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Connecting, interacting and supporting

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Chapter 7

Summary, conclusions and discussion

This chapter presents an overview of the results of the five empirical studies and general conclusions, as well as the scientific and practical implications of these findings. Finally, this chapter offers some promising directions for further research.

7.1. Motivation for this research

Small group teaching can help students meet academic requirements and build a new social network (Hattie, 2009; O'Donnell, 2006)—two of the most pressing challenges that first-year students encounter when they enter higher education (Beyers & Goossens, 2002; Buote et al., 2007; Rausch & Hamilton, 2006; Wilcox, Winn, & Fyvie-Gauld, 2005). This thesis proposes that building social capital and informal peer networks are important mechanisms for effective small group teaching. Furthermore, the formation of peer relations, which constitutes a form of social capital that can be leveraged in small group teaching settings, depends on students' prior achievement and cognitions, especially their self-efficacy, growth mindsets, and self-perceived popularity in a network. From a social capital perspective, small group teaching is effective if students can rely on relationships that provide them with support, information, or advice. Access to and use of social resources in turn can help students achieve their personal goals, such as getting good grades (Coleman, 1990a; Flap & Völker, 2004; Lin, 1999). From a peer network perspective, small group teaching is effective if higher education students actively approach their peers when they do not understand the study material or seek to collaborate, which enables them to build informal peer networks for obtaining academic and social support (i.e., social capital). Informal peer networks are created by the students, not the faculty, and exist outside the classroom (e.g., Hommes et al., 2012).

Self-efficacy and growth mindsets also are relevant for individual outcomes, such as academic achievement (Burnette, O'Boyle, Van Epps, Pollack, & Finkel, 2013; Richardson, Abraham, & Bond, 2012). Theoretically, these cognitions may be influenced by social capital (e.g., Usher & Pajares, 2008), and the inverse path also is plausible, such that cognitions and prior achievement could be determinants of social capital and informal peer networks (Cleland, Arnold, & Chesser, 2005; Siciliano, 2016; Vaughan, Sanders, Crossley, O'Neill & Wass, 2015). To date, little educational research examined the extent to which students' cognitions affect selections of others into their networks or their access to social capital (cf. Zander & Hannover, 2014). Although self-efficacy and growth mindsets are both important for dealing with academic challenges, self-efficacy, which targets the self, is defined as a personal belief that the student can accomplish certain tasks, according to a "I-can-do-cognition" (Bandura, 1977b, 1997; Kraft, Rise, Sutton, & Røysamb, 2005), whereas growth mindsets target both the self and others and represent the general, optimistic belief that ability results from effort, as explained by implicit theories of intelligence, or the "one-can-grow-cognition" (Dweck, 1999, 2006; Ferla, Valcke & Schuyten, 2009; Yeager & Dweck, 2012). In higher education, the students need one another to gain support. The resources derived from peer relationships then must be applied to attain the potential benefits that can arise from small group teaching. In particular, students must believe that effort and support contribute to their achievement. Furthermore, self-perceived popularity in peer networks is a cognition reflecting the student's self-perceived integration among peers, yet it often is overlooked in peer network research (Kilduff, Tsai & Hanke, 2006; Kwon & Adler, 2014). To address these research gaps, this thesis works to answer the following main research question, relative to small group teaching: *To what extent and how are prior achievement, cognitions, social capital, and informal peer networks in (formal) small group*

teaching related? To address this main research question, this thesis investigates three sub-questions:

- (1) To what extent and how are cognitions, faculty interaction, peer interaction, different dimensions of social capital, and study success interrelated in small group teaching, controlling for prior achievement?
- (2) To what extent are cognitions and prior achievement determinants of the establishment of informal peer networks in small groups?
- (3) To what extent does the formal setting of small group teaching contribute to the establishment of informal peer networks?

Using a combination of survey and network data, gathered longitudinally from the Netherlands and Germany, the studies contained in this thesis offer a greater understanding of the mechanisms of small group teaching. Specifically, this thesis captures five empirical studies. Chapter 1 introduced the mechanisms of small group teaching. Chapter 2 provided a model of the determinants, including provided peer support (i.e., peer consideration), of early study success (i.e., during the first semester), which function directly or indirectly through self-efficacy. Chapter 3 specified the impact of peer and faculty interactions on self-efficacy and study success in two forms of small group teaching, learning communities and mentor groups, that differ mainly in the number of contact hours and the role of the mentor. The two forms are interesting to compare, because learning communities may facilitate social capital more than mentor groups by requiring students to meet more frequently and encounter more possibilities to collaborate with the same group members. The mentor of the learning community also gets to know students better during individual feedback meetings, and students can derive additional social capital from this relationship. Chapter 4 focused on different dimensions of students' social capital and its relation to study success, with self-efficacy as a potential mediating factor. This chapter also checked for the possible influence of students' prior achievement level. Chapter 5 investigated how self-efficacy and growth mindsets influence self-perceived and actual popularity in academic and social support peer networks. Chapter 6 elaborated on the findings of the two previous chapters. While Chapter 4 showed that friends of high-achieving students contribute more to study success than friends of low-achieving students, Chapter 5 showed that high levels of self-efficacy make students attractive in academic support networks, indirectly through self-perceived popularity in that network. Finally, Chapter 6 provided a nuanced picture of the evolution of peer networks, using stochastic actor-based modeling that revealed the interrelated peer group dynamics in academic and social (friendship) support networks. This study described how these dynamics link simultaneously with student characteristics (self-efficacy, prior achievement) and structural network features.

Section 7.2 presents an overview of the main findings. These findings lead to some general conclusions about social capital and informal peer networks in small group teaching, organized according to the three aims that guided this research. The discussion covers both scientific and practical implications, as well as some suggestions for further research.

7.2. Summary of main findings

7.2.1. Determinants of early study success in contemporary higher education

Chapter 2 focused on the determinants of early study success in contemporary higher education context. Two theoretical approaches—Walberg’s (1984, 1986) educational productivity model and expectancy-value theory (Pintrich & De Groot, 1990; Wigfield & Eccles, 1992)—underlie this study, providing a complete, parsimonious conceptual framework for investigating early study success factors in a contemporary higher education context. The educational productivity model captures nine factors, divided into three groups: (1) students’ characteristics and aptitude, which comprises students’ prior achievement or ability, age or development, and motivation; (2) psychosocial environment, involving the home environment, peer environment, school environment, and mass media; and (3) the quantity and quality of instruction (Walberg, 1984, 1986). The motivational factor also appears in the educational productivity model, but extending this model with concepts derived from expectancy-value theory (Pintrich & De Groot, 1990) held the promise of offering more insight in the determinants of early study success. Prior research has shown that expectancy (self-efficacy) relates closely to study success (e.g., Richardson et al., 2012). Affect (emotion) also seems important for first-year students, who feel pressure to graduate on time (e.g., Stegers-Jager & Cohen-Schotanus, 2012), which in turn may affect how they value the study program or related tasks. Therefore, this chapter investigated how psychosocial environmental factors, among other factors, relate to early study success, directly or indirectly through self-efficacy cognitions. Study success during the first semester is critical to enable timely completion of the first year (McKenzie, Gow, & Schweitzer, 2004). Using a sample of 407 first-year social science students, with measures at the mid-term and at the end of the first semester, a path model showed that the extended educational productivity model explained early study success very well. The psychosocial environment (peer consideration, social media use), as well as the educational productivity factors age, prior achievement (ability), and quality of instruction (satisfaction with the program, study skