# The Moderating Role of Popular Peers' Achievement Goals in 5th- and 6th-Graders' Achievement-Related Friendships: A Social Network Analysis

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This research investigated whether classroom-based peer norms for achievement goals moderate friendship selection, maintenance and influence processes related to academic achievement in 46 Grade 5 and Grade 6 classrooms ($N = 901$, 58.7% Grade 5 students, 48.5% boys). A distinction was made between peer norms for mastery (i.e., developing competence) and performance (i.e., demonstrating competence) goals. Peer norms were measured in terms of popularity norms (the within-classroom correlation between student achievement goals and popularity) and descriptive norms (the class-level aggregated average achievement goals). As hypothesized, longitudinal social network analyses revealed that achievement goal popularity norms played a role in friendship processes, rather than achievement goal descriptive norms. Specifically, adolescents formed friendships with similarly achieving peers in classrooms with high performance goal popularity norms but not in classrooms with low performance goal popularity norms. Conversely, adolescents remained friends with similarly achieving peers in classrooms with low performance goal popularity norms but not in classrooms with high performance goal popularity norms. Furthermore, friendship influence on achievement took place in classrooms with high mastery goal popularity norms, but not in classrooms with low mastery goal popularity norms. This study indicates that friendship processes regarding achievement depend upon the extent to which certain achievement goals are made salient by virtue of their association with popularity in classrooms.

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***Educational Impact and Implications Statement***

The salience of achievement goals is known to affect social interactions with peers around academic tasks. In contrast to prior work which has focused on how teachers make different goals salient, the current study focused on the role that popular peers play in making achievement goals salient in the classroom. Results of the current study were consistent with the idea that the goals pursued by popular peers created classroom norms that influenced friendship processes around achievement. In classrooms where popular students endorse performance goals (i.e., demonstrating competence relative to others), adolescents initially select their friends based on similarity in (high) achievement; however, these friendships among high-achieving peers do not hold over time. In classrooms where popular students endorse mastery goals (i.e., developing competence), achievement increases when adolescents have high-achieving friends but decreases when they have low-achieving friends. Teachers need to appreciate and attend to popular peers and their impact on classroom climate, friendship processes and academic achievement in early adolescence.

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Academic achievement in adolescence is a crucial predictor of future educational and occupational success (Crosnoe & Benner, 2015). For better or worse, peers may provide an important developmental context for adolescent academic achievement (Rodkin & Ryan, 2012). Academic achievement may shape peer relationships through processes in which adolescents select or maintain similarly achieving others as friends; relationships, in turn, may shape individual academic achievement, through friendship socialization (i.e., influence) processes. These processes result in similarity in academic achievement among friends. However, friendship selection, maintenance and influence processes do not operate in isolation, but take place in broader peer contexts, such as classrooms and schools (Veenstra & Dijkstra, 2011), which may play a role in the direction and magnitude of these friendship dynamics. One

way of characterizing the broader social context in the classroom is by using the concept of *peer norms* (Dijkstra & Gest, 2015). As peer norms reflect the expected and accepted behaviors and attitudes of a social group (Shaw, 1981), they may play a role in determining whether academic achievement is a salient attribute for friendship selection, maintenance and influence processes. Therefore, the current study examined the role of peer norms in friendship processes (i.e., selection, maintenance and influence) related to adolescents' academic achievement (see Figure 1 for a conceptual model).

In the current article, we focus on *peer-perceived achievement* (or *academic reputation*; Gest, Rulison, Davidson, & Welsh, 2008) as index of academic achievement, as this has both practical and theoretical value for the current study. First, peer-perceived achievement has been shown to be a valid indicator of adolescent academic competence that is highly correlated with grade point average (GPA; correlations varying from .60 to .70; Gest et al., 2008), but that also captures unique information on how well adolescents are doing at school. Peers can be seen as expert observers and have a unique perspective on classmates' academic functioning, because their proximity to and direct interaction with classmates permit unique observations about the speed and ease (or difficulty) with which classmates finish assignments, expend effort on tasks, and give or receive help. These insights may not always be captured by tests, grade point averages or teacher ratings (Gest et al., 2008). Second, having a positive academic reputation (i.e., high peer-perceived achievement) may be associated with having academic successes recognized and remembered by peers, being approached more often for academic help (which is fruitful for one's own academic development as well), and affiliating with other classmates perceived as high-achieving (Greenwood, 1991), which in turn may have implications for friendship selection, maintenance and influence processes.

## Friendship Selection, Maintenance, and Influence Processes Related to Achievement (Figures 1a and 1b)

Theoretically, selection and maintenance of friends on the basis of similarity in achievement can be explained with the similarity-attraction hypothesis (Byrne & Nelson, 1965), which

states that adolescents prefer interacting with partners who maintain similar attitudes and values, as this enhances perceived trust and predictability in social interactions (Byrne & Lamberth, 1971). Friends may not only be similar in achievement due to selection or maintenance processes, but also due to socialization (i.e., influence) processes. Friends are assumed to socialize adolescents' achievement through information exchange, modeling, reinforcement of peer norms and values (Kindermann & Gest, 2009; Ryan, 2000), and peer tutoring experiences (Gest et al., 2008).

Innovative methodological advances in social network analysis allow researchers to disentangle the dynamic, reciprocal interplay of friendship selection, maintenance, and influence processes in a methodologically sound way, yielding reliable and accurate indications of the strength and direction of these processes (using stochastic actor-based models; Steglich, Snijders, & Pearson, 2010). A few previous studies have applied these statistical techniques to investigate the extent to which friendship selection and influence processes related to achievement take place, but their findings on the presence and direction of friendship processes vary considerably across and within studies; and only one study addressed friendship maintenance processes.

With regard to the presence of friendship processes, one study on high-school students (Grades 9 and 10) found that influence, maintenance and (especially) selection processes contributed to similarity in achievement among friends (Rambaran et al., 2016), whereas another study on elementary students (Grade 6) found influence but not selection processes contributed to similarity in achievement among friends (Shin & Ryan, 2014a). Furthermore, in one other previous study, the extent to which selection and influence were present varied across contexts within the study. This study of Flashman (2012) on high-school-students' academic achievement in eight schools (Grades 7 through 12) indicated that both selection and influence explained similarity in grade point averages (i.e., GPA rank) between high school friends at the two largest schools analyzed, but not at the six small, private and rural schools analyzed.

With regard to the direction of friendship processes, one study indicated that friendship selection and maintenance mainly occurred among similarly low-achieving peers (Rambaran et al., 2016), whereas the direction of friendship selection varied between



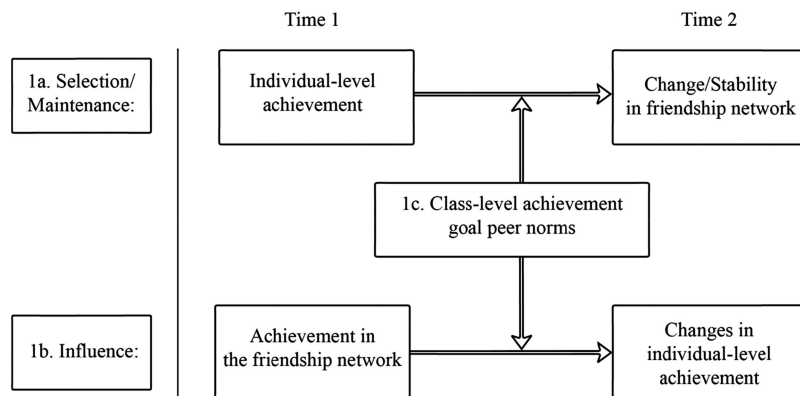| | Time 1 | Time 2 |
|---|---|---|
| 1a. Selection/ Maintenance: | Individual-level achievement | Change/Stability in friendship network |
| | 1c. Class-level achievement goal peer norms | |
| 1b. Influence: | Achievement in the friendship network | Changes in individual-level achievement |

*Figure 1.* Conceptual model on the role of achievement goal peer norms in friendship selection, maintenance, and influence on achievement.

schools in the study of Flashman (2012). That is, in one large, public school, high-achieving students mostly formed relations with other high-achieving students, whereas in the other large, public school, similarity-based selection took place equally among low-achieving students and high-achieving students. Only one study examined the direction of friendship influence on achievement, indicating that friends influenced one another to increase rather than decrease in achievement over time (Rambaran et al., 2016). On the basis of these studies, it can be concluded that maintenance processes have been underinvestigated, and, more importantly, that the magnitude and the direction of friendship selection and influence processes varied across studies and even across different settings within the same study (i.e., larger schools compared with smaller schools; Flashman, 2012). So far, studies have only reported this variation between settings; an explanation of why selection and influence processes vary across different settings is lacking.

In the current study, we propose that one reason why friendship processes related to achievement may vary across settings is that different settings represent different peer contexts, which in turn have diverging implications for friendship processes (Kiuru et al., 2012). One way of measuring the peer context is by using the concept of peer norms which has received attention in several recent studies due to its linkages with adolescent behavior and peer relations (Dijkstra & Gest, 2015; Laninga-Wijnen et al., 2016; McCormick & Cappella, 2014; Rambaran, Dijkstra, & Stark, 2013). Peer norms represent the expected and appropriate behaviors and attitudes in a particular setting and, therefore, may determine the valence of certain behaviors for friendship selection, maintenance and influence processes (McCormick & Cappella, 2014). That is, according to social misfit theory (Wright, Giammarino, & Parad, 1986), adolescents have a tendency to conform to the peer norm in order to fit in with the expectations of the peer group and to gain acceptance and avoid rejection by their peers. When adolescents are liked in a particular setting, peers may perceive them as attractive friendship partners and, hence, these adolescents have a greater chance of being selected and maintained as friends. Furthermore, based on social identity theory (Tajfel & Turner, 1986) it could be reasoned that adolescents may be especially susceptible for friendship influence related to behaviors that are in line with the peer norm, as this yields a shared identity that provides emotional and social support, behavioral confirmation and a sense of self. Therefore, peer norms in the classroom may foster friendship selection, maintenance and influence processes, for instance related to achievement (Veenstra & Dijkstra, 2011).

Indeed, two previous studies indicated that peer norms played an important role in determining the direction and magnitude of friendship influence and selection processes related to peer-perceived aggression (Laninga-Wijnen et al., 2016) and risk attitudes (Rambaran et al., 2013). In the current study we will extend this work by examining whether classroom-based peer norms for achievement goals also play a role in friendship processes related to achievement. As detailed next, we consider achievement goal peer norms given extensive theory and research about the importance of achievement goals for academic beliefs and behaviors as well as for interpersonal relations in the classroom (Linnenbrink-Garcia & Patall, 2016; Poortvliet & Darnon, 2010; Wigfield et al., 2016).

## Achievement Goal Popularity Norms and Friendship Processes (Figure 1c)

In achievement settings, two contrasting goals are often evident: mastery and performance goals (Ames, 1992; Dweck, 1986; Elliot, 2005). When mastery goals are salient in the classroom, there is a focus on developing academic competence or task mastery, whereas when performance goals are salient, there is a focus on demonstrating academic competence relative to other students, through superior performance or looking smart (Pintrich, 2000). An extensive body of research has shown that the salience of these achievement goals (due to manipulation in experiments or natural variation in classrooms) affects academic motivation and behavior (Anderman & Wolters, 2006; Linnenbrink-Garcia & Patall, 2016; Wigfield et al., 2016). Relevant to the present study, achievement goals have been found to influence social interactions with peers on academic tasks (Darnon, Dompnier, & Poortvliet, 2012; Levy-Tossman, Kaplan, & Assor, 2007; Levy-Tossman, Kaplan, & Patrick, 2004; Poortvliet & Darnon, 2010).

In the achievement goal literature, theory and research have tended to focus on how teachers make achievement goals salient in the classroom (Ames, 1992; Patrick, Mantzicopoulos, & Sears, 2012). However, teachers and peers both contribute to the classroom context (Pianta & Hamre, 2009). In the current study, we focus on how peers can make particular achievement goals salient within the classroom, as during early adolescence, students may become more likely to model behaviors after their peers and might be less likely to model parent or teacher behaviors (Cairns, Cairns, Xie, Leung, & Hearne, 1998; Galván, Spatzier, & Juvonen, 2011; Sumter, Bokhorst, Steinberg, & Westenberg, 2009).

Ushered in with the pubertal and social changes of early adolescence, youth show increased susceptibility to peer influence during this stage (Steinberg, 2007). Peers can set a norm for adolescent's academic behaviors and attitudes in the classroom (McCormick & Cappella, 2014). Yet, it is unlikely that all peers are equally influential, and during early adolescence especially popular peers may set a norm within the classroom (Rambaran et al., 2013) as there is a peak in the desire for popularity among peers during this age period (LaFontana & Cillessen, 2010). As a result, adolescents may be highly attuned to the behaviors and attitudes of popular peers, as these behaviors and attitudes are reputationally salient (reputational salience hypothesis; Hartup, 1996). This implies that these behaviors and attitudes are positively valued within a setting and an important tool for improving an adolescent's own reputation (i.e., popularity).

Popular students can make the achievement goals they endorse salient (i.e., set a norm) within the classroom via task-related messages that refer to mastery or performance goals, or via academic behaviors and endeavors (Urdan & Schoenfelder, 2006). More specifically, students are likely to voice various reasons for and reactions to their work that may refer to mastery goals or performance goals, respectively. For instance, when working on some math problems, some students might especially try to hurry and be the first to finish (performance goal), whereas others might focus on really learning the material, solving problems themselves, and not compare themselves to others (mastery goals). All of these goals could go together with visible behaviors and explicit comments (e.g., "Yeah I am first compared with all of you!" or "Yeah, I solved this problem myself!"; see Shin & Ryan, 2014b). Indeed,

numerous studies and experiments have indicated that achievement goals are outwardly exhibited and can be recognized by specific behaviors and messages referring to these goals (see for instance Darnon et al., 2012, and Poortvliet & Darnon, 2010, for an overview). In this way, students may notice the goals of popular peers.

One approach to capture the norms of popular adolescents (i.e., the popularity norm; Laninga-Wijnen et al., 2016) is by examining the within-classroom correlation between popularity and behaviors or attitudes (also referred to as *norm salience*; Henry et al., 2000; Rambaran et al., 2013). These achievement goal popularity norms, in turn, may have important implications for the coevolution of interpersonal relations and achievement within the classroom, which we describe in the following text.

## Friendship Selection and Maintenance Related to Achievement

Performance goal peer norms and mastery goal peer norms can be linked with friendship selection and maintenance processes related to achievement based on social comparison theory (Festinger, 1954). In classrooms where performance goals are salient, interpersonal standards are used to define relative competence. As a result, adolescents tend to use social comparison to ensure that they did better (or not worse) than others in terms of their achievement (see Brophy, 2005, for a review). These social comparison processes may play a role in friendship selection and maintenance processes related to achievement in two ways. On the one hand, it could be hypothesized that when performance goals are salient in the classroom, students have a higher tendency to select and maintain similarly achieving peers as friends than when performance goals are less salient in the classroom. Differences in achievement to a friend can be threatening because of the emphasis on social comparison and achievement as validating one's sense of self-worth (Elliot, Murayama, & Pekrun, 2011; Festinger, 1954). When the levels of achievement are similar, comparisons would be less threatening for self-worth. Therefore, it could be expected that when popularity norms make performance goals salient, similarity-based selection and maintenance related to achievement would take place, both among low-achieving students and among high-achieving students. On the other hand, it could be hypothesized that when performance goals are salient, students have a lower tendency to select and maintain similarly achieving peers as friends because they have self-enhancement motives. More specifically, to fulfill the need of maintaining a positive self-view (i.e., self-enhancement), adolescents may have a tendency to select and maintain lower achieving peers as friends and use them as a proximal comparison standard (Régner, Escribe, & Dupeyrat, 2007) to boost their self-view with a favorable comparison.

In regards to mastery goal norms and friendship selection, two alternate hypotheses can be formulated as well. When mastery goals are salient, the focus is on personal improvement and task mastery, and not on interpersonal differences in achievement (Poortvliet & Darnon, 2010). In such a situation, achievement differences (i.e., social comparison; Festinger, 1954) among students may be less important or valuable for friendship selection and maintenance processes. Therefore, it can be hypothesized that mastery goal peer norms may not be powerful enough to break down the general tendency of selecting and maintaining similar

friends (similarity-attraction hypothesis, Byrne & Lamberth, 1971), which would result in similarity-based selection and maintenance of friends irrespective of whether popularity norms make mastery goals salient. On the other hand, it can be considered that classrooms with salient mastery goals *are* characterized by social comparison, as social comparison with others can also serve the goal of self-improvement (Collins, 1996, 2000). Social comparison can be a useful learning resource for gaining accurate information for self-evaluation and acquiring information about how to improve, which are compatible with the requirements of mastery goals (Butler, 1995; Collins, 1996, 2000; Lockwood & Kunda, 1997; Régner et al., 2007). In this way, achievement may be a valuable characteristic and important indicator of competence, and students may use social comparison (i.e., upward comparison) to seek out friends they can learn from (i.e., the high-achieving students). Therefore, it could also be hypothesized that when popularity norms make mastery goals salient, friendship selection and maintenance takes place based on dissimilarity in achievement, with students selecting and maintaining higher achieving peers as friends.

## Friendship Influence on Achievement

Achievement goal peer norms can be linked with friendship influence processes by social interdependence theory (Johnson & Johnson, 1989, 2005). Social interdependence exists when individual goal attainment is affected by others' actions (Johnson & Johnson, 1989, 2005). There are two types of interdependence: *Positive interdependence* refers to a situation in which there is a positive relation between goal attainments of individuals, whereas *negative interdependence* exists when individuals perceive that they can obtain their goals (only) if the other individuals with whom they are competitively linked fail to reach their goals (Deutsch, 1949, 1962; Johnson & Johnson, 1989, 2005). The extent to which a classroom is characterized by positive or negative interdependence has implications for social interactions around academic tasks (Deutsch, 1949, 1962; Roseth et al., 2008), and hence, for the magnitude and direction of friendship processes related to achievement.

In classrooms where performance goals are salient, individuals may experience negative interdependence with their classmates (also referred to as a *competitive goal structure*; Deutsch, 1949, 1962; Elliot et al., 2016), because they reach their goals when others do not reach their goals, as they aim at outperforming others (Poortvliet & Darnon, 2010). This negative interdependence may result in oppositional interaction patterns within the classroom, with individuals discouraging and obstructing each other's efforts to achieve their goals. In such a situation, individuals focus both on being productive and on preventing any other person from being more productive than themselves (Deutsch, 1949). In other words, individuals may develop an exploitation orientation toward information exchange, which reflects the incentive to profit from task-related efforts of exchange partners, paired with a reluctance to offer good or valuable information in return (Poortvliet, Janssen, Van Yperen, & Van de Vliert, 2007; Poortvliet & Darnon, 2010). Indeed, previous studies indicated that when performance goals are made salient within a setting, individuals have a reduced willingness to coordinate efforts with potential exchange partners, a reluctance to be dependent on the actions of others (for instance

with regard to asking for help; Ryan, Gheen, & Midgley, 1998; Ryan & Shim, 2012), and a reduced readiness to be influenced by exchange (see Poortvliet & Darnon, 2010). There may even be suspiciousness about exchanging information as performance goals have been linked to tactically deceiving peers in order to outperform them (Poortvliet, Anseel, Janssen, Van Yperen, & Van de Vliert, 2012). Hence, on the basis of the social interdependence theory (Deutsch, 1949, 1962) it could be hypothesized that when popularity norms make performance goals salient, productive social interactions around academic tasks are less likely, which minimizes the opportunities for friends to influence each other and become similar over time.

When mastery goals are salient in a setting, students are likely to perceive positive interdependence with fellow students (Elliot et al., 2016; Poortvliet & Darnon, 2010), as they see others as helpers in achieving their goals (Karabenick, 2003; Roussel, Elliot, & Feltman, 2011; Ryan & Shim, 2012). Positive interdependence (also referred to as a *cooperative goal structure*; Deutsch, 1949, 1962) is associated with promotive interaction, implying that individuals encourage and facilitate each other's efforts to complete tasks in order to reach the group's goals (Deutsch, 1949). Social exchanges can serve as an important means by which individuals can obtain their goal of self-improvement, which may enhance an adolescent's willingness to invest in relationship building with potential exchange partners. Indeed, previous research indicated that when mastery goals are salient, students have a higher tendency to reciprocally share valuable information, actively engage in adaptive help-seeking, have constructive discussions and collaborate on academic issues (Darnon et al., 2012; Karabenick, 2003; Ryan & Shim, 2012). Also, mastery goals have been linked to the provision of resources and effort to help team members who are apparently failing to perform well (Porter, 2005). We therefore hypothesized that in classrooms where popularity norms make mastery goals salient, the conditions and processes through which friends have the potential to influence each other are enhanced (Kindermann & Gest, 2009; Ryan, 2000), which results in more similarity among friends in achievement. More specifically, we expect that the promotive interaction patterns will result in positive friendship influence; that is, we expect that friends will influence adolescents to increase rather than to decrease in achievement over time.

## Achievement Goal Descriptive Norms and Friendship Processes (Figure 1c)

Another approach to examine classroom peer norms and achievement goals is to use descriptive norms rather than popularity norms. Descriptive norms refer to the average behaviors or attitudes of all peers in a given setting, for instance a classroom (Wright et al., 1986). However, previous studies indicated that descriptive norms were not predictive of variations in friendship processes regarding peer-perceived aggression (Laninga-Wijnen et al., 2016) and risk attitudes (Rambaran et al., 2013). According to social impact theory, the strength of social forces (in this case: peer norms) is a function of the status of peers, closeness of peers, and number of peers present (Latané, 1981). Descriptive norms only represent the last, quite subtle aspect of this function and hence may not be strong enough to determine social impact (Laninga-Wijnen et al., 2016). Therefore, we do not expect that descriptive

norms play a role in friendship processes related to achievement. However, given the examination of popularity and descriptive norms in relation to friendship processes is quite new, we examine both to add to the empirical evidence on this issue.

## Present Study

We examined the role of achievement goal peer norms in friendship processes related to achievement (see Figure 1). We hypothesized that achievement goal popularity norms rather than achievement goal descriptive norms would play a role in friendship processes related to achievement, because popularity norms represent the behaviors and attitudes that are positively valued in classrooms (i.e., reputationally salient; Hartup, 1996), especially during early adolescence. We conducted our investigation in the context of math and science classrooms, where academic achievement is likely to be especially salient to peers. In contrast to language arts or social studies classrooms, which often emphasize writing and evaluating information that can be interpreted in different ways, math and science coursework more often involves formulas and clear-cut "right" or "wrong" answers (Franke, Kazemi, & Battey, 2007; Martin, Way, Bobis, & Anderson, 2015; Fredricks et al., 2016). Thus, it may be easier for students to garner information about their peers' performance in math and science classrooms because they can more readily compare results on assignments and tests (Stodolsky & Grossman, 1995; Wang, Fredricks, Hofkens, & Schall, 2016).

## Method

### Procedure and Participants

Data were collected as part of the Classroom and Peer Ecologies Project, a longitudinal study examining early adolescent social and academic adjustment in school. Schools were recruited from three school districts located in small urban communities with comparable demographics in the Midwest region of the United States. The school districts serve a sizable proportion of low-income (50% to 71%) as well as middle-income families. In these school districts the elementary schools contained students in kindergarten through Grade 5 and the middle schools contained Grades 6 through 8. All of the middle schools in these districts (N = 6) agreed to participate in the project. Two feeder elementary schools for each middle school also agreed to participate (N = 12). In the elementary schools, children were in a self-contained classroom with one teacher for the majority of the day. In the middle schools, students rotated among different teachers for their main academic subjects. However, middle school students and teachers were organized into smaller teams within their grade level, so students saw many of the same peers in their different classrooms at middle school.

To provide a common reference point across the different school settings, we focused on the classroom context in the domains of math and science (for a similar approach, see Eccles et al., 1993; Midgley, 2002). We focused on both math and science to garner a higher number of unique teachers and distinct classrooms at the middle school level than would have been possible had we exclusively focused on just math or science teachers. All math and science teachers in Grade 6 at the middle schools agreed to

participate and we chose one of their classrooms to administer surveys. For the teachers from the feeder elementary schools, we aimed to focus on math or science in equal proportions (e.g., if there were two math and two science teachers at the middle school we would focus on math class for one teacher and science class for the other teacher within each of the two feeder elementary schools). Two factors contributed to our sample having more math than science classrooms: (1) there were more Grade 6 math than science teachers in the middle schools and (2) for some elementary school teachers, science instruction was not occurring during the time frame of our study (e.g., science and social studies instruction would alternate every few weeks) and in those cases we conducted our investigation in math class.

Letters describing the project were given to all students to take home to their parents early in the school year. Eighty-four percent of the students returned permission slips granting them parental approval to participate. About 2 to 3 months into the school year, surveys were administered to students in their classrooms by two trained research assistants. Instructions and items were read aloud while students read along and responded. Survey administration was repeated about 6 months later in the spring of the school year. All classrooms did not complete all measures at Wave 2 due to timing and scheduling constraints (predominantly coming from one elementary and one middle school). The missing data included measures used in the present study and thus students from those classrooms were not included in this investigation. The total sample ($N = 901$ at Wave 1 and $N = 859$ at Wave 2) was about half female (51.5%) and ethnically diverse (36.8% African American, 46.9% European American, 7.5% Hispanic, and 8.8% other ethnic groups). Students came from 46 classrooms, each with different teachers and students (19 classrooms at the Grade 6 level, consisting of 11 math classrooms and 8 science classrooms and 27 classrooms at the Grade 5 level, consisting of 20 math classrooms and 7 science classrooms) situated within 16 schools (5 middle schools and 11 elementary schools).

## Measures

**Friendship networks.** Adolescents' friends within classrooms were measured by asking students to nominate their friends in the classroom, further described to students as "the friends you hang around with and talk to the most." Embedded in each child's survey was a class list, and students were told they could nominate as many or as few friends as they wanted by putting a check next to names of their friends. Friendship networks were calculated for each classroom. A value of 1 equaled a given friendship nomination, whereas a value of 0 depicted an absent nomination.

**Peer-perceived academic achievement.** Students were asked to nominate which peers within the classroom "gets good grades." Similar to the friendship networks, students put a check next to names on a class list that followed the question. The number of nominations received were standardized by class for all participants into z scores. Because RSIENA analyses (Ripley, Snijders, Boda, Vörös, & Preciado, 2016) require ordinal categorical dependent behavior variables, these peer perceived achievement z scores were recoded into four roughly equally populated categories based on quartiles (for Wave 1: Category $1 = z \leq -.737$; Category $2 = -.737 < z \leq -.338$; Category $3 = -.338 < z \leq .581$ and Category $4 = z > .581$; for Wave 2: Category $1 = z \leq -.748$;

Category $2 = -.748 < z \leq -.392$; Category $3 = -.392 < z \leq .580$; and Category $4 = z > .580$).

**Achievement goal peer norms.** Achievement goal popularity norms were measured at Time 1 (T1) as the within-classroom correlation between peer-nominated popularity and achievement goals (Dijkstra & Gest, 2015; Dijkstra, Lindenberg, & Veenstra, 2008; Laninga-Wijnen et al., 2016).

Peer-nominated popularity was assessed by taking the average of two items: (1) "Which students in this class do you admire most?" and (2) "Which students in your class are really cool?"; in line with Sandstrom (2011). The correlations between these two items were $r = .60$ and $r = .70$ for Waves 1 and 2, respectively (both $p < .001$). To assess the achievement goals of students, we used the Patterns of Adaptive Learning Survey (Midgley, Arunkumar, & Urdan, 1996). Mastery goals were measured with six items focusing on developing academic competence (e.g., "An important reason I do my math/ science work is because I want to improve my skills" and "An important reason I do my math/ science work is because I like to learn new things"). Performance goals were measured using five items focusing on demonstrating high academic competence relative to other students in the class (e.g., "Doing better than other students in my math/science class is important to me" and "An important reason I do my math/science work is because I want to do better than other students in my class"). Participants were asked to rate on a 5-point Likert scale, ranging from 1 (*not at all true*) to 5 (*very true*). The scales measuring achievement goals were found to be reliable in the present sample at both time points (Cronbach's $\alpha = .84$ and .87 for mastery goals, and .84 and .87 for performance goals, for Waves 1 and 2, respectively). The mastery items and the performance items were averaged, to create scales for mastery goals and performance goals, respectively.

We made a distinction between three types of classrooms based on quartiles of the within-classroom correlation between popularity and achievement goals. Classrooms with low popularity norms were characterized by a correlation in the lowest quartile for performance or mastery goal popularity norms (low mastery: $r < -.13$, $N_{classrooms} = 11$; low performance: $r < -.26$, $N_{classrooms} = 11$). Classrooms with average popularity norms scored in the middle quartiles (25% to 75%) of achievement goal popularity norms (moderate mastery: $-.13 \leq r \leq .29$, $N_{classrooms} = 24$; moderate performance: $-.26 \leq r \leq .11$, $N_{classrooms} = 24$). Classrooms with high popularity norms scored in the highest quartile of achievement goal popularity norms (high mastery, $r > .29$, $N_{classrooms} = 11$; high performance, $r > .11$; $N_{classrooms} = 11$).

Descriptive norms were measured at T1 as the aggregated average score for mastery and performance goals, respectively, across all students in the class (Dijkstra & Gest, 2015; Rambaran et al., 2013; Laninga-Wijnen et al., 2016). We made a distinction between three types of classrooms based on quartiles, both for mastery goal norms and performance goal norms. As the distribution of mastery goal descriptive norms was negatively skewed in that most classrooms were characterized by quite high mastery goal norms (in line with previous studies, see for instance Ryan & Shim, 2012). Classrooms in the lowest quartile for performance or mastery descriptive norms where indicated as *moderate mastery goal descriptive norm classrooms* and *low performance goal descriptive norm classrooms* (moderate mastery: $M < 4.08$, $N_{classrooms} = 11$; low performance: $M < 2.93$, $N_{classrooms} = 11$). Classrooms with

descriptive norms in the middle quartiles (25% to 75%) of achievement goals, were referred to as *high mastery goal descriptive norm classrooms* and *moderate performance goal descriptive norm classrooms* (high mastery: $4.08 \leq M \leq 4.41$, $N_{classrooms} = 24$; moderate performance: $2.93 \leq M \leq 3.47$, $N = 24$). Classrooms in the highest quartile of achievement goals were indicated as *very high mastery goal descriptive norm classrooms* and *high performance goal descriptive norm classrooms* (very high mastery: $M > 4.41$, $N_{classrooms} = 11$; high performance: $M > 3.47$; $N_{classrooms} = 11$).

