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**A Capital Investment: The Effects of Teacher Human and Social Capital on Student Achievement in Improving Schools**

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**UNDER REVIEW SCHOOL EFFECTIVENESS AND SCHOOL IMPROVEMENT**

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## **A Capital Investment: The Effects of Teacher Human and Social Capital on Student Achievement in Improving Schools**

As accountability policies worldwide press for higher student achievement, elementary schools across the globe are enacting a host of reform efforts with varied outcomes. Mounting evidence suggests reforms that support greater collaboration among teachers may enhance the resources available in a school to support increased student learning. In this study, we argue that multiple types of resources/capital are important in the process of school reform and increasing student outcomes. In exploring this idea, we draw on human and social capital, and examine the influence of these forms of capital on student achievement using social network analysis and hierarchical linear modeling. Our results indicate that teacher human and social capital separately have a significant and positive relationship with student achievement. Moreover, both teacher human and social capital *together* have an even stronger effect on student achievement than either human or social capital alone.

**Keywords:** Human Capital; Social Capital; Social Networks; Student Achievement; Collaboration

*The idea of a school as a learning community suggests a kind of connectedness among members that resembles what is found in a family neighborhood, or some other closely knit group, where bonds tend to be familial or even sacred.*

Sergiovanni, 1992, p. 47

Successful elementary school reform, as Sergiovanni suggests, seems to require close collaboration and especially trust among teachers in support of student achievement (Bryk & Schneider, 2002). If schools are to be learning communities, teachers must draw on these trusting relations to enhance critical content and pedagogical information as well as support the flow of knowledge throughout the entire school. Reform efforts have focused more on providing opportunities for teacher collaboration and the creation of professional learning communities especially at the elementary level (Stoll & Louis, 2007). Mounting evidence suggests that grade level or interdisciplinary communities can achieve greater collaboration, joint productive work, and exchange of knowledge that enhances student learning (Lomos, Hofman, & Bosker, 2011; McLaughlin & Talbert, 1993; Stoll & Louis, 2007; Wood, 2007). However, the flow of knowledge resources in elementary schools may be limited given long-held traditions of teacher autonomy and isolation (Bakkenes, Imants, & De Brabander, 1999; Little, 1990). This autonomous practice often restricts the flow of individual knowledge ('human capital') and the social interaction ('social capital') necessary to lead to improved teaching and learning (Chrispeels, Andrews & Gonzales, 2007; Feiman-Nemser, 2001). In this paper we explore how human and social capital may be individually and collectively associated with student achievement outcomes.

Reform efforts that stimulate teacher interactions to improve student achievement are typically implemented using a variety of formal structures and accountability levers meant to increase a teacher's knowledge base and ultimately improve performance. This focus on

developing the individual knowledge of teachers has shown results and is often thought of as an investment in “human capital” (Smylie & Hart, 1999). With the current emphasis on developing teachers’ individual human capital, while necessary and well documented, there has been less attention to the way in which teachers share and access one another’s human capital, thought of as “social capital”, in which social interactions support the flow of knowledge (Coburn & Russell, 2008; Penuel, Riel, Krause & Frank, 2009). Educational scholars around the world acknowledge the importance of teachers’ social interaction for reform (Carmichael, Fox, McCormick, Procter & Honour, 2006; Hopkins & Reynolds, 2001; Authors, 2011) and more recently, but still understudied, the association of those relationships to achievement (Andrews, 2005; Authors, 2010; Authors, 2012; Pil & Leana, 2009;). Therefore, understanding patterns of interactions between elementary teachers as they share and access knowledge in support of student learning is important as these social ties may have influence on achievement (Pil & Leana, 2009).

In this study we seek to understand human and social capital as two concepts that may, both separately and in synergy, support student achievement. We assess the human and social capital of 90 teachers and the achievement of over two thousand students within five elementary schools as these schools engage a district-wide effort at reform. Our exploratory case study takes place in the Avaluar Elementary School District, an urban fringe district in the United States that is in the third year of progressive governmental sanction for underperformance. The district has undertaken a system-wide reform effort aimed at improving teacher knowledge related to reading comprehension to improve student achievement. In this paper, we aim to determine how human capital (in terms of teachers’ accumulated experience), and social capital (in terms of teachers’ social interactions around reform), may be associated with student achievement in English

Language Arts.

### **Theoretical Framework**

In our theoretical framework we argue that human and social capital both separately and together are important in understanding student outcomes. In this section we outline human capital, social capital, and their potential relationship with student achievement.

#### *Human capital*

The importance of having a skilled teacher workforce has been reinforced in policies around the world, for instance in the U.S.A. where No Child Left Behind (2001) calls for well-trained teachers and the provision of high quality professional development. Similarly, educational policies in the U.K. (e.g., Department of Education, 2010), The Netherlands (e.g., Ministry of Education, Culture and Science, 2011), and Australia (e.g., Department of Education and Training, 2004) foreground the importance of educator human capital by emphasizing teachers' skills, knowledge, and experience as cornerstones of strong educational systems. Human capital can be defined as "an individual's cumulative abilities, knowledge, and skills developed through formal and informal experiences" (Pil & Leana, p. 1103). Through these acquired skills and capabilities, an individual is able to act in new ways (Coleman, 1988). For teachers in particular, human capital is often conceptualized as teachers' accumulated personal and professional knowledge and skills, which encompasses aspects such as general instructional skills, pedagogical content, and subject matter knowledge (Grossman & Richert, 1988; Shulman, 1986; Tamir, 1991).

Research on teacher development has indicated that teachers who have accumulated

human capital through formal teacher preparation programs have acquired essential knowledge, tend to be more effective, and are more likely to remain in their positions (Darling-Hammond, 2000). However, initial training is not sufficient, and beginning teachers often find, "...they must demonstrate skills and abilities that they do not yet have and can only gain by beginning to do what they do not yet understand" (Feiman-Nemser, 2001, p.1027). In other words, it takes time in the profession to develop the necessary craft and content knowledge necessary to be an effective teacher (Kennedy, 2002). School systems often aim to support teachers' human capital by offering opportunities for professional development in an effort to increase student achievement (Baker-Doyle & Yoon, 2010; Kilburn & Karoly, 2008; Milanowski, Heneman III, & Kimball, 2011).

Teachers' human capital has received ample attention as a key ingredient for successful school reform, improved teacher quality, and ultimately, increased student achievement (Cohen & Hill, 2001; Darling-Hammond, 2004; Milanowski et al., 2011). Research on teacher effects on student outcomes suggests that teachers' human capital is critical to student achievement (Spillane & Zuberi, 2009; Sanders & Horn, 1998). For instance, Pil and Leana (2009) found that students' mathematics performance was related to teacher ability to teach mathematics, as reflected in teachers' formal education as well as years of experience in the profession and perceived ability to teach mathematics. As such, human capital that teachers accrue over time through experience with both formal and on the job professional development encompasses explicit and codified knowledge (e.g., strategies for improving instruction embedded in the teacher's manual or other text) and implicit or tacit knowledge acquired through years of daily practice in the classroom (Edvinsson & Sullivan, 1996; Nahapiet & Ghoshal, 1998). With codified knowledge often being introduced through more formal forms of professional

development and tacit knowledge through more informal means such as social interaction and teachers' reflections on classroom experiences, the resulting human capital has been marked as an important ingredient of teachers' ability to affect student performance (Ball & Cohen, 1999; Pil & Leana, 2009; Sanders & Horn, 1998; Sanders & Rivers, 1996; Spillane & Zuberi, 2009; Taylor, Pressley, & Pearson, 2000). Given the documented relationship between teachers' accrued human capital through experience and student outcomes we propose the following hypothesis:

H1: Teacher human capital as measured by teachers' years of experience as an educator, experience in current position, and experience at a particular school will be positively associated with student achievement.

Although human capital is considered as an individual property, human capital development, as suggested earlier, often occurs through social interaction. Coleman (1988) in particular has noted that the potential or opportunity to enhance human capital is dependent on the access to social capital. Teachers can improve instructional practice through a process of interaction and relationship building (Supovitz, Sirinides, & May, 2010; Wei, Darling-Hammond, Andree, Richardson & Ophanos, 2009). The significance of collaborative structures and social networks for successful school improvement and continuous teacher development is well recognized. Studies of educational reform and school change across the globe, such as Australia (Hollingsworth, 2004), the Netherlands (Authors, 2010; Authors, in press), Portugal (Lima, 2009), Uganda (Hite, Rew & Nsubuga, 2006), the United Kingdom (Earl & Katz, 2007; Hopkins & Reynolds, 2001; Carmichael et al., 2006), and the United States (Authors, 2010, 2013; Pil & Leana, 2009) illustrate the importance of collaboration and the development of social capital among teachers. In further theorizing the importance of teachers' social

relationships for student achievement we draw on the concept of social capital.

### *Social capital*

Social capital is concerned with the resources that exist in social relations ('ties') between individuals as opposed to the resources of a specific individual (human capital). Lin (2001) points out that the common denominator across social capital theorists is the understanding that social capital consists of, "The resources embedded in social relations and social structure which can be mobilized when an actor wishes to increase the likelihood of success in purposive action" (p. 24). The structure and quality of those relations ultimately determine opportunities for social capital transactions and access to resources (Burt, 1992; Coleman, 1988; Granovetter, 1973; Putnam, 2000). Social capital is therefore composed of a system of social relations through which the resources of other individuals can be accessed, borrowed, or leveraged to achieve a change or benefit for the individual or the collective (Lin, 2001).

The role of social ties has been implicated as both supports and constraints in the process of organizational change, learning, and improvement (Balkundi & Kilduff, 2005; Kilduff & Krackhardt, 2008; Leana & Van Buren 1999; Mehra, Dixon, Brass & Robertson, 2006; Weinbaum, Cole, Weiss & Supovitz, 2008). This literature suggests that the structure of social ties in social networks can support organizational goals by facilitating the flow of information between individuals and overcoming problems of coordination (Adler & Kwon 2002; Tsai & Ghoshal 1998). Research further suggests that strong reciprocated ties within and across a network have been associated with initiating and sustaining change efforts (Authors, in press; McGrath & Krackhardt, 2003; Tenkasi & Chesmore, 2003). However, strong ties may also constrain organizational change as such ties may over time be prone to recycling redundant information and restrict opportunities for the development of novel connections. In addition,

networks of negative or difficult ties (e.g., gossip, avoidance, dislike) may exclude individuals from the transfer of knowledge and information and be even more consequential for (lack of) organizational improvement than positive relationships (Authors, 2013; Labianca & Brass, 2006). As such, teachers' social capital may be influential as it reflects the supports and constrains of teachers' social relationships through which they may access resources to strengthen their practice (e.g., Authors, in press; Authors, 2011; Pil & Leana, 2009).

