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# The Association Between Co-authorship Network Structures and Successful Academic Publishing Among Higher Education Scholars

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THE ASSOCIATION BETWEEN CO-AUTHORSHIP NETWORK STRUCTURES  
AND SUCCESSFUL ACADEMIC PUBLISHING AMONG HIGHER EDUCATION  
SCHOLARS

by

Anne Rumsey-Wairepo

A dissertation submitted to the faculty of  
Brigham Young University  
in partial fulfillment of the requirements for the degree  
Doctor of Philosophy

Department of Educational Leadership and Foundations

Brigham Young University

June 2006



BRIGHAM YOUNG UNIVERSITY

**GRADUATE COMMITTEE APPROVAL**

of a dissertation submitted by

Anne Rumsey Wairepo

This dissertation has been read by each member of the following graduate committee and by a majority vote has been found to be satisfactory.

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As chair of the candidate's graduate committee, I have read the dissertation of Anne Rumsey Wairepo in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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## ABSTRACT

# THE ASSOCIATION BETWEEN CO-AUTHORSHIP NETWORK STRUCTURES AND SUCCESSFUL ACADEMIC PUBLISHING AMONG HIGHER EDUCATION SCHOLARS

Anne Rumsey Wairepo

Department of Educational Leadership and Foundations

Doctor of Philosophy

This research explores and describes co-authorship network structures in the academic publication process. The production of academic publications, through co-authorship choices or strategies, creates a network structure among co-authoring scholars which can influence research visibility and enhance stature among peers (Bayer & Smart, 1991). A specific scholar's co-authorship network may reflect a structure of more cohesion (Coleman, 1988) or one which fills more structural holes (Burt, 1992), both of which are theorized, from contrasting perspectives, to be associated with publication success. Therefore, this study examined the association of these two academic co-authorship network structures with publication success, specifically within the field of research and scholarship on higher education. The network population consisted of 810



academic scholars who published articles in at least one of four top-ranked higher education research journals.

Based upon structural holes and cohesion, seven different co-authorship network structures were identified. In terms of total publications, findings suggest that filling structural holes—a network structure that spans across the larger network and provides authors with a greater variety of co-authors—may even be further enhanced when there were also multiple publications with the same co-authors. Thus, an ideal hybrid network structure of both structural holes and strong ties may be possible. The data suggested that co-authoring multiple times with the same scholars (mean tie strength) may be critical to realizing the potential value buried within the structural holes (Burt, 2001).



## ACKNOWLEDGMENTS

From the beginning, you can't really understand all that will be involved in completing such a degree. Certainly you're put through a battery of tests, you're given pages of future requirements, and professors discuss the rigors of academia, but nothing can really convey the complexity and downright hard work you'll encounter. I'll be the first one to say, "That's a good thing." You might never start if you really knew what would be necessary to complete the journey. However, the other thing you're not prepared for is the joy along the way: those moments of inspiration when you understand something you've struggled with for weeks; the times a colleague shares a fresh insight with you; and that great feeling of accomplishment that envelopes you when you do something that stretches you beyond your known limits. All these things and more I've experienced on this journey toward completing my Ph.D.

Our international cohort became the family of learners we all needed to sustain each other on this arduous journey. Perhaps it is the keystone of my experience. Never before had I learned so much about the world, the human race, and myself. No one culture could exist in the classroom without others sharing insights from their cultures. This painted a global picture for all of us. From Palestine to Pakistan, Uganda to China, we learned from each other. The overarching culture that soon developed was one of support and cooperation. We helped one another with everything from sickness to statistics. I have gratitude and love for each of my fellow students in the cohort.

As for the faculty and staff of the Department of Educational Leadership and Foundations, I am grateful for the "beautiful minds" from which I was blessed to learn, particularly my committee and most particularly my mentor and chair, Julie Hite. She



made such a journey into excellence possible. It is true that there is nothing about her that is easy or substandard. However, she has inspired a level of excellence in me of which I never dreamed I was capable. I know that I have learned far beyond what casual students might have. I have become a strategist, a theorist, and a writer. She never left me unstretched, but she also never left my side.

The most significant debt of gratitude I owe is to my mother and father. My parents have been lifelong supporters of education. We sisters: Elaine and Lisa and I were endlessly encouraged to learn. From childhood we had the light of learning. We could not imagine a world without library books and 4-H horse shows. Over the years, my mother and father both sacrificed so that we could afford university experiences, the way their parents, who were largely uneducated, had sacrificed for them. Not so far forward from the pioneer ancestors that made it possible for me to be in this time and this place; I feel a great sense of humility and appreciation for my heritage and the blessing of attending Brigham Young University. It has been a privilege to work and study at the Lord's university.

As I embrace the new educational journeys that are yet ahead of me, I wish to express thankfulness to my husband. Jason has introduced me not only to a new side of the globe, but to a new side of understanding. He has helped me plan my academic progress and he has consoled me along the way when I wasn't where I thought I should be. That's one of the most frustrating things about independent research, you're never quite sure where you are, but you know it isn't as far as it ought to be. Jason helped me get through hard times but more importantly he helped me celebrate the joyful times, those unintended moments of joy that came along the path of this most excellent journey.



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## CHAPTER ONE

### INTRODUCTION

Co-authorship is a potential strategy in the academic publication process. Co-authorship occurs when an academic publication has more than one author (Persson & Melin, 1996). These publications, and the profile they create, become the essential means for academic scholars to efficiently navigate the turbulent waters of “publish or perish.” The choice of co-authorship strategies may facilitate, and potentially be associated with, the total number of publications and, thereby, the academic scholar’s influence in the field (Stokes & Hartley, 1989). Thus, academic scholars may need to be more aware of their co-authorship structures, the strategic opportunities they may represent, and the potential relationship of these network structures to successful publication.

The relationship between article publication and influence in the field (Stokes & Hartley, 1989) may be due to the role of publication in creating *social capital*, defined as follows: “a function of social structure producing advantage” (Coleman, 1990, p. 302). Publications create a social structure of scholars which can influence the research visibility and enhance the stature of scholars among their peers (Bayer & Smart, 1991) as well as of their institution’s stature (Alpert, 1985). Among academic scholars, research visibility is highly valued because it is a necessary condition of social capital and influence (Friedkin, 1998) in the field.

For academic scholars in tenure track positions, conscientious management of publications is critical. An essential aspect of publication management is co-authorship

strategy, given that academic publications will be central in decisions regarding an academic scholar's tenure, promotion, and salary (Coe & Weinstock, 1984; Hunt & Blair, 1987; Luthans, 1967), and in how they are seen by their academic peers. If academic scholars recognize that specific types of co-authorship choices exist, they may gain an advantage by strategically pursuing the co-authorship network structure that could be most beneficial for their particular circumstance. For example, an academic scholar may engage in a certain co-authorship strategy as a method to help insure that they efficiently leverage their limited academic resources and to increase the likelihood of achieving a successful publication. In addition, given that their influence in the field can be specifically advanced by article publication (Stokes & Hartley, 1989), co-authorship strategies become a critical concern.

Co-authorship strategies provide an avenue to deliberately influence academic publishing. If an academic scholar does not proceed with deliberate consideration and strategic decision making in the academic publishing process, career progress may be slowed, valuable resources such as time and effort may be wasted, and personal opportunities may not be optimally leveraged. With an understanding of the co-authorship strategies at their disposal, academic scholars may make a more informed choice from the specific network structures demonstrated in the literature. Being strategically sound with regard to publishing tactics is instrumental if academic scholars are to effectively invest their valuable resources. Thus, with greater understanding about individual co-authorship structures and how they are associated with an academic scholar's total number of publications, and thereby influence in the field, future academic scholars may be better positioned to intentionally create an academic social structure that

increases their social capital and ability to contribute to the advancement of their fields. Therefore, this study used network theory to examine the relationship between co-authorship structures and total number of publications within the field of research and scholarship on higher education.

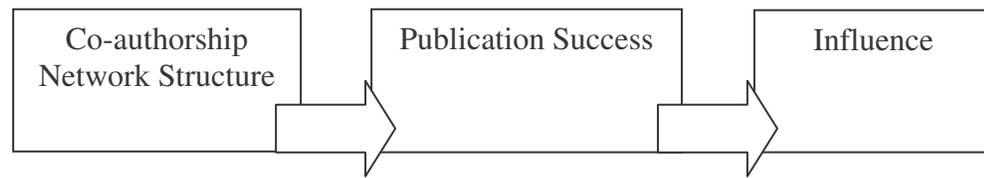
### *Background*

Co-authorship is a common practice in many fields of academic publishing. Specifically, in the field of research and scholarship on higher education, co-authorship has increased (Fox & Faver, 1984). In Creamer and McGuire's study (1998), almost all of the participants in their higher education publishing research said that their productivity was sustained by association with other scholars who were engaged in research and publishing. This so-called culture of scholarship among scholars in higher education was described as "an intellectual and social community that shares an active interest in and commitment to research and writing and the exchange of ideas" (p. 80). These relationships are a key part of co-authorship associations which may, in turn, affect the total number of a scholar's publications and the consequent presence of influence within an academic specialty (Stokes & Hartley, 1989).

Publishing in top-tier journals builds influence in the field, both at an individual level and at an organizational level (Stokes & Hartley, 1989). Arguably, individuals who consistently publish in premier journals may be conducting better research than those who do not (Stahl, Leap, & Wei, 1988). The perceived quality of journals is highly correlated with their acceptance rates, journals that more carefully referee and screen papers tend to be given higher prestige by the members of a profession (Coe & Weinstock, 1984). Given that academic circles are often small and relatively closed

(Gomez-Mejia & Balkin, 1992), publishing in top-tier journals provides high visibility in the academic labor market. This visibility can result in an increase in influence among peers and administrators (Nathan, Hermanson, & Hermanson, 1998; Stokes & Hartley, 1989) because interpersonal visibility is a necessary condition of social capital and thus influence (Friedkin, 1998).

Co-authorship may be a strategy that raises both the quantity and quality of an individual's academic publishing record (Beaver & Rosen, 1979; Diamond, 1985; Nathan et al., 1998; Presser, 1980). The professional influence that results from the quantity and quality of publications associated with a scholar's name represents the academic and social collateral sought after in educational circles (Clement & Stevens, 1989; Gomez-Mejia & Balkin, 1992). Figure 1 illustrates the relationship between these major constructs and the research model for this dissertation.



*Figure 1.* The research model.

### *Academic Publishing as a Method to Influence in the Field*

Social capital is a key factor in understanding how co-authorship strategies may be associated with publication success and, therefore, with influence in the field. *Social capital* has been foundationally defined by Bourdieu (1992) as the resources resulting from social structure. This definition of social capital aligns with the concept that

influence (Friedkin, 1998) can be derived from an academic scholar's network of interpersonal visibilities as created by their academic social positions. Stokes & Hartley (1989) explain that as information flows between scholars, behavior may change based on that shared information which represents influence and "the paradigmatic formal mode of communication is the published article" (p. 102).

This social capital perspective suggests that influence may be specifically identifiable as a result of article publication, lending credence to the importance of co-authorship strategies. In other words, influence is likely related to this so-called "paradigmatic formal mode of communication" known as the published article (Stokes & Hartley, 1989). Additionally, Cole and Cole (1968) point out that academic scholars may become deeply concerned with the visibility of their work not only because of the influence, but because one of the greatest rewards they can have is the knowledge that it has been read and used by colleagues.

Given that the literature supports the concept that successful academic publishing is associated with influence in the field of research and scholarship on higher education (Stokes & Hartley, 1989), the issue becomes one of determining the factors that are related to publication success. Co-authorship network structures are likely to be an important factor. The accumulation of co-authorship relationships from an academic scholar's published works creates an egocentric co-authorship network structure that can be identified and may, if consciously created, reflect the scholar's co-authorship strategy.

#### *Co-authorship Network Structures*

Network structures are derived from the individuals, known as actors, inside the network and the connections, or ties, between the actors. The patterns established from

the ties between actors reveal social network structures. Specifically, when one academic scholar co-authors an article with another academic scholar, he creates a relationship between them known as a dyadic tie. An egocentric network is the social network structure around one individual, including the individual's direct ties and the ties among the individual's direct ties (Kilduff & Tsai, 2003). Consequently, egocentric network data views the network from the perspective of one individual (also known as *ego*) in the network. Thus, the set of ties around an academic scholar represents his or her egocentric network structure.

A co-authorship tie between academic scholars acknowledges their relationship, both intellectual and personal. As an academic scholar co-authors with additional scholars, more ties are created. Academic scholars may differ in how they approach co-authorship. For example, some do not co-author, some have few co-authors and some have many co-authors. Some co-author repeatedly with the same person; some only work once with a co-author. The set of an individual academic scholar's co-author relationships, across multiple publications, creates his or her egocentric co-authorship network. While the academic scholar may not consciously approach the development of this network, nonetheless, the combination of the co-authorship relationships creates an egocentric network structure that can be identified, described, measured and used to represent the co-authorship strategy.

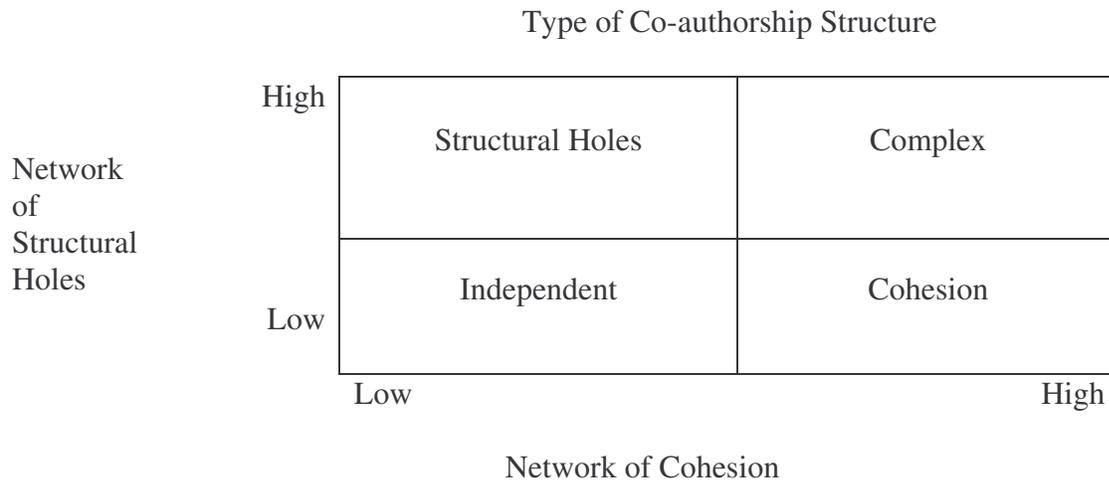
Different egocentric network structures are created by different combinations of these co-authorship choices. That is, different academic scholars will have different co-authorship network structures that represent different co-authorship strategies. These different co-authorship network structures may be associated with different implications

for publication success, specifically in terms of total number of publications. The egocentric structure can be described and measured in terms of factors that may explain the academic scholar's total number of publications, and thereby their influence in the field (Peters & Van Raan, 1991; Stokes & Hartley, 1989).

Theoretically, these egocentric network structures of co-authorship ties may represent two basic core forms, structural holes and cohesion. Burt (1992) defines *structural holes* as “relationships of non-redundancy between two contacts” (p. 65) where the benefit of linking new streams of resources and information creates a competitive advantage for an academic scholar whose relationships span the holes (Burt, 2001). Coleman's (1988) structure of cohesion is characterized by shared responsibilities and high trust relationships and is demonstrated by co-authors who have dense egocentric networks. These two possibilities of network structure are actually at odds with each other, given that the presence of one structure makes it less likely that the other structure may be present. The potential combination of these forms (see Figure 2), however, creates the possibility for additional network structures that can be identified as independent and complex.

#### *Research Problem and Questions*

The objective of this research was to identify the relationship between co-authorship network structures and publication success with publication success being linked to the acquisition of influence (Friedkin, 1998) in the field of higher education. With an understanding of the co-authorship network options available, academic scholars may be better positioned to make an informed choice from the specific strategies available to them. Being strategic in publishing tactics is instrumental if academic



*Figure 2.* Types of co-authorship network structures.

scholars are to wisely invest their valuable resources as they build their profile of publications and seek to influence the field. Specifically, this research examined the association between egocentric co-authorship network structures of academic scholars and their total number of publications within the context of the field of research and scholarship on higher education. This research addressed the following questions:

1. To what extent are egocentric co-authorship network structures, foundationally based upon cohesion and structural holes, exhibited in academic publications in the field of research and scholarship on higher education?
2. How are these egocentric co-authorship network structures associated with an academic scholar's total number of publications in the field of research and scholarship on higher education?

### *Methods*

To address the first research question, the first phase of this study identified and examined co-authorship network structures through network analysis. The researcher collected data regarding co-authorship relationships from the population of academic scholars who had contributed to four top-tier journals in higher education—*Higher Education Quarterly*; *Journal of Higher Education*; *Research in Higher Education*; and *Review of Higher Education*--for the period of six years, 1999-2004.

From the population of authors who had published in four top-tier journals of higher education, co-authorship ties provided the basis for a network analysis to identify and examine the co-authorship structures known as independent; structural holes (Burt, 1992); cohesive (Coleman, 1988); middle; and complex, along with their corresponding network patterns. UCINet Software (Borgatti, 2005) was used to identify the structures of the academic scholars' egocentric co-authorship networks (based on two constructs of network position) (Borgatti, Everett, Freeman, &, 2002), cohesiveness (Coleman, 1986), and structural holes (Burt, 1992). Network variables of size, mean strength of ties, constraint, and efficiency represented the independent variables from which the co-authorship network structures were derived.

To address the second research question, the second phase of the study statistically analyzed the relationship between co-authorship network structures and total number of publications. Correlation analysis, ANOVA, and regression analysis informed this examination of the data.

### *Implications*

One need communicated in the literature was for research to help explain co-authorship strategies (Bayer & Smart, 1991). A scarcity of studies exists that clearly identify the potential theories and typologies. According to Gomez-Mejia & Balkin (1992), “research has been largely conducted without the benefit of any theory to explain findings” (p. 946). The lack of clear theoretical foundations and solutions hinders addressing strategic co-authorship problems that are as yet unsolved (Kuhn, 1996). Social network analysis is a theoretical perspective that can inform co-authorship structures and its processes. Such analysis is a way to better understand the intricacies of influence and introduce measurement techniques. The advantage of social network analysis is that a wide range of empirical phenomena can be explored in terms of their structural patterning (Freeman, 1996). These research questions specifically seek to examine the value of applying network theory to co-authorship processes.

Indeed, many articles on co-authorship conclude by recognizing the need for further research in the area of authorship strategies (Bayer & Smart, 1991; Diamond, 1986; Gomez-Mejia & Balkin, 1992; Presser, 1980; Stark & Miller, 1976) indicating a consistent request to clarify the dimensions surrounding “best practices” for academic publishing. As such, co-authorship publishing strategies need to be explored across a variety of disciplines to enable a broader generalization of both the strategy constructs as well as their effectiveness in academics. That is, as co-authorship strategies are refined in one discipline, as in this research, the improved strategy may be shared across disciplines. To make such inference less tentative, the robustness of the results regarding co-authorship strategies should be tested with data from many different disciplines

(Diamond, 1986). This study has added to this conversation with its examination of co-authorship from a network perspective within the field of research and scholarship on higher education.

Academic scholars in higher education may be able to develop an intentional strategy in their individual publishing efforts and in turn, potentially increase their influence in the field. From a practical individual standpoint for academic scholars, potential outcomes such as a less ambiguous path toward the goal of publishing is attractive given the tremendous investment of resources necessary to achieve publication. If academic scholars can be more sophisticated in regard to analyzing and assessing their approach to co-authorship, and then more strategically select a co-authorship path that may increase their total number of publications, they may likely be more effective in their careers.

An important key to academic success may be provided in understanding the association of co-authorship and publication's success because, indeed, the "paradigmatic formal mode of communication" otherwise known as the published article does generate influence in the field (Stokes & Hartley, 1989). As such, this research represents a step forward in solving the greater "puzzles" (Kuhn, 1996) that exist within academic publishing. The role of this research has been to identify some of the co-authorship network factors of publication success, thus helping to clarify some of the smoke and mirrors currently associated with the publication process. This research may benefit many parties: administrators, researchers, and particularly academic scholars who must rely on their publishing profile to gain career advantages. This need for personal competency in publishing will become increasingly critical as institutional dollars

continue to tighten (Campbell, 1995), and the quest for promotion becomes more and more competitive (Bayer & Smart, 1991).

This study has examined the relationships between co-authorship network structures, total number of publications, and influence in the field from the perspective of network theory. The logical argument has been that co-authorship structures are associated with the total number of publications which in turn, are associated with influence among academic scholars in the field of research and scholarship on higher education. Thus, this research has facilitated a better understanding of the tangible applications of co-authorship and will shed light on the familiar academic dilemma known as “publish or perish.”

Chapter Two reviews the literature which corresponds with the current research and theory of publishing in higher education, influence, and co-authorship network structures. Chapter Three presents the methods which were employed in the completion of the research. Chapter Four presents the descriptive and quantitative findings that address the two research questions and the two hypotheses regarding co-authorship network structures and publication success. Chapter Five provides a discussion of these findings including theoretical and practical implications, limitations, and suggestions for future research. Chapter Six concisely summarizes the entire research project.

## CHAPTER TWO

### REVIEW OF THE LITERATURE

The purpose of this study has been to examine the relationship between co-authorship network structures from the perspective of network theory and successful academic publication given that academic publication creates a critical influence in academic fields (Stokes & Hartley, 1989). These publications, and the cumulative profile they create, become the essential means for academic scholars to efficiently navigate the path to “publish” rather than “perish”. The choice of co-authorship strategies may facilitate, and potentially be associated with, the total number of publications and, thereby, the academic scholar’s influence in the field (Stokes & Hartley, 1989). Thus, academic scholars need to be more aware of co-authorship network structures and their relationship to potential strategies toward successful publication, particularly academic scholars in the field of higher education, who must rely on their publishing profile to gain career advantages.

This chapter provides an overview of the literature. Three major topic areas are reviewed. First, the environment of higher education is observed through the lens of academic publishing, including the following: 1) the effects of article publication on an academic scholar’s influence within the field; 2) the role of collaboration among academic scholars on quantity and quality of publications; and 3) publication as an appropriate form of incentive alignment and a factor of tenure status and salary determinants of academic scholars.