The class-level correlation of achievement goal norms from Wave 1 to Wave 2 was moderate for popularity norms (with $r_{T1\text{-}T2mastery} = .33$, $p = .02$; and $r_{T1\text{-}T2performance} = .40$, $p = .01$), and moderate to high for descriptive norms (with $r_{T1\text{-}T2mastery} = .43$, $p = .01$; and $r_{T1\text{-}T2performance} = .60$, $p = .001$). Correlations between popularity norms and descriptive norms were low and nonsignificant ($r_{mastery} = .05$, $p = 0.77$; $r_{performance} = .23$, $p = .13$). Correlations between mastery norms and performance norms were low for popularity norms and moderate for descriptive norms ($r_{popularity} = .14$, $p = .37$; $r_{descriptive} = .50$, $p < .001$).

## Analytic Strategy

**Attrition analyses.** We performed attrition analyses for students who had partially missing data on the achievement (goal) variables (13.8% in T1 and 12.0% in T2), and we did not find significant or substantial differences between partially missing cases and complete cases on achievement and achievement goals. Little's missing completely at random test produced a normed chi-square ($\chi^2$/df) of 1.48, indicating that the data were likely missing at random and that it was safe to impute missing values on achievement (goal) data (Bollen, 1989). Therefore, to gain statistical power, we estimated missing values for achievement (goal) data in SPSS using the expectation maximization procedure (Gupta & Chen, 2010).

For the friendship nomination data, missing data due to nonresponse were handled through the SIENA missing data method (Huisman & Steglich, 2008), and participants who joined and left the friendship network between time points were treated using the "last observation carry forward" method (Ripley et al., 2016). In this method, for each missing tie variable, the last previous nonmissing value (if any) is imputed; if the previous values are missing as well, the value 0 (referring to no friendship tie) is imputed. Whenever imputed values are used, parameter estimate updates are based on the nonimputed parts of the data. This minimizes the impact of imputations on the results.

**RSIENA analyses.** Analyses were conducted using longitudinal social network analysis (also called 'stochastic actor-based models'; Snijders, Steglich, & Schweinberger, 2007) with the Simulation Investigation for Empirical Network Analyses (SIENA 4.0–R Version 3.1.2; RSIENA Version 2.8.9) software program. SIENA allows us to examine the extent to which similarity between friends in academic achievement is the result of selection or socialization processes. An assumption of SIENA is that adolescents change their friendship ties and their behaviors in continuous time between the observation moments (i.e., measurement waves) on the basis of individual preferences. At a given moment, students may either change a friendship tie (i.e., create a new tie, drop an existing tie, or maintain a tie) or their behavior (go one step up, one

step down, or keep their behavior the same; also called *microsteps*) in response to the current network structure and the behavior of other peers in the network. In this way, SIENA controls for dynamic feedback between behavior change and friendship change, as well as for structural network and individual predictors for changes in friendships and academic achievement. An important assumption of the model is that students have full information about the relationships and behaviors in the network, which is quite realistic in the current study as we examine small class-level networks (in which adolescents spent most of their time at school) and achievement as perceived by peers (not "objective" achievement like GPA). Parameter estimates are derived from iterative simulations using the Robbins-Monro stochastic approximation algorithm (Ripley et al., 2016). For a detailed, more technical explanation of longitudinal social network analyses, we refer to Snijders and colleagues (2007) and Veenstra, Dijkstra, Steglich, and Van Zalk (2013). In the following paragraphs we discuss the parameters we analyzed in our models. See Table S1 in the online supplemental material for further conceptual interpretation of these effects, for information on how the terminology used in this study corresponds to the terminology used in prior RSIENA studies, and for information on how each variable label can be interpreted.

**Parameters in the RSIENA model.** RSIENA analyses yield parameter estimates related to the network (i.e., structural dynamics and attribute-dependent selection and maintenance dynamics) and behavior dynamics (i.e., influence dynamics and behavioral tendencies). Most of these parameters can be considered as "control parameters," which have to be included to more accurately assess and avoid overestimation of selection and influence dynamics (Snijders, Van de Bunt, & Steglich, 2010). In the following text, we discuss the parameters that are of main interest for testing our hypotheses. See Appendix S3 in the online supplemental material for more details regarding control parameters.

**Selection parameters (Figure 1a).** To assess the extent to which similarity in achievement among friends is explained by friendship selection processes, we included several selection parameters. The "effect of achievement on friendship nominations received" indicated the extent to which achievement predicted being selected as a friend. Conversely, the "effect of achievement on friendship nominations given" indicates the extent to which achievement predicted the number of friendship nominations given to peers. By including these two parameters, the "similarity-based selection of friends based on achievement" gave a reliable estimate to test our hypotheses about the extent to which adolescents had the tendency to select similarly achieving friends or not, depending on the peer norm.

Next, to assess the direction of friendship selection, we calculated ego-alter maintenance tables (cf. Ripley et al., 2016) that contained the log odds for friendship selection (i.e., formation). These tables indicate whether similarity-based selection takes especially place among higher achieving students or among lower achieving students.

**Maintenance parameters (Figure 1a).** We examined the extent to which being similar in achievement predicted that a friendship present at one time point would still be present at the next time point (using endowment effects). A positive parameter for similarity-based maintenance of friends indicates that similarity in achievement predicts friendship maintenance, whereas dissimilarity in achievement predicts friendship dissolution (i.e., deselec-

tion). Next, to assess the direction of friendship maintenance, we calculated ego-alter maintenance tables (cf. Ripley et al., 2016) that contained the log odds for friendship maintenance. These tables indicate whether similarity-based maintenance takes place among higher achieving students or among lower achieving students.

**Influence parameters (Figure 1b).** To assess the extent to which friendship influence on achievement took place, we included the "Friendship influence on achievement" parameter (average similarity). This reflects the tendency of students to change their academic achievement to more closely resemble their friends' average achievement. This tendency could work in the upward or in the downward direction (or remain similar), depending on whether friends display higher or lower levels of achievement than the adolescent does. To assess the direction of friendship influence on achievement, we calculated ego-alter influence tables (cf. Ripley et al., 2016), indicating whether friends influenced adolescents to increase or decrease in achievement over time.

**The moderating role of achievement goal peer norms (Figure 1c).** We tested whether peer norms at T1 play a role in friendship processes related to academic achievement in four steps. In Step 1, the aforementioned parameters (selection, maintenance, influence and control parameters) were analyzed in RSIENA for all 46 classrooms in multigroup analyses (Ripley et al., 2016).[1] Hence, in this first step (in line with previous studies) the peer norm within the classroom was not taken into account. In Step 2, we performed 12 additional multigroup analyses for all types of classrooms separately (i.e., classrooms with low, moderate, and high performance goal and mastery goal popularity norms; those with low, moderate, high performance goal descriptive norms; and those with moderate, high, and very high mastery goal descriptive norms, respectively). Hence, in total we performed 13 multigroup analyses examining the extent to which friendship processes took place in different class types distinguished by different peer norms. In Step 3, we tested whether there were significant differences between parameter estimates of selection, maintenance, and influence parameters across classrooms with low, moderate, and high norms (and moderate, high, and very high norms for mastery goal descriptive norms) using the following formula: $z = (\beta_a - \beta_b)/\sqrt{(s.e._a^2 + s.e._b^2)}$, with estimates and $\beta_a$ and $\beta_b$ and standard errors $s.e._a^2$ and $s.e._b^2$, respectively. This resulted in a $z$ score that under the null-hypothesis of equal parameters has an approximate standard normal distribution (see Steglich, Sinclair, Holliday, & Moore, 2012, p.367; Laninga-Wijnen et al., 2016). We used the significance criterion of $p < .05$.

In Step 4, we assessed convergence of all our models and calculated auxiliary statistics to assess the goodness of fit. Four auxiliary network statistics were assessed: outdegree distribution, indegree distribution, geodesic distance, and triadic census. One auxiliary behavior statistic was assessed: behavioral distribution for achievement. For each auxiliary statistic, the differences between the values in the observed network (summed across the two waves of data) and the simulated values in the model were assessed with the Mahalonobis distance (cf. Ripley et al., 2016) and visually inspected using violin plots.

To facilitate the interpretation of the findings, we calculated odds ratios by taking the exponential function of the parameter estimates ($= exp.[\beta k]$). Odds ratios represent the odds that an outcome will occur given a particular situation, compared with the odds of the outcome occurring in the absence of that situation. For selection and maintenance processes, the odds ratios indicate the odds of adding or retaining someone as a friend relative to the odds for choosing others, conditional on the rest of the model and given the current state of the network. For influence processes, having one additional friend who scores higher (or lower) than oneself increases the odds of an increase (or decrease) in achievement as compared with no change by a factor. For the friendship influence dynamics, we first divided the estimates with the number of answer categories minus one to reflect the effect of a one-unit increase or decrease on the scales. Odds ratios were not calculated for the quadratic shape terms because these are not linear.

## Results

### Descriptive Statistics

Description of the network and individual variables are presented in Table 1 and Table 2 for classrooms distinguished based on performance goal status norms and mastery goal status norms, respectively. See Appendix S2 in the online supplemental material for a more detailed discussion of these descriptive results. Preliminary analyses indicated that the results were similar for Grade 5 and Grade 6 classrooms. First, we found no significant differences between Grade 5 and Grade 6 classrooms in popularity norms and descriptive norms. Furthermore, the presence and direction of friendship processes related to achievement did not differ significantly across Grade 5 and Grade 6. We also found that the role of peer norms in friendship processes was similar in Grade 5 and Grade 6 classrooms. Therefore, we performed our final analyses on both grades together, in order to gain power. Convergence of all models was good (overall $t$-ratio for convergence $< .21$), and in one case, one class was omitted from the multigroup analyses in order to get desirable convergence, which did not affect the interpretability of results. The goodness of fit was acceptable or good for all auxiliary statistics in in all classrooms, indicated by a nonsignificant Mahalonis distance and violin plots that indicated that the simulated values did not depart too far from the observed values.