Understanding and drawing on social capital resources may be of particular use as elementary schools and districts attempt to enact reform strategies as a way to meet student achievement targets. Although it has been recently suggested that more work needs to be done to explore teacher networks (Coburn & Russell, 2008; Authors, 2010; Penuel et al., 2009), there are few studies that examine the social networks of teachers in reform and even fewer that explore these networks in underperforming elementary schools and their relation to student outcomes (Authors, in press). Our exploratory study builds on recent scholarship emphasizing the importance of understanding relational linkages in support of organizational outcomes (e.g., Balkundi & Kilduff, 2005) as well as those that suggest the importance of these links in terms of student outcomes (Pil & Leana, 2009). To explore teachers' social capital, we build on current work that employs a social network perspective to understand teachers' social interactions (e.g., Penuel et al., 2009; Spillane, Frank, & Kim, 2012).

A social network perspective foregrounds the importance of the pattern of relational linkages among actors for the flow of resources (e.g., information, social support, instructional materials) among these actors (Burt, 1992; Lin, 2001). Social networks are often studied at the level of the overall network as well as the individual actor. An examination of an individual actor's social network position offers insights into the resources that this actor has access to by

virtue of social relationships with others in the network, which may eventually support or constrain individual action (Brass & Burkhardt, 1993; Burt, 1982, 1992).

An individual actor's social network position is therefore often assessed by the number of people an actor seeks for resources (as reflected in the measure of out-degree) and the number of people who seek that actor for resources (as reflected in the measure of in-degree). Actors that have many connections in the network, and as such can be characterized as being "active" (high out-degree) or "popular" (high in-degree) in the network, are described as occupying a more central position in a social network, and therefore may have disproportional influence in the network through their increased access to, and opportunities to leverage, resources (Burt, 1992; Lin, 2009; Authors, 2010; Hanneman & Riddle, 2005; Wasserman & Faust, 1994, 1998). In sum, teachers who occupy more central network positions (more social capital) may have increased access to resources (e.g., information, reform-related knowledge and materials) that may support them in improving student performance (e.g., Authors, 2011; Penuel, Riel, Joshi, Pearlman, Kim, & Frank, 2010; Pil & Leana, 2009).

In addition, an actors' social network position can also be assessed by examining the extent to which their relationships with others are reciprocated (Burt, 1992; Ghoshal & Moran, 1996; Nahapiet & Ghoshal, 1998). Reciprocal relationships may reflect "stronger" relationships than unidirectional relationships (Coleman, 1988), and are suggested to play an important role in supporting sustainable change efforts in organizations (McGrath & Krackhardt, 2003; Tenkasi & Chesmore, 2003) and school systems (Authors, 2012). However, as mentioned previously, such "strong" ties may also come at a cost of constraining individual's actions and access to novel resources given the social pressures involved in such strong relationships (Burt, 1992; Granovetter, 1973; Krackhardt, 1999; Simmel, 1950). Given the limited empirical evidence on

the role of teachers' reciprocal relationships in supporting student achievement, we underline the importance to increase our understanding of the relationship between teachers' relational reciprocity and student outcomes. Therefore, given the importance of social capital and its potential relationship to outcomes we propose the following hypothesis:

H2: Teacher social capital as measured by a teacher's position in a social network (in/out-degree and reciprocity) will be positively associated with student achievement.

### ***Human and social capital***

In addition to their separate influence, scholars have argued that a combination of human capital and social capital co-evolve and may jointly affect organizational outcomes (e.g., Nahapiet & Ghoshal, 1998; Pil & Leana, 2000; Zuckerman, 1988). In examining the potential interplay of human and social capital in support of student achievement, we conceptualize this synergy as reflecting the sharing, exchange, and combination of knowledge that occurs in a socially bounded community leading to the creation of new intellectual resources and action not necessarily possible by individual actors alone (e.g., Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998).

Critical to achieving student improvement are coherent changes in instructional practices that are aligned across grade levels (Newmann, Smith, Allensworth & Bryk, 2001; Schmidt, Chi Wang & McKnight, 2004). In elementary schools, collaborative settings such as grade level meetings, peer observations, and team teaching offer the opportunity for such exchanges and sharing of tacit or craft knowledge (Geijsel, Slegers, Stoel & Krüger, 2009; Horn & Little, 2010; Kennedy, 2002; Spillane, 2006). Knowledgeable and experienced teachers (those with robust human capital), working in collaborative settings with ample exchange of information (social capital), create the potential of improved outcomes (Nahapiet & Ghoshal, 1998). For both

human and social capital to be applied to instructional issues, organizational members must perceive that through sharing, exchanging, and collaborating in the generation of knowledge both the individual and collective will benefit (Nahapiet & Ghoshal, 1998). In other words, learning is situated and occurs in a social network of individuals in which there is an interdependence of individual and social processes in the co-construction of knowledge (Datnow, Lasky, Stringfield & Teddlie, 2006; Gallucci, 2008; John-Steiner & Mahn, 1996). This mutually reinforcing aspect of learning between individual and the community offers the opportunity for simultaneously transforming the individual through internalization of new knowledge and the practices of the collective through the exchange and combination of information (John-Steiner & Mahn, 1996). For example, Andrews (2005) found that when elementary teachers engaged in joint productive work (e.g. collaboratively creating and co-teaching a lesson), changes in instructional practices by individual teachers occurred and student learning was affected. In this way, value and benefit is generated for both the individual and collective.

The interplay of human and social capital may offer a plausible explanation of how teachers who are exchanging knowledge around an instructional focus may develop new insights and instructional practices that benefit student outcomes. School improvement requires social capital to be nurtured, enabling teachers to share and combine their individual human capital to effectively translate and mobilize that knowledge for action. According to Hargreaves (2001), “low social capital among teachers entails lack of trust and networking among colleagues, who thus fail to share their pedagogic knowledge and skills, derived from research evidence or personal experience” (pp. 492-493). As such, teachers’ learning is influenced not only by individual education, experiences, and actions (human capital), but also by social interactions that facilitate access to knowledgeable colleagues and reciprocity in the exchange of individual

knowledge (social capital) (Coleman, 1988; John-Steiner & Mahn, 1996).