Second, the review discusses influence in academic fields as it relates to co-authorship networks as a system of interpersonal visibilities, visibilities that are amplified

by article publication. The scene of collegial networks is explored, including their relation to collaboration and an analysis of their potential advantages and disadvantages.

Third, theoretical co-authorship network structures are identified, linked by their common denominator of social capital. Specifically, the dilemma of how opposing co-authorship network structures may both promote publication and thus provide influence in the arena of higher education is demonstrated. Particular attention is given to the co-authorship network structures of cohesion and structural holes. Finally, the chapter concludes with a presentation of the research problem and the research questions that are addressed.

### *Publishing in Higher Education*

A fundamental concern of higher education is the pursuit of knowledge (Mourad, 1997). As such, in the United States, research and scholarly productivity play a central role in the stratification of universities, and thereby in the hierarchy and academic reward structure for individual faculty members (Dey, Milem, & Berger, 1997). This research focuses on the pursuit of knowledge within the specific academic field of higher education. While the academic field of higher education can trace its roots back to the early 20<sup>th</sup> century (Altbach, 1996), this field has only significantly matured in terms of research and scholarly productivity to achieve a noteworthy level of professional standing and intellectual rigor since the 1960s (Altbach, 1996). Thus, academic scholars in this field may benefit from understanding factors that contribute to successful academic publishing.

The keystone of the entire knowledge market is the creation of knowledge. One mechanism for this process is academic research and publication. Research that is

published can stimulate comprehension and raise questions regarding what is currently known (Kuhn, 1996) and spur new understanding (Luthans, 1967). For institutions of higher education, particularly those granting advanced degrees, facilitating this critical process of knowledge creation is evidenced and motivated through scholarly publications.

Academic publication is tied to the tenure processes for academic scholars within the field of higher education (Kezar, 2000). Given this need to publish, Kezar suggests that collaboration in the field of higher education is critical to increase the quantity and quality of academic publication and will be instrumental in helping the profession “bear useful fruit.” As such, collaboration may be useful at an organizational level because the perceived quality and prestige of a university are highly correlated with the scholarly output of its faculty (Reskin, 1977). Academic scholars publishing in top-tier journals contribute to a university’s reputation and prestige (Miller, 1987; Niemi, 1988). In addition, university reputation can be an essential element in recruiting both faculty and students, which is a foundational aspect of financial stability (Campbell, 1995).

Top academic scholars have high visibility in their professional communities and draw other top scholars who want to collaborate with them as well as superior students anxious to be mentored by them. Such academic scholars may even be a crucial link to external funding (Gomez-Mejia & Balkin, 1992). Thus, in turn they may influence or control scarce resources that help diminish uncertainty for their universities (Newman, 1988) because having influential academic scholars increases the likelihood that funding will be secured for a particular university (Creamer & McGuire, 1998).

At an individual level, many faculty members are choosing to collaborate in an effort to improve both the quantity and the quality of their research (Nathan et al., 1998; Presser, 1980). For example, the number of authors of a paper has been positively associated with the probability that the paper will be accepted for publication (Bayer & Smart, 1991; Gordon, 1980; Presser, 1980). Bayer and Smart (1991) believe there is evidence that collaborative scholarship results in an improved product. In his research, Diamond (1985) found more citations to multiple-author articles than single-author articles. He then infers that article quality may be related to the number of authors. While this may be a curvilinear relationship, the important point is that there may be an opportunity to gain influence. Therefore, the need for academic scholars to manage their profile of publications becomes apparent at the individual level as it is a source of influential criterion that inform many types of decisions regarding their academic careers.

#### *Association between Total Publications and Influence*

The time-honored measure of productivity in academia has been the number of papers published (Rustum, Roy, & Johnson, 1983). Publishing is a performance measure that enjoys a wide variety of advantages, including, but certainly not limited to influence among peers (Gomez-Mejia & Balkin, 1992). This concept is buoyed up by the cumulative advantage phenomenon which in essence means that productive academic scholars perpetuate increased opportunity for productivity. According to Allison and Stewart (1974), “resources and the motivation to publish flow to those with high esteem in the academic community, and that esteem flows to those who are highly productive” (p. 604). Those academic scholars who are highly productive publishers generate esteem in the academic community, so much so that they are empowered with resources,

financial and social, to do even more publishing. The phenomenon perpetuates an attractive cycle.

Consider the potential effect of accruing many co-authored articles. Despite the less acknowledged reality that varying amounts of work may be contributed in different authorship strategies, the conclusion that an individual academic scholar is a prolific publisher may glow brighter than any concern about the amount of his or her contribution. “An author with a tall stack of multiple-authored papers to his or her credit may appear to be more productive than a colleague with only half as many individually authored papers” (Lindsey, 1982, p. 391). The strategy of high productivity through co-authorship can be an effective choice.

High productivity has been associated with influence in the field of research and scholarship on higher education. Stokes and Hartley (1989) examined patterns of co-authorship and determined how to identify the most influential contributors. When a faculty member co-authored more than 60% of the papers from a particular group in Stokes and Hartley’s study, they were considered to have sufficiently significant social influence within that group to be designated as a “key figure.” Thus, a relatively high percentage of publishing was the primary indicator of an academic scholar with significant social influence.

Indeed, scholarly productivity is positively correlated with the prestige of the institution as well as with the prestige of an individual academic scholar (Creamer & McGuire, 1998). First, from a university perspective, the perceived quality and prestige of that particular university are highly correlated with the scholarly output of its faculty (Reskin, 1977). Secondly, those academic scholars employed by a prestigious university

enjoy the increased credibility, distinction and prominence it supplies. Such that thirdly, individual prestige goes hand in hand with prolific scholarly publishing. This may explain why the most commonly used measure of individual productivity is the number of publications (Toutkoushian, Porter, Danielson, & Hollis, 2003).

Stokes and Hartley (1989) believe influence in the field is related to the “paradigmatic formal mode of communication” (p. 102) otherwise known as the published article. This relationship lends credence to the importance of selecting and implementing a specific co-authorship strategy, tying the total number of publications to the desired level of visibility. Scholarly visibility likely enhances stature among peers (Alpert, 1985), and such visibility is highly valued because it is a necessary condition of interpersonal influence among fellow academics (Friedkin, 1998).

#### *Academic Scholars in Higher Education*

Developing extensive collegial networks is a key characterization of prolific scholarly authors in higher education (Creamer & McGuire, 1998). DiMaggio and Powell (1983) emphasize the importance of formal educational credentials for academic scholars as professionals in legitimate areas of specialization and the resulting proliferation and development of professional networks that span organizations. Within these programs, the disciplinary associations (e.g., ASHE, AERA) are likely to have an impact on the research and publication; therefore, it is possible to suggest that those authors who are part of the culture of these associations may influence the resultant research and literature (Kezar, 2000).

In Creamer and McGuire’s recent study (1998), almost all of the participants in their higher education publishing research said that their productivity was sustained by

association with other academic scholars who were engaged in research and publishing. This so-called culture of scholarship among academic scholars in higher education is “an intellectual and social community that shares an active interest in and commitment to research and writing and the exchange of ideas” (p. 80). This community, rather than the departmental reward structure or formal recognition, seemed to set the norms of productivity (Creamer & McGuire, 1998).

For some prolific contributors in the field of research and scholarship on higher education, the supportive environment of collaboration was more than institutional, extending to what is termed an “invisible college” of higher education scholars who have similar performance expectations (Hunter & Kuh, 1987). The collaboration within this invisible college was examined by Price and Beaver (1966). They examined co-author relationships to investigate social structures, influence and, more specifically, communication networks, concluding that the research front is dominated by a small core of active authors and a large, weak, transient group of collaborators.

On an individual basis, some academic scholars are known as boundary spanners, faculty members who are outstanding academic scholars (Newman, 1988). Goldring (1995) identifies them as individuals who have their own set of external ties and boundary spanning strategies. This function is identifiable as a scholar who bridges both the internal university network and the network outside of their particular institution. A boundary spanner may prove extremely valuable in the external environment for their respective institutions because they can help generate scarce economical resources, which in turn, can then shrink financial ambiguity for their universities (Newman, 1988). As economic climates become less predictable for the world of higher education, (Campbell,

1995) having influential academic scholars increases the likelihood that funding may be secured for a particular university (Creamer & McGuire, 1998).

*Social capital* is foundationally defined by Bourdieu (1992) as the resources resulting from social structure. The traditional view from Coleman (1988) stresses the production of social norms and sanctions that build trust and cooperative exchanges. Since academic circles are often small and relatively closed (Gomez-Mejia & Balkin, 1992), it stands to reason that members of such a closely knit network can trust each other to honor obligations, which diminishes uncertainty and increases the ability to cooperate in pursuit of common interests (Gargiulo & Benassi, 2000). Publishing in top-tier journals creates a social structure that contributes to the resource of high visibility in the academic market, and this visibility can thus produce an increase in influence among peers (Friedkin, 1998). Co-authoring with boundary spanners may generate critical social capital.

#### *Collaboration in the Quality and Quantity of Publication*

Publication distinction can be determined from both a quantity and a quality perspective (Hamermesh, Johnson, & Weisbrod, 1982). Measurement diversity of both breadth and depth is an important factor. A simple count of accepted publications can accrue as the quantity component, yet it would limit the robustness of the academic scholar's performance if a quality factor was not also assessed.

The co-authorship process itself may assist in improving the quality of an article internally. Diamond (1986) also suggests that some support exists for the concept that collaborative research produces a better product. The internal refereeing which occurs during the actual work of co-authorship can also provide a substantial benefit for article

quality. Each collaborator should find in the other collaborators “a careful editor: a more careful reader than most authors obtain” (Ellerby & Waxman, 1997, p. 209), therefore promoting the production of an article more likely to be accepted in a top-tier journal. In his research, Diamond (1986) found more citations to multiple-author articles than single-author articles, suggesting that article quality may be a positive function of the number of authors. The benefits of collaborating may also include increased influence in the field given its association with publication in prominent journals. Indeed, many academic scholars are choosing to collaborate to improve both the quantity and the quality of their research (Nathan et al., 1998).

Quality of publication may also be judged by the quality of the outlet where the article is published (Gomez-Mejia & Balkin, 1992). A top-tier journal article is peer-reviewed and scrutinized in such a way that quality is more likely. Presumably, academic scholars who consistently publish in premier journals may conduct better research than those who do not (Stahl et al., 1988). Therefore, an administrator is justified in using a journal’s acceptance rate as a screening tool for article quality. Ultimately, publishing in a top-tier journal holds more rewards than publishing in less prestigious journals, both at an individual level and at an institutional level. At an individual level, journal acceptance rates are an important factor with ramifications in regard to influence among peers.

At an institutional level, the perceived quality and prestige of a university are highly correlated with the scholarly output of its faculty (Reskin, 1977). Secondary publications by themselves tend to contribute less than top-tier publications to a university’s reputation and prestige (Miller, 1987; Niemi, 1988). University reputation can be an essential element in recruiting both faculty and students. Having top academic

scholars adds to this component because they have high visibility in their professional communities. They help recruit other top academic scholars who want to collaborate with them as well as superior students anxious to be mentored by them (Gomez-Mejia & Balkin, 1992). Ultimately, because collaboration is purported to help with research and publication in higher education (Blackburn, Behymer, & Hall, 1978), it may therefore be linked with interpersonal visibility (Friedkin, 1998).

*Publication as an Appropriate Form of Incentive Alignment*

An astute university administration recognizes that it is in the best interest of their institution to take care of such a valuable asset, their academic scholars. Administrators hire faculty members who have acquired a specialized knowledge base; such specialization creates experts. A fair amount of independence and sovereignty are associated with being an expert—truly a privileged and nonprogrammable position (Clement & Stevens, 1989). To work effectively, academic scholars must be granted sufficient resources and autonomy to accomplish their tasks, yet under these conditions the university runs the risk of employees pursuing their own interests rather than those that the university promotes. Indeed, academic scholars may find themselves in a “moral hazard” (Holmstrom, 1979) choosing between self-interests such as consulting and working on personal projects or closely adhering to the interests of the institution.

Agency theory (Eisenhardt, 1989) is concerned with resolving two problems that can occur in principal-agent, or administrator-faculty, relationships. The first is the agency problem that arises when (1) the desires or goals of the principal and agent conflict, and (2) it is difficult or expensive for the principal to verify what the agent is actually doing. The problem here is that the principal cannot verify that the agent has

behaved appropriately. The second issue is the problem of risk-sharing that arises when the principal and agent have different attitudes toward risk. Indeed, it is troublesome that the principal and the agent may prefer different actions because of the different risk preferences. According to Eisenhardt (1989), agency theory makes two specific contributions to organizational thinking as follows:

The first is the treatment of information. In agency theory, information is regarded as a commodity. It has a cost and it can be purchased. The implication is that organizations can invest in information systems in order to control agent opportunism. A second contribution of agency theory is its risk implications. Organizations are assumed to have uncertain futures. The future may bring prosperity, bankruptcy, or some intermediate outcome, and that future is only partly controlled by organization members. (p. 68)

Monitoring the unique projects and progress of the individual faculty member is very difficult and expensive for the university. A more effective method is for the university to rely on incentives to reward academic scholars for producing appropriate outcomes: the most appropriate outcome being that of publishing in a top-tier journal (Bayer & Smart, 1991; Gomez-Mejia & Balkin, 1992). Thus, savvy administrators may base financial rewards on appropriate outcomes like research productivity and publication to align individual interests with institutional interests (Luthans, 1967). It is a way to secure the superordinate organizational goals of the university and the individual needs of the faculty simultaneously.

Thus it behooves the administration to keep top academic scholars well paid to deter them from choosing to work for a competing university. In essence, to compete

nationally and to secure institutional prestige, administrators often target their scarce dollars toward attracting and retaining strong academic scholars who could presumably benefit from high mobility if they chose to go elsewhere (Gomez-Mejia & Balkin, 1992; Jolson, 1974).

Agency theory reestablishes the importance of incentives and self-interest in organizational thinking (Perrow, 1986). Agency theory reminds us that much of organizational life, whether we like it or not, is based on self-interest. From an institutional perspective, requiring high numbers of publications is an appropriate form of incentive alignment. It provides incentives for academic scholars to produce a steady stream of high quality research. Agency theory provides a unique, realistic, and empirically-testable perspective on such problems of cooperative effort (Eisenhardt, 1989). As such cooperative effort, an academic scholars' tenure status and salary are closely tied to academic publishing.

*Publishing in relation to tenure status.* Academic institutions in America have made it critical for academic scholars to publish in order to survive and prosper. The “publish or perish mantra” has become a household term for faculty (Gad-el-Hak, 2004, p. 61). The time-honored measure of productivity has been “the number of papers published” (Rustum et al., 1983, p. 118). Undoubtedly the necessity of publishing is a certainty for academic scholars concerned with tenure, rank, and status (Coe & Weinstock, 1984; Hunt & Blair, 1987; Luthans, 1967).

Knowing that it isn't a question of “to publish or not to publish,” but rather how and what to publish should lead a scholar to strategize in regard to the best method to achieve publication. Not just any publication will do—clearly, the merit of publishing in

a top-tier journal is distinctively superior (Coe & Weinstock, 1984; Stark & Miller, 1976). With such an essential goal as publication resting on the shoulders of the vast majority of academic scholars, it certainly makes sense to determine the optimum strategy to achieve this step. Unadvisedly, some may disregard a strategic approach, choosing to be more *laissez faire* in their publishing career, but wisdom would indicate that strategy should play a critical role for successful academic scholars. Davidson (2004) notes the following:

The key feature of academic publishing is that it touches so many aspects of our academic lives, since it is the chief evaluating and credentialing mechanism upon which the reward system of academe is based. (p. 129)

The most significant and established criteria of faculty pay at both private and public institutions is the number of times a faculty member has been published in a top-tier journal (Clement & Stevens, 1989; Luthans, 1967). However, like other limited resources, quality academic scholars are a scarce commodity. Although there are internal rewards and motivators that encourage an individual to dedicate time, knowledge and effort toward the goals espoused by an institution of learning, there also need to be clear external rewards. These external rewards must provide considerably strong rationale to academic scholars for they are choosing how to invest their biggest asset, themselves. Among the strongest external reward mechanisms for such investment are tenure and promotion.

The principal expression of academic values about academic scholarly performance lies in promotion and tenure decisions. Scholarly productivity is most meaningfully defined and evaluated within the tenure process (Fairweather, 2002).

Across almost all types of higher education institutions, faculty respondents almost always defined their own productivity by refereed publications and secondarily by research grants. When pushed to tell “what matters, . . . respondents were more likely to [say] . . . research and publication” (Massy & Wilger, 1995, p. 12), lessening even further the importance of research grants or anything other than publications.

In regard to granting tenure, universities are growing more selective (Clement & Stevens, 1989) due, in part, to the serious financial commitment that granting tenure can be (Campbell, 1995). Tenure is being granted more and more deliberately and cautiously (Bayer & Smart, 1991; Jolson, 1974; Stark & Miller, 1976). This higher selectivity means that university administrators need objective performance appraisal systems to defend their tenure decisions. Organizationally, administrative decisions are often based on faculty performance interpreted by publication outcomes (Creswell, 1985). This particular research aims to inform administrators in the field of higher education regarding factors that may be associated with higher publication outcomes.

*Publishing as a primary determinant of salary.* Another acknowledged reward for academic scholars is salary which provides a foundational motivator, for which typical employees choose to invest their life-force toward the goals of an exterior source. In fact, how faculty members disseminate their time and effort is a likely reflection of their university’s compensation system (Reskin, 1977). Therefore it is important to understand the critical factors in compensation decisions.

Diamond (1986) intimates that although quality is important, quantity is still the most critical factor and, in fact, that quality is second to quantity as a criterion of salary

For the non-astute faculty member, the results reported here might highlight the importance of quality of research as a determinant of salaries at research-oriented universities. For the astute faculty member, the results will confirm prior beliefs. (p. 212)

According to Gomez-Mejia and Balkin (1992), the primary determinant of faculty salary is the number of authored works accepted by top-tier journals. Indeed, research activity resulting in publication may be the administration's single primary criterion for promotion, tenure, and salary increases (Coe & Weinstock, 1984; Jolson, 1974; Luthans, 1967). The more significant and established criteria of scholar salary at both private and public institutions is the number of times a scholar has been published in a top-tier journal (Clement & Stevens, 1989; Luthans, 1967). "Publishing in top-tier journals is a measure of performance that enjoys extensive normative consensus and convergence" (Gomez-Mejia & Balkin, 1992, p. 948). By far, the most commonly used measure of both individual and departmental research productivity is the number of faculty publications (Toutkoushian et al., 2003).

In summary, the environment of higher education has been observed through the lens of academic publishing, including the following: 1) the effects of article publication on an academic scholar's influence within the field; 2) the collaboration of academic scholars towards quantity and quality publishing; and 3) the use of publication as an appropriate form of incentive alignment along with the role of publication in tenure status and salary determinants of academic scholars.

The review will now discuss influence in academic fields as it relates to co-authorship networks as a system of interpersonal visibilities, visibilities that are amplified

by article publication. The scene of collegial networks will be explored, including their relation to collaboration and an analysis of their potential advantages and disadvantages.

*The Association of Publication and Influence among Scholars*

The relationship between academic publication and the acquisition of influence in academic fields, the goal of both higher education institutions as well as individual academic scholars, can be informed from the perspective of social network theory. First, this section addresses the emergence of interpersonal visibilities (Friedkin, 1998) as they relate to network structure and the facilitation of influence in the field. Second, the concept of collaborative collegial networks explains how publication facilitates influence in the field. Lastly, the potential advantages and disadvantages of collaboration are discussed.

*Influence from a Network of Interpersonal Visibilities*

The key construct of individual influence in the field of research on higher education is derived from an academic scholar's network of interpersonal visibilities consisting of the academic scholar's social positions and interpersonal influences (Friedkin, 1998). An important factor in the construction of these social positions and interpersonal influences stems from their co-authoring relationships. In regard to studies specifically targeting influence in the field of research and scholarship on higher education, Price and Beaver (1966) were early researchers who used co-author relationships to investigate social structures and influence, specifically within communication networks. Research and publication in higher education are supported by engagement in formal and informal collegial networks (Blackburn et al., 1978). This engagement is an advantage that supports research and publication at prestigious

institutions (Creamer & McGuire, 1998). Publication is recognized both formally and informally as a key visible distinction, visibility being a critical component of influence (Friedkin, 1998), and thus publication is associated with influence.

The commodity known as influence is not static, but rather a dynamic, interactive phenomenon (Forgas & Williams, 2001). Influence relates to the processes whereby people agree or disagree with behavior and the formation, maintenance, and changing of social norms and social conditions surrounding the norms (Turner, 1991). Given that people form and conform to social norms, influence processes and implicit pressures for agreement are inherent in social relationships (Turner, 1991). Newcomb's (1943) study provides some of the foundational work on norms illustrating that in a real social setting people gradually internalize the norms of the group they join and how persistent those norms can be even over many years. Lewin's (1947) group decision studies showed how difficult it is to change individuals' behavior in isolation from the norms they share as group members. However, isolating and measuring influence is difficult because the development of interpersonal influence measures assumes a causal effect (direct and unmediated) (Friedkin, 1998), yet determining if an observed opinion change is direct and unmediated is not always reliable.

Addressing this challenge, network theory provides a structural approach to understanding interpersonal influence (Friedkin, 1993). The key concept is visibility. Simply stated, *invisible* behavior and opinion cannot be influential (Cole & Cole, 1968). According to Forgas and Williams (2001), Max Weber was among the first to show that a clear understanding of the effects of social influence processes on behavior must involve both the study of externally observable behavior, as well as the subjectively perceived

meanings that are attached to a behavior by the actor. Thus, network theory, or the theory of social influence, includes measures of actors' social positions and interpersonal influences which are derived from the network structure of their interpersonal visibilities (Friedkin, 1998).

