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Social network effects on academic achievement[☆]

Robert M. Bond^{a,*}, Volha Chykina^b, Jason J. Jones^c

^a Ohio State University, United States

^b Pennsylvania State University, United States

^c State University of New York, Stony Brook, United States

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ABSTRACT

How peer groups contribute to educational outcomes has long interested researchers. However, the possibility that peer groups dominated by either low- or high-achieving youth can have substantively different effects on achievement has been largely ignored. In this paper, we show that while being embedded in a high-achieving network of friends is not associated with increased own achievement, being embedded in a low-achieving network is associated with decreased own achievement. In additional analyses, we present evidence that these associations are at least in part due to influence, as opposed to only selection effects or shared environment. We also examine whether the structure of the network in which a student is embedded might affect their educational achievement. We show that achieving at higher levels positively predicts how centrally located a student is in their network, but being more centrally located does not predict concurrent achievement. This finding suggests that the behavior of individuals is affecting the formation of network structure and not the reverse.

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1. Introduction

Peers play a vital role in adolescent development (Petersen, 1993; Ryan, 2000). The socioeconomic status of classmates (Vandenberghe, 2002), how diverse they are (Angrist & Lang, 2004; Hermansen & Birkelund, 2015), and the gender balance of classrooms (Hoxby, 2000; Lavy & Schlosser, 2007) have all been found to influence student achievement. Researchers have increasingly turned to social network analysis to examine peer group formation and peer group influence (Carbonaro & Workman, 2016; Carolan, 2014; Ryabov, 2011). While there is much

evidence that friends' achievement can influence own achievement (Altermatt & Pomerantz, 2005; Lefgren, 2004; Ryabov, 2011), either immediate friends or a bigger peer group that is often conceptualized as a classroom or as a school have largely been the focus of researchers' interest. To the best of our knowledge, Carbonaro and Workman (2016) is the only study that directly examines the influence of friends' friends on own educational achievement.

Scholars have not yet examined whether students might be more susceptible to the negative influence of low-achieving friends or to the positive influence of high-achieving friends using social network analysis. Lavy, Silva, and Weinhardt (2012) find that attending a school with a higher number of low-achieving students carries stronger negative consequences compared to the potential benefits of attending a school with a greater number of high-achieving students. The authors, however, conceptualize a student's peer group as their school, which means that they cannot determine with certainty whether the students

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* Corresponding author at: 3072 Derby Hall, 154 N. Oval Mall, The Ohio State University, Columbus, OH 43210, United States.

E-mail addresses: bond.136@osu.edu, rmbond15@gmail.com (R.M. Bond).

that they examine are connected to each other and belong to the same friendship group. With that said, their finding that being surrounded by high- or low-achieving students can have substantially different effect on own achievement is intriguing and needs to be examined further. Our study design allows us to directly capture the associations that result from students being connected to each other, as opposed to the effects of sharing an environment with low- or high-performing peers.

Since today's adolescents are more connected to each other than ever before in history (Christakis & Fowler, 2009), attempts to better understand the potential effects of friends' achievement on own achievement, as well as the dynamics of friendship formation, are both timely and important. In this paper, we build on work by Carbonaro and Workman (2016) and Lavy et al. (2012) and examine whether the magnitude of the relationship between friends' and own achievement is different in low-achieving social networks and in high-achieving social networks. Our work presents several empirical findings. First, we show that while being embedded in a low-achieving network is associated with own decrease in achievement, being embedded in a high-achieving network is not associated with a change in achievement. Second, we demonstrate that the relationships that we find are driven at least in part by influence. Third, we find that own academic achievement is associated with future network position, indicating that higher achieving students are more likely to be more centrally located in their respective networks. This finding adds to the growing literature on the relationship between network position, network norms, and individual behaviors (Mejs et al., 2010; Ortiz, Hoyos, & López, 2004; Shepherd, 2016).

2. Theory

How the behavior of one individual can influence the behavior of others in the same friendship network has been studied extensively (Christakis & Fowler, 2009; Sacerdote, 2011). The influence that a student's friends and classmates have on their behavior and scholastic outcomes is often referred to as 'peer effects' (Angrist & Lang, 2004; Hoxby, 2000). These peer effects can manifest in several ways. Starting with the development of the Wisconsin model of status attainment (Sewell, Haller, & Portes, 1969), researchers have regularly found that friends' expectations to matriculate into college are positively related to own expectations to matriculate into institutions of higher learning and own eventual educational attainment (Carbonaro & Workman, 2016; Kiuru, Aunola, Vuori, & Nurmi, 2007). Further, one of the most consistent relationships found in the study of peer effects in primary and secondary schools is the positive link between friends' achievement and own achievement (Altermatt & Pomerantz, 2005; Lefgren, 2004; Ryabov, 2011). Research on higher education suggests that a similar relationship might exist in college settings. Some studies have found a significant association between roommate achievement and own achievement (Sacerdote, 2011; Stinebrickner & Stinebrickner, 2006; Zimmerman, 2003).

However, prior work largely ignores the possibility that the effects of low-achieving networks and high-achieving networks can vary. The norms that peer groups induce and reinforce vary extensively. On the one hand, adolescent networks can serve as an important conduit through which students can access resources available to them, thus leading to a more advantaged status and better achievement for those in certain groups (Coleman, 1988). At the same time, the dissemination of negative adolescent culture can adversely affect students, by sabotaging their commitment to education and impairing their academic motivation (Coleman, 1961) as well as by discouraging excellence in low-performing peer groups (Portes, 1998). As such, studies that examine the continuous increase in achievement within networks of friends (Carbonaro & Workman, 2016) might be missing an important conditional relationship, namely that the effect of low-achieving networks might be substantively different from the effect of high achieving networks.

While Lavy et al. (2012) examine this relationship for students and their school peers, our study improves on theirs by examining the students that are linked to each other through their friendship networks. As such, our work offers a more direct test of the relationship. Our sample is also comprised of older students than Lavy et al.'s (2012), which is important since the dynamics of peer groups differ depending on the age and developmental stage of those in the peer group (Gifford-Smith & Brownell, 2003). Building on work by Carbonaro & Workman (2016) and Lavy et al. (2012), we formulate the following hypothesis:

H1. Having a greater number of low-achieving contacts will be associated with decreased own achievement while having a greater number of high-achieving contacts will not be associated with a change in achievement.

Furthermore, many of the findings about own and friends' educational achievement outlined above focus on the potential effects that classmates have on one another. This line of research, while fruitful, has important limitations as outlined by Sacerdote (2011). First, students are not randomly assigned to classrooms, and peers may be selected for them on the basis of achievement. Second, teacher quality may affect all students, causing classmates to appear more similar based on the quality of the instruction they are receiving, which may have nothing to do with peer effects. In order to control for these problems, scholars have used student and teacher fixed effects (Burke & Sass, 2013; Lavy et al., 2012). Other studies, such as Whitmore (2005), use the random assignment of students to classrooms to isolate the causal effect of achievement, finding a clear positive effect. In sum, whether or not the relationship that scholars observe between friends' achievement and own achievement is at least in part causal remains an open empirical question. Given this, our second hypothesis is:

H2. A reliable association between directly tied friends' achievement and own achievement will remain even after controlling for all observed indicators of shared individual characteristics and shared environment.

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