While this literature offers strong suggestions for the synergy between human and social capital, there is a dearth of empirical research on how this interplay between teachers' human and social capital may support teaching practice and increased student performance, specifically in educational contexts that are undergoing reform (Baker-Doyle & Yoon, 2010; Coburn & Russell, 2008; Authors, in press; Authors, 2011; Penuel et al., 2010; Pil & Leana, 2009). In a recent study in education, Pil & Leana (2009) found that teachers' individual human capital (their experience and ability to teach) was positively related to student achievement, and that this relationship was dependent on the social capital (density and strength of relationships) in their grade level teams. In other words, teachers with increased access to resources in their grade level team may be better equipped to use their knowledge and skills to influence student achievement than teachers in grade levels that are characterized by lower exchange of resources.

Extending this work, we argue that teachers' human and social capital may collectively affect student achievement to a greater extent than either forms of capital separately. Teachers' social capital (i.e., their network position) may impact student achievement above and beyond the influence of human capital (i.e., their accumulated knowledge through experience). Increased outcomes may come when those who possess unique knowledge interact with others, combine their knowledge, and yield a blend of ideas that supports new understanding or alternate points of view. This new knowledge creates the potential for teachers to take collective action and bring about changes in practice, which converts knowledge to value and benefit for students, teachers, and schools (Bolívar & Chrispeels, 2010; Edvinsson & Sullivan, 1996; Olsen & Chrispeels, 2009). Given that the literature suggests the potent combination of human and social capital, we hypothesize the following:

H3: Teacher human capital and social capital together will be positively associated with student achievement more than either human or social capital separately.

## **Methods**

### ***Context and sample***

We selected the Avaluar Elementary School District (AESD), an urban fringe district in Southern California USA. This district is in the third year of sanction from the federal government for underperformance. In response to this underperformance, this particular district has been enacting a district-wide reform effort around reading comprehension for the past two years. Avaluar typifies systems in the USA and perhaps globally that have enacted multiple reform initiatives in order to meet accountability mandates and increase student performance. Currently, 18,745 students in kindergarten through eighth grade are served in 24 schools in the elementary district. As such the district represents the student diversity found in many schools across California (the most populous state in the USA). The district-wide reform focus on reading comprehension was induced by Avaluar's underperformance with low achievement scores in English Language Arts (ELA). The following aspects are part of the reform: a district-wide literacy curriculum, professional development of leadership teams in instructional strategies for reading comprehension, and a commitment for a multi-year sustained effort. The overall aim of the reform is to ensure access to high quality literacy instruction and improve student performance by providing a consistent approach across all elementary schools in the district.

As part of a university intervention program we randomly selected the five elementary schools in our sample. They each comprise grades kindergarten (age of students 5 years) through

fifth grade (age of students 10-11 years). With regard to socio-economic background and academic performance levels, the schools are reflective of the range of schools in the district. Table 1 provides the demographic data for the district and sample schools as well as the Academic Performance Index (API) score. API is a California state measure of a school's academic performance on a scale of 200-1000 with 800 as a target of minimum desired performance. As the school level data suggest, these elementary schools are relatively similar to one another in terms of overall demographics as well as being within range of overall district averages.

Insert Table 1 About Here

We had an 86% response rate on our survey representing five schools and 90 teachers reflecting grades second through fifth, as those are the grades that are tested using the California Standards Test of English Language Arts (CST ELA). Table 2 provides the overall teacher demographics. The demographics of the sample suggest that most staff have been in education and at their own schools for a relatively long period of time, suggesting ample opportunity to develop human capital related to the local context.

Insert Table 2 About Here

We also collected student level data from 2114 students in grades second through fifth grade (see Table 3). As can be seen in Table 3 the sample was evenly distributed across grade levels. The only area of note is the CST ELA score for the third grade, which is significantly lower than the other grade levels. This finding was consistent with results across the state of California for the 2008 test administration (CDE, 2008).

Insert Table 3 About Here

### ***Data collection***

#### *Independent variables: teacher human capital.*

In assessing human capital, we draw on previous work (Authors, in press; Pil & Leana, 2009) that suggested years of experience serves as a proxy for human capital. This is based on the assumption that a teacher who spends more time in a specific context will have the opportunity to learn more from contextual experiences and attend more local professional development seminars and trainings. In this study we assessed a teacher's human capital through years of educational experience. Albeit incomplete, we use this proxy for knowledge accumulated over time to represent teachers' human capital, as we did not have access to a measure that could more specifically assess teachers' complete accumulated knowledge and experience. We also considered including alternative proxy measures such as teachers' formal (advanced) degrees, and national board certifications, but based on previous work (Pil & Leana, 2009; Sigler & Ucelli Kashyap, 2008) we selected teachers' years of experience as our human capital measure. To reflect the breadth of teachers' experience and development, we included three measures for teachers' experience, namely *years as an educator*, which reflects overall teaching experience; *years in position*, which reflects experience teaching in the same role; and *years at the same school*, which reflects "local context knowledge" and potential exposure to the ongoing mandatory professional development at each school (Authors, in press).

#### *Independent variables: teacher social capital*

In collecting data on the *social capital* in AVALUAR, we developed an online social network survey. Social network questions were generated from previous social network research (Author, 2009; Author, 2010). Here we focused on sharing knowledge about reading comprehension as

this network question was most directly related to the reform effort. The network was generated by the prompt, “Please select the frequency of interaction with teachers with whom you share knowledge around reading comprehension...”. Respondents were asked to indicate the frequency of their interaction on a 4-point scale ranging from 1 (1-2 times in six months) to 4 (1-2 times a week). A roster with teachers from their schools in rows and the frequency of interactions for each relationship in columns was presented to the respondents. A bounded method provides a more complete picture of the network and thus supports valid results and is an often used social network data collection strategy (Scott, 2000).