Interpersonal visibility exists when one actor has some information about another actor. This interpersonal visibility is a precondition of social control processes, not only because it allows a response to actors whose behavior or opinion have been observed, but also because it allows the observed behavior and opinion to become *influential* (Friedkin, 1998). According to Berger, Rosenholtz, & Zelditch, (1980)

The key scope condition is that the network of interpersonal visibilities, from which the structural measures are derived, must be formed by a status-organizing process so that the network's structural features can serve as reliable indicators of actors' social positions and interpersonal influence. (p. 505)

An academic scholar's profile of article publications distinctively fits the criteria of a status-organizing process. In its most general sense, *social influence* is defined as an attempt to understand and explain how the thoughts, feelings, and behavior of individuals are influenced by the actual, imagined, or implied presence of others. The implied presence of others refers to the "position of the person being influenced *in a complex social structure* and their membership of a cultural group" (Allport, 1985, p. 3, italics added). In a specific way, this perspective suggests that, for academic scholars, influence is easily identifiable in article publication (Stokes & Hartley, 1989). Thus research visibilities that are inherent in article publication may enhance the stature of academic scholars among their peers (Alpert, 1985). Therefore, among academic scholars,

interpersonal visibility is highly valued because it is a necessary condition of interpersonal influence (Friedkin, 1998). This argument lends credence to the importance of co-authorship network structures as they create the social structures that may, in turn, increase research visibility.

### *Social Network Theory*

Social network theory focuses on factors associated with the development of social structures as well as their implications (Baron, Field, & Schuller, 2000; Freeman, 1996). As such, social network theory provides an important perspective to the understanding of the influence processes and structures as well as introduces methods of measurement and analysis. One advantage of social network theory and analysis is that a wide range of empirical phenomena can be explored in terms of their structural patterning (Freeman, 1996).

There has long been interest in networks and structures of social relationships as a foundation for sociological analysis. This concern stems from the human desire to understand how we interact together (Breiger, 1991). As early as 1931, Leopold von Wiese asked his reader to imagine what would be seen if “the constantly flowing stream of interhuman activity” (p. 29) could be halted in its course for just one moment to see the apparently impenetrable network of lines between men. This mental picture of social networks is critical to understanding its concept and definition. The existence of a social relationship is, after all, initially a function of the individual perceiving and constructing a dyadic tie (Hite, 2003). The set of these ties creates a larger network. Castells (1996) refers to these networks as open structures that are able to expand by creating ties to new nodes (e.g. people) along lines of common communication patterns.

However, mainstream social research has often been accused of separating the individual from the behavior, neglecting the *social* part of behavior, the part that examines the ways individuals interact with and influence each other (Freeman, 1996). In the last two decades, an increasing extent of social research has focused on the social relationships linking people rather than on the individuals themselves (Friedkin, 1993). This particular kind of research that examines the links among people is defined as a *structural approach*.

Within social science, the structural approach which studies the interaction among social actors is known as social network theory and is “grounded in the intuitive notion that the patterning of social ties in which actors are embedded has important consequences for those actors” (Freeman, 1996, p. i). Social network theory focuses on the relationships among the social entities and the patterns and implications of these relationships (Baron et al., 2000). Modern social network theory and analysis is based on the following four assumptions (Freeman, 1996)

1. Social network theory is motivated by a structural intuition based on ties linking social actors;
2. Social network analysis is grounded in systematic empirical data;
3. Social network analysis utilizes extensive graphic imagery; and
4. Social network analysis relies on the use of mathematical/computational models.

*Social network theory and analysis* provide an important means to understand the interactions within network structures and the exchange of content that flows through these network relationships (Hite, 2003). Network content is described in terms of the

purpose of the relationship (e.g. friendship, communication) and can involve the exchange of a broad range of resources. Exchange of resources within network relations is facilitated by the use of some type of capital. While financial capital is likely the most recognized facilitator of exchange between parties in a market setting, social capital is crucial to the facilitation of many types of resource exchanges across social networks (Portes, 1998).

### *Social Capital*

*Social capital* has been foundationally defined by Bourdieu (1992) as the resources resulting from social structure. This definition of social capital aligns with the concept that influence (Friedkin, 1998) can be derived from an academic scholar's network of interpersonal visibilities as created by their academic social positions. Social capital is a key factor in understanding how co-authorship strategies may be associated with publication success and, therefore, with influence in the field.

The flow of information through network structures provides the critical link that connects social capital to influence. According to Burt (2001), people gain advantages by exploiting informational gaps in the formal organizational structure. Thus, it is important to understand how an individual academic scholar's co-authorship strategy utilizes their network structure for information acquisition and dissemination. Academic scholars may better position themselves to intentionally create an academic social structure that increases their social capital and ability to contribute to the advancement of their fields.

The relationship between article publication and influence in the field (Stokes & Hartley, 1989) may be due to the role of publication in creating social capital. The visibility of publishing a top-tier article is the key that initiates the production of social

capital in higher education academic circles (Friedkin, 1998). How an academic scholar publishes may facilitate different mechanisms for creating social capital. In this study, these different mechanisms will be demonstrated for individual academic scholars through the contrasting theoretical constructs of cohesion versus structural holes.

Two noted theorists, James R. Coleman and Ronald S. Burt, are largely responsible for the definition of and clarity surrounding social capital as well as the stark contrast in how each believes social capital is produced. By the time of his death, James Coleman was one of the most highly regarded social theorists in North America (Baron et al., 2000). Coleman's chief contribution to the social capital debate is in his "relatively straightforward sketch of the concept" (Baron et al., 2000, p. 6). The lowest common denominator in the pursuit of influence is social capital and is described by its utility, "a function of social structure producing advantage" (Coleman, 1990, p. 302). He was an exponent of rational choice theory as he sought to draw together the insights of two separate disciplines, sociology and economics. His work has strongly shaped the contemporary debate and, yet, he has also been widely criticized.

The other noted theorist, Burt, is "probably the most prominent scholar to have made an explicit bridge between networks and social capital" (Baron et al., 2000, p. 21). Burt's approach exemplifies a linear methodology, and his key insight is that people gain advantages by exploiting informational gaps in the formal organizational structure (Baron et al., 2000). According to Burt (2000), social capital is two things at its core, the potent technology of network analysis and an explanation of the critical issue of individuals' differential performance. He insists that "social capital promises to yield new insights,

and more rigorous and stable models, describing why certain people perform better than others” (Burt, 2000, p. 2).

Like any other form of capital, social capital is ultimately productive, making possible certain achievements that could not be accomplished without it. Both Coleman and Burt agree that social capital is less tangible than the wholly tangible form of physical capital or the semi-tangible form of human capital which is embodied in the skills and knowledge of an actor. Social capital is the contextual complement to human capital according to Burt, (2001), “social capital and human capital are often complimentary” (p. 304). Clearly there is agreement between the two researchers on several aspects of social capital. In further agreement, Burt, (2001) goes on to a description to which Coleman concurs,

The social capital metaphor is that the *people who do better are somehow better connected* [italics added]. Essentially, it boils down to one word, advantage. Certain people are connected to others, trusting certain others, obligated to support certain others, dependent on exchange with certain others. Holding a certain position in the structure of these exchanges can be an asset in its own right. That asset is social capital. (p. 2)

However, unlike other forms of capital, social capital is found in the relations *between* actors, it is not lodged in the actors themselves or in physical implements of production (Coleman, 1988). In considering social capital, two key elements are that first, it includes some aspect of social structure and that second, it facilitates certain actions by the actors involved (Coleman, 1988). Social capital comes about through the relations

among persons and facilitates action. Coleman (1988) points out the key concept of social capital as a resource,

The function identified by the concept of “social capital” is the value of these aspects of social structure to actors as *resources that they can use to achieve their interests*. [italics added]. (p. S101)

Social capital is built by people, through people, for people. Collaboration is a comprehensive method used to access the inherent value of social capital. To further the understanding of the development and outcomes of collaboration, collaboration can be viewed from the theoretical lens of social capital. Collaboration is purported to help in research and publication in higher education (Blackburn et al., 1978) and therefore would generate interpersonal visibility; therefore, collaboration is highly valued because it may be a necessary condition of interpersonal influence (Friedkin, 1998).

#### *Collegial Networks as Collaboration*

In the broadest sense, collaboration in published scholarship represents the majority of work in many academic fields (Peters & Van Raan, 1991); in fact, this has been the case since the Second World War (Beaver & Rosen, 1979). Truly collaboration is entrenched in the more mature disciplines with strong paradigmatic development (Bayer & Smart, 1991). Glanzel (2002) states that “the most characteristic tendency of recent times is intensifying scientific collaboration” (p. 461). For example, co-authorship makes economic sense in fields that are constrained by the use of multi-million dollar equipment and facilities (Persson & Melin, 1996), like those in many of the hard sciences. Thus, for example, the escalating collaboration and the associated increase of multi-authored papers in the fields of chemistry and biomedical research are not

surprising. Also due to the scale and complexity of some psychological research, collaboration has increased there as well with co-authorship becoming the norm in that field (Cronin, Shaw, & LaBarre, 2003).

In almost any given discipline, a small group of highly productive scholars often generate a disproportionately large number of entries to the literature (Hunter & Kuh, 1987; Price & Beaver, 1966). Specifically, research and publication in higher education are supported by engagement in formal and informal collegial networks (Blackburn et al., 1978). Additionally, engagement in formal and informal collegial networks is an advantage that supports research and publication, particularly at prestigious institutions (Creamer & McGuire, 1998). A key assumption from the work of Hunter and Kuh (1987) is that knowledge production is associated with shared patterns of behavior and experiences. Indeed developing extensive collegial networks is a key aspect that characterizes prolific scholarly writers in the research literature of higher education (Creamer & McGuire, 1998). According to noted sociologist and frequent collaborator Mary Frank Fox (1985),

Freedom and independence are certainly strong precepts in science and scholarship . . . and scholarship tends to attract the “solitary mind.” Yet the solitary dispositions and independent norms of science and scholarship are contravened by the communalism of the work . . . The communalism and exchange of research engenders cooperation and interdependence . . . We need to know much more about the way in which collegiality operates. (p. 271)

Collaboration is based on a relational value system that provides an alternative to competition and hierarchy (Dickens & Sagaria, 1997). Collaboration can also be seen as

a “functional interdependence between scholars in their attempt to coordinate skills, tools, and rewards” (Zorach & Melin, 2001, p. 134). And finally, Persson and Melin (1996) refer to collaboration as “an intense form of interaction, that allows for effective communication as well as the sharing of competence and other resources” (p. 363).

Academic scholars from the field of research and scholarship on higher education use a variety of metaphors to describe their collaborative relationships including “a good marriage, a successful creative alliance, or a winning sports team” (Baldwin & Austin, 1992, p. 8). A quilt and a stew pot have also been suggested (Zorach & Melin, 2001). The terminology used to portray the following depiction of collaboration from Zorach and Melin (2001) is insightful,

With each project we refined our strategies for achieving stylistic unity and continued the precedent for reciprocity, whereby one compensated for the momentarily depleted resources of the other, with the final product reflecting merged voices and scholarship. (p. 132)

Social capital is generated through collaboration. In a utilitarian way, collaboration can be broken down for application with specific co-authorship terminology. For a given publication, one aspect of the co-authorship strategy may be ascertained by the number of contributing authors. Simply stated, a document is co-authored if it has more than one author (Persson & Melin, 1996). Co-authorship strategies can be delineated as isolate, dyadic, triadic, or subgroup. An isolate strategy occurs when an academic scholar publishes his or her work independently. A dyadic strategy consists of two academic scholars working together, and a triadic strategy is a set of three academic scholars. Four or more academic scholars constitute a subgroup strategy.

Thus, collaboration among co-authors represents a critical vehicle for accessing the inherent value of social capital which can facilitate greater influence in the field.

To further understand the development and outcomes of social capital, the advantages and disadvantages of collaboration will be presented. The literature supports the benefits of collaboration over the disadvantages, but acknowledges the potential risks that may accompany collaboration.

*Potential advantages of collaboration.* Zorach and Melin (2001) suggest that collaboration is a “renewable resource” which serves to counterbalance the limited options of one’s academic opportunities and finite energies. Collaboration offers the potential to better sustain one another through increased access to resources, for today’s academic market requires not only intellectual mettle, but a tremendous amount of other resources. Collaboration can be a means of sharing the burden of such resources. The give and take of resources such as ideas, inspiration, and information is essential.

From a long-term career perspective, such collaborative relationships can play a crucial role in sustaining general intellectual momentum or specifically, a particular research agenda. “Collaboration can help keep at bay the stagnation in scholarly creativity cited so often in media critiques of tenure in higher education” (Zorach & Melin, 2001, p. 134). Effective collaboration may also increase the potential for social evaluation among themselves which may contribute to social influence. Such social evaluation can motivate greater performance than merely self-evaluation (Harkins & Lowe, 2000).

Collaboration can be promoted for many different reasons. Academic scholars with similar methodological interests and complementary views may find it easier to

work together. Also disciplinary norms may determine likely forms of collaborative scholarship (Dickens & Sagaria, 1997). Fox and Faver (1984) note that collaboration certainly provides opportunities to join together and alleviate academic isolation. The reason for collaboration may, however, be as simple as the human urge for companionship.

For example, collaboration as relationships of support may be instrumental, particularly to those with scholarly interests in competitive research institutions. Fox and Faver (1984) go on to state that “to work in collaboration with other scholars with whom they share . . . research interests arguably offers a variety of professional and personal advantages” (p. 80). In addition, instrumental collaborative relationships are likely motivated by a direct need to generate research and publications (Dickens & Sagaria, 1997). Pragmatism may strongly motivate an author to seek a collaborative opportunity.

Additionally collaboration may open the door to becoming a better scholar by enabling academic scholars to better navigate the traditional academic processes, particularly for new scholars, women, minorities (Zorach & Melin, 2001) or others who may be otherwise isolated or marginalized. One professor in Dickens and Sagaria’s work (1997) shared the following perspective,

Politically it was very important to collaborate when I was young, because I needed the strength of the senior people. They needed my abilities, but they had years and status. So there are times early in my career where I was the worker and they were the name and *we used each other mutually* [italics added]. (p. 90)

The transition to collaborative scholarship is often reflective of the professional pattern where mentors and protégés find each other (Zorach & Melin, 2001). “The importance of

being ‘adopted’ by a sponsor with an established track record in research and publication activities cannot be overstated” (Hunter & Kuh, 1987, p. 456).

At an institution where the collegial value of a “team player” is acknowledged, experience as a co-author may prove an unqualified asset and may be regarded as evidence of this collaborative ability. The institution also stands to benefit as academic scholars who collaborate are enriched by a broader range of skills which are essential to the multi-dimensional roles definitive of twenty-first century faculty. As Bayer and Smart (1991) state, “the tremendous expansion in collaborative scholarship requires greater research attention to the effects and conditions under which it contributes to the growth and utility of knowledge” (p. 633). This research may be an incremental step toward that knowledge.

*Potential disadvantages of collaboration.* Collaboration, however, may also encounter disadvantages. “Collaborative projects encounter scrutiny primarily where individual faculty performance is central such as in merit, tenure and promotion evaluations” (Zorach & Melin, 2001, p. 129). The safeguard in such situations may be found in more clearly articulated expectations regarding authorship both within the field and the institution.

Dickens and Sagaria (1997) advise that collaboration requires compromise and a willingness to give up some control—the paper won’t look exactly the way one author would have written it independently. Ellerby and Waxman (1997) support this position that “because of its dialogic underpinnings, a co-authored piece is epistemologically different” (p. 205) than a sole-authored piece. However, Zorach and Melin (2001) disagree and maintain that even with the pressure of a tenure track position, ultimately no

disadvantage is associated with collaboration and co-authored works are not likely to be treated differently than those under the name of a single author.

Disadvantages such as extra time requirements, increased costs and intensive personal investments necessary to preserve the relationship should also be taken into consideration. Collaborative relationships raise questions about how co-authors manage their differences and perhaps more importantly, how differences both advance and inhibit meaningful scholarship (Dickens & Sagaria, 1997). In fact, some academic scholars may wonder why collaboration is such a good idea when they consider the myriad difficulties which inherently occur when working with others. Certainly the hassles of time-management and group-coordination can be a monumental task in itself and may create complaints of delay or even jeopardize the research project itself (Fox & Faver, 1984).

Another concern for scholars in some fields is the inability to be counted in the *Science Citation Index* as anything but the first author. A total citation count is much more time-consuming and costly than a first-author count because the interested party must find an alternate source of all a scholar's multiple-authored publications (Diamond, 1986).

Unfortunately, fraudulent scholarship has recently become a matter for some university administrators and scholars to contend with (Bayer & Smart, 1991). According to Persson and Melin (1996),

There may be other causes of co-authorships besides research collaboration, for example when research leaders demand to have their names on the articles without actually contributing to the specific work reported. (p. 364)

Honorary authorship is perhaps a lesser problem which is done with no malicious contempt. *Noblesse oblige* grants authorship to those with minimal contribution. Also gift authorship occurs when the names of an entire research team are listed but in essence, only two or three genuinely authored the work. This is done to increase the publication records of all involved (Blau, 1973). Diamond (1986) suggests that citation-exchange relationships can be developed, sometimes even tacitly. Certainly in almost all fields, there is a legitimate need for each individual author to take responsibility for the content.

Perhaps the most ubiquitous potential misunderstanding in academic collaboration surrounds the order in which the authors' names are listed (Bayer & Smart, 1991). Author order is often a misleading determinant of the importance of their contribution (Stokes & Hartley, 1989). In fact, according to Gomez-Mejia & Balkin (1992), it is practically impossible to discern with any degree of accuracy who contributed what to a manuscript. As stated by Martin, (1988),

Individual attitudes determine in which order the authors' names are listed, some professors use alphabetical order, others try to list by degree of contribution to the work (with the main contributor first), some always put their names first, and some practice the reverse snobbery of always placing their names last. (p. 141)

Thus, order cannot be regarded as a reliable source of information in regard to social structure and influence within a research group (Stokes & Hartley, 1989). Yet, ironically, the more authors the paper has, the greater the amount of visibility and recognition it produces for all authors, although the paper's contribution to scientific knowledge remains the same (Lindsey, 1982).

Even with some potential downsides of collaboration apparent, the advantage of a helpful collaborative strategy in the push to publish or perish deserves further consideration. Concerns of negative repercussions are minimal according to Long and McGinnis (1982), who indicate that colleagues don't discount multiple authorship—other scholars gave similar credit to each author of a paper since it is not reliable to determine where credit is due by the order of authors' names (Bayer & Smart, 1991).

In summary, this review has discussed influence in academic fields as it relates to co-authorship networks as a system of interpersonal visibilities which are amplified by article publication. Collegial networks have been explored, including their relation to collaboration and an analysis of their potential advantages and disadvantages. Next, co-authorship strategies were identified, which were linked by the common denominator of social capital. Specifically, the dilemma of how the opposing co-authorship network structures of cohesion and structural holes may both promote publication and provide influence in the arena of higher education was demonstrated. Collaboration is alleged to assist in higher education research and publication (Blackburn et al., 1978) and therefore interpersonal visibility. Collaboration is, thus, valued because it can be a necessary condition of interpersonal influence (Friedkin, 1998). Finally, the chapter now concludes with a presentation of the research problem and additionally the research questions that were addressed.

#### *Structural Holes versus Cohesion, Opposing Network Structures*

Differences among academic scholars in how connected they are can be extremely consequential for understanding their attributes and behavior. There are good theoretical reasons along with some empirical evidence to believe that these basic

properties of social networks have very important consequences: the single main question, however, is the structure of these connections (Hanneman & Riddle, 2005) given the implications of these structures on the resulting social capital. This differential social capital may be useful in further explaining successful academic publication.

Found at polar ends of the network structure paradigm, yet both empirically purported to produce social capital, are the constructs of cohesion (Coleman, 1988) and structural holes (Burt, 1992). Although the definitions of social capital previously given by Coleman (1988) and Burt (2000) were somewhat complex, they were relatively congruent. However, now the congruence between Coleman and Burt ends.

The remaining key argument revolves around these two contrasting network structures, each touted to best create social capital. These structures are competing because the network characteristics of one strategy generally make the other much less likely or feasible.

On the one hand, Coleman's view of social capital stresses the positive effects of cohesive ties in promoting a normative environment that facilitates trust and cooperation between individuals (Coleman, 1988). On the other hand, structural holes theory (Burt, 1992) insists that the benefits from social capital stem from the brokerage opportunities created by diverse ties, also known as a lack of network cohesion (Gargiulo & Benassi, 2000). Structural holes theory suggests that cohesive social bonds jeopardize flexibility and increase rigidity.

This section describes and explains each of the two network structures and applies these structures to co-authorship networks. A discussion of the implications of these two contrasting network structures will be presented.



additive rather than overlapping (Burt, 1992). Breiger (1991) referred to such network characteristics in the following way:

These networks consist largely not of connections but of 'holes' . . . possibilities of relationships which do not in fact exist; that internal boundaries of interactions within and across multiple networks do not neatly fit such culturally defined boundaries as 'academic disciplines' or 'fields of specialization;' that the boundaries of a network population may be 'open' and intrinsically difficult to ascertain. (p. 29)

In relating the structural holes of a scholar's egocentric co-authorship network to successful publication, the benefit of linking new streams of resources and information creates a competitive advantage for an academic scholar whose relationships span the holes (Burt, 2001). More importantly, even greater benefits can occur based on an extended social network which is inherent in a structural holes strategy. The increased potential visibility by co-authorship with new and different academic scholars is a method to increased interpersonal influence (Friedkin, 1998). According to Burt (1992)

Structural holes can determine who knows about opportunities, when they know, and who gets to participate in them. Players with a network optimized for structural holes enjoy higher rates of return on their investments because they know about, and have a hand in, more rewarding opportunities. (p. 76)

The interpretation of this benefit is that structural holes provide an opportunity to broker the flow of information between people and control the projects that bring people from the opposite sides of the structural network hole together (Burt, 2001). In essence, the potential visibility which is vital to influence (Friedkin, 1998) in the field can be

exponentially increased with connections to non-redundant scholars as found in filling structural holes.