Reported in Table 3 are the controlling variables that do not pertain to our research questions (see also Appendix S3 in the online supplemental material). In the following text, we discuss the main results of interest for testing our hypotheses. As expected,

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[1] We used multigroup analyses because our classroom-level networks were rather small which prevented us from obtaining well-converged parameter estimates when analyzing the classrooms separately. Therefore, in line with various previous studies that included rather small classrooms (i.e., Svensson et al., 2012; Delay et al., 2016; Shin & Ryan, 2014a; Logis, Rodkin, Gest, & Ahn, 2013; Weerman, 2011), we combined classrooms and analyzed them simultaneously using multigroup analyses. The multigroup option binds these separate class-level data sets into a large multigroup project, assuming that different data sets are unrelated with one another except for having the same parameter values. In other words, each classroom network is assumed to follow the same rule to evolve, except for the behavioral and network rate functions which are allowed to vary (i.e., class-level variation) within the same multigroup project. In this way, multigroup analyses differ from meta-analyses which take into account class-level variation for each parameter in the model. For more information on multigroup analyses, we refer the reader to the *RSIENA Manual* (see p. 96 and further; Ripley et al., 2016).

Table 1

*The Role of Performance Goal Popularity Norms in Changes in Friendship Networks and Achievement*

| Sample | Low performance goal popularity norms, Mean (*SD*) | | Moderate performance goal popularity norms, Mean (*SD*) | | High performance goal popularity norms, Mean (*SD*) | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T1 | T2 | T1 | T2 |
| Friendship | | | | | | |
| Average number of friends | 5.37 (2.00) | 5.04 (1.24) | 5.59 (1.49) | 5.33 (1.55) | 6.16 (1.90) | 6.13 (2.57) |
| Cohesion in friendship network | .30 (.09) | .28 (.06) | .31 (.09) | .28 (.07) | .31 (.08) | .31 (.09) |
| Proportion reciprocated friendships | .41 (.08) | .39 (.11) | .46 (.12) | .43 (.10) | .39 (.06) | .41 (.13) |
| Proportion triadic friendships | .55 (.09) | .57 (.08) | .56 (.09) | .57 (.08) | .56 (.11) | .55 (.09) |
| Achievement change | T1–T2 | | T1–T2 | | T1–T2 | |
| Fraction increased students | 18.0% | | 17.8% | | 22.2% | |
| Fraction decreased students | 23.1% | | 17.7% | | 20.1% | |
| Fraction stable students | 58.9% | | 64.5% | | 56.4% | |
| Friendship change | | | | | | |
| Average number of friendship changes | 84.36 (33.97) | | 83.83 (37.27) | | 76.82 (34.68) | |
| Proportion of stable friendships | .41 (.08) | | .45 (.10) | | .41 (.09) | |
| Friendships emerged | 38.45 (17.98) | | 39.62 (20.81) | | 54.18 (34.12) | |
| Friendships dissolved | 45.91 (24.68) | | 44.21 (22.30) | | 47.55 (27.55) | |
| Friendships maintained | 76.36 (37.92) | | 81.67 (36.17) | | 86.36 (39.62) | |
| *N* classes | 11 | | 24 | | 11 | |
| *N* students | 209 | | 471 | | 221 | |

*Note.* Achievement refers to peer-perceived achievement. T1 = Time 1 (fall); T2 = Time 2 (spring).

popularity norms played a role in friendship processes rather than descriptive norms. Therefore, we first display our results on popularity norms.

## Popularity Norms and Friendship Selection

**Performance goal popularity norms.** The similarity-based selection effect was significant in the model with *all classrooms* ($OR$ = 1.35; Table 3, first column; Figure 1a). However, the analyses on classrooms with low, moderate and high performance goal popularity norms separately (Figure 1c), indicated that the parameter for similarity-based selection related to achievement was *significantly positive* in classrooms with high performance

goal popularity norms and *significantly negative* in classrooms with low performance goal popularity norms. Moreover, similarity-based selection was significantly more likely in classrooms with high performance goal popularity norms compared with classrooms with moderate popularity norms ($z$ = 2.04, $p$ = .04) and low popularity norms ($z$ = 4.11, $p$ < .001). Also, similarity-based selection was significantly more likely in classrooms with moderate performance goals popularity norms compared with classrooms with low popularity norms ($z$ = 2.97, $p$ = .003). Hence, in high performance goal popularity norm classrooms, students were more likely (by 229% higher odds, which can be seen as a large effect) to select a friend who matched their

Table 2

*The Role of Mastery Goal Popularity Norms in Changes in Friendship Networks and Achievement*

| Sample | Low mastery goal popularity norms, Mean (*SD*) | | Moderate mastery goal popularity norms, Mean (*SD*) | | High mastery goal popularity norms, Mean (*SD*) | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T1 | T2 | T1 | T2 |
| Friendship | | | | | | |
| Average number of friends | 4.85 (1.33) | 4.97 (1.37) | 6.07 (1.97) | 5.77 (1.95) | 5.63 (1.10) | 5.24 (1.78) |
| Cohesion in friendship network | .29 (.06) | .28 (.05) | .31 (.09) | .29 (.08) | .32 (.12) | .30 (.07) |
| Proportion reciprocated friendships | .47 (.12) | .42 (.10) | .42 (.09) | .41 (.12) | .44 (.11) | .42 (.12) |
| Proportion triadic friendships | .56 (.09) | .55 (.09) | .56 (.09) | .56 (.08) | .55 (.10) | .56 (.07) |
| Achievement change | T1–T2 | | T1–T2 | | T1–T2 | |
| Fraction increased actors | 16.1% | | 20.1% | | 19.6% | |
| Fraction decreased actors | 16.3% | | 20.1% | | 22.9% | |
| Fraction stable actors | 67.6% | | 59.8% | | 57.5% | |
| Friendship change | | | | | | |
| Average number of friendship changes | 72.55 (29.00) | | 97.88 (44.86) | | 82.91 (36.31) | |
| Proportion of stable friendships | .45 (.09) | | .43 (.10) | | .41 (.09) | |
| Friendships emerged | 36.18 (20.42) | | 46.17 (24.21) | | 42.18 (28.81) | |
| Friendships dissolved | 36.36 (14.73) | | 51.71 (29.04) | | 40.73 (12.42) | |
| Friendships maintained | 61.72 (27.78) | | 90.25 (38.06) | | 82.27 (36.79) | |
| *N* classes | 11 | | 24 | | 11 | |
| *N* students | 207 | | 488 | | 206 | |

*Note.* Achievement refers to peer-perceived achievement. T1 = Time 1 (fall); T2 = Time 2 (spring).

Table 3

*Performance Goal Popularity Norms and Friendship Dynamics Related to Achievement: RSIENA Multigroup Analyses in All Classes and Classes With Low, Moderate, and High Associations Between Popularity and Performance Goals*

| SIENA parameters | All classes (n = 46) | | | Low performance goal popularity norms (n = 11) | | | Moderate performance goal popularity norms (n = 24) | | | High performance goal popularity norms (n = 11) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | SE | OR | B | SE | OR | B | SE | OR | B | SE | OR |
| Network dynamics | | | | | | | | | | | | |
| Tendency to make friends | −1.69*** | .04 | .18 | −1.71*** | .07 | .18 | −1.77*** | .05 | .17 | −1.60*** | .07 | .20 |
| Reciprocated friendships | 1.03*** | .04 | 2.80 | .95*** | .09 | 2.59 | 1.20*** | .06 | 3.32 | .77*** | .08 | 2.16 |
| Transitive group formation | .20*** | .01 | 1.22 | .20*** | .01 | 1.22 | .21*** | .01 | 1.23 | .18*** | .01 | 1.20 |
| Cyclical group formation | −.23*** | .01 | .79 | −.25*** | .03 | .78 | −.24*** | .02 | .79 | −.19*** | .02 | .83 |
| Selection dynamics | | | | | | | | | | | | |
| Same gender (1 = boy) selection | .51*** | .03 | 1.67 | .57*** | .06 | 1.75 | .46*** | .04 | 1.58 | .58*** | .05 | 1.79 |
| Same race selection | .24*** | .03 | 1.27 | .34*** | .06 | 1.40 | .21*** | .04 | 1.23 | .22*** | .05 | 1.25 |
| Effect of achievement on friendship nominations received | .08*** | .01 | 1.08 | .11*** | .03[a] | 1.12 | .09** | .02[a] | 1.09 | .08* | .03[a] | 1.08 |
| Effect of achievement on friendship nominations given | .04*** | .01 | 1.04 | .13*** | .03[a] | 1.14 | −.01 | .02[b] | .99 | .06 | .03[ab] | 1.06 |
| Similarity-based selection of friends | .30* | .16 | 1.35 | −.91* | .37[a] | .40 | .36 | .21[b] | 1.43 | 1.19*** | .35[c] | 3.29 |
| Maintenance dynamics | | | | | | | | | | | | |
| Similarity-based maintenance of friends | .31* | .15 | 1.36 | 1.07* | .39[a] | 2.92 | .26 | .21[b] | 1.30 | −.15 | .35[c] | .86 |
| Influence dynamics | | | | | | | | | | | | |
| Achievement linear shape | −.13* | .06 | .88 | −.32 | .15 | .73 | −.10 | .09 | .90 | −.05 | .10 | .95 |
| Achievement quadratic shape | .36*** | .07 | | .47* | .19 | | .36*** | .09 | | .29** | .12 | |
| Friendship influence on achievement | 2.49*** | .78 | 2.29 | 3.51 | 2.05[a] | 3.22 | 2.25* | 1.09[a] | 2.12 | 2.26 | 1.41[a] | 2.12 |

*Note.* All models represent separate multigroup analyses. *B* = the unstandardized multinominal logit coefficient. Different superscripts of standard errors (*SE*s) indicate that class types differ significantly from each other in estimate (as computed with *z* tests). Low, moderate, and high performance goal popularity norms refer to low, moderate, and high class-level associations between popularity and performance goals. Achievement refers to peer-perceived achievement.
* $p < .05$.  ** $p < .01$.  *** $p < .001$.

own achievement than to select someone with a different achievement. These results are in line with the hypothesis that adolescents in classrooms with higher performance goal popularity norms have an increased tendency to select peers as friends based on similar levels of achievement, and not in line with the alternate hypothesis that adolescents would have an increased tendency to select lower achieving peers as friends in classrooms with salient performance goals.