The focus of analysis was put on *most frequent* ties, meaning interactions that occurred from two to four times a month (3 and 4 on the rating scale). We selected the most frequent ties as research has shown that respondents are more accurate at identifying ongoing patterns than determining occasional interactions (Carley & Krackhardt, 1999). Additionally, the dissemination of more complex information may be the result of stronger links as the result of the most frequent interactions and as such these frequent links may best support student achievement (Authors, in press).

Using the social network data, we calculated several network measures using the UCINET software (Borgatti, Everett & Freeman, 2002) reflecting each teacher’s interaction pattern around reading comprehension. All of the network measures were normalized to facilitate comparisons between schools, and categorized into three levels: none, mid-range, and high.

*Indegree* and *outdegree* were calculated as the actual number of relationship nominations that a teacher receives (indegree) or the actual number of relationship nominations that a teacher makes (out-degree) divided by the maximum possible of ties in a school. Normalized in-degree and out-degree are expressed as a percentage, and can vary on a scale of 0 (the teacher has no in-

and out-going relationships and occupies a marginal position in the social network) to 100 (the teacher initiates all the in- and outgoing ties and occupies a central position in the network).

We computed the measure of *ego-reciprocity* to examine the extent to which a teacher's relationships are mutual or uni-directional. Normalized ego-reciprocity was calculated for each teacher as the percentage of reciprocated ties relative to the total number of ties to and from that teacher. An ego-reciprocity score of 0 indicates that an individual has no mutual relationships, while 100 means that all relationships with an actor are reciprocated.

For the social capital measures of in-degree, out-degree, and ego-reciprocity we created three categories (no ties, mid range, and high, each representing roughly a third of the population, see Table 2) because social network data is usually not normally distributed. The means and standard deviations for the network measures are included in Table 2.

*Dependent variable: student performance.*

We used the California Standards Test of English Language Arts (CST\_ELA) to determine student level achievement from the Spring 2008 administration for 2114 students in grades 2-5 of the five sample schools. The test draws on a multiple-choice format and produces a series of scale score cut point scores indicating performance levels (CDE, 2008). The scale scores for each grade and subject area range between 150 (low performance) to 600 (high performance). For the Spring 2008 administration, a score of 350 reflected proficiency for students at all grade levels.

*Control variables: student level controls.*

In these analyses we controlled for student grade level (2<sup>nd</sup> vs. 5<sup>th</sup>, 3<sup>rd</sup> vs. 5<sup>th</sup>, and 4<sup>th</sup> vs. 5<sup>th</sup>) as well as special education status. Of our sample, approximately 7% of the students were enrolled in some sort of special education instruction. In addition to these variables, we controlled for

number of days absent in school, and a proxy of socio-economic status (SES) by employing a dummy variable to capture if students received free or reduced-cost lunch.

### *Data analysis strategy*

To examine our hypotheses, we applied multilevel analysis (HLM). In this way we were able to account for the nested structure of our data (students of teachers in schools). In addition, we created a graphic representation of the reading comprehension network using Netdraw (Borgatti, 2002), which provides a visual image of the network and illuminates overall relational and achievement patterns to graphically understand the data.

### **Results**

First, we ran a series of Pearson correlations to explore our hypotheses regarding the relationships between human capital, social capital, and student achievement (see Table 4). Results indicate that a teacher's experience measured by years at school, years in position, and years as an educator were positively and significantly correlated with the CST-ELA. These findings suggest a relationship between teacher human capital and student achievement, meaning the more years of experience a teacher reports the higher the student achievement. We also found a positive and significant association between indegree and student achievement (.22,  $p < .05$ ), indicating the more a teacher was sought for knowledge about reading comprehension, the greater the student achievement on the CST-ELA. We did not find any statistically significant relationships between the other social capital measures (outdegree and reciprocity) and achievement. Finally no significant relationships were noted between the human and social capital measures indicating they are assessing unique aspects of teacher capital.

Insert Table 4 About Here

As our data are nested (students in classrooms in schools) we used three-level hierarchical linear modeling (HLM) using grand mean centering to test our hypotheses (Raudenbush, Bryk, Cheaon & Congdon, 2004). We examined the impact of teacher human and social capital on student achievement using the CST ELA scores as the outcome measure. The HLM models are reported in Table 5.

Insert Table 5 About Here

Model 1 examined the impact of student level demographics on student achievement. We found that special needs students had significantly lower CST\_ELA scores compared to students with no special needs (-30.95,  $p < 0.01$ ). We also found that students who were enrolled in free/reduced-cost lunch program (low SES) had significantly lower CST\_ELA scores compared to students who were not enrolled in free/reduced-cost lunch program (-20.80,  $p < 0.001$ ).

***The effect of human capital on student achievement.***

Model 2 showed that teacher gender, while not significantly affecting student achievement, did slightly improve the model compared to Model 1 ( $\chi^2_{(2 \text{ vs. } 1)}(1) = 6.2$ ,  $p < .05$ ). In Model 3, we added three teacher human capital measures. Model 3 showed strong support for the effects of years in position (1.46,  $p < .05$ ) on student achievement and as such our first hypothesis can be confirmed.