The underlying value added of filling structural holes is that they access non-redundant sources of information (Burt, 2005). People on either side of a structural hole are diverse and circulate within different flows of information. According to John Stuart Mills (1848),

It is hardly possible to overrate the value . . . of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar . . . such communication has always been, and is peculiarly in the present age, one of the primary sources of progress.”  
(p. 581)

Multiple benefits accrue from filling structural holes. The concept infers that by filling or spanning structural holes, the diversity of network ties is enhanced. The more holes spanned, the richer the information benefits from the network. Burt (2005) cautions, however, that the actual value of these type of relationships is defined by the social contexts around the relationships rather than merely the number of ties, such that constraint and efficiency are important measures. In addition, specific information benefits of spanning structural holes are access, timing, and referrals (Burt, 1997). A network tie that spans a structural hole provides access to information and knowledge well beyond what a person could access and process alone. In addition, timing benefits suggest that a tie across a structural hole may provide information earlier than a tie within the same network cluster, and finally, a referral may be provided to a valuable contact. Benefits are also found in that more innovative solutions are to be expected from the

social capital of bridge relationships (Burt, 2000). Creativity and learning are central to the co-authoring advantage from structural holes. Bridging structural holes enhances an individual's ability to learn.

Another benefit of structural holes is that those academic scholars experienced with networks containing structural holes may more easily recognize the holes in new networks thus enacting a type of multiplier affect, such that more social capital accrues to those who already have it (Burt, 2000). Thus, an academic scholar who chooses to utilize the co-authorship strategy of structural holes from the beginning of their career would likely expand their social capital more quickly and thus be more likely to be seen as influential in the field of research and scholarship on higher education. The implication is that this social capital cumulates over a career and therefore is exponentially better to acquire early in one's career. Thus, in addition to the efficient benefit of determining a co-authorship strategy early in one's career, the overarching advantage of structural holes, according to Burt (2000), is that social capital is most effectively produced in this manner.

Burt has also facilitated a great deal of thinking about how and why the ways that an actor is connected affects their constraints and opportunities, and hence their behavior.

Hanneman and Riddle (2005) explain this as follows:

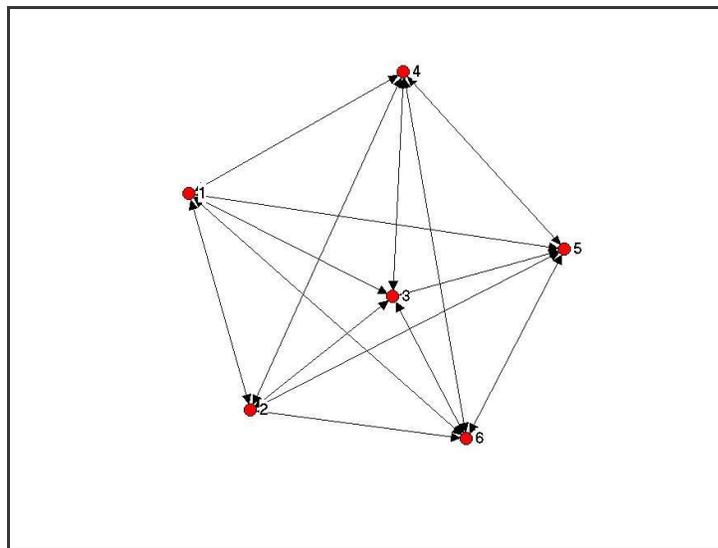
Network analysts often describe the way that an actor is embedded in a relational network as imposing constraints on the actor and offering the actor opportunities. Actors that face fewer constraints and have more opportunities than others are in favorable structural positions. Having a favored position means that an actor may extract better bargains in exchanges, have greater influence, and that the actor will

be a focus for deference and attention from those in less favored positions. (p. 10)

Thus, structural holes, and how and where they are distributed, can be a source of inequality (in both the strict mathematical sense and the sociological sense) among actors embedded in networks (Hanneman & Riddle, 2005). However, structural holes are in distinctive contrast to the co-authorship network structure of cohesion.

#### *Cohesion as a Co-authorship Network Structure*

The structure of cohesion is demonstrated by co-authors who have dense egocentric networks (see Figure 4) meaning ego is connected to others who are also connected to one another. These academic scholars may also tend to co-author multiple times (strength of ties) with a smaller handful of other scholars. Coleman's (1988) central argument about cohesion is that it develops within communities; more specifically, in communities which are characterized by shared responsibilities and high trust relationships. A community of academic scholars may fit Coleman's description.



*Figure 4.* Cohesion network structure.

Coleman argued that social relations create a source of useful capital resources through such processes as establishing obligations, expectations and trustworthiness, creating channels for information, and setting norms backed by efficient sanctions (Coleman, 1988). Coleman saw the creation of social capital as a largely unintentional process which functioned precisely because it arises mainly from activities intended for other purposes—essentially social capital is a by-product (Baron et al., 2000).

In terms of channels of information norms and trust, according to Coleman (1990), a cohesive structure will first increase access to information, which corresponds with Friedkin's (1998) concept of influence involving an actor's network of visibilities, because, secondly, cohesion makes it less risky for people in the network to trust one another (Coleman, 1988) and therefore to be more readily influenced by each other. In terms of expectations, "in a structure with closure, actors can combine to provide a collective sanction" (Coleman, 1986, p. S106). These sanctions can monitor and guide behaviors and expectations. Without cohesion or closure, closure being a network where the actors are largely connected and therefore cohesive, the only avenue for sanction lies wholly on the shoulders of the individual person to whom the obligation is owed, as the rest of the structure members are not likely to participate in the sanction.

Strong relations among contacts are argued by Coleman (1988) to give more reliable protection from exploitation because other network members are able to act in concert (Uzzi, 1996) against someone who violates their norms of conduct. Thus, according to Coleman (1988), closure of the social structure is also critical as trustworthiness allows the proliferation of obligations and expectations. He insists that "closure creates trustworthiness in a social structure" (Coleman, 1988, p. S108).

In terms of norms, Coleman (1988) also insists that a cohesive structure is especially important in facilitating social capital due to the generation of community norms. Effective norms are imperative to the establishment of social capital, but without closure, there can be no norms. When a norm does exist and is effective, it constitutes a powerful, though sometimes fragile, form of social capital (Coleman, 1988). For example, norms that inhibit crime may make it possible for people to leave their houses and walk unimpeded at night. Among academic scholars, one example may be the norm to cite other community members' research. A necessary but not sufficient condition for the emergence of effective norms is action that imposes external effects on others (Coleman, 1987). Norms arise as attempts to limit negative external effects or as attempts to encourage positive ones, or in other words, norms facilitate certain actions and constrain others. One small disadvantage is that effective norms in an area can reduce innovativeness (Coleman, 1988); however, when identified and acknowledged, appropriate steps can neutralize the shortcoming.

However, Coleman is criticized for overemphasizing the strong or dense ties found in cohesive networks to the neglect of weaker ties (Granovetter, 1973) which have proven more effective than dense ties in providing access to new knowledge and resources (Portes, 1998). Another potential downside of strong ties is that communities and networks rich in cohesion require a greater amount of time, energy, and resources to build and maintain (Burt, 2000). In addition, cohesive networks of strong ties depend on a high degree of stability (Baron et al., 2000). According to Burt (1988),

The larger the group over which one has to distribute one's time and interpersonal energy, the weaker the relationship one can sustain with any one member of the

group and the stronger the relations with people of relatively short path distance from you in the group. (p. 7)

Burt's view (1992) remains that the effort necessary to retain certain cohesive network contacts can be exhaustive—too costly to maintain. He notes that having weaker ties with many different actors, a structural holes network, can alleviate some of the relational investment necessary to sustain the level of closeness necessary for cohesion (Burt, 1992).

Admittedly, however, Burt (2001) does acknowledge one prospective drawback of weak ties in that there can be more difficulty with team communication and coordination. Potentially structural holes between people in a group can weaken in-group communication and coordination, which also weakens the group's ability to take advantage of brokerage beyond the group. "Closure eliminates structural holes within the team, which improves communication and coordination within the team" despite coalitions or factions separated by holes within the team (Burt, 2001, p. 20). Coleman (1988) would agree that strong relations among contacts give more reliable communication channels. However, most importantly, while the fact remains that both network structures have demonstrated the production of social capital, albeit through different mechanisms, is one preferable in co-authorship networks for facilitating academic publications?

#### *The Contrast between Cohesion and Structural Holes*

The bottom line is that the networks of structural holes and cohesion are competing. These co-authorship structures continue to exhibit a tension between the two opposing views of how networks create social capital. To summarize, on the one hand,

Coleman's view of social capital stresses the positive effects of cohesive ties in promoting a normative environment that facilitates trust and cooperation between individuals (Coleman, 1988). On the other hand, structural holes theory (Burt, 1992) insists that social capital stems from the brokerage opportunities created by diverse ties, also known as the lack of network cohesion (Gargiulo & Benassi, 2000).

Social capital facilitates performance (Burt, 2001). The tension is, however, that social capital is said to be generated from both structural holes and cohesion. Thus, testing the association between the two co-authorship network strategies of structural holes and cohesion and performance, as measured by successful publication, provides a summary test between these two leading network mechanisms argued to both provide social capital (Burt, 1992). According to Burt, 2001,

More constrained networks span fewer structural holes, which means less social capital according to the holes argument. If networks that span structural holes are the source of social capital, then performance should have a negative association with network constraint. More constraint means more network closure, and so more social capital according to the closure arguments. If network closure is the source of social capital, then performance should have a positive association with constraint. (p. 11, underline in original.)

The two network mechanisms of brokerage (structural holes) and closure (cohesion) have been the foundation for work on social capital. In the end, closure is about status, while brokerage is about change (Burt, 2000). Neither mechanism assumes that network structure replaces information so much as they affect the information flow and what people do with it (Burt, 2000). Coleman's (1988) view of social capital focuses

on the risks associated with incomplete information and the benefit of network closure: “reputation cannot arise in an open structure and collective sanctions that would ensure trustworthiness cannot be applied” (p. S107). The closure prediction is that an individual with more social capital will use the density among contacts as more reliable communication channels as well as protection against exploitation because the contacts are able to act in concert against those who violate the group norms. Closure is about closing ranks with like-minded people and the advantages that go to people in a cohesive group.

Burt’s view of social capital is explicitly about brokerage that cuts across structural holes in the current social structure (Burt, 2000). In stark contrast to the closure argument, the structural hole argument is about advantages that go to individuals who build bridges between cohesive groups. Burt’s (2000) hole argument stands apart from closure,

both in its empirical predictions and in describing a world of change—a world of discovering and developing opportunities to add value by changing social structure with bridges across holes in the structure . . . it’s a story about the social order of disequilibrium. (p. 14)

Burt (1997) insists that “structural hole theory gives concrete meaning to the concept of social capital” (p. 340). The social capital of structural holes in regard to the brokerage mechanism is about a short-term advantage on the path to equilibrium. Once equilibrium is reached, the advantage is gone. Certain aspects of timeliness must therefore be taken into consideration. The gains associated with brokerage can be expected to disappear as more and more individuals build bridges across the same

structural holes. Value is eliminated long before everyone eligible to span the hole has done so. Consequently, “value declines with subsequent entrants down to some equilibrium level at which value is marginally higher than the cost of bridging the hole” (Burt, 2000, p. 13).

In summary, when considered in the context of higher education publications, academic scholars who have social capital may be more successful in publication and therefore more influential in the field. The issue then becomes which co-authorship network structure provides more publications and hence, more social capital. Certainly something of value is produced for those who have higher social capital, e.g. due to publications in this context, because research visibility enhances institutional stature among peers (Alpert, 1985). Such visibility can also thus produce an increase in influence among peers (Friedkin, 1998).

According to Coleman, the following hypothesis would be correct: Because academic circles are often small and relatively closed (Gomez-Mejia & Balkin, 1992), it stands to reason that members of such a closely knit network can trust each other to honor obligations and produce social norms and sanctions that build trust and cooperative exchanges (Coleman, 1988) which diminishes uncertainty and increases the ability to cooperate in pursuit of common interests (Gargiulo & Benassi, 2000). Social capital is best created by a network structure of highly interconnected actors driven by obligations, expectations, and trust.

The hypothesis that corresponds with the structural holes argument (Burt, 1992) is that social capital is created by a network structure in which people can “broker connections between otherwise disconnected segments” (Burt, 2001, p. 1); this brokerage

across structural holes is the source of value added. Participation in, and control of, information diffusion underlies the social capital of structural holes (Burt, 1992). There is a competitive advantage for someone whose relationships span the holes. Structural holes is exhibited in co-authorship networks by scholars who have a broader range of co-author partners that connect or span across various network subgroups.

Therefore, these structures are competing because the network characteristics of one generally make the other much less likely or feasible. Thus, as noted in Table 1, the tension between these two opposing views of how networks create social capital is demonstrated in the theoretically-supported opposing outcomes of network measures for each structure.

Table 1

*Network Characteristics of Co-authorship Structures*

Network Characteristics				
Network Structure	Structural Holes: Efficiency	Structural Holes: Constraint	Size	Mean Strength of Ties
Cohesion	Low	High	Low	High
Structural Holes	High	Low	High	Low

While high cohesion alone or high structural holes alone are the structures so far discussed. The potential combinations of these two co-authorship structures also create the potential for additional structures. As previously demonstrated in Figure 2, the axis in the matrix represents the two opposing co-authorship structures, the combination equals

five potential network structures. However, in addition, it may be possible that an academic scholar may not display any of these structures. That is, a scholar may demonstrate an isolate structure focusing mostly on sole-authored articles or a dyadic structure co-authoring only with one other scholar. These structures are unable to span structural holes or create cohesion (see Figure 5).

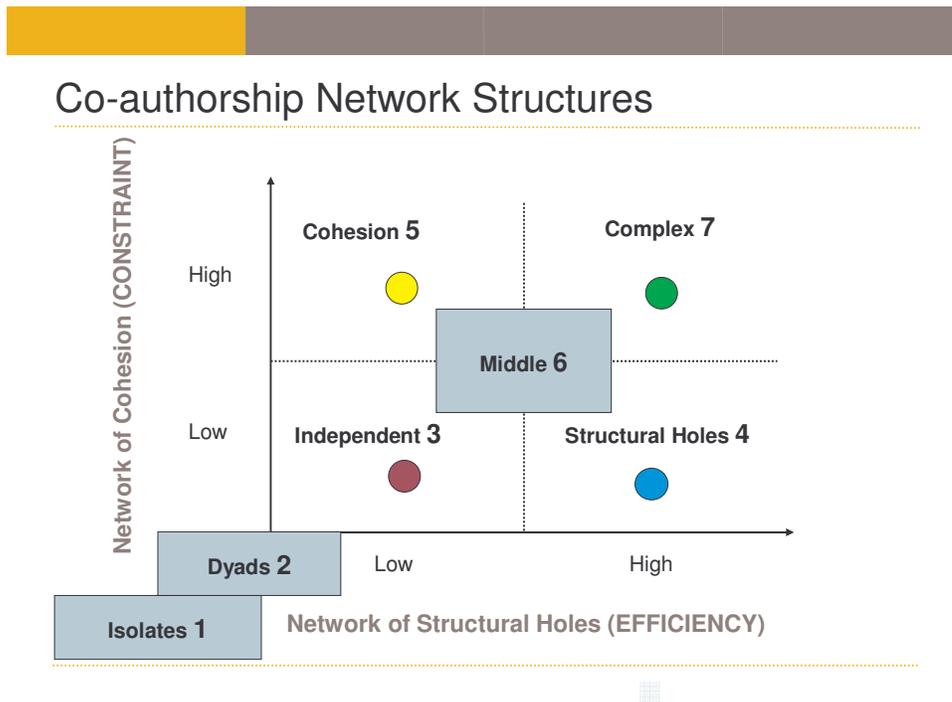


Figure 5. Co-authorship network structures.

At the other extreme, an academic scholar may use both structures well, although this is relatively unlikely according to both Burt (1992) and Coleman (1988). This scholar would have high cohesiveness as well as a high degree of filling structural holes, representing the tension of a dual network structure. This structure is labeled as the Complex Structure.

In summary, one purpose of this research has also been to examine the extent to which these co-authorship network structures are evident among academic scholars in the field of higher education. This chapter has reviewed the role of co-authorship structures, from the perspective of network theory, on: 1) academic publishing; (2) influence in the field, including the relation to collaboration; and 3) social capital and the opposing network structures of structural holes and cohesion. This review provides critical explanations for the expected relationship between co-authorship network structures and influence in the field. Finally, the chapter concludes with a presentation of the research problem and research questions.

The objective of this research has been to identify co-authorship network structures from the perspective of network theory and examine the relationship of these structures to successful publication and thus influence in the field of research and scholarship on higher education. Figure 1 illustrated the relationship between these major constructs and the research model for this dissertation.

Co-authorship strategies may facilitate, and potentially be associated with, the total number of publications and, thereby, the academic scholar's influence in the field (Stokes & Hartley, 1989). However, academic scholars may not be aware that their individual co-authorship choices actually aggregate into a larger network structure. They may not realize that by consistently choosing to co-author with those that are also co-authoring with each other, that they are facilitating a cohesive network structure. They may not realize that by consistently choosing to co-author with other academics who are not connected, and may actually represent different aspects of the field or different fields altogether, that they are facilitating a co-authoring network that is spanning structural

holes. However, if there is an association between these co-authorship network structures and successful publication, they may want to be more aware of these potential co-authorship network structures as potential strategies to positively benefit their publication success, career advantages, and ultimately, their influence in the field,

To recap, without more deliberate consideration and tactical decision making in the academic publishing process, career progress may be slowed and valuable resources, such as time and effort, may be wasted. Clearly, a need exists to understand more about individual co-authorship structures and how they affect a scholar's total number of article publications which is associated with influence in the field of research and scholarship on higher education (Stokes & Hartley, 1989). Therefore, given the need and value, the objective of this research has been to answer the following questions:

1. To what extent are egocentric co-authorship network structures, foundationally based upon cohesion and structural holes, exhibited in academic publications in the field of research and scholarship on higher education?
2. How are these egocentric co-authorship network structures associated with an academic scholar's total number of publications in the field of research and scholarship on higher education?

This chapter has provided a review of the literature in three content areas that have informed this research as well as the research problem and questions. Chapter Three examines the methods that were used to conduct the research and provides a description of the research objectives, the theoretical research orientation, and the detailed methods for the two research phases.

## CHAPTER THREE

### METHODS

The objective of this research was to identify co-authorship network structures through network analysis and to evaluate their relationship with publication success. Armed with an understanding of the co-authorship options available, academic scholars may make a more informed choice from the specific co-authorship strategies demonstrated in the literature. Being strategic in regard to publishing tactics is instrumental if academic scholars are to wisely invest their valuable resources as they build their profile of publications and seek to gain influence in the field. Specifically, this research examined the association between the egocentric co-authorship network structures of academic scholars and their total publications within the context of the field of research and scholarship on higher education.

Simply stated, a scholarly document is co-authored if it has more than one author (Persson & Melin, 1996). Co-authoring creates ties between academics. The set of these ties creates an egocentric network for each academic and a larger network among the set of academics. Specifically based on network theory, these egocentric networks structures reflected one of two core structures, cohesion or structural holes. Given these core structures, five co-authorship strategies were identified: independent, structural holes (Burt, 1992), cohesive (Coleman, 1988), middle or complex (see Figure 5). This research sought to identify the extent to which these co-authorship network structures were found in the literature of higher education and how these structures were related to publication success.

### *Research Questions*

As stated, the purpose of this research was to identify co-authorship network structures through network analysis and to evaluate their relationship with publication success, specifically within the context of the field of research and scholarship on higher education. To address that purpose, this research pursued the following questions that explored the specifics of co-authorship strategies,

1. To what extent are egocentric co-authorship network structures, foundationally based upon cohesion and structural holes, exhibited in academic publications in the field of research and scholarship on higher education?
2. How are these egocentric co-authorship network structures associated with an academic scholar's total number of publications in the field of research and scholarship on higher education?

The first phase of this study identified the co-authorship network structures of academic scholars in the field of research and scholarship on higher education through network analysis. The second research phase, which consisted of a statistical analyses, examined the relationship between the co-authorship network structures identified in the first phase and the total number of publications of these academic scholars.

### *Phase I – Network Analysis*

This research adhered to a theoretical orientation of post-positivism. Discovery is a valuable part of inquiry when tempered with strongly supported ideas and beliefs (Phillips & Burbules, 2000). Those informed beliefs should be guiding lights in the search for truth, but at the same time, the post-positivist perspective understands that

human beliefs, ideals, and thoughts are certainly imperfect (Phillips & Burbules, 2000). Nonetheless, post-positivism allows the human race to make sense of their world.

In striving to make that sense, traditional social science approaches have long been interested in the explanations, forms and implications of social relationships. Specifically, network research has a few distinctive features that differentiate its approach to social relationships from that of traditional social science (Kilduff & Tsai, 2003),

1. The focus is on relations and patterns of relations as opposed to the attributes of actors;
2. Multiple levels of analysis are possible providing both micro and macro linkages;
3. Quantitative, qualitative, and graphical data can all be integrated to allow a more in-depth analysis.

Mainstream social research has often been accused of separating the individual from the behavior, neglecting the social part of behavior, the part that examines the ways individuals interact with and influence each other (Freeman, 1996). In the last two decades, an increasing extent of social research has focused on the social relationships linking people rather than on the individuals themselves (Friedkin, 1993). This particular kind of research that examines the links among people is defined as structural. *Social structures* themselves are defined as “patterns of connectivity and cleavage within social systems” (Wellman, 1988, p. 26). These social structures are abstract representations of patterns of relationships between actors (Nadel, 1957). They lend understanding to the ways in which actors cluster together in social space.

More specifically, within social science, the structural approach which studies the interaction among social actors is known as social network theory and is “grounded in the intuitive notion that the patterning of social ties in which actors are embedded has important consequences for those actors” (Freeman, 1996, p. i). Social network theory and analysis stresses several important things, the relationships among the social entities and the explanations for, as well as the patterns and implications of, these relationships (Baron et al., 2000).

Social network theory and analysis provide a perspective that can inform influence, its structure, and its processes. Such analysis is a way to understand the intricacies of influence and introduce measurement techniques. One key advantage of social network analysis is that a wide range of empirical phenomena can be explored in terms of their structural patterning (Freeman, 1996). The following sections discuss the design, data collection, data analysis, and limitations of Phase I, the analysis of co-authorship network structures.

### *Design*

The basic idea of a social network is very simple. A social network is a set of actors that may have relationships (known as edges or ties) with one another. Networks can have few or many actors, and one or more kinds of relations between pairs of actors. To build a useful understanding of a social network, a complete and rigorous description of a pattern of social relationships is a necessary starting point for analysis (Hanneman & Riddle, 2005).

