This number should be interpreted with caution because the larger the network, the lower the measure of density may be. Because there is a relatively small network, we can be surer that this measure is accurate.

The interpretation of this density value can be used as a measure of whether or not faculty members in the department all work with one another. It should also be noted that the density equation does not take into account the current status of the faculty member (full time, adjunct, emeritus) or the length of time the professor has served in the department.

**Centrality**

Degree centrality answers the question “how well connected are the nodes?” and involves direct influence. The following table summarizes the findings of the top degree centrality scores using the Freeman Degree method (Freeman 1977). The Freeman Degree measure of centrality (or degree centrality) is an index of exposure to what is flowing through the network. High degree centrality is often interpreted as a greater opportunity to influence and be influenced directly. Whereas lower degree centrality can be interpreted as less opportunity to influence and be influenced. Degree centrality has been shown to predict a wide variety of outcomes from the flow of gossip to the spread of disease (Borgatti 2005).
Following faculty member B 1b, the degree centrality scores drop, and begin to include departments. As expected, the most “central” players in the network are all assistant and full professors. It should also be noted that faculty member T 1a has a degree centrality that is substantially higher than all other faculty in the department. This means, that faculty T 1a serves on the most committees and with more different faculty members than any other faculty members in the department.

Another measure of centrality that is critical to the understanding of doctoral committee networks is eigenvector centrality. Whereas degree centrality answers “how well connected are the nodes” eigenvector centrality answer “who is in the know”. In other words, a node has a high eigenvector centrality score if they are connected to many nodes who are well connected. It is also an indicator of popularity, and similar to degree centrality, an index of exposure and risk. Eigenvector centrality can also be used to identify centers of large groups (such as the network utilized in this study).

Eigenvector centrality is computed as $A \mathbf{v} = \lambda \mathbf{v}$; where A is an adjacency matrix and V is the eigenvector centrality. V is the principal eigenvector of A. Table 2 shows the standardized values
of Bonacich eigenvector centralities for faculty from Figure 3. The higher the score, from 1-100, the better the nodes one is connected with.

Table 2 Selected Faculty Scores for Bonacich Eigenvector Centrality Measures

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>T 1a</td>
<td>91.525</td>
</tr>
<tr>
<td>J 1</td>
<td>45.436</td>
</tr>
<tr>
<td>A 1</td>
<td>38.906</td>
</tr>
<tr>
<td>B A</td>
<td>32.365</td>
</tr>
<tr>
<td>B 1a</td>
<td>31.784</td>
</tr>
</tbody>
</table>

In Table 1, faculty T1a was identified as the most central, or the faculty who served on the most committees. In addition to this finding, Table 2 demonstrates that faculty T1a is also the faculty member that serves on the most committees with others who have high centrality scores. Although the order of the centrality scores for faculty for the previous tables are the same, the distance between the individual faculty members differ. The difference in the measure of Eigenvector centrality for T1a and their colleagues is even greater than the difference found in Table 1.

In addition to viewing the whole network, or just the department, social network analysis also allows the visualization and interpretation of individual, or ego, maps. Below is a network mapping the faculty member identified as the most “central”, or with the most committees, faculty T1a. It includes the committees served on within and outside the department.
In addition to demonstrating the sheer number and variation of committees this faculty member serves on, an ego map can also give insights into the committee preferences for faculty members. The majority of this faculty member's ties occur within the department, and with a variety of different faculty. Interestingly, the strongest connection is between the faculty member and another department, within the same college. It should be noted that department inside 5 correlates strongly with the research of faculty member T 1a. T 1a also has numerous connections with other professors. Because of faculty member T 1a’s high centrality score, they may be identified as a key player of the committee network. This means that faculty member T
1a serves on more committees with a greater variety of other faculty members than any other faculty member in the department.

Differences in Networks Created Within the Department and Outside the Department

Figures 1 and 2 represent all the committee’s faculty from the department serve on and only those committees within the department respectively. The primary difference between the two network visualizations are the amount of outliers along the periphery of the map. The majority of faculty members in Figure 2 are fairly well connected. There are only 2 examples, faculty members K E and K A that have only one connection. However, the departments examined in Figure 1 are primarily on the periphery, meaning they are only connected one or two time with faculty members in the department. The conclusion may be drawn that although faculty members in the department do work with committees outside the department, this is not a regular occurrence. An exception here is faculty member T 1b. This faculty member actually appears to serve on more committees outside the department than within the department.

Conclusion

This study has both methodological and practical implications. Methodologically, this study serves as a demonstration of the power of the use of social network analysis in higher education. Practically, this study also has policy implications by being able to visually display the connections created by committees, and better inform the department when making admission and advisory decisions.

One of the most important, yet sometimes overlooked, steps in a graduate students progression towards a degree is the selection of their doctoral committee. This committee can
have a profound impact on the topic and type of research on which they embark. Doctoral committees also have a great impact on length of time spent in exams, proposals and dissertation stages. Committees, though their connections and letters of recommendation can also have a major effect on job placement. For graduate students, the committee can be somewhat of a mystery, one that can have profound impacts on their graduate and professional careers.

Committee structure can also affect the nature and efficiency of the department. Smaller and larger departments alike can function like a well oiled machine or like a disordered, tangled web. By analyzing the structure of both well organized and somewhat disarrayed departments, department chairs and other leaders have the opportunity to examine the inside structure of the organization and make better, data driven decisions that can effect graduates, faculty and the department as a whole.

Social network analysis is a methodological breakthrough that allows researchers from many different fields to visually display and evaluate network structures. Although used often in schools of management, medicine, sociology and anthropology, social network analysis has yet to make as large of an impact in the growing body of higher education literature. As this example demonstrates, the techniques and methods used in social network analysis are easily adaptable to research questions in education.

References