***The effect of social capital on student achievement***

We then examined the effect of three social capital measures (reading comprehension indegree, outdegree, and reciprocity) on student achievement. Outdegree and reciprocity are not reported

as they were not significantly associated with student achievement, did not affect the model parameters, nor improve the overall model. Model 4 therefore included one social capital measure of *indegree*. This model rendered a positive significant effect of teachers' *indegree* (high vs. none) on English Language and Arts test scores (16.96  $p < .05$ ). No significant effect was found for low/medium vs. none *indegree* comparison.

***The total effect of social and human capital on student achievement.***

In Model 5 both social capital and human capital measures were included. When we compared Model 5 against Models 3 and 4, we found support for the third hypothesis – both types of capital together provide a better relationship than using either one, human capital or social capital (for social capital:  $\chi^2$  (5 vs. 3) (2)=4.07,  $p < .05$ ; for human capital:  $\chi^2$  (5 vs. 4) (3)=2626.2,  $p < .001$ ) suggesting their collective influence on student achievement.

While the HLM provides the statistical analysis of our data, the results can also be portrayed graphically, which suggests what the results may mean for a representative elementary school in our study. The sociogram in Figure 1 displays the pattern of relationships of teachers who interact from two to four times a month around reading comprehension from a representative school in the study. This school was chosen because it reflects the same pattern across the other schools. The nodes are organized by grade level with second grade at the bottom and moving clockwise order ending in the fifth grade team<sup>1</sup>. The nodes in this figure are sized by *indegree* (larger size indicates more incoming ties) and are colored by achievement rankings (the lighter the color, the higher the achievement). In addition, the nodes are 'shaped' by a human capital measure of 'years in school' with similar shape meaning same years within the school;

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<sup>1</sup> Only grades 2-5 are included as they are the only grades assessed using the CST ELA

diamonds refer to those in the schools the longest (13 years and greater); followed by up triangles (8-12 years); and down triangles (less than 7 years). The lines are sized by reciprocated relationships with thicker lines representing reciprocated relations.

Insert Figure 1 About Here

The sociogram illustrates that those teachers with more experience at the school, thus more human capital (diamonds) are often the nodes with higher student achievement (lighter in color). In addition, those teachers who have more incoming ties, thus more social capital (larger shapes) are typically the ones with higher student achievement outcomes (lighter in color). However, what is also clear from this sociogram is that grade levels have different levels of human and social capital and that those resources are not evenly distributed across grade levels, which was the same pattern across all schools. For example, over one-third of the teachers in the fifth grade team have been at the school less than seven years and there are few ties within that grade level around reading comprehension. Moreover, there are no teachers in that grade level whose students scored at proficient and above on the CST ELA. This work suggests that independently and in combination both human and social capital have a relationship with student achievement. In the following section we will discuss these results in terms of implications for research, practice, and policy.

## **Discussion**

As more schools across the globe adopt structures for teacher collaboration and the development of learning communities, there is a need to better understand how schools may capitalize on these opportunities in ways that yield improved student learning. For purposes of this study, we argued that teachers' human and social capital are important elements in the process of teaching

and learning. Drawing on research from multiple fields we postulated that individual knowledge and experience (human capital) as well as opportunities for social interactions (social capital) are related to student achievement, both separately as well as collectively. By examining human and social capital we were able to better understand the individual and additive relationship each of these forms of capital may have with student achievement. Our results suggest that human capital in the form of length of time at a school has a significant and positive relationship with student achievement. Social capital as measured by high indegree (colleagues being sought for knowledge) was also significantly and positively associated with higher student achievement. Moreover, both human and social capital together proved an even stronger model than human and social capital individually. Overall this work suggests that the critical foundational elements of human and social capital are individually and collectively associated with student achievement. In the following paragraphs we will discuss each of the major findings and their potential implication on the work of improving student achievement.

### ***The role of human capital in supporting student achievement***

Similar to other scholars (Authors, in press; Pil & Leana 2009), this study found that years in current position was associated with higher student achievement on standardized English Language Arts tests. This result suggests that similar to other professions, teachers learn by doing and that time in a specific context may be critical in developing the needed craft knowledge to effect student achievement. Teachers with more experience in a specific context are likely to have more knowledge about a student population as well as experience in teaching academic content. Given this knowledge and experience, these teachers may also have a better handle on instruction and be able to incorporate new instructional knowledge provided through professional development (Parise & Spillane, 2010; Penuel, Fishman, Yamaguchi & Gallagher,

2007; Wei et al., 2009).

The findings from this study around human capital also echo the conclusions of other researchers (Author, 2009; Mintrop, 2004; Author, 2010) who have been examining the deleterious effects of teacher turnover in urban and underperforming schools. One of the biggest concerns in the high rates of turnover is that the local craft knowledge that supports student achievement is lost when a teacher leaves a particular school site. As our data suggests the length of time a teacher spends at a particular school site is associated with student achievement, but that skill set takes a number of years to develop. If teachers leave the school site after a few years of teaching then the opportunity to develop those context related instructional skills may be inhibited. Therefore, this work provides additional support for maintaining a consistent teaching staff in improving schools in order to allow for the development of teacher knowledge and instructional skill sets (Authors, in press). Our results add to growing body of literature that a variety of aspects of teacher quality are important to student learning (Rivers & Sanders, 2002; Sanders & Horn, 1998).

### ***Role of social capital in improving student achievement***

This study's findings also indicate that social capital has a significant relationship with higher student achievement. We explored the structural aspects of social capital (indegree, outdegree, and reciprocity) related to reading comprehension. We found no significant relationship between outgoing ties or reciprocity and student achievement. This may suggest that just seeking knowledge or just mutually sharing is not sufficient to impact achievement, as seeking without application or just sharing may be unlikely to alter practice. Research suggests that simply seeking knowledge does not result in its use and to actually change instructional practices, more intense engagement and joint work is needed (Andrews, 2005; Chrispeels et al., 2007; Little,

2003). In contrast, those who are frequently (2 – 4 times a month) sought for knowledge around reading comprehension were associated with higher levels of student achievement in terms of English Language Arts. This suggests that those teachers who play central roles in the reading comprehension network may also be those who are likely to obtain increased student outcomes.

These central actors are not only important in a network sense, but may also serve as sources of expertise and movement of resources related to reform. In understanding the result of indegree being associated with student achievement, research around reciprocal teaching with students may provide some insight (Spörer, Brunstein, & Kieschke 2009). As teachers repeatedly come to knowledgeable others around reading comprehension, the request for knowledge may set up an iterative and reinforcing cycle of improvement most noticeably for the teacher who is sought for knowledge. Through the process of sharing knowledge the teacher who is sought may engage in a metacognitive process as she explains her work to her colleague. This process may enable the teacher who is sharing to refine their knowledge and understanding related to reading comprehension. This idea may be most closely associated with the concept that “when you teach you learn.” This suggests that providing teachers the opportunity to “teach” others what they know may directly improve their students’ outcomes, but may also result in secondary “learning” benefits to others as has been suggested in the professional development literature (Wei et al., 2009). Therefore, carefully auditing the expertise that resides in a school and providing opportunities for teachers to play a central role in a variety of networks related to instruction may provide direct benefit for the students of the central teacher.

It should be noted these results were different than our previous work in which we found a positive relationship between outgoing ties and student achievement on an interim benchmark assessments (Authors, in press). The difference may be explained by the fact that in this study,

we used the more summative student achievement measure (CST-ELA), while the former study examined a more formative assessment, suggesting that different types of relationships (seeking vs. being sought for advice) may have differential relationships with alternative ways of measuring student achievement. Looking across both studies suggests that not only are incoming relationships important, as indicated in this paper, but outgoing ties are important for another type of student achievement. Taken together this suggests that providing opportunities to both seek and be sought for knowledge will be important in a more complete student achievement picture.

### ***The total role of human and social capital***

Our results suggest that human and social capital together are important for student outcomes. This potent combination of human and social capital is critical and highlighted by learning theorists who offer that in building communities of practice both elements must be present (Engeström, 1996; Lave & Wenger, 1991; Rogoff, 1994; Tharp & Gallimore, 1988; Vygotsky, 1978). In the educational improvement literature much has been written about the importance of human capital, but less so about attending to the social elements in educational change (Author, 2010). Our findings suggest that a focus around improving student outcomes must include both human and social capital elements as these forms of capital together yielded significant associations with student achievement above individual elements .

### ***Implications for policy***

We have outlined a few issues for practice based on our findings. However, we think that our work also has potential implication for teacher evaluation and accountability policy especially in light of our early grade level results presented in the representative school sociogram. One of the

most discussed and debated element related to teacher effectiveness is the “amount of value” a teacher adds to the achievement of a student (Harris, 2011). This idea is hotly contested and includes vigorous debate around issues of testing, measurement, and what is considered “important” in terms of student learning. One major assumption underlying the idea of “value-added”, as typically construed, is that student achievement is the result of the interaction between teacher knowledge/training/experience; ability to effectively teach content; and previous student performance, and that that combination can be captured in a measure (Harris, 2011). In this sense, a teacher’s ability to “add-value” is a very individualized undertaking determined almost exclusively by the human capital, or training, knowledge, and skills, of the individual teacher and the demographics of the student (McCaffrey, Lockwood, Koretz & Hamilton, 2003). Our exploratory work suggests that while human capital is important in the achievement equation, perhaps also important is the influence and access to knowledgeable others in a high trust social context that supports student achievement. This combination may well be important in ongoing debates about how “value” is added by a teacher.

### ***Delimiters and areas for future research***

Although our exploratory study provides some interesting results that provide support to related work (Pil & Leana, 2009), there are several delimiters that must be noted. First we are asserting the direction of relationship between the study variable, in that indegree, for example, is associated with student achievement. However, the opposite argument could be made such that those teachers with high performing students are highly sought for knowledge (high indegree). We acknowledge that our analysis strategy was not intended to determine causality and that the direction of the relationship between indegree and achievement may be an issue of debate. In this early exploration on the relationship between social capital and achievement we argue, in a

similar vein to Pil & Leana (2009) that a teacher's social and human capital are critical as they represent a level of resources that may support student outcomes. Our study is also limited in that we have examined a relatively small sample of teachers within elementary schools that are improving, which may have contextual influence of which we have not accounted for in our work.

The limitations to our work also indicate important areas for further examination. First, additional studies that have larger and more varied samples are indicated. In addition, although we used robust statistical techniques the examination of all forms of capital would benefit from qualitative study to better understand the nuance of findings.

### *A capital investment*

The work of school reform is complex and involves multiple moving components. There exists a developing empirical base around the importance of investing in both human *and* social capital that could lead to the needed changes in instructional practices and resulting student outcomes. However, a capital investment also requires understanding that human and social capital are critical elements in the improvement equation both individually and collectively. Policy makers and educational leaders must consider not only the knowledge and experience of a teacher, but the role that social relations can play in improving outcomes, which appears to be a potentially rich and important line of inquiry. The idea of attending to the relational infrastructure suggests supplementing not supplanting traditional human capital approaches in how we approach improvement and student achievement and what we mean when we discuss "adding value."

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**Table 1: Sample Demographics: School Level**

<b>School</b>	<b>Enroll</b>	<b>% Free/Reduced Lunch</b>	<b>% Hispanic</b>	<b>% White</b>	<b>% African American</b>	<b>API</b>
A	596	62.10	63.40	18.80	5.20	726
B	677	48.10	37.70	47.80	2.40	775
C	679	63.20	73.20	16.90	3.10	709
D	629	72.90	88.50	8.20	1.50	692
E	670	61.40	70	20	4.90	762
Sample Average	650.2*	61.20	67.40	22.34	3.42	732
District Average	598	61.00	65.00	25.50	2.90	734

N=5 \*Includes students from all grades

**Table 2: Sample Demographics: Teacher Level**

Characteristic	% or Mean	SD
Gender		
Male	20.6%	--
Female	79.4%	--
Years as an Educator		
Range 1-35 Years	14.7	7.62
Years in Current Position		
Range 1-30 Years	7.1	6.25
Years at School		
Range 1-30 Years	9.8	6.22
ELA-IBA 2008 (3 <sup>rd</sup> Trimester)		
Range 0-100	72.6	9.48
Reading Comprehension		
Indegree		
0 (none)	32.9%	NA
0.1-0.499 (low/medium)	33.9%	
5.0-1.00 (high)	33.2%	
Outdegree		
0 (none)	41.6%	NA
0.1-0.499 (low/medium)	25.1%	
5.0-1.00 (high)	33.6%	
Reciprocity		
0 (none)	42.6%	NA
0.1-0.499 (low/medium)	36.9%	
5.0-1.00 (high)	20.5%	

**Table 3: Sample Demographics: Student Level**

Grade Level	% of Sample	% Male	% Female	% Free and Reduced	% Special Education	Days Absent	ELA Average Score
2	25.6	51.2	48.8	58.3	8.2	5.6 (5.5)	341.1 (54.0)
3	24.5	51.7	48.3	56.0	8.5	6.0 (6.6)	328.7 (56.3)
4	23.9	48.0	52.0	55.0	6.4	6.3 (6.0)	350.8 (54.3)
5	26.1	47.5	52.5	57.2	7.3	5.9 (5.6)	346.3 (50.9)

N = 2114

**Table 4: Correlation Matrix of Study Variables**

	1	2	3	4	5	6	7
1. CST ELA	-						
2. Years as Educator	.20	-					
3. Years in Position	.17	.47**	-				
4. Years at School	.30**	.58**	.58**	-			
5. Reading Comp. Outdegree	.04	.06	.02	-.07	-		
6. Reading Comp. Indegree	.22*	.05	.06	.07	.18	-	
7. Reading Comp. Reciprocity	.05	.07	.01	.01	.15	.19	-

N=90

\*p&lt;0.05

\*\*p&lt;0.01

**Table 5: Results of HLM Analyses on Student Performance<sup>a</sup> in 2008**

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	356.64 *** (8.88)	372.77 *** (10.50)	374.00*** (11.28)	383.75*** (11.25)	384.76*** (12.94)
<i>Level 1: Students</i>					
2 <sup>nd</sup> Grade (ref: 5 <sup>th</sup> Grade)	2.18 (7.40)	4.67 (7.32)	10.98 (7.37)	3.43 (7.20)	8.68 (7.31)
3 <sup>rd</sup> Grade	-10.23 (7.34)	-10.21 (7.19)	-9.47 (7.06)	-11.42 (7.07)	-11.41 (6.99)
4 <sup>th</sup> Grade	13.30 (7.17)	11.75 (7.07)	14.54 (7.64)	11.34 (7.01)	13.52 (7.55)
Reduced/Free Lunch	-20.80*** (2.06)	-20.80*** (2.06)	-20.60*** (2.15)	-20.80*** (2.06)	-20.61*** (2.15)
Special Education	-30.95** (3.65)	-31.07** (3.65)	-31.47** (3.77)	-30.99*** (3.64)	-31.40*** (3.77)
Days Absent	-0.54*** (0.16)	-0.54*** (0.16)	-0.61*** (0.17)	-0.54*** (0.16)	-0.62*** (0.17)
<i>Level 2: Teachers</i>					
Teacher Gender (Female)		-19.54 (7.99)	-20.22 (8.63)	-16.96 (7.85)	-20.79 (8.49)
Years as Educator			-0.45 (0.45)		-0.55 (0.45)
Years in Position			1.46* (0.61)		1.49* (0.59)
Years in School			0.61* (0.64)		0.55 (0.63)
Reading Comp. Indegree (Ref: No Ties)					
Low/Medium				3.15 (6.78)	5.86 (6.97)
High				16.96* (7.85)	14.72 <sup>a</sup> (7.80)
-2 log likelihood Deviance (df) $\chi^2$	21815.7	21809.5 2 vs. 1 (1) 6.2*	19182.5 3 vs. 2 (3) 2626.9***	21804.8 4 vs. 2 (2) 4.7*	19178.6 5 vs. 3 (2) 4.07* 5 vs. 4 (3) 2626.2***
School Variance	11.24%	9.22%	11.95%	11.42%	14.84%
Teacher Variance		24.90%	21.69%	23.96%	20.83%
Student Variance	26.00% 62.76%	65.88%	66.36%	64.62%	64.33%

Notes: <sup>a</sup>Student Performance is measured by CST\_ELA

Null model for CST\_ELA:  $\chi^2_{\text{Null}}(4) = 22092.9$ ; School variance: 16.1%; Teacher variance: 29.4%; Student variance: 54.5%.

ICC<sub>CST\_ELA</sub> = .127,  $\chi^2(1) = 472.39$ ,  $p < .001$ . N = 5 schools, 90 teachers, 2114 students. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < .001$ ; <sup>a</sup> $p = 0.0592$

Figures

Figure 1: Representative school network with human and social capital indicators