Phase I was a study of the co-authorship relations that exist in top-tier academic journals in the field of research and scholarship on higher education. The co-authorship

relations in these journals provided the basis for network analysis to identify and examine the patterns of the co-authorship network structures of the individual academic scholars.

The first necessity was to identify and then bound the population of authors in the co-authorship network. Bounding a social network is a critical step in network analysis (Hanneman & Riddle, 2005). Social network analysts rarely use samples in their work. Most commonly, network analysts identify a population and conduct a census of that population. The boundaries are those imposed by the researcher or even created by the actors themselves. Social network studies often draw the boundaries around a population that is known, a priori, to be a network (Hanneman & Riddle, 2005).

In this study, the population consisted of all academic scholars who have published articles in the following four top-tier journals: *Higher Education Quarterly*; *Journal of Higher Education*; *Research in Higher Education*; and *Review of Higher Education*. Since the American Association of Higher Education (AAHE) did not specifically identify a more preferable system of rating journals, these top four were selected in the following manner: first upon the criterion of subject matter and secondly upon their discriminating acceptance rates. Thus while there are arguably many ways to determine status among journals, these were selected because of their overall notable contributions to the field of research and scholarship on higher education, as well as their acceptance rates. All acceptance rates were less than 30% as follows: *Journal of Higher Education*, 6-10%; *Research in Higher Education*, 11-20%; and both *Review of Higher Education* and *Higher Education Quarterly*, 21-30% acceptance rate (Cabell, 2003, p. 789). Thus these were the top four journals recognized in the AAHE directory.

The six year period, 1999-2004, was selected based on the concept of critical mass, authors needed a period wherein they could potentially have submitted as many as five articles. Some academic scholars may have contributed less, but the period had to be sufficient opportunity for each author to demonstrate a co-authorship strategy. Within the population, a co-authorship network was constructed from the data retrieved from the publication archive. While the primary data focus was on the ties of academic authors, the analysis also included actor gender given its previous association with network structure (Staber, 1994) .

#### *Data Collection*

Data regarding co-authorship relations from the population of academic scholars was collected by electronically accessing the journals through the Harold B. Lee Library of Brigham Young University. The pre-existing information was available as archival data through independent organizations such as J-Stor which are dedicated to creating and preserving a digital archive of scholarly journals. The data regarding co-authorship ties was manually entered into Excel spreadsheets. All academic scholars who had published a minimum of one article during that six year period were included in the population.

Data was initially organized into three Excel spreadsheet tables: an Author Attribute Table; an Article Attribute Table; and an Edgelist Table. In the Author Attribute Table (Table 2), the individual rows represented each author and the columns represented attributes of each author. Each author was given a unique author identification number. Additionally, for each author, attributes were recorded including their last name and first name and their gender. The total number of publications for each

author was obtained by tallying the total number of articles published by that specific author within the four journals and timeframe of the study. In the event that the author's gender was not available or discernable from the journal, all effort was made to locate this information from university websites or directories.

Table 2

*Author Attribute Table*

Author ID #	Last Name	First Name	Gender	Total # Pubs
1	Anderson	Alan	0	3
2	Bratt	Benjamin	0	2
3	Cook	Cam	0	2
4	Drake	Darla	1	1
5	Emerson	Elaine	1	5
6	Ferrari	Felix	0	1

The Article Attribute Table (Table 3) stored data regarding all articles published during the six year period from the four top-tier journals. The individual rows represented each article and the columns represented the attributes of each article, including an article identification number, a journal identification number, the year, the volume, the number, the total number of contributing authors, and finally, the author identification number of each contributing author.

The Edgelist Table (Table 4) that identified the network relationships or ties among academic scholars was constructed to identify and categorize all co-authoring relationships found in the articles used in this study. As individual academic scholars co-authored with each other inside this population, ties were formed. An edgelist was

Table 3

*Article Attribute Table*

Article ID #	Journal ID #	Year	Volume	Number	Total # Authors	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
						A. ID #	A. ID #	A. ID #	A. ID #	A. ID #
A1	1	1999	4	18	5	1	3	5	7	9
A2	1	2001	2	22	5	2	4	6	8	10
A3	2	2001	3	25	4	3	5	7	9	
A4	2	2000	3	32	4	4	6	8	10	
A5	3	1999	3	21	3	5	7	9		
A6	4	2000	1	8	3	6	8	10		

Table 4

*Co-authorship Edgelist*

Article ID	Tie ID #	Author X	Author Y
A1	1	1	3
A1	2	1	5
A1	3	1	7
A1	4	1	9
A1	5	3	5
A1	6	3	7
A1	7	3	9

essentially the list of the dyadic ties between authors recorded using their unique author identification numbers. Each row represented a co-authorship tie by identifying the two authors' identification numbers. This edgelist was imported into UCINet to analyze the network structures created by these ties.

### *Data Analysis*

Data analysis focused on an egocentric analysis of each individual academic scholar's co-authorship network structure. An egocentric network is the social network structure around one individual, including the individual's direct ties and the ties among that individual's direct ties (Kilduff & Tsai, 2003). Consequently, egocentric network data viewed the co-authorship network from the perspective of one individual (also known as ego) in the network.

Academic scholars could each have different egocentric network structures, e.g. some did not co-author, some had few co-authors and some had many co-authors. Some co-authored repeatedly with the same person; some only worked once with a co-author. The set of an individual academic scholar's co-authorship relations across multiple publications created his or her egocentric network structure. This network structure could then be described using measures that represented cohesion and structural holes.

In this research, the network analysis process involved a series of data management procedures. First, the co-authorship edgelist that lists the ties (or edges) between actors for a specific relation (e.g. co-authoring) was created in Excel (see Table 4). This edgelist was then converted to a .txt file in the UCINet text editor and prepared for import into UCINet. The main software used in the analysis was UCINet (Borgatti, Everett, & Freeman, 1999). Available as a Windows program, UCINet enabled analysis of basic network graph theoretical concepts and positional analysis. Importing the edgelist into UCINet created a co-author network matrix, with rows representing actors and the columns representing the status of their relationship. These matrix datasets were created and manipulated using both UCINet and other software tools such as Excel. Each

UCINet dataset consisted of two separate files that contained header information (e.g. myfile.##h) and the data lines (e.g. myfile.##d). In the example matrix in Table 5, the rows and columns both represent actors (n=9). Each cell in the matrix represents a measure of the specific relationship (e.g. co-authoring). In this example, Actor 1 (in row 1) has no co-authoring relationship with Actors 1, 2, 3 or 6 (columns 1, 2, 3, and 6). However, Actor 1 has co-authored 6 times with Actor 4 and once each with Actors 7, 8 and 9. In matrix format, co-authorship network data was ready for analysis in UCINet.

Table 5

*Co-author Network Matrix*


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	1	2	3	4	5	6	7	8	9
1	0	0	0	6	1	0	1	1	1
2	0	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	1	0	0	0	0
5	0	0	0	2	0	0	1	0	0
6	0	0	0	0	0	0	0	1	0
7	0	0	0	0	1	0	0	0	0
8	1	0	0	0	0	0	0	0	0
9	1	0	0	0	1	0	0	0	0

---

The data file was edited after the initial entry and various transformations were made to manipulate the data into subsets for further analysis. In addition to the network matrix, the Author Attribute Table (see Table 2) was also imported into UCINet. The individual rows represented each author and the columns consisted of the attributes of each academic scholar. This table was copied from Excel into UCINet's internal spreadsheet and produced a matrix which was saved (e.g.coauthor\_attributes.##h file).

Thus both the network matrix and the author attributes matrix were formatted and ready for analysis in UCINet, which then systematically computed standard egocentric network measures for every actor in the network (Borgatti et al., 1999). These measures provided the data to identify each scholar's egocentric network structure.

UCINet (Borgatti et al., 1999) identified the structures of the academic scholars' egocentric co-authorship networks focusing on two network constructs that address the research questions: 1) cohesion and 2), structural holes. Each of these constructs were analyzed by a distinct measure. Cohesion in an egocentric network was measured in terms of constraint. Structural holes was measured in terms of efficiency. The next section will summarize and define each network variable and its indicator.

#### *Network Variables and Indicators*

The construct of co-authorship network structure was examined based on the two competing variables of cohesion and structural holes. Based upon these two variables, each academic scholar's co-authorship network structure was identified (See matrix in Figure 5). The combination of the two competing variables of cohesion and structural holes created five different potential co-authorship network structures, including the possibility that some co-authors would not utilize either strategy (independent) or perhaps, in some situations, both (complex). In addition, authors who did not co-author (isolates) or who co-authored only with other person (dyads) were categorized outside of the matrix.

While cohesion and structural holes represented the two primary co-authorship structures and the primary focus of this research, each of the additional structures that result from the matrix of these primary structures was examined for extent and

relationship to successful publication. When an academic scholar demonstrated a strategy of low cohesion and low structural holes, this represented a more independent co-authorship network structure. On the other side of the matrix, when an academic scholar demonstrated both high cohesion and high structural holes strategies, this scholar was categorized with a more complex co-authorship strategy. This strategy may be indicative of an academic scholar who is adept at selecting the most advantageous strategy for the particular situation and interchanging them. In the center of the matrix, the middle area represented some extent of both structures and therefore was referred to simply as middle ground. The two additional co-authorship network structures, isolate and dyadic, provided a more complete model. To further explain the primary network structures of cohesion and structural holes, the definitions, and illustrations of each of these two strategies will next be presented, along with the definitions of their indicators.

*Cohesion.* Constraint, an indicator of cohesion, measured the extent to which a person's contacts were redundant (Burt, 1992) or connected to others who are also connected to one another. To the extent that an academic scholar only had co-authors who had also co-authored with each other, the academic scholar's behavior and decisions may have been more highly constrained. Figure 4 illustrated a cohesion network structure.

The network constraint index is essentially a measure of the extent to which ego is invested in people who are invested in other of ego's alters (Burt, 1992). Therefore, "more constraint means fewer structural holes" and "more network closure" (Burt, 1997, p. 347). Constraint considered the relative constraint of all actors in the larger network. Therefore, lower constraint indicated a greater degree of filling structural holes and by

default, higher constraint meant more cohesion. Efficiency is weakened by increasing contact redundancy and tying up time. The more time spent with any specific primary contact, the more likely that contact will introduce his or her contacts, promoting redundancy and closure.

*Structural holes.* The term "structural holes" referred to key aspects of positional advantage/disadvantage of individual actors that resulted from how they were embedded in the larger network. A network position in which an academic scholar fills or spans a structural hole in the larger network may suggest the extent to which the scholar is connected to different subgroups and, thus, may indicate a broader influence in the field (Burt, 1992).

Figure 3 illustrated a structural holes network structure. Specifically, note Actors 4, 6, 7, and 8 in the middle of the network. These actors are each bridging a structural hole, or creating the only tie, between two network clusters. For example, without the tie between Actors 4 and 8, the network would become disjointed creating two network components. Thus, the network position of Actor 4, for example, is structurally distinct from the actor in the middle of a cohesive network (Figure 4). The more that an academic scholar's co-authors are not connected to previous co-authors, the more likely that the tie will span a structural hole.

As networks grow in size, they tend to become less dense and as density decreases, more structural holes are likely to open in the social fabric of the network (Burt, 1992). This is particularly so as the academic scholar creates new ties that are not connected with the scholar's previous co-authors. UCINET examined the position and ties of each actor in the larger network to determine the extent to which the actor was filling

structural holes. Structural hole indicators are computed on binary data (whether a relation is present or not) (Hanneman & Riddle, 2005) and are computed for all actors in the network, treating each one in turn as ego. Thus, a structural hole indicator is relative to the other actors in the same network.

The structural holes variable was measured by the indicator of efficiency. Efficiency, as the indicator of structural holes, is the extent to which an actor's ties are non-redundant or not connected to the actor's other contacts (Burt, 1992). An academic scholar may gain little from a new co-author who is redundant or connected with existing co-authors, time and energy may be better invested recruiting a new co-author to tap into fresh network subgroups yet unreached (Burt, 1992). Non-redundant ties that span structural holes can provide benefits of diversity and non-redundant information and resources. Maximizing efficiency, or contacts of nonredundancy, maximizes the opportunity to fill structural holes (Burt, 1992). The network efficiency index returns a score of 0-100, relative to all of the other actors in the larger network. Greater efficiency represents a greater extent of filling structural holes.

#### *Identification of Co-authorship Network Structures*

The co-authorship network structure of each of the academic scholars in the field of higher education was first identified based upon the extent to which their networks demonstrated cohesion or structural holes. Greater cohesion structures were indicated by greater constraint. Greater structural hole structures were indicated by greater efficiency. Based upon the combination of the extent of each structure demonstrated, each academic scholar's structure was categorized as one of the seven co-authorship structures in Figure 5. This analysis addressed the first research question which inquired to what extent were

the co-authorship network structures, foundationally based upon cohesion and structural holes, exhibited in academic publications in the field of research and scholarship on higher education.

Once the indicators of efficiency and constraint were calculated, the first stage of the data manipulation process was to develop categorization for each of the two variables. After subsequent research, a reply from Steve Borgatti (author of UCINet) (Borgatti, 2006) suggested using the median score of the range, thus the cutpoints were determined by dividing the range in half. The purpose of these cutpoints was to establish a high or low categorization for each indicator. This categorization helped place each actor into a specific cell in the matrix in Figure 3. A cutpoint was used to split each of the indicators. The cutpoint for efficiency was .5000, based upon the midpoint of the range. Thus, authors with efficiency scores less than the cutpoint were recoded as 1 (low), and authors with efficiency scores more than this cutpoint were recoded as 2 (high). The cutpoint for constraint was .69, based upon the midpoint of the range. Thus, authors with constraint scores less than the cutpoint were recoded as 1 (low), and authors with constraint scores more than this cutpoint were recoded as 2 (high).

The second stage of the data manipulation process was to identify cell membership for each author. Constraint and efficiency variables were recoded such that all authors, except those excluded as isolates and dyads were assigned group membership in cells 3, 4, 5, and 7 (see Figure 3). An efficiency variable of 1 (low) and a constraint measure of 1 (low) was coded as 3 (low-low). An efficiency variable of 2 (high) and a constraint measure of 1 (low) were recoded as 4 (low-high). An efficiency variable of 1 (low) and a constraint measure of 2 (high) were recoded as 5 (high-low). And finally, an

efficiency variable of 2 (high) and a constraint measure of 2 (high) were recoded as 7 (high-high).

The third stage of the data manipulation process determined the middle area of Figure 3. This was accomplished by trichotomizing each of the two indicators and creating a 3x3 matrix. To perform this process, the cutpoints were based on dividing the given ranges of constraint and efficiency each into thirds. The indicators were recoded such that less than one third was recoded as a 1 (low); in between one third and two thirds was recoded as a 2 (mid); and anything more than two thirds was recoded as a 3 (high). This recoding allowed actors to be placed inside cells of the 3x3. This process identified the authors that were in cell 2, 2 the middle cell. Only these actors were recoded as Group 6, pulling them out of their previous respective cell memberships. Now all actors were represented, measured, and categorized based on their individual co-authorship structure.

In addition, to increase the validity of the network analysis, the egocentric network data of academic scholars representing each co-authorship structure was graphically analyzed using NetDraw (Borgatti, 2003) to confirm that the network structure was aligned with and was representative of the co-authorship strategies suggested by the analysis results. This process specifically helped to identify the authors with isolate and dyad egocentric network structures.

### *Phase II – Statistical Analysis*

Phase II examined the hypotheses suggesting that co-authorship network structures would be associated with publication success. This phase utilized statistical

analyses of the author-level data. The following section will discuss the design, data collection, data analysis, and limitations of Phase II.

### *Design and Data Collection*

The second research phase examined the relationship between co-authorship network structures and an academic scholar's total number of publications in the field. The logical argument was that co-authorship structures are associated with the number of publications. Publications which have been shown in the literature to be associated with influence among academic scholars (Friedkin, 1998; Stokes & Hartley, 1989). The population for this study included the same population identified in Phase I.

The data collection for Phase II occurred during Phase I. The data for Phase II were based upon the author-level network variables and cell memberships for co-authorship structures (see Figure 5) generated from the Phase I analysis. First, the egocentric network indicators of cohesion and structural holes were generated by UCINet. Second, the categorization of the type of co-authorship network structure utilized, as determined in Phase I, was included in the Phase II data. Third, the author-attribute variables, specifically focusing on the gender and total number of publications, collected in Phase I, were included in the Phase II data (see Table 2). These data were imported into SPSS to analyze the research hypotheses.

### *Data Analysis*

The data were analyzed using a variety of descriptive and inferential statistics including measures for central tendency, and variability. Specifically, correlation, ANOVA, and multiple regression were the primary means of analysis used along with

Independent Samples T-Test and Chi-square tests which were used in relation to gender data. This section identifies the variables and analyses used in Phase II.

### *Variables*

*Independent variables.* The independent variables were the network variables of cohesion and structural holes, as measured in Phase I by the indicators of constraint and efficiency. The categorization of co-authorship structures, based upon these variables, was also used as independent variables in the ANOVA analysis to represent the potential combinations of co-authorship strategies. In addition to efficiency and constraint, the regression analysis also included gender and two network structure variables of network size (number of different co-authors) and mean strength of ties (number of times co-authoring with same co-author).

*Dependent variable.* Publication data was collected during the initial data collection for Phase I. In the Author Attribute Table (see example in Table 2), data regarding all articles published during the six year period from the four top-tier journals was recorded for each author. The total number of publications for each author was obtained by tallying the total number of articles published by that specific. Total number of publications was the dependent variable in these analyses.

### *Analysis 1: Correlation*

To determine the association between variables, a correlational analysis was run. It was run between both indicators of cohesion and structural holes: constraint, and efficiency and total number of publications (the dependent variable).

### *Analysis 2: ANOVA Analysis*

Analysis of variance (ANOVA) was conducted to examine the association of co-

authorship network structures and total number of publications. Based on Figure 5, this analysis examined whether academic authors with different co-authorship network structures differed in terms of their publication success, as measured by total number of publications.

Not only does this ANOVA and post-hoc analysis compare different strategies, this analysis added depth to understanding the combination of co-authorship network structures. While the categorization into the two combined co-authorship structures (independence and complex) indicated the extent to which these strategies actually existed, the ANOVA examined whether these structures were related to publication success.

### *Analysis 3: Multiple Regression Analyses*

Using multiple regression analyses in SPSS, the researcher examined the association between the academic scholar's co-authorship structures, as measured by indicators of cohesion and structural holes, and the total number of publications. This analysis examined the following two hypotheses,

Hypothesis 1a: Greater constraint, reflecting a cohesive co-authorship network structure, is associated with an increase in the total number of articles published.

Hypothesis 1b: Greater efficiency, reflecting a structural holes co-authorship network structure, is associated with an increase in the total number of articles published.

Multiple regression facilitated the examination of a more complex perspective of network structure through the combination of multiple indicators across both co-

authorship structures to identify any association with total number of publications (Allison, 1999). In addition, given that network structure has been shown to vary by gender (Staber, 1994), the regression analysis included gender as a control variable.

### *Delimitations*

Network analysis is a growing research approach to examining a variety of phenomenon. However, network analysis alone is often criticized for being too heavy on methods and analytic techniques and too light on theoretical foundations and implications (Hanneman & Riddle, 2005). Therefore, this study was designed with the foundation of network theory to inform the network methods.

One concern with network analysis is that relationships are often reduced to simple binary terms, e.g. a relationship exists or it does not. Many of the most powerful insights of network analysis and many of the mathematical and graphical tools used by network analysts were developed for simple network graphs (i.e. binary, undirected). Thus, many characterizations of actor relations, and the networks themselves, are most commonly thought of in discrete terms in the research literature. However, binary data is so widely used in network analysis that it is not unusual to see data that are measured at a "higher" or valued level transformed into binary scores before analysis proceeds (Hanneman & Riddle, 2005). As a result, it is often desirable to reduce even interval data to the binary level by choosing a cutting point (e.g. mean or median) and coding tie strength above that point as "1" and below that point as "0" (Hanneman & Riddle, 2005).

Another potential delimitation with network data was that, according to Hanneman and Riddle (2005), network observations are almost always non-independent by definition. Consequently, conventional inferential statistical formulas may not apply to

network data (though formulas developed for other types of dependent sampling may apply). The non-independence of network observations will often result in underestimates of true sampling variability and thus, too much confidence in results (Hanneman & Riddle, 2005). However, given that network analysis in general, and this network analysis, in specific, examined the entire population, inferential statistical analysis provided a fundamental basis for descriptive analysis—a description of the entire population.

### *Summary*

This chapter has provided details regarding the methodology and methods that were used to conduct the research and has provided a description of the research objectives, the theoretical research orientation, and the detailed methods for the two research phases. To summarize, this research examined the association between egocentric co-authorship network structures of academic scholars and their total number of publications within the context of the field of research and scholarship on higher education.

Phase I was a study of the co-authorship relations that existed in top-tier academic journals in the field of research and scholarship on higher education. The co-authorship network structures in these journals provided the basis for a network analysis to identify and examine network patterns of co-authorship. Phase II examined the hypotheses suggesting that co-authorship network structure would be associated with publication success. This phase incorporated a quantitative method and utilized a statistical analysis of the data to assess the association of cohesion and structural holes with publication success in the field of research and scholarship on higher education.

The following chapter provides a discussion of the findings. Chapter 4 presents both the descriptive and quantitative findings that explore the two research questions and the two hypotheses regarding co-authorship network structures and publication success.

## CHAPTER FOUR

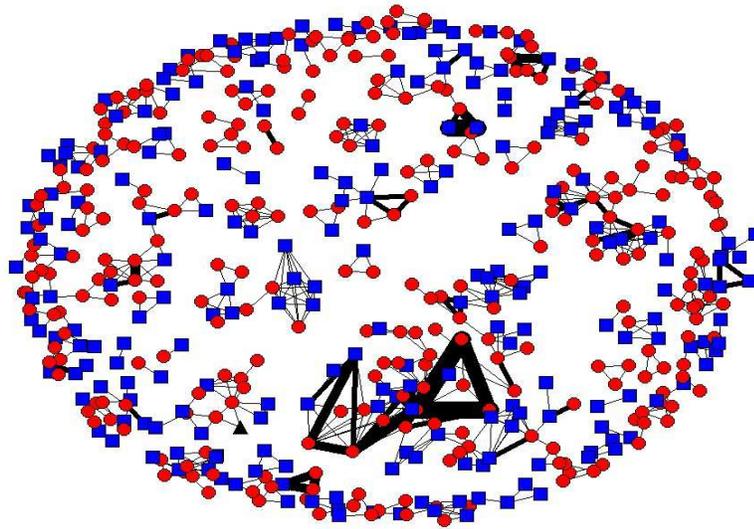
### FINDINGS

The purpose of this study was to explore the following questions dealing with the specifics of co-authorship network structures,

1. To what extent are the co-authorship structures, which are foundationally based upon cohesion and structural holes network structures, exhibited in academic publications in the field of research and scholarship on higher education?
2. How are these co-authorship network structures associated with an academic scholar's total number of publications in the field of research and scholarship on higher education?

#### *Descriptive Findings*

The population consisted of all academic scholars who have published articles in the following four top-tier journals, *Higher Education Quarterly*; *Journal of Higher Education*; *Research in Higher Education*; and *Review of Higher Education*. These journals were selected for this study based on their subject matter (higher education) and competitive acceptance rates (6%-30%). Within these journals, for the six year period of 1999-2004, co-authorship relationships between academic scholars were identified from all articles. Using these relationships, an overall co-authorship network was constructed, (see Figure 6 with males represented by squares and females by circles) as well as the individual egocentric co-authorship networks for each individual scholar.



*Figure 6.* Overall co-authorship network structure.

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Note. Males are represented by squares and females by circle. Thicker lines represent multiple co-authorships.

Social network analysis addressed the first research question which inquired about the extent to which co-authorship network structures, foundationally based upon cohesion and structural holes, are exhibited in academic publications in the field of research and scholarship on higher education. For this analysis, the set of an individual academic scholar's co-authorship relations across multiple publications created his or her egocentric network structure. Each author's egocentric network structure ( $n=810$ ) was analyzed based upon measures of cohesion and structural holes and categorized as representing one of seven potential co-authorship network structures. Figure 7 presents each co-authorship network structure identified by a title and the number of academic scholars within the population.

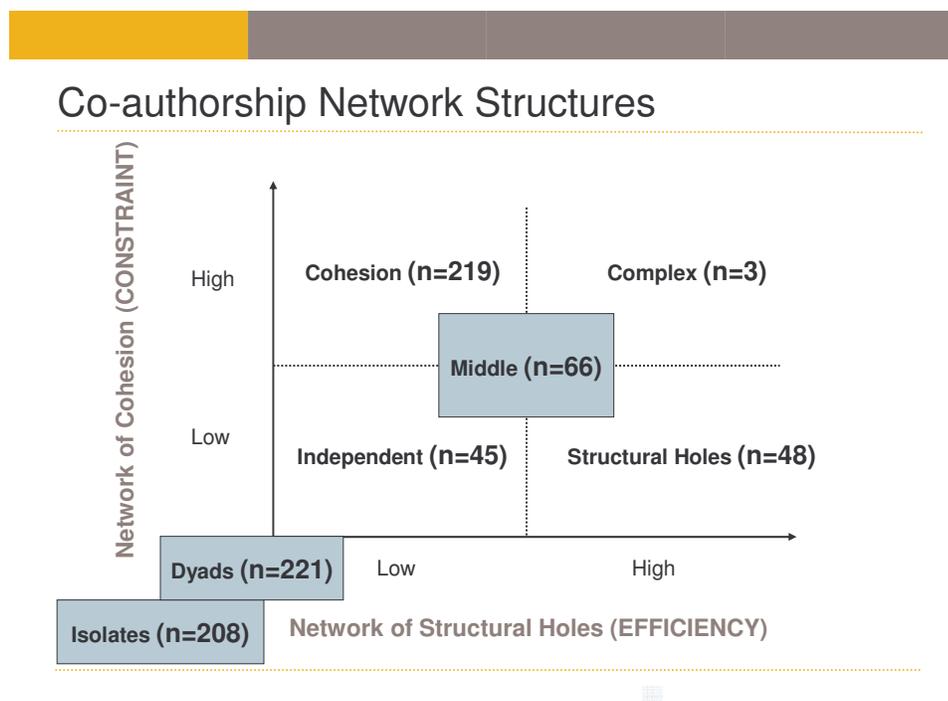


Figure 7. Distribution of co-authorship network structures.

### Network Structure Analysis

Table 6 presents the distribution of the groups by number and location of journal publications. In total, 810 authors produced 928 articles in four journals over a six year period. Of keen interest, however, is the observation that in only the Structural Holes Group and the Complex Group were scholars' publications found at a rate nearly twice their number of authors. This suggests that group membership may be associated with total publications. The 48 members of the Structural Holes Group (6% of authors) produced 93 (10 %) articles and three members Complex Group (0.4% of authors) produced eight (1%) articles. All the remaining groups produced roughly the same number of articles, or slightly more, as its number of members.

Table 6

*Distribution of Journal across Co-authorship Network Structures*

Co-authorship Network Structure		Journal Publication				Total
Group	N	J1	J2	J3	J4	
Isolate	208 (25%)	46	38	62	72	218 (24%)
Dyad	221 (28%)	72	81	51	37	241 (26%)
Independent	45 (5%)	24	16	10	0	50 (5%)
Structural Holes	48 (6%)	32	34	27	0	93 (10%)
Cohesion	219 (27%)	54	100	53	28	235 (25%)
Middle	66 (8%)	18	43	22	0	83 (9%)
Complex	3 (0.4%)	3	3	2	0	8 (0.9%)
Total	810	249	315	227	137	928

Note. J1=*Journal of Higher Education*; J2=*Research in Higher Education*; J3=*Review of Higher Education*; and J4=*Higher Education Quarterly*.

The Isolate and Dyad Groups, with each fairly equal in size, constituted over half of the overall population of authors. The Isolate Group (25%), representing authors who did not co-author with anyone during the six years and was comprised of predominantly males scholars, with articles reasonably well distributed across all four journals. *Higher Education Quarterly*, however, did have the highest number of isolate authors. The Dyad Group (28%) representing authors who co-authored only with one other scholar during the six years and was approximately evenly distributed by gender. In terms of journals, *Research in Higher Education* had the highest number of dyadic authors.

Together, these two co-authorship network structures represented 53% of the authors among these journals.

The Independent Group (5%), representing academic scholars whose networks demonstrated low network constraint (cohesion) and low efficiency (structural holes) and constituted a small portion of the overall group of scholars. The gender split was very close to even for this group. Most of these authors appeared in the *Journal of Higher Education* and none appeared in *Higher Education Quarterly*.

The Structural Holes Group (6%) representing academic scholars whose networks had low network constraint and high network efficiency, constituted a small portion of the scholars. Within this group, twice as many authors were male rather than female. There was an average of 30 publications each within the top journals with the now-typical exception of *Higher Education Quarterly*.

The Cohesion Group (27%), representing academic scholars with more cohesive networks, was similar in size to the isolates and dyads groups. In fact, in comparative size to the Structural Holes Group, the Cohesion Group constituted a healthy segment of the remaining population. In regard to gender, more male scholars were in this group than females. All four journals received publications from this group.

The Middle Group (8%), reflecting co-authorship network structures of both cohesion and structural holes to a moderate degree, did not demonstrate either clearly and had only slightly more academic scholars than the Independent or Structural Holes Groups. In terms of gender, the Middle Group was an almost even split between male and female. In terms of journal publication, this group had almost twice as many appearances occurred in *Research in Higher Education* and none in *Higher Education Quarterly*.

In the last group, the Complex Group (.4%), the numbers drop dramatically. Only three authoring patterns out of the entire 810 reflected a co-authorship network structure of both high constraint and high efficiency. All three authors, a male and two females, appeared in the *Journal of Higher Education* and in *Research in Higher Education*, only two authors appeared in *Review of Higher Education* and none from the Complex Group appeared in *Higher Education Quarterly*.

#### *Publication Analysis*

No academic scholars published in all four journals (see Table 7). Of the 30 (3.7%) authors who published in three journals, none published in *Higher Education Quarterly*. These authors reflected a 2:1 gender ratio with more males than females successfully publishing in three of the four journals. Twice as many authors (n=59, 7.2%) published in two journals, although only one of these published in *Higher Education Quarterly*.

Table 7

#### *Number of Journals in which Scholars Published*

Number of Journals	Authors	Male	Female
Published in Four	0	0	0
Published in Three	30 (4%)	20 (67%)	10 (33%)
Published in Two	59 (7%)	34 (58%)	25 (42%)
Published in One	721 (89%)	422 (59%)	299 (41%)
Total	810 (100%)	476 (59%)	334 (41%)

While the gender distribution for this group still reflected more male authors, the distribution better reflected the gender distribution of the overall population of authors. The remaining 89% of authors published in only one journal; while they may have published multiple times, it was only in one journal.

The range of publications among these authors during this six-year time frame (1999-2004) was 1 to 13 publications, with a mean of 1.46 (SD=1.254). Table 8 presents the mean number of publications and standard deviations for each of the seven groups of co-authorship network structures. Means for the Structural Holes Group and the Complex Group dramatically supersede those of the other groups. Table 8 also presented the frequencies of co-authors, articles, and the total number of articles by the top-producing author in each group.

Table 9 lists the top 20 authors (2%) who each published at least six articles over the identified timeframe of six years. While most of these authors published in three different journals ( $x=2.70$ ,  $SD=.571$ ), none of them published in *Higher Education Quarterly*. Among these top twenty productive academic scholars, males (65%) were more represented than females (35%). A clear pattern occurred among the top nine authors, who each published seven or more papers in the six year period (1999-2004). Eight of nine of these top-publishing academic scholars (89%) demonstrated co-authorship networks characterized by filling more high structural holes. Of the remaining 11 authors (55%), who each published six articles during the given timeframe, seven (63%) also displayed a structural holes or complex network structure (both high structural holes and high cohesion), and two used a Middle structure.

Table 8

*Descriptive Statistics of Co-authorship Network Structures*

Strategy	Mean Number of Articles	SD	# Scholars per Group	# Articles per Group	Range of Number of Articles from any Group Member
Isolates	1.13	.414	208	218	1-3
Dyads	1.26	.844	221	241	1-10
Independent	1.31	.996	45	50	1-6
S. Holes	4.40	2.703	48	93	1-13
Cohesive	1.16	.539	219	235	1-4
Middle	1.97	1.228	66	83	1-6
Complex	5.33	1.155	3	8	1-6

Note. S. Holes = Structural Holes.

The key point in this table is that within this industrious group of authors, 15 of 20 authors (75%) demonstrated a co-authorship network structures that spanned structural holes. Adding the complex network structure, 17 of 20 (85%) of these top 20 authors represented co-authorship network structures that demonstrated high levels of filling structural holes.

Thus, although most academic scholars in the overall population of 810 demonstrated co-authorship network structures of Isolate, Dyad or Cohesion Groups, the group of the most productive scholars demonstrated a structural holes network structure. Note that not a single cohesion network structure is indicated among the top 20 authors.

Table 9

*Top Twenty Author Table*

#	Network Structure	Last Name	Gender	Number of Publications	J1	J2	J3	J4	Number of Journals
1	S. Holes	Pascarella	Male	13	6	4	3	0	3
2	S. Holes	St. John	Male	11	2	5	4	0	3
3	Dyad	Perna	Female	10	3	5	2	0	3
4	S. Holes	Kezar	Female	10	6	2	2	0	3
5	S. Holes	Kuh	Male	10	1	7	2	0	3
6	S. Holes	Terenzini	Male	8	5	1	2	0	3
7	S. Holes	Hu	Male	8	2	4	2	0	3
8	S. Holes	Antonio	Male	7	2	1	4	0	3
9	S. Holes	Toutkoushian	Male	7	1	4	2	0	3
10	Dyad	Morphew	Male	6	1	0	5	0	2
11	Indepen.	Nora	Male	6	3	1	2	0	3
12	S. Holes	Smart	Male	6	3	2	1	0	3
13	S. Holes	Sax	Female	6	0	3	3	0	2
14	S. Holes	Wolf-Wendel	Female	6	2	0	4	0	2
15	S. Holes	DesJardins	Male	6	1	5	0	0	2
16	S. Holes	Pike	Male	6	0	6	0	0	1
17	Middle	Colbeck	Female	6	3	2	1	0	3
18	Middle	Pierson	Male	6	3	1	2	0	3
19	Complex	Johnsrud	Female	6	3	2	1	0	3
20	Complex	Rosser	Female	6	3	2	1	0	3

Note. J1=*Journal of Higher Education*; J2=*Research in Higher Education*; J3=*Review of Higher Education*; and J4=*Higher Education Quarterly*. #Pubs=Total Number of Publications and #Js=Total Number of Journals.

### *Gender Analysis*

Table 10 indicates the gender distribution of academic scholars that published in each of the four journals. Overall, of the 810 authors, 476 (59%) of the academic scholars were male and 334 (41%) were female. Each journal followed suit in that there were always more male authors than female; however, the gender differentiation ratio came closest to being even in the *Review of Higher Education* and was farthest from it in *Higher Education Quarterly*.

Table 10

#### *Gender Distribution by Journal*

Gender	Overall Frequency	<i>Journal of Higher Education</i>	<i>Research in Higher Education</i>	<i>Review of Higher Education</i>	<i>Higher Education Quarterly</i>
Male	476 ( 59%)	141 (57%)	196 (62%)	120 (53%)	93 ( 68%)
Female	334 ( 41%)	108 (43%)	119 (38%)	108 (47%)	44 (32%)
Total	810 (100%)	249 (30%)	315 (39%)	228 (28%)	137 (17%)

The highest number of authors, regardless of gender, appeared in *Research in Higher Education*, more than doubling the number that appeared in *Higher Education Quarterly*. Academic scholars who authored more than once in a particular journal were counted as many times as his or her name appeared.

In regard to distribution by groups, as noted in Table 11, the gender distribution indicated that a higher percentage of women were found within the Dyad, Independent, Middle and Complex co-authorship network structure Groups, while a higher percentage of men were found in both Isolate and Structural Holes Groups. Also, while the Cohesion Group had more men than women by number, the gender distribution percentage is reflective of the larger population distribution for this group.

Table 11

*Distribution of Gender across Co-authorship Network Structures*

Co-authorship Network Structure		Gender	
Group	N	Male	Female
Isolate	208 (25%)	137 (29%)	71 (21%)
Dyad	221 (28%)	120 (25%)	101 (30%)
Independent	45 (05%)	21 (04%)	24 (07%)
Structural Holes	48 (06)%	33 (07%)	15 (04%)
Cohesion	219 (27%)	130 (27%)	89 (27%)
Middle	66 (08%)	34 (07%)	32 (10%)
Complex	3(0.4%)	1(0.2%)	2(0.6%)
TOTAL	810	476 (59%)	334 (41%)

Chi-square tests were performed to assess gender distribution in each of the seven network structure groups (see Table 12). No significant gender distribution differences were apparent in terms of structural holes and cohesion in co-authorship network structures distribution.

Table 12

*Chi-Square Tests*

Group by gender	Observed N	Expected N	Residual	Chi- square	df	Signifi- cance
Isolate Males	137	122.7	14.3	4.053	1	.044*
Isolate Females	71	85.3	-14.3			
Dyad Males	120	130.4	-10.4	2.019	1	.155
Dyad Females	101	90.6	10.4			
Independent Males	21	26.6	-5.6	2.830	1	.093†
Independent Females	24	18.5	5.6			
Structural Holes Males	33	28.3	4.7	1.886	1	.170
Structural Holes Females	15	19.7	-4.7			
Cohesive Males	130	129.2	.8	.012	1	.914
Cohesive Females	89	89.8	-.8			
Middle Males	34	38.9	-4.9	1.529	1	.216
Middle Females	32	27.1	4.9			
Complex Males	1	1.8	-.8	.817	1	.366
Complex Females	2	1.2	.8			

Note. \*  $p < .05$ . †  $p < .10$

Two findings should be observed. First, observed gender distribution did not differ significantly from expected in any of the groups, except in the Isolate Group. The Isolate Group had a residual that was large enough to make the difference significant ( $p=.044$ ). This means that there were significantly more males in Group 1 than what was expected; the “expected N” being that which approximately reflected the ratio in the actual population (male, 60%; female 40%). The results in the Isolate Group may relate to males having smaller networks as reported in the literature (Staber, 1994).

Second, the results from the Independent Group also aligned with Staber’s (1994) work, given the significant trend of more females than expected, that indicated women’s networks as less cohesive (Staber, 1994). However, no significant gender differences were apparent in co-authorship network structure distribution in terms of structural holes and cohesion. Thus, Chi-Square analysis indicated that gender was not associated with either network structure or total publications.

Given that the majority of top publishers were men (65%) whose network structures tended to demonstrate structural holes, an Independent Samples T-Test sought to determine whether gender was associated with total publications. The T-Test indicated that the mean number of publications does not significantly differ by gender ( $p=.168$ ).

The first phase of this study has addressed the first research question and identified the pattern of co-authorship network structures of academic scholars in the field of research and scholarship on higher education through network analysis. The second phase of this study addressed the relationship between these co-authorship network structures and academic publication. The next section presents the findings for the second research phase.

*Relationship between Co-authorship Network Structures and Publication*

Building upon the descriptive findings, the second research phase addressed the second research question,

How are these co-authorship network structures associated with an academic scholar's total number of publications in the field of research and scholarship on higher education?

A correlation analysis, an ANOVA, and a linear regression model are now presented in order to address this research question.

*Correlation Analysis*

The purpose of the correlation analysis was to discover and examine any association between variables. This correlation analysis (Table 13) included the independent variables (constraint, efficiency, network size and mean tie strength) and the dependent variable of total publications.

Table 13

*Correlations between Total Publications and Independent Variables (N = 602)*

Independent Variables	Network Size	Mean Tie Strength	Efficiency	Constraint	Total Publications
Network Size	-	.159**	-.531**	-.784**	.529**
Mean Tie Strength		-	-.031	-.093*	.501**
Efficiency			-	.183**	.069*
Constraint				-	-.516**

Note. \*Correlation significant at 0.05 level (1-tailed). \*\*Correlation significant at 0.01 level (1-tailed).

Total publications demonstrated positive correlations with efficiency, mean tie strength and network size and a negative correlation with constraint. Although the relationship between mean tie strength and efficiency was expected to be negative, it is noteworthy that it was not significantly correlated. Additionally, the negatively correlated trend between mean tie strength and constraint was unexpected given the theory behind cohesive networks suggesting that tie strength is generally associated with cohesion. The correlation analysis indicated that greater efficiency, reflecting a structural holes co-authorship network structure, was associated with total publications while increased constraint, reflecting a cohesion co-authorship network structure was not.

#### *ANOVA Analysis*

The Analysis of Variance was performed to examine if the co-authorship network structures were associated with total publications by observing the overall difference between the means of the groups. The ANOVA (Table 14) indicated a difference between the means of the seven co-authorship network structure groups. Authors whose co-authorship patterns reflected certain network structures produced more than others.

Table 14

#### *Analysis of Variance for Total Publications*

Source	df	F	$\eta$	$\rho$
Between Groups				
Co-authorship Groups	6	95.037	87.984	.000
Within Groups				
Co-authorship Groups	803	-	.926	-

Using an S-N-K post-hoc analysis to compare means, three distinctive subsets of co-authorship network structures became apparent (Table 15). The means for the Isolate, Dyads, Independent, Cohesion, and Middle groups were categorized together indicating that these network structures did not differ significantly from each other in terms of total publications.

Table 15

*S-N-K Post Hoc Analysis*

Group	N	Subset for alpha=.05		
		1	2	3
1 Isolates	208	1.13		
5 Cohesion	219	1.16		
2 Dyads	221	1.26		
3 Independents	45	1.31		
6 Middle	66	1.97		
4 Structural Holes	48		4.40	
7 Complex	3			5.33
		Significance		
		.078	1.00	1.00

Note. Means for groups in homogeneous subsets are displayed. Harmonic mean sample size = 17.265, group sizes are unequal, therefore, type 1 error levels are not guaranteed.

The mean publications for the Structural Holes Group and the Complex Group were each significantly different from each other and from the other network structures in terms of their mean number of total publications. Both of these network structures involve co-authorship patterns that fill structural holes. This ANOVA analysis for the entire population of academic scholars may provide an explanation for the high extent of structural holes in the distribution of co-authorship network structures among the top twenty authors (see Table 9). Overall, there was a difference between the means of the seven co-authorship network structure groups. Specifically, the structural holes and the complex network structures produced significantly different numbers of total publications.

#### *Linear Regression*

The purpose of the regression model was to examine the second research question as well as specifically testing two competing hypotheses,

Hypothesis 1a: Greater constraint, reflecting a cohesion co-authorship network structure, is associated with an increase in the total number of articles published.

Hypothesis 1b: Greater efficiency, reflecting a structural holes co-authorship network structure, is associated with an increase in the total number of articles published.

The regression model (Table 16) for the dependent variable of total publications included seven independent variables. The two explanatory variables included efficiency and constraint. The squared variables, efficiency squared, and constraint squared, account for the curvilinearity of efficiency and constraint.

Table 16

*Summary of Regression Analysis for Variables Predicting Total Publications*

Variable	B	SE B	$\beta$
Efficiency	7.742	1.019	1.543**
Constraint	-6.547	1.724	-1.022**
Gender	-.088	.068	-.031
Efficiency Squared	-4.377	.722	-1.189**
Constraint Squared	3.342	.979	.826**
Mean Tie Strength	1.785	.116	.386**
Network Size	.357	.049	.470**

Note. \*\*p. < .01.

Without the squared variables, the model only accounts for a straight line, which doesn't match the actual data. Therefore, both the variable and squared variables were included. The regression model had an Adjusted R Square of .658. This model explained approximately 66% of the phenomena occurring here. To be more precise, constraint, efficiency, mean tie strength, and network size were each significant and together explained approximately two-thirds of the variability in total publications.

To better visualize the associations between variables, two plots are provided. Figure 8 demonstrates the negative curvilinear association between constraint and total publications. Figure 9 shows the positive curvilinear association between efficiency and total publications.