Next, we calculated ego-alter selection tables to inspect the direction of selection processes in classrooms with high and low performance goal popularity norms (ego-alter tables for moderate performance goal classrooms are available from the corresponding author). In classrooms with high performance goal popularity norms (see Table 4), similarity-based selection especially took place among equally high-achieving peers. Moreover, in low performance goal popularity norm classrooms, ego-alter tables indicate that adolescents had a higher tendency to select lower achieving peers as friends (see Table 4). These findings are generally in line with our hypotheses.

**Mastery goal popularity norms.** For mastery goal popularity norms (see Table 5), the similarity-based selection effects did not differ significantly from each other (low vs. high mastery popularity norms: $z = 0.49$, $p = .62$; low vs. moderate mastery popularity norms: $z = 0.26$, $p = .79$; moderate vs. high popularity norms: $z = 0.29$, $p = .77$). These results are in line with the hypothesis that mastery goal popularity norms are not strong enough to break down the adolescents' tendency to select peers as friends based on similar levels of achievement, and not with the alternate hypothesis that mastery goals would strengthen friendship selection based on similarity in high achievement. We did not

calculate ego-alter tables as none of the selection parameters were significant (data available from the corresponding author).

**Popularity Norms and Friendship Maintenance**

**Performance goal popularity norms.** In the model with all classrooms, the friendship maintenance parameter was significant ($OR = 1.36$; see Table 3 and Figure 1a). However, the analyses on classrooms with low, moderate, and high performance goal popularity norms separately (see Figure 1c), indicated that the similarity-based maintenance for achievement was only significantly positive in classrooms with low performance goal popularity norms. Furthermore, maintenance processes based on similarity in achievement took significantly less place in classrooms with high performance goals than in classrooms with low performance goal popularity norms ($z = 2.33$, $p = .02$), whereas differences between other types of classrooms were nonsignificant (low vs. moderate performance popularity norms: $z = 1.00$, $p = 32$; moderate vs. high performance popularity norms: $z = 1.84$, $p = .07$). Hence, in low performance goal popularity norm classrooms, students were more likely (by 192% higher odds, which is a large effect) to maintain a friend who matched their own achievement than to maintain a friend with a different achievement. We calculated ego-alter maintenance tables for low and high performance popularity norms which indicated that in high performance goal popularity norm classrooms, adolescents maintained friendships with peers who were dissimilar in achievement in classrooms; for instance, adolescents with higher achievement had a tendency to maintain lower achieving peers as friends (see Table 4). At the same time, in low performance goal popularity norm classrooms,

Table 4

*Likelihood of Peer Selection and Maintenance Based on Achievement in Classes With Low and High Performance Goal Popularity Norms*

| Individual | Peer | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Selection in classrooms with low performance goal popularity norms | | | | |
| 1 | −.74 | −.33 | .09 | .50 |
| 2 | −.30 | −.49 | −.08 | .33 |
| 3 | .13 | −.06 | −.25 | .16 |
| 4 | .57 | .38 | .19 | −.01 |
| Selection in classrooms with high performance goal popularity norms | | | | |
| 1 | .52 | .21 | −.12 | −.44 |
| 2 | .18 | .66 | .34 | .02 |
| 3 | −.16 | .32 | .79 | .47 |
| 4 | −.50 | −.02 | .45 | .93 |
| Maintenance in classrooms with low performance goal popularity norms | | | | |
| 1 | .11 | −.14 | −.39 | −.64 |
| 2 | −.12 | .35 | .10 | −.14 |
| 3 | −.34 | .13 | .60 | .35 |
| 4 | −.57 | −.10 | .37 | .84 |
| Maintenance in classrooms with high performance goal popularity norms | | | | |
| 1 | −.29 | −.17 | −.04 | .09 |
| 2 | −.19 | −.16 | −.03 | .09 |
| 3 | −.08 | −.06 | −.03 | .10 |
| 4 | .02 | .05 | .08 | .10 |

*Note.* Numbers (1 through 4) in the table reflect the strength of attraction for students to select or to remain friends with certain peers on the basis of their levels of achievement (columns dependent on rows). The values in the cells can be transformed to odds by taking the exponential function (exp.[βk]).

high-achieving peers (rather than low-achieving peers) maintained each other as friends based on similarity in achievement (see Table 4). These findings are in line with the hypothesis that in high performance goal popularity norm classrooms, adolescents remain friends with peers who were dissimilar in achievement and not with the alternate hypothesis that they would remain friends with similarly achieving peers.

**Mastery goal popularity norms.** Next, the analyses on mastery goal popularity norms indicated that there were no significant differences in maintenance processes between the three types of classrooms (low vs. high mastery popularity norms: $z = 0.33$, $p = .74$; low vs. moderate mastery popularity norms: $z = 0.42$, $p = .67$; moderate vs. high mastery popularity norms: $z = 0.01$, $p = .99$). These findings are in line with the hypothesis that mastery goals are not strong enough to break down the tendency of maintaining similar friends, and not with the alternate hypothesis that mastery goals strengthen adolescents' tendency of selecting higher achieving peers as friends. We did not calculate ego-alter tables as none of the maintenance parameters were significant (data are available from the corresponding author).

## Popularity Norms and Friendship Influence

**Performance goal popularity norms.** In the model with all classrooms, the friendship influence parameter was significant

($OR = 2.29$; see Table 3 and Figure 1b), indicating that, in general, adolescents had a tendency to become similar in academic achievement to their friends. Furthermore, the influence parameter estimates did not differ significantly across classrooms with low, moderate and high associations between popularity and performance goals (Figure 1c), implying that, in contrast to our hypothesis, performance goal popularity norms did not play a significant role in friendship influence on achievement (low vs. high performance popularity norms: $z = 0.51$, $p = .61$; low vs. moderate performance popularity norms: $z = 0.55$, $p = .58$; moderate vs. high performance popularity norms: $z = 0.00$, $p = .996$). We did not calculate ego-alter tables to further inspect the direction of friendship influence as the strength of influence effects did not differ significantly between classes with different types of norms (data are available from the corresponding author).

**Mastery goal popularity norms.** The analyses separated across classrooms with low, moderate, and high mastery goal popularity norms indicated that the friendship influence parameter was negative and nonsignificant in classrooms with low mastery goal popularity norms. Friendship influence processes occurred in classrooms with moderate mastery goal popularity norms, and particularly in classrooms with high mastery popularity norms, indicating an increase in strength of friendship influence processes as the within-classroom association of popularity with mastery goals increased. The estimate for influence processes did not differ significantly between classrooms with high and moderate mastery goal popularity norms ($z = 1.36$, $p = .18$); but significantly between classrooms with moderate and low mastery goal popularity norms ($z = 2.17$, $p = .03$) and low and high mastery goal popularity norms ($z = 2.42$, $p = .02$). Hence, having one additional friend who scored higher (or lower) than oneself made it more likely to increase (or decrease) in achievement as compared with no change by a factor by 907% higher odds in classrooms with high mastery goal popularity norms, which can be interpreted as a very large effect. This implies that, in line with our hypothesis, the tendency to become similar to friends in achievement increases when the within-classroom association between popularity and mastery goals increases.

We calculated ego-alter tables to further inspect the direction of friendship influence on achievement in high mastery goal popularity norm classrooms (and not in low mastery goal popularity norm classrooms as the influence effect was nonsignificant, available upon request). In these classrooms, the differences in the top rows were larger than in the bottom rows, indicating that in contrast to our hypothesis, students were more likely to decrease in achievement when they had low-achieving friends than to increase in achievement when they had high-achieving friends (see Table 6).

## Descriptive Norms and Friendship Dynamics

As expected, descriptive norms did not play a role in the extent to which friendship processes took place within classrooms (see Tables S2 and S3 in the online supplemental material; $z$ scores are available from the corresponding author). Hence, the average aggregated mastery and performance goals within the classroom did not play a role in friendship selection, maintenance, and influence processes with regard to achievement over time. Ego-alter tables are also available from the corresponding author.

Table 5

*Mastery Goal Popularity Norms and Friendship Dynamics Related to Achievement: RSIENA Multigroup Analyses in Classes With Low, Moderate, and High Associations Between Popularity and Mastery Goals*

| SIENA parameters | Low mastery goal popularity norms (n = 11) | | | Moderate mastery goal popularity norms (n = 24) | | | High mastery goal popularity norms (n = 11) | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | SE | OR | B | SE | OR | B | SE | OR |
| Network dynamics | | | | | | | | | |
| Tendency to make friends | −1.83*** | .08 | .16 | −1.65*** | .05 | .19 | −1.92*** | .08 | .15 |
| Reciprocated friendships | 1.19*** | .11 | 3.29 | 1.00*** | .06 | 2.72 | 1.03*** | .10 | 2.80 |
| Transitive group formation | .27*** | .02 | 1.31 | .19*** | .01 | 1.21 | .27*** | .02 | 1.31 |
| Cyclical group formation | −.31*** | .03 | .73 | −.21*** | .02 | .81 | −.28*** | .03 | .76 |
| Selection dynamics | | | | | | | | | |
| Same gender (1 = boy) selection | .54*** | .06 | 1.72 | .42*** | .04 | 1.52 | .64*** | .06 | 1.90 |
| Same race selection | .13* | .06 | 1.14 | .25*** | .04 | 1.28 | .33*** | .06 | 1.39 |
| Effect of achievement on friendship nominations received | .06 | .03[a] | 1.06 | .10*** | .02[a] | 1.11 | .08* | .03[a] | 1.08 |
| Effect of achievement on friendship nominations given | .02 | .03[a] | 1.02 | .06* | .02[a] | 1.06 | .03 | .03[a] | 1.04 |
| Similarity-based selection of friends | .40 | .26[a] | 1.49 | .31 | .23[a] | 1.36 | .18 | .36[a] | 1.20 |
| Maintenance dynamics | | | | | | | | | |
| Similarity-based maintenance of friends | .19 | .28[a] | 1.21 | .34 | .23[a] | 1.40 | .34 | .35[a] | 1.40 |
| Influence dynamics | | | | | | | | | |
| Achievement linear shape | .01 | .14 | 1.01 | −.12* | .08 | .89 | −.28 | .19 | .76 |
| Achievement quadratic shape | .07*** | .16 | | .34*** | .09 | | .65** | .25 | |
| Friendship influence on achievement | −2.00 | 1.69[a] | .51 | 2.26* | .99[b] | 2.12 | 6.93* | 3.28[b] | 10.07 |

*Note.* All models represent separate multigroup analyses. *B* = the unstandardized multinominal logit coefficient. Different superscripts of standard errors (*SE*s) indicate that class types differ significantly from each other in estimate (as computed with *z* tests). Low, moderate, and high mastery goal popularity norms refer to low, moderate, and high class-level associations between popularity and mastery goals. Achievement refers to peer-perceived achievement.
* $p < .05$. ** $p < .01$ *** $p < .001$.

## Discussion

The current study investigated the role of achievement goal peer norms in friendship processes related to academic achievement. Our results indicate that the salience of mastery and performance goals within the classroom context, measured in terms of popularity norms, has meaningful implications for the magnitude and direction of these processes. Hence, the extent to which popular peers pursue mastery goals or performance goals has implications for the coevolution between friendships and academic achievement across the school year.

Table 6

*Likelihood of Peer Influence on Student's Achievement in Classes with High Mastery Goal Popularity Norms*

| Peer achievement | Individual achievement | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 | 6.04 | 2.19 | −.37 | −1.64 |
| 2 | 3.73 | 4.50 | 1.94 | −.67 |
| 3 | 1.42 | 2.19 | 4.25 | 2.98 |
| 4 | −.89 | −.12 | 1.94 | 5.29 |

*Note.* Numbers (1 through 4) in the table reflect the strength of friendship influence on certain levels of peer-perceived achievement for the student resulting from the average levels of their friends' achievement (columns dependent on rows). The values in the cells in these tables can be transformed to odds by taking the exponential function (exp.[βk]).

## The Moderating Role of Achievement Goal Popularity Norms in Friendship Processes

**Selection and maintenance.** In line with our expectations, we found that performance goal popularity norms moderated friendship selection and maintenance processes related to achievement. Interestingly, the salience of performance goals had a differential impact on friendship selection and maintenance processes: the higher the performance goal popularity norms, the higher the tendency of adolescents to select similarly achieving peers as friends, and the lower the tendency of adolescents to maintain similarly achieving peers as friends. These results provide valuable insight in the differential impact of performance goal popularity norms on friendship selection and maintenance processes. With regard to selection processes, we found in line with one of our hypotheses that similarity-based selection took place among both low-achieving and (especially) high-achieving students in classrooms with high performance goal popularity norm classrooms. Hence our alternate hypothesis that adolescents would select lower achieving peers as friends (possibly due to self-enhancement perspectives) was not supported. In classrooms with high performance goal popularity norms, it may be useful to select similarly achieving friends for two reasons. First of all, classrooms where performance goals are salient are generally characterized by competition and social comparison, implying that students are highly attuned to interpersonal differences in achievement and academic reputation (Brophy, 2005). It could be theorized that when levels of achievement are similar, comparisons are less threatening for self-worth (Elliot et al., 2011; Festinger, 1954). Second, selecting similarly

high-achieving friends (which took place most often) may be useful in classrooms where performance goals are salient, as adolescents may have an exploitation orientation toward other students, even toward friends (Levy-Tossman et al., 2007; Poortvliet et al., 2007). One can profit from information exchange from similarly high-achieving friends and take advantage of their knowledge and skills (Poortvliet et al., 2007) to reach the goal of outperforming others. Therefore, forming friendships with similarly high-achieving friends may serve the salient goal of achieving superiority over others.

However, with regard to maintenance processes, friendships among similarly high-achieving peers are less likely to last in classrooms where performance goals are made salient by popular peers (compared with classrooms with low performance goal popularity norms). More specifically, in line with one of our alternate hypotheses, adolescents had an increased tendency to maintain friendships with peers who were dissimilar in achievement in classrooms where performance goals were salient. Hence, the alternate hypothesis that adolescents would maintain similarly achieving peers as friends was not supported. This might be due to the fact that, as soon as similarly achieving peers become friends, social comparison may increase because they become closer to each other (and the higher the proximity, the more social comparison may take place; Festinger, 1954). Due to this increased proximity, minor differences in academic functioning may become more visible and threatening (for instance, when one friend receives positive feedback from a teacher whereas another does not, or when one friend scores a slightly higher on a test than the other; see also Sommet et al., 2014; Sommet, Darnon, & Butera, 2015). As a consequence, similarly high-achieving friends may increasingly see each other as a threat toward obtaining the goal of outperforming others, which may result in the dissolution of friendships among these similarly high-achieving peers. As very different others are a less relevant source for comparison, friendships among dis-similar peers may be less threatening at the longer term (Festinger, 1954). Second, it could also be theorized that friendships among similarly high-achieving peers dissolve because the quality of these friendship decreases due to the aforementioned competition or "exploitation practices", which may lead to mutual mistrust, tension, and lower intimacy among friends (Levy-Tossman et al., 2007; Poortvliet et al., 2007).

Next, in line with one of our hypotheses, mastery goal popularity norms did not play a role in similarity-based selection, nor in similarity-based maintenance, related to achievement. Hence, the alternate hypothesis that mastery goals would strengthen friendship selection and maintenance based on similarity in high achievement was not supported. Even though previous studies indicated that social comparison may take place in classrooms where mastery goals are salient (Collins, 1996, 2000), it might be the case that social comparison does not take place based on achievement, but rather based on aspirations and underlying motivation to learn more about a particular topic. Therefore, if social comparison would take place in these classes with salient mastery goals, it might not play a role in friendship selection and maintenance related to achievement. In general, it seems the focus on developing competence and the intrinsic value of learning might not be strong enough to break down the tendency to select and maintain similar friends (similarity-attraction hypothesis, Byrne & Lamberth, 1971). Hence, the attraction to similar peers as friends

due to higher levels of perceived trust and predictability (Byrne & Lamberth, 1971) may be important in all classrooms, regardless of the mastery goal popularity norm within the classroom.

**Friendship influence.** Contrary our hypothesis, we found that performance goal popularity norms did not play a role in the extent to which adolescents have a tendency become similar to their friends in terms of achievement. Even though friendship influence was generally lower when the association between popularity and performance goals was higher, the influence parameter did not significantly diverge across classrooms with different performance goal popularity norms. This finding can be explained as follows: although performance goal popularity norm classrooms may be characterized by less information exchange (i.e., Poortvliet et al., 2009), even among friends (Levy-Tossman et al., 2007), it could be hypothesized that students are highly attuned to any useful or high-quality information within their exchanges with their friends because of their exploitation orientation (Poortvliet et al., 2007). In this way, fewer interactions among students may still have important implications for the extent to which friends may influence each other in achievement over time. Future work that includes examination of the quality and quantity of information exchanged in the classroom could further our understanding of the implications of achievement goal norms for friend processes in the classroom.

Next, in line with our hypothesis, mastery goal popularity norms played a role in the extent to which adolescents became similar to their friends in terms of academic achievement. First of all, the tendency of adolescents to become similar to their friends increased when the association between mastery goals and popularity increased. Adolescents are more susceptible to friendship influence on academic achievement in classrooms where mastery goals are the popularity norm. Prior work indicates that mastery goals yield a cooperative goal structure in which adolescents perceive others as helpers to achieve their goals (Elliot et al., 2016; Karabenick, 2003; Roussel et al., 2011; Ryan & Shim, 2012). It could be hypothesized that this may be associated with useful exchange patterns and elaborated problem solving discussions (Harris, Yuill, & Luckin, 2008) in which adolescents reciprocally share information with each other (Porter, 2005; Poortvliet et al., 2007). Information exchange is the mechanism theorized to underlie peer socialization (Kindermann & Gest, 2009; Ryan, 2000) and our results indicate that when popular students increase the conditions for this mechanism by endorsing mastery goals, socialization is enhanced. Future studies are encouraged to test whether the increased tendency to be influenced by friends in these high mastery goal popularity norm classrooms indeed could be due to higher levels of information exchange.

Second, our results indicate that this increased susceptibility for friendship influence in high mastery goal popularity norm classrooms can be beneficial (in that adolescents' achievement will increase when their friends' achievement is higher on average) or detrimental (in that friends may influence adolescents to become lower in achievement). These unanticipated detrimental effects may be explained in two ways. First, previous studies have found that students with mastery goals are less apt to detect low-quality information when working with others which can hinder task performance (Poortvliet et al., 2007). This may be due students' cooperative mindset (i.e., the inclination to view other students as helpers, even lower achieving students; Porter, 2005). Further, the

salience of mastery goals may enhance a focus on what is interesting, which could distract students from the focus of the task. This finding implies it is important for teachers to provide guidance for productive discussions and help-seeking among students, even when they are focused on mastery goals. Second, our finding could be due to the fact that we measured peer-perceived achievement (i.e., academic reputation) instead of teacher-assigned grades. It could be hypothesized that mastery goal popularity norm classrooms are characterized by higher levels of information exchange among students that provide more opportunities for students to learn more about the academic skills of their classmates compared with in classrooms with less information exchange (i.e., high performance goal popularity norm classrooms). As the school year unfolds, there are more opportunities to see classmates struggle with challenging tasks, which may affect their perception on how well their peers are doing at school. Therefore, especially in these high mastery goal popularity norm classrooms, students may be more highly aware of the struggles and difficulties their fellow-students experience, which may result in a decline in peer-perceived achievement of classmates and friends. Future studies could compare friendship processes related to peer-perceived achievement and teacher-assigned grades in mastery goal popularity norm classrooms to investigate whether potential differences may be due to increased knowledge about each other's difficulties in completing tasks.

## Achievement Goal Descriptive Norms and Friendship Processes

As expected, descriptive norms did not play a role in the extent to which friendship selection, maintenance and influence processes take place. First of all, this finding could be due to the fact that descriptive norms are a quite subtle aspect of the environment as they represent average aggregated goals. This does not say much about the valence of a particular behavior, as it might be the case that there is a lot of variation within classrooms regarding these goals, and this variation is not taken into account. Moreover, according to social impact theory, the strength of social forces (in this case, peer norms) is a function of the status of peers, closeness of peers, and number of peers present (Latané, 1981). Descriptive norms only represent the last, quite subtle aspect of this function and hence may not be strong enough to determine social impact (Laninga-Wijnen et al., 2016). Second, descriptive norms represent only the behavioral characteristics of a group, whereas popularity norms refer to corresponding rewards of a group given compliance with the norm (i.e., gaining popularity). Third, descriptive norms place equal weight on all students within the classroom, but not all students may be equally influential. As shown in former studies and in the current study, popular students may be especially influential, as popularity is often more highly desired and more actively pursued by adolescents than by children (LaFontana & Cillessen, 2010), and behaving like popular peers may be an important tool to gain popularity in the peer group (Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010). Descriptive norms also include the behaviors of less popular peers and students may have the tendency to behave opposite to the behaviors of these non-popular students (see, e.g., Teunissen et al., 2012). Therefore, descriptive norms may be less important for friendship processes. Fourth, in the current study, there was not a high variation in the

averages of descriptive norms (especially for mastery goals, which is a common finding in other studies, e.g., Kaplan, Middleton, Urdan, & Midgley, 2002; Patrick, Kaplan, & Ryan, 2011; Régner et al., 2007; Urdan, Midgley, & Anderman, 1998). However, previous studies indicated that even variation at the higher end of the mastery goal scales seemed to matter for academic adjustment and interpersonal relations (i.e., Kaplan et al., 2002; Patrick et al., 2011; Régner et al., 2007; Urdan et al., 1998). Therefore, even though there was not a high variation in average descriptive norms, this variation could still have been predictive of friendship processes.

## Limitations and Strengths

Several limitations of the present study need to be acknowledged. First, our reasonably complex model could initially not be identified (convergence problems) in our small classroom-level networks of just 11 to 30 students. Therefore, we combined classrooms with similar levels of peer norms (low, moderate and high) and analyzed them simultaneously using multigroup analyses, which is an approach that is in line with various previous studies that included rather small classrooms (i.e., Delay et al., 2016; Logis et al., 2013; Shin & Ryan, 2014a; Svensson, Burk, Stattin, & Kerr, 2012; Weerman, 2011). Although the use of multigroup analyses increases power and allows for model identification, class-level variation is only considered for some and not all parameters.[1] In this way, multigroup analyses differ from meta-analyses which take into account class-level variation for each parameter in the model. Future studies with larger sample sizes may attempt to replicate our study with meta-analyses, so that class-level variation can be taken into account for all parameters in the model. Moreover, these future studies also could include class-level variables like gender-ratio and educational level, as these variables may play a role in the extent to which achievement goal peer norms are associated with friendship processes on achievement (Anderman & Midgley, 1997; Gherasim, Butnaru, & Mairean, 2013; Shin & Ryan, 2014a).

A second limitation is that we analyzed math and science classrooms without attention to potential differences between subjects (and did not have an adequate design or number of classrooms to do so). Some recent work has conceptualized science and math classrooms as having many similar features that affect adolescents' motivation and engagement similarly (see Fredricks et al., 2016; Wang et al., 2016). However, there are also differences in classroom activities (e.g., doing experiments in science but not math). Future work that assesses peer dynamics, engagement and achievement in both domains for the entire sample could address potential differences.

Third, we did not specifically address potential differences in achievement goals and friendship processes between fifth and sixth grade students due to power limitations. Preliminary analyses revealed no significant differences between Grade 5 and Grade 6 with regard to our research questions (see the Results section). Hence, our findings might imply that the extent to which popular students make achievement goals salient for friendship processes related to achievement might be independent of how often students are together. Indeed, previous studies and theory argue that group dynamics emerge when teacher and students come together each day in classroom, be it for alone hour or for most of the day

(Veenstra & Dijkstra, 2011). Moreover, both grades consist of early adolescents, which experience quite similar levels of hormonal changes and a similar peak in the desire for popularity (Steinberg, 2007). Also, previous studies indicated that peer-perceived achievement operated in middle school math and science classrooms in similar ways as in elementary school classrooms (North & Ryan, 2017). Future studies with larger sample sizes are encouraged to further examine whether achievement goals of the norms of popular peers play a similar role in the coevolution of friendships and achievement in both Grade 5 and Grade 6.

These limitations notwithstanding, this research has several strong and innovative points. First, our study responds to the "context gap" in the current literature on friendship processes regarding academic achievement. Until now, studies investigated achievement-related friendship processes without considering the broader social peer context in which these processes take place. Our study, aimed at capturing the broader social context in terms of achievement goal peer norms (specifically in terms of popularity norms), found that the direction and magnitude of friendship processes is dependent upon the broader social peer context in which they take place. An avenue for future research on the role of peer norms and friendship processes related to achievement would be to analyze whether peer norms play a role in the relative contribution of selection and socialization processes (see, e.g., Rambaran & colleagues, 2016). On the basis of the results of the current study, it could be expected that in classrooms with higher performance goals, selection processes would contribute more to similarity than socialization, whereas in classrooms with higher mastery goals, this would be the opposite.

Second, next to selection processes, we analyzed friendship maintenance processes, which have been rarely studied so far with regard to achievement. Our results indicate the importance of making a distinction between these two processes, as the context (in terms of performance goal popularity norms) may play a differential role in the direction and magnitude of these processes. Hence, future studies are encouraged to make a distinction between maintenance and selection processes related to achievement. Also, we encourage future researchers to take into account the quality (e.g., a 'close' friend or an acquaintance; see for instance Berndt, 1999) of the friendship relationship in examining the role of norms on friendship processes.

Third, an innovative point is that we examined friendship dynamics related to peer-perceived achievement and not to actual grades. The use of peer-perceived achievement as an outcome variable has both practical and theoretical value for the current study. First of all, an important assumption of SIENA is that students have full information about behavior in the network. The use of peer-perceived achievement assures us that we really measure the perception, and thus, the actual information students have on others' behaviors in the network. Second, previous studies indicated that adolescents may especially be influenced (in their friendship choices and in their behavior) by what they think their peers are doing (Bandura, 1986; Helms, Choukas-Bradley, Widman, Giletta, Cohen, & Prinstein, 2014). They may not always be aware of the GPA of other peers, but their close proximity and interactions with classmates may certainly contribute to their perceptions on how well someone is doing at school (Gest et al., 2008). Hence, capturing the perceptions of peers may provide

novel intriguing information on how selection, maintenance and influence processes related to achievement takes place.

## Contributions and Future Directions

Contributions of our study are twofold. First of all, our research adds to the current field by adopting a social psychology perspective on the role of achievement goals (Doise, 1986; Darnon et al., 2012) and by adequately examining processes of achievement-based friendship selection, maintenance, and socialization with stochastic actor-based modeling. In this way, the current study adds a new dimension to a more social understanding of achievement goals and contributes to our understanding of the interpersonal effects of achievement goals (Darnon et al., 2012). Future studies are encouraged to expand upon the current study to examine whether other types of academic peer norms relate to friendship processes on achievement as well, as there may be a variety of peer norms regarding academic behaviors and attitudes.

Second, the current study examined descriptive norms and popularity norms, and showed that (in line with an increasing number of studies on social adjustment; i.e., Laninga-Wijnen et al., 2016; Rambaran et al., 2013) popularity norms create an important context for the coevolution of friendships and behavior (i.e., achievement in the current study). Our results show that in classrooms where performance goals are endorsed by popular students, this may be detrimental for friendships among peers with similar levels of achievement. Moreover, influence processes are marginal, indicating that there are less possibilities to really learn from each other and to improve skills (everybody on their own island). Classrooms where popular students endorse mastery goals seem to provide an environment in which every student can be successful, but also an environment with certain hazards. Students may profit from interactions with friends who are high-achievers, resulting in similarity in achievement over time. However, we also found that higher achieving students may be disadvantaged by interactions with lower achieving friends (possibly because these friends do not share high-quality information in exchanges). Hence, teachers need to provide guidance and support for students' task-related interactions so that the exchanged information remains of high quality (Poortvliet et al., 2007). The higher susceptibility for peer influence in classrooms where popularity norms make mastery goals salient has potential benefits and drawbacks. Therefore, more studies are needed on the protective factors that could play a role in the direction of friendship influence on achievement in these classrooms with mastery goal popularity norms.

By indicating the importance of popularity norms for friendship processes related to achievement, the current study presents a clarion call to perform more studies in the educational field on the role of popularity norms for academic behaviors and social relations (McCormick & Cappella, 2014). Especially during adolescence, when popularity is such a highly valued characteristic and goal, the norms of popular adolescents may have a profound impact on which academic behaviors are positively valued and reputationally salient within a particular setting (Hartup, 1996). Another interesting area of future research would be to also examine the potential moderating role of individual-level popularity in friendship processes related to achievement in this age-group. This may provide a fuller account of the role of popularity in friendship processes related to achievement in early adolescence. Importantly, in the current study we made a first

step in investigating the role of achievement goal salience in friendship processes, by focusing on the role of performance and mastery goal status norms separately. Our study provides a basis regarding these key relations for future studies that may examine the effect of these popularity norms more in depth. For instance, as performance goals and mastery goals can also form constellations within classrooms (Tuominen-Soini, Salmela-Aro, & Niemivirta, 2011), according to the multiple goals perspective (Pintrich, 2000), and it might be interesting to examine what friendship processes look like in classrooms where both performance and mastery goals are salient, compared with classrooms where either mastery or performance goals are salient or in classrooms where neither achievement goals are salient.

## Conclusion

In conclusion, by considering the achievement goals of popular students in classrooms in relation to friendship dynamics across the school year, the present research contributed to the literature on achievement goals as well as friendship processes related to achievement. Classrooms are social places where students are developing friendships and learning, and our results shine light on the complex interplay between social and academic adjustment during early adolescence. For decades, theory and research has given much attention to how teachers affect students' achievement goals and learning outcomes (Ames, 1992; Brophy, 2005). There has been growing recognition in recent years about the role that teachers play in peer dynamics in classrooms (Farmer, Lines, & Hamm, 2011; Gest, Madill, Zadzora, Miller, & Rodkin, 2014). An implication of our findings is that attention to popularity dynamics by teachers is warranted and likely to play a key role in the motivational climate in classrooms of early adolescent students. Teachers receive little to no training in how to manage peer relationships in the classroom. When asked about their efficacy for managing peer relations, both elementary and middle school teachers reported feeling less efficacious about this aspect of their work compared with instruction, motivation and classroom management (Ryan, Kuusinen, & Bedoya-Skoog, 2015). Thus, research and theory to guide professional development supporting teachers in managing peer relationships is an important direction for educational psychology that could advance our understanding of how educators can best support early adolescents' social and academic adjustment.

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