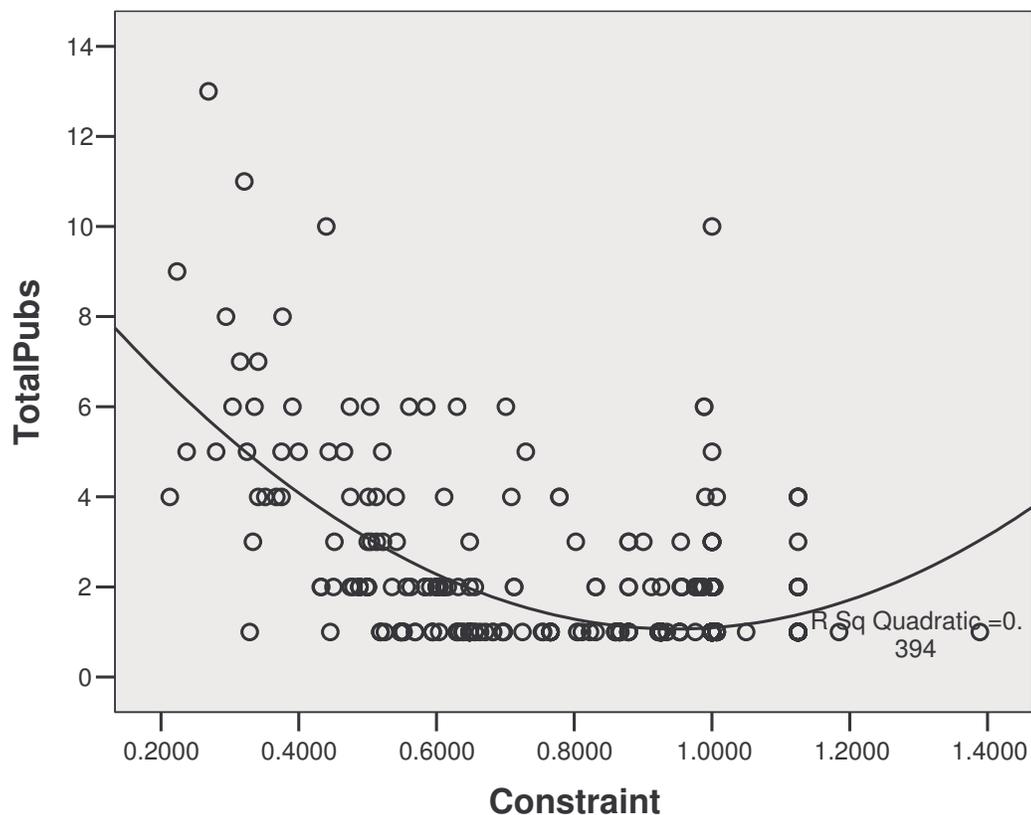


Figure 8. Plot of constraint and total publications.

Gender was included as a dummy control variable. The reason was that research has shown that women often demonstrate different network structures, specifically in terms of less cohesion and larger size (Staber, 1994).

Although, in terms of gender, a higher percentage of male authors were evident in the population. The overall point of interest being that gender was insignificant in this model. In both the T-Test and regression analyses, the variable of gender was not associated with total publications within the field of research and scholarship on higher education.

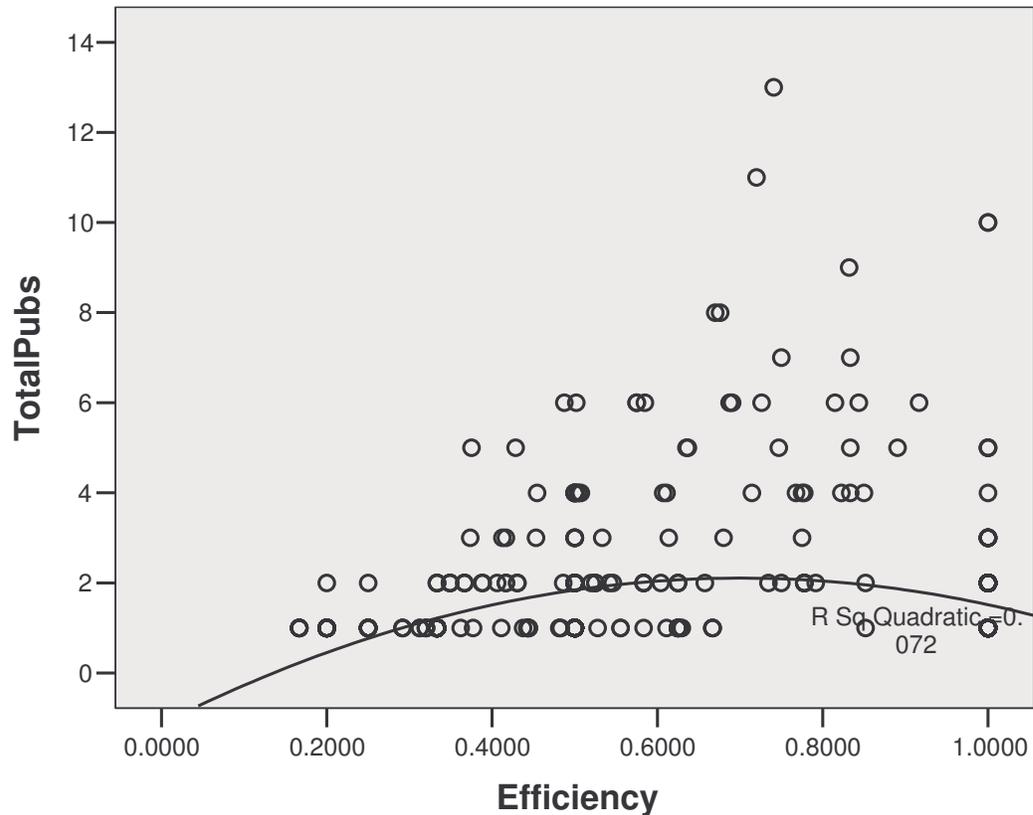


Figure 9. Plot of efficiency and total publications.

Regarding Hypothesis 1a, the explanatory variable of constraint was negatively associated with total publications. This finding did not support Hypothesis 1a. Also, the relationship did not appear to be linear as constraint squared was positive, which meant that this line began to turn up as constraint increased. Thus, constraint may potentially be associated with the case of diminishing losses as increasing constraint eventually provided less decrease in total publications.

The explanatory variable of efficiency was positively associated with total publications in the regression model. This finding did support Hypothesis 1b. However, the relationship did not appear to be linear as efficiency squared was negative which

suggested that this line curves down as efficiency rises. Thus, efficiency may be associated with the case of diminishing returns as increasing efficiency eventually provided less increase in total publications. Ultimately though, the variable of efficiency was positively associated with total publications.

Two additional variables, mean tie strength and network size, were included as additional elements of the egocentric network structures that may also have a theoretical relationship to total publications. Mean tie strength was measured as average strength of each co-authorship tie, with tie strength measured as the number of times a scholar published with a co-author. Network size was measured as the number of different co-authors in the scholar's egocentric network.

Mean tie strength was included in this model because theoretically the strength of ties would be expected to be positively associated with total publications due to the established connections that may ease the production of more publications. Indeed, in this model, mean tie strength was positively associated with total publications. Of interest, however, is that mean tie strength, which is also generally associated with cohesion (Coleman, 1988) due to the tendency of strong ties to become cohesive, was not positively associated with cohesion in this analysis. However, mean strength of ties is only one aspect of cohesion as it does not capture the density of relationships between co-authors.

In terms of total publications, this finding may suggest that filling structural holes—a network structure that spans across the larger network and provides authors with a greater variety of co-authors—may have been even further enhanced when there were also multiple publications with the same co-authors (known as mean tie strength). This

dual co-authorship network structure of both structural holes and strong ties may be the structure potentially associated with the Complex Group. However, note how few authors actually demonstrated this type of network structure (n=3 of 810). Clearly, however, the top publishers' demonstrated structural holes and complex co-authorship network structures.

Network size was included in this model because theoretically the number of co-authors would be expected to be positively associated to total publications given the increased number of potential co-authors in one's egocentric network. In this model, network size was positively associated with total publications. In this data, adding three co-authors in the scholars' co-authorship networks was associated with an increase of about one publication. This is easily interpreted as an increase in the size of co-authorship network means a scholar has more academic scholars to publish with and less constraint within their egocentric network. That is, the greater the network size (number of co-authors), the less likely the network is to be constrained or associated with cohesion (Burt, 1992). A greater number of ties may also indicate a broader range, and thereby diversity, of co-authors which may suggest a network structure that is perhaps more likely to fill structural holes.

### *Summary of Findings*

This chapter has presented the descriptive and quantitative findings that addressed the two research questions dealing with the specifics of co-authorship network structures as well as the two contrasting hypotheses which specifically examine the tension between structural holes and cohesion network structures. In the correlation analysis (see Table 13), total publications demonstrated positive correlations with efficiency, mean tie

strength and network size and a negative correlation with constraint. The ANOVA (Table 14) indicated a difference between the mean number of total publications between the seven co-authorship network structure groups. The S-N-K post-hoc analysis compared these means and indicated three distinctive subsets of co-authorship network structures (Table 15), with the Structural Holes and Complex Network structures each having significantly higher mean publications than the other structures and being significantly different from each other in terms of total publications.

Hypothesis 1a, which addressed the association between cohesion (as indicated by constraint) and total publications, was not supported by the regression analysis (Table 16). However, Hypothesis 1b was supported by the regression analysis, which indicated that a co-authorship network structure that demonstrated filling more structural holes was positively associated with an academic scholar's total number of publications in the field of research and scholarship on higher education.

The following chapter provides a discussion of these findings. Theoretical and practical implications, limitations, and suggestions for future research are addressed.



## CHAPTER FIVE

### DISCUSSION

The purpose of this study has been to examine the relationship between co-authorship network structures and total numbers of academic publication. Examined from the perspective of network theory, this research moved forward from the foundation that academic publication creates a critical influence in academic fields (Stokes & Hartley, 1989). Publications in the field of higher education during a six-year time period, and the cumulative profile they created, became the essential means to examine the benefits surrounding the opposing network structures of cohesion and structural holes (Burt, 1992; Coleman, 1988; Hanneman & Riddle, 2005).

While the academic scholars in this study may not have consciously or strategically approached the development of their co-authorship networks, nonetheless, the combination of their co-author relationships created an egocentric network structure that may have had implications for their total number of publications. The researcher used these egocentric networks to identify, describe, and measure co-authorship network structures and the relationship of these structures to total number of publications.

Given that academic scholars may not have been aware that their individual co-authorship choices actually aggregated into a larger co-authorship network structure, and yet certain network structures were found to be associated with total number of publications, an opportunity may exist to facilitate a more measured and strategic approach to academic co-authorship in the future. Previously, academic scholars may not have realized that by consistently choosing to co-author with those that are also co-authoring with each other, they were facilitating a cohesion co-authorship network

structure and that this structure was not as effective at increasing publication as other network structures. More importantly, academic scholars may not have previously realized that by consistently choosing to co-author with other academics who are not already connected, they were facilitating a co-authorship network structure that was spanning structural holes and that this structure may have contributed to increasing their total number of publications. This study clearly indicates that there may be an association between the co-authorship network structures and total number of publications. Knowledge of these findings may help academic scholars to be more aware of how these co-authorship network structures may be consciously and strategically created to increase their total number of publications, thus potentially increasing their influence in the field and ultimately benefiting their career.

In this study of co-authorship networks, the academic scholars in the Structural Holes Group outperformed the scholars in the Cohesion Group. The relationship of interest was between efficiency, which measured the extent of structural holes within the co-authorship network, and the total number of publications. This association between publications and co-authorship using structural holes merits closer observation. Consider again the following totals from Table 6. The Structural Holes Group of 48 members produced 93 articles (ratio = 1.94), compared to the Cohesion Group where 219 members produced 235 articles (ratio = 1.07). Academic scholars in the Structural Holes Group produced roughly twice as many articles per person as the Cohesion Group. Table 17 also presents an observation based on the productivity level of the group members. In stark contrast to each other, 90% of all academic scholars in the Cohesion Group

produced only one article in the six year timeframe, while only 6% of the Structural Holes Group produced only one article.

Table 17

*Percentage of Each Group Publishing Only One Article*

Strategy	%
Isolates	90%
Dyads	83%
Independent	87%
Structural Holes	6%
Cohesion	90%
Middle	46%
Complex	0%

In addition, the contrast between the co-authorship strategies of cohesion and structural holes became even clearer upon further examination of the number of articles produced. Not only did the majority of the academic scholars classified in the Cohesion Group produce only one article (Table 17), no one in the entire group produced more than four articles during the entire six-year timeframe (see Table 18). This is a pale comparison to the Structural Holes Group where 42% of scholars produced five or more articles during the same period, including one author with the study's top production number of 13 articles.

Table 18

*Production Contrast Between Structural Holes Group and Cohesion Group*

	Structural Holes Co-authors		Cohesion Co-authors	
# of Articles Produced	# Producing that many Articles	% Producing that many Articles	# Producing that many Articles	% Producing that many Articles
1	3	6 %	196	90 %
2	13	27%	16	7%
3	4	8%	2	1%
4	8	17%	5	2%
5	7	15%	0	0%
6	5	11%	0	0%
7	2	4%	0	0%
8	2	4%	0	0%
9	0	0%	0	0%
10	2	4%	0	0%
11	1	2%	0	0%
12	0	0%	0	0%
13	1	2%	0	0%
Total	48	100%	219	100%

Ultimately, this study clearly supported that greater efficiency (Hypothesis 1b), reflecting a structural holes co-authorship network structure, was associated with an increase in the total number of articles published. According to the ANOVA, scholars whose co-authorship patterns reflected certain authorship network structures produced more publications than others. The regression analysis supported Hypothesis 1b, specifically, the explanatory variable of Efficiency was positively associated with the dependent variable of total publications in the regression model.

This research has addressed and contributed toward the single main question posed by Hanneman and Riddle (2005) regarding what was the most productive co-authorship network structure among academic scholars, given the potential implications of these network structures on the resulting social capital (Burt, 2005). Social capital facilitates performance (Burt, 2001). However, there is tension between the two opposing views of how networks create social capital. Coleman's view of social capital stresses the positive effects of cohesive ties in promoting a normative environment that facilitates trust and cooperation between individuals (Coleman, 1988). Structural holes theory (Burt, 1992) insists that social capital stems from the brokerage opportunities created by diverse ties, also known as the lack of network cohesion (Gargiulo & Benassi, 2000). Thus, testing the association between the two co-authorship network strategies of structural holes and cohesion and performance, as measured by successful publication, provides a summary test between these two leading network mechanisms argued to both provide social capital (Burt, 1992). In this research, the social capital mechanism of structural holes was associated with producing more publications than the mechanism of

cohesion. Therefore, the most productive co-authorship network structure from this study was achieved through generating bridges across a greater extent of structural holes.

### *Theoretical Implications*

The literature clearly communicated a need for research to help explain co-authorship strategies (Bayer & Smart, 1991). According to Gomez-Mejia & Balkin (1992), “research has been largely conducted without the benefit of any theory to explain findings” (p. 946). This study has utilized the theoretical perspective of social network analysis to inform co-authorship structures and their implications for publication rates. Hanneman and Riddle (2005) state that there are good theoretical reasons, along with some empirical evidence, to believe that the basic properties of social networks have very important consequences. Their single main question focuses on the structure of these network connections, particularly given the implications of these network structures on the resulting social capital. This research addressed this question about the differences in network structure and the potential resulting social capital from differential publication. Indeed, the pattern of how an academic scholar co-authored did create different network structures. These network structures did implicate different mechanisms for creating social capital, which in turn has the potential to provide greater influence in the field (Friedkin, 1998; Stokes & Hartley, 1989). These different mechanisms were illustrated in the contrasting theoretical constructs of cohesion versus structural holes. In this case, one potential source of an academic scholar’s social capital might be reflected in their co-authorship network structures, particularly those that conform to a structural holes pattern, as this structure was positively associated with the number of total publications.

*Social capital.* Burt has asserted that “social capital promises to yield new insights, and more rigorous and stable models, describing why certain people perform better than others” (Burt, 2000, p. 2). Perhaps this research has identified some new ways of considering strategies that could lead to better publication performance. In this study, the regression model suggested that those co-authors clustering into structural holes yielded the highest number of publications. These academic scholars clearly outperformed those clustering under the structure of cohesion. Burt, (2001) proposes that the social capital metaphor indicates that people who do better are somehow better connected. The debate in the literature has revolved around which type of connections—cohesion or structural holes. In academic publishing, the structural holes strategy may have allowed better connections through increased visibility. In essence, the potential visibility, which is vital to influence (Friedkin, 1998) in the field, may have been increased with connections to non-redundant scholars as suggested with structural holes strategies (Burt, 1992, 2005).

For this study, the construction of these social positions within the field, and the potential resulting interpersonal influences, was associated with the co-authorship relations of academic scholars. Specifically, in terms of influence within the field of research and scholarship on higher education, a structural holes strategy suggests that consistently choosing to co-author with other academics who are not already connected through co-authorship could broaden one’s name recognition and interpersonal visibility. Note that interpersonal visibility can only exist when one actor has some information about another actor. This interpersonal visibility is a precondition of social control processes because it allows the observed behavior and opinion to become influential

(Friedkin, 1998). With the broadened exposure of a structural holes strategy, the visibility potential of academic scholars is likely to be more fully leveraged, and thus provide increased influence in their field. This study suggests that an academic scholar's individual influence in their field may be derived from their network of interpersonal visibilities and that these interpersonal visibilities may result from their social positions as reflected in their co-authorship networks structures (Friedkin, 1998).

This concept of interpersonal visibilities is also possibly related to collegiality. This research has sought to illuminate collegiality due to its foundational role in networks. As noted sociologist Mary Frank Fox (1985) requested, "We need to know much more about the way in which collegiality operates" (p. 271). This research examined the scene of collegial networks, exploring their potential for collaboration and their potential advantages and disadvantages.

*Key findings.* A key finding from the regression analysis was that mean tie strength, which is generally positively associated with cohesion (Coleman, 1988; Uzzi, 1996), was positively associated with total publications whereas cohesion was clearly not. Specifically, in the correlation, the variable of mean tie strength was not significantly related to the variable of efficiency. Yet, as expected, the correlation between mean tie strength and constraint was significant at the  $p \leq 0.05$  level. Most notably in confirmation of the regression analysis, the correlation between mean tie strength and total publications was significant at the  $p \leq 0.01$  level. In terms of total publications, these findings suggests that the structural holes strategy, a network structure that spans across the larger network and co-authors with a greater variety of co-authors, was even further enhanced when there were also multiple publications with the same authors. This dual

network structure, of both structural holes and strong ties, may be associated with the Complex Group (see Figure 7). The challenges of creating and sustaining this network structure may be indicated by the scant membership in this group. This dual network structure mirrors Burt's (2001) summary remarks in his chapter on structural holes versus network closure as social capital,

In short, structural holes and network closure can be brought together in a productive way. The integration is only with respect to empirical evidence. The mechanisms remain distinct. Closure describes how dense or hierarchical networks lower the risk associated with transaction and trust, which can be associated with performance. The hole argument describes how structural holes are opportunities to add value with brokerage across the holes, which is associated with performance. The empirical evidence supports the hole argument over closure. However, my summary conclusion is that while brokerage across structural holes is the source of added value, closure can be critical to realizing the value buried in the structural holes. (p. 25)

Overall, the findings from this research align closely with Burt's (2001) position. First, the empirical evidence consistently supported the structural hole argument over closure. Clearly, constraint, representing cohesion, was negatively associated with total number of publications in contrast to efficiency, representing structural holes, which showed a positive association. Second, the data suggest that co-authoring multiple times with the same scholars (mean tie strength) may be critical to realizing the potential value buried within the structural holes (Burt, 2001). This finding may suggest that a type of symbiotic relationship may actually exist between structural holes and an aspect of

cohesion. That is, more specifically, mean tie strength theoretically represents an aspect of cohesion. Thus, an ideal hybrid network structure may combine structural holes and cohesion and may have been typified by scholars with a complex network structure.

The ANOVA and S-N-K post-hoc analysis indicated that this Complex Group was distinct from other groups in terms of total number of publications. The Complex Group was the only group that produced almost three articles for each member of the group, a 3:1 ratio as compared to the Cohesion Group which operated on approximately a 1:1 ratio, and the Structural Holes Group which produced almost two articles per group member, a 2:1 ratio. However, an important point to note is how few authors actually demonstrated this type of network structure ( $n=3$  of 810). While, theoretically, the Complex Group was expected to have a low N, given the delicate balance of utilizing competing strategies, the observed membership was even much lower than anticipated.

Despite the incredibly low number of co-authors who actually demonstrated the complex structure in this academic field during this six-year timeframe, the question is raised as to whether increased awareness of the potential of this co-authorship network structure for publications could be the catalyst for future academic scholars to pursue a complex co-authoring network strategy. In academics generally, instrumental collaborative relationships are quite possibly motivated by a direct need to generate research and publications (Dickens & Sagaria, 1997). However, if academic scholars were empowered with knowledge of what type of co-authorship relations to pursue, they may be able to successfully develop an even more effective pathway to scholarly publication. The question begs further research given that the results from this study are limited to this population. Yet the potential for a more generalizable strategy is apparent.

*Filling structural holes.* In this study, the structural holes network structure was associated with an increase in the total number of publications. The reasons why may be explored by considering several concepts, such as the scarcity of personal resources available, the concepts of creativity and innovation, and the critical factor of non-redundant contacts.

An academic scholar has a limited amount of personal resources, time and energy, which can be tapped to create and sustain relationships. Consequently, from one side of the equation there was resource scarcity in initiating and maintaining relationships and from the other side of the equation, there were certain relationships that may prove more valuable than others based on the useful information that they provide and should potentially take a higher priority than pursuing relationships of lesser benefit. Therefore, at some point, the impending gain of creativity and innovation derived from those potentially more useful relationships should be weighed and considered in regard to productivity.

The underlying value-added of structural holes is the access to non-redundant sources of information (Burt, 2005). An academic scholar may gain little from a new co-author who is redundant or connected with existing co-authors. Time and energy may be better invested recruiting a new co-author to tap into fresh network subgroups yet unreached (Burt, 1992). People on either side of a structural hole are diverse and circulate within different flows of information. Thus non-redundant contacts may be helpful in publishing as well as innovation because non-redundant ties that span structural holes can provide benefits of diversity and non-redundant information and resources (Burt, 1992). It would be anticipated that non-redundant contacts would provide network

benefits that are additive rather than overlapping (Burt, 1992). The interpretation of this benefit is that spanning structural holes would present an opportunity to broker the flow of information between people and control the projects that bring people from different sides of the structural network hole together (Burt, 2001).

*Gender of academic scholars.* This study also took into consideration the role of the scholar's gender in his or her co-authorship network structure and total number of publications. Of the 810 academic scholars in this study, 59% were male. Each of the journals reflected a similar distribution as each had more male authors than female. In terms of publication, however, both T-Test and regression analysis indicated that gender was not associated with publication production. Theoretically, however, it was necessary to include gender in the analysis of network structure given that research has shown women often demonstrate different network structures, specifically in terms of less cohesion and larger size (Staber, 1994). Thus, previous research suggested that women might have been less prevalent in the Cohesion Group and implied that they may lean more toward the Structural Holes Group. Contrary to previous research, however, Chi-Square analysis did not bear out any significant differences in gender distribution within group memberships.

One point of interest was in the first group. There were significantly more males in the Isolate Group than what was expected. The results may relate to the smaller networks that males are purported to have (Staber, 1994). Also, there was a trend that showed more females than expected in Group 3, those categorized as Independent. This seemed to align with literature that indicated women's networks as less cohesive (Staber,

1994). However, no significant gender differences were apparent in co-authorship network structure distribution in terms of structural holes and cohesion.

*Isolate and dyad groups.* In regard to the Isolate Group and Dyad Group, these academic scholars demonstrated distinctly different network structures than those based upon cohesion and structural holes (Groups 3-7). The Isolate and Dyad Groups' network structures were incapable of either cohesion or structural holes. Isolates Group members had no co-authors, and Dyad Group members had only one co-author. Thus these two groups were not included in the extended study based on their inability to provide a network structure relevant for the analysis of cohesion or structural holes. Nonetheless, these two groups did constitute just over half of the overall population of authors (53%) and produced just under half of all the articles (49%). The ANOVA analysis indicated that scholars in these groups published similarly with scholars in the Independent, Middle and Cohesion Groups, approximately one publication per person in six years.

Therefore, the Isolate and Dyad Groups' network co-authorship structures provided no inherent publication advantage. Thus, in conclusion regarding co-authorship in the field of research and scholarship on higher education scholars, the Isolate, Dyad, Independent, Middle or Cohesion Groups did not demonstrate the same high level of publication productivity as the Structural Holes or Complex Groups.

*Summary.* The outcomes from this study contradicted some of the previous literature, particularly Coleman (1988, 1990). He believed that cohesion made it less risky for people in the network to trust one another and therefore willing to be more readily influenced by each other. Stronger relations among contacts, usually found with cohesion, were argued by Coleman (1988) to give more reliable protection from

exploitation due to social governance in that other network members were able to act in concert (Uzzi, 1996) against someone who violated their norms of conduct. Yet, the protection and sanctions that stem from the social governance found in cohesion may not operate toward the facilitation of publications. Perhaps these collective sanctions and protection from exploitation are not necessary in the academic publishing environment. Thus, while stronger ties themselves were associated publication, this association did not likely contribute to social governance as much as to the depth of the dyadic relationship.

Cohesion network structures were found to be similar in publication production value to the Isolate, Dyad, and Independent Groups' network structures. Thus, this study does not support the literature of Coleman (1988), but rather supports the views established by Burt (1992) that participation in, and control of, information diffusion underlies the social capital of structural holes. A competitive advantage was clearly apparent for academic scholars whose relationships spanned the structural holes within the larger network. This brokerage across structural holes was potentially the source of value-added towards publication. As a result, networks that fill structural holes, in which co-authors could "broker connections between otherwise disconnected segments" of the larger network (Burt, 2001, p. 1), may provide additional social capital to these scholars. Scholars in the Structural Holes Group would be more likely to have a broader range of partners that connected or spanned across various network subgroups, and these were the academic scholars who produced the most publications.

### *Practical Implications*

This study indicated that constraint, representing network cohesion, was negatively associated with total publications. According to the regression analysis; more

constraint meant fewer publications. Coleman's (1988) theory of cohesion was not supported by this study. According to Burt, (2001),

More constrained networks span fewer structural holes, which means less social capital according to the holes argument. If networks that span structural holes are the source of social capital, then performance should have a negative association with network constraint. More constraint means more network closure, and so more social capital according to the closure arguments. If network closure is the source of social capital, then performance should have a positive association with constraint. (p. 11, underline in original.)

Thus, based on Burt (2001), in the academic co-authorship network in this study, social capital would stem from filling structural holes or co-authoring with a variety of unconnected co-authors.

*Variable of mean tie strength.* From the linear regression model, two subtle phenomena took shape from the complementary variables. Mean tie strength and network size were included because they had a theoretical relationship to the explanatory variables of efficiency and constraint (Burt, 1992; Hanneman & Riddle, 2005).

Mean tie strength, measured as the average number of times a scholar published with a co-author, provoked a question. The concern being that, theoretically, broadening one's network increases the difficulty of building strong ties (Coleman, 1988) and, conversely, repeated co-authorship increases the difficulty of broadening one's network unless one is publishing a great deal. In this research, mean tie strength illustrated this contradictory condition. The total number of publications of academic scholars whose co-authorship networks filled structural holes, spanning across the larger network and

thus likely co-authoring with a greater variety of co-authors, was even further enhanced when there were also multiple publications with the same co-authors. Therefore, although cohesion was not positively associated with total publications, mean tie strength, which is generally thought of as an aspect associated with cohesion (Coleman, 1988; Uzzi, 1996), was positively associated with total publications.

*Variable of network size.* Network size was measured as the number of different co-authors in the scholar's egocentric network and demonstrated a positive relationship to total publications. This finding suggested that as scholars were involved with more co-authors to their network, thus increasing the size of their co-authorship network, their number of publications increased. In this study, adding co-authors was associated with an increase in the number of publications. Consequently, while network size may have been expected to demonstrate a negative association with total publications (Burt, 1992), it demonstrated a positive association as explained by the condition that a larger network means more potential co-authorship possibilities. Indeed, adding more co-authors might allow more spanning, if redundancy is not rampant among the relationships established. Thus, scholars could strategically choose which co-authors to add such that these new relationships spanned more structural holes rather than increasing the cohesion within their existing co-authorship network.

*Potential practical benefits.* Given the above information, from a practical standpoint, if academic scholars were empowered with knowledge of what type of network relationships were more likely to produce more publications, would they be more able to pursue a more effective pathway to research publication? Based upon this research, the answer could be yes given that structural holes networks appeared more

advantageous to publication production when compared with cohesion network structures. The practical implications of this research suggest that academic scholars may want to analyze their own current egocentric co-authorship network structure. The ability for academic scholars to first, be aware that different co-authorship network structures exist and then, secondly, to identify one's own co-authorship network structure are potentially key steps toward conscientiously choosing to pursue specific co-authorship relations in an effort to increase total publications produced over a career.

Thus, the findings in this research, while limited to this population, may suggest that academic scholars in the field of higher education could become more strategic and intentionally develop their co-authorship network relations. Specifically, they could endeavor to promote a structural holes co-authorship strategy with underpinnings of tie strength. From a practical standpoint, this strategy would create co-authorship network relations that would span across the larger network field, include co-authors with a greater variety of co-authors, and seek to publish multiple times with some of their co-authors.

In regard to this study's findings, the keystone was the structural holes strategy, an overall network structure that spans across the larger network and co-authors with a greater variety of co-authors. Breiger (1991) saw clearly that the boundaries around structural holes networks are broad and fluid,

internal boundaries of interactions within and across multiple networks do not neatly fit such culturally defined boundaries as 'academic disciplines' or 'fields of specialization' ... the boundaries of a network population may be 'open' and intrinsically difficult to ascertain. (p. 29)

Following suit in this study, the top twenty scholars (see Table 9) demonstrated very broad connections to other scholars. These productive scholars reflect Hunter & Kuh's (1987) statements that in almost any given discipline a small group of highly productive scholars often generate a disproportionately large number of entries to the literature. In this study of the field of higher education, the structural holes network structure was an explanatory factor potentially associated with the larger number of publications of the more productive scholars. Co-authoring across structural holes could provide an opportunity to broker the flow of information between people and control the projects that bring people from the different sides of the structural network hole together (Burt, 2001). Hanneman and Riddle (2005) explained this in the following manner:

Network analysts often describe the way that an actor is embedded in a relational network as imposing constraints on the actor and offering the actor opportunities. Actors that face fewer constraints and have more opportunities than others are in favorable structural positions. Having a favored position means that an actor may extract better bargains in exchanges, have greater influence, and that the actor will be a focus for deference and attention from those in less favored positions. (p. 10)

The most important practical implication from this research is that a co-authorship network that fills structural holes may potentially facilitate a "favored position." Thus in understanding the existence of and the pathway to this "favored position," the practical solution seems to be to pursue a structural holes network strategy. This strategy indicates "a world of discovering and developing opportunities to add value by changing social structure with bridges across holes in the structure" (Burt, 2000, p. 14). From a practical standpoint, this may look like academic scholars crossing the boundaries of geographical

location, academic specialties, and areas of expertise, to cross into each other's interests, positions of power, and paradigms.

### *Delimitations*

The delimitations of this research are bounded by the fact that only four journals were analyzed. Analyzing more journals would have produced a different dataset and potentially different results. In regard to journals and associations being linked together, such associations may potentially have an effect on co-authorship network structures. However, this research did not explore the following connections. The *Review of Higher Education* is the official journal of the Association for the Study of Higher Education (ASHE). *Higher Education Quarterly* is published in association with the Society for Research into Higher Education. *Research in Higher Education* is associated with AIR, the Association for Institutional Research. The *Journal of Higher Education* does not appear to be directly associated with any one organization.

In addition, given that only six years of data were collected and the tenure stage of the scholars was not identified, the question of the impact of career life cycles is raised. Future research should examine co-authorship network structures during different academic life cycle stages. Perhaps academic scholars begin their publishing careers with isolate or dyad network structures until they develop sufficient reputations that then affords them the option of adding co-authors; maybe once an author is famous, other authors from far and near wish to co-author articles with the famous. The issue is order. This research has not controlled for "tenure" of academics, and the question can be asked, "Does it matter how long an author has been publishing?" This is a critical opportunity for future research.

Note that in this research, the Isolate and Dyad Groups did not have the same potential for redundant contacts and thus did not have the chance to develop a structural holes or cohesion network structure. They were removed from the final analysis in this study. Together, these two strategies represented 53% of the authors in this study and therefore, another delimitation was that over half of the authors did not demonstrate any kind of network at all.

Another question that may be raised is “How do we know that productive scholars would not simply be productive in any network structure?” Maybe they are productive and so they have more opportunities to build “network” ties. This study does not address this question as the scope of this research did not include an examination of the publication histories of the most prolific authors or scholars in the Structural Holes or Complex Groups. However, this question should be examined in future research.

#### *Future Research*

Indeed, many articles on co-authorship reviewed for this study concluded by recognizing the need for further research in the area of authorship strategies (Bayer & Smart, 1991; Diamond, 1986; Gomez-Mejia & Balkin, 1992; Presser, 1980; Stark & Miller, 1976). These studies indicated a request to clarify the dimensions surrounding “best practices” for academic publishing. This study has added to the conversation with its examination of co-authorship within the field of research and scholarship on higher education, however, there is much more to do.

As previously mentioned in the delimitations, the question of career life cycle, sequencing and order in regard to the preferred pathway that network structures are formulated needs to be examined. Collecting data in regard to the year academic

scholar's acquired his or her decrees may add temporal and reputational aspects One question that should be asked is, "does it matter how long an author has been publishing?" A related issue comes from Burt, (2001) the implication being that social capital cumulates over a career and therefore is more valuable to acquire earlier in one's career.

The most productive authors and their publishing careers should be examined with specific interest in how early a co-authorship network emerged that filled structural holes. Even examining basic information about where an academic scholar is located and what his or her professional title is holds answers to how an individual's network structures evolved. While far from exhaustive, Table 19 profiles two key factors of the top-twenty most prolific authors; their titles and the universities by which they are currently employed. From the data available, it appears that only eight of the twenty most prolific scholars may be full professors. There are seven associate professors and three assistant professors, as well as one administrator and one postgraduate researcher. Such information whets the appetite for more details that potentially may paint a clearer picture of how individual networks may be formed into actual network strategies. Indeed there may be numerous explanations for the association between network structure and publication. Some possible explanations include the actual nature of the academic specialties of academic scholars in the network; the resources available within the network; the aforementioned career stages of the network members, etc. Although this study discusses the association between co-authorship network structures and publications, there are potentially other factors that may be more important for publication production and those factors should be explored as well.

Table 19

*Top Twenty Most Prolific Author Profiles*

#	Name	Title	University Employer
1	Pascarella, Ernest T.	Professor of Higher Education in Planning, Policy, and Leadership Studies	University of Iowa
2	St. John, Edward P.	Professor of Educational Leadership	Indiana University
3	Perna, Laura W.	Assistant Professor of Higher Education	University of Maryland
4	Kezar, Adrianna	Professor for Higher Education	University of Southern California
5	Kuh, George D.	Professor of Higher Education	Indiana University Bloomington
6	Terenzini, Patrick T.	Professor of Higher Education	Pennsylvania State University
7	Hu, Shouping	Associate Professor of Higher Education in the Department of Educational Leadership and Policy Studies	Florida State University
8	Antonio, Anthony L.	Associate Professor of Education	Stanford University
9	Toutkoushian, Robert K.	Associate Professor in the Department of Educational Leadership and Policy Studies	Indiana University
10	Morphew, Christopher C.	Associate Professor of Higher Education	University of Georgia

Table 19 (continued).

#	Name	Title	University Employer
11	Nora, Amaury	Professor in the College of Education	University of Houston
12	Smart, John C.	Professor of Educational Research and Higher Education	University of Memphis
13	Sax, Linda J.	Associate Professor Graduate School of Education and Information Studies	University of California Los Angeles
14	Wolf-Wendel, Lisa E.	Associate Professor Department of Teaching and Leadership	University of Kansas
15	DesJardins, Stephen L.	Assistant Professor College of Education	University of Iowa
16	Pike, Gary R.	Assistant Vice Chancellor for Student Affairs	University of Missouri-Columbia
17	Colbeck, Carol L.	Associate Professor of Higher Education	Pennsylvania State University
18	Pierson, Christopher T.	Postgraduate Researcher in Higher Education	University of Iowa
19	Johnsrud, Linda K.	Professor in the Department of Educational Administration Planning and Policy	University of Hawai'i at Manoa
20	Rosser, Vicki J.	Assistant Professor, Educational Leadership and Policy Analysis	University of Missouri-Columbia

Another topic for future research is that of innovation. According to Burt (2000), more benefits are available from structural hole networks because more innovative

solutions are to be expected from the social capital of bridge relationships. Creativity and learning are central to the co-authorship advantage from structural holes. Bridging structural holes could enhance a scholar's ability to learn and be innovative. Future research could compare articles that were produced by a structural holes network and those produced by an alternative network structure and then determine which network structure was associated with the more innovative articles.

One major insight from this research raised a question about the journals themselves. Could it be possible that not only do individual academic scholars unknowingly demonstrate a particular co-authorship network structure, but that perhaps academic journals may also demonstrate a predilection for certain co-authorship patterns. Each journal may create and perpetuate its own publication patterns, either by choice, chance, or some combination. Several potential reasons exist as to why this phenomenon might occur. For example, consider differing acceptance rates, how broadly distributed the journal is, extent of international subscriptions, how many articles a year each journal publishes, etc. In this research (see Table 9), the top 20 most prolific authors (2%) published in three of the four different journals, yet none of them published in *Higher Education Quarterly*. It begs the question, why are top academic scholars (as defined by numbers of publications in the other three journals) not publishing here? And the follow-up question; is this associated with a journal strategy, or perhaps an author strategy? Perhaps this phenomena regarding *Higher Education Quarterly* is due to the fact that it is essentially a British journal, being published by Blackwell Publishing Limited UK. Another possibility is that it is specifically designed for the "discussion and analysis of

current policy questions in higher education” (Cabell, 2003) rather than on something like empirical studies. The questions still remain.

Indeed, there are many different potential questions which this research has brought to the surface. That is the destiny of any thought-provoking inquiry (Kuhn, 1996). Yet the fact remains that some questions, although constrained by their scope, have been answered. Specifically, Hypothesis 1b was supported, indicating that a co-authorship network structure that demonstrated filling more structural holes was positively associated with an academic scholar’s total number of publications in the field of research and scholarship on higher education.

This chapter has served to discuss the theoretical and practical implications of this study. It has also addressed the limitations inherent in the study. Finally, the context of future research was examined. Chapter 6 is now presented to offer the conclusions of this study.



## CHAPTER SIX

### CONCLUSION

This study was initiated to look into the field of research and scholarship on higher education, specifically into academic publications and how co-authorship network structures, which are foundationally based upon cohesion and structural holes, might be associated with strategies toward successful publication. The overarching premise was that since total number of publications is related to an academic scholar's influence in the field (Stokes & Hartley, 1989), academic scholars need to be more aware of these co-authorship network structures and their potential association with total number of publications.

Figure 1 illustrated the relationship between these major constructs and the research model for this dissertation. This study focused on the first arrow, detecting the potential presence of an association between co-authorship structure and publication success. The second arrow, symbolizing the relationship between publication success and influence, has already been well-established in the literature and was beyond the scope of this current study.

Differences among academic scholars in how they are connected to one another is consequential for understanding how they acquire social capital, which is an underlying source of influence (Friedkin, 1998) that can be derived from an academic scholar's network of interpersonal visibilities (Alpert, 1985) as created by their academic social positions. Value is thus produced for those who have higher social capital, e.g. publications in this context. This social capital perspective suggests that influence may be specifically identifiable as a result of article publication, lending credence to the

importance of co-authorship strategies and the network structures that correspond to them. In this study, the accumulation of co-authorship relationships from academic scholars' published works created their egocentric co-authorship network structures.

The two egocentric network structures that formed the foundation and focus for this study were cohesion (Coleman, 1988) and structural holes (Burt, 1992). These structures are competing because the network characteristics of one strategy generally make the other much less likely or feasible. On the one hand, Coleman suggests that the benefits of social capital stem from the positive effects of cohesive ties in promoting a normative environment that facilitates trust and cooperation between individuals (Coleman, 1988). On the other hand, structural holes theory (Burt, 1992) insists that the benefits from social capital stem from the brokerage opportunities created by diverse ties, also known as a lack of network cohesion (Gargiulo & Benassi, 2000). Structural holes theory suggests that cohesive social bonds jeopardize flexibility and increase rigidity.

The two network mechanisms of brokerage (structural holes) and closure (cohesion) have been the foundation for work on social capital. However, they are about two distinctly different approaches to social capital, closure is about status, while brokerage is about change. Neither mechanism assumes that network structure replaces information so much as that they affect the information flow and what people do with it (Burt, 2000). Coleman's (1988) view of social capital focuses on the risks associated with incomplete information and the benefit of network closure. Closure is about closing ranks with like-minded people and the advantages that go to people in a cohesive group. In stark contrast to the closure argument, the structural holes argument is about advantages that go to individuals who build bridges across cohesive groups. Brokerage is

explicitly about action that cuts across and fills structural holes in the current social structure (Burt, 2000). The tension between these two opposing views of how networks create social capital was the basis for this study.

In summary, when considered in the context of higher education publications, academic scholars who have social capital may be more successful in publication and therefore more influential (Friedkin, 1998; Stokes & Hartley, 1989) in the field. The issue then became which co-authorship network structure provided more social capital in terms of the total number of publications. These two co-authorship structures created the potential for other related network structures.

Based upon these two competing co-authorship structures, the first phase of this study identified the co-authorship structures of academic scholars in the field of research and scholarship on higher education through network analysis. As demonstrated in Figure 3, five co-authorship structures were identified: independent, structural holes, cohesive, middle or complex. Each author's network structure was calculated and then their structures were categorized. The research found that the network structure prescribed by Burt was much more effective in producing articles than the network structure prescribed by Coleman, academic scholars in the Structural Holes Group produced roughly twice as many articles per person as the Cohesive Group.

The second research phase examined two hypotheses regarding their association with publication success. Hypothesis 1a regarding cohesion was not supported by the regression analyses. The only aspect of cohesion that was positively related to Total Publications was the Mean Strength of Ties within the egocentric network. However,

mean strength of ties is only one aspect of cohesion as it does not capture the density of relationships between co-authors. .

Hypothesis 1b regarding structural holes was supported by the regression analyses. In addition, given that mean tie strength, generally associated with cohesion, was also positively associated with total publications, this finding may suggest that a type of symbiotic relationship may actually exist between structural holes and cohesion. Thus, in terms of total publications, this finding suggests that filling structural holes—a network structure that spans across the larger network and provides authors with a greater variety of co-authors—was even further enhanced when there were also multiple publications with the same co-authors. Thus, an ideal hybrid network structure may combine structural holes and cohesion. This dual co-authorship network structure of both structural holes and strong ties may be the structure that was reflected in the Complex group. The data suggested that co-authoring multiple times with the same scholars (mean tie strength) may be critical to realizing the potential value buried within the structural holes (Burt, 2001).

Clearly, however, the top publishers' demonstrated structural holes and complex co-authorship network structures. However, so few authors actually demonstrated this type of network structure (n=3 of 810) that this may represent a difficult and delicate balance of utilizing competing strategies. The question is raised as to whether increased awareness regarding the potential of this co-authorship network structure for publications could be the catalyst for future academic scholars to pursue a complex strategy.

This empirical evidence consistently supported the structural holes argument over cohesion. The addition of the potential for the dual complex co-authorship strategy is also mirrored by Burt's (2001) comment as follows:

In short, structural holes and network closure can be brought together in a productive way. The integration is only with respect to empirical evidence. The mechanisms remain distinct . . . the empirical evidence supports the hole argument over closure. However, my summary conclusion is that while brokerage across structural holes is the source of added value, closure can be critical to realizing the value buried in the structural holes. (p. 25)

In academics generally, instrumental collaborative relationships are quite possibly motivated by a direct need to generate research and publications (Dickens & Sagaria, 1997). To that end, if academic scholars were empowered with the knowledge of what type of co-authorship relations to pursue, they may be able to successfully develop an even more effective pathway to increasing total numbers of publication. The question begs further research given that the results from this study are limited to this population. Yet the potential to develop a more efficient generalizable strategy has become apparent.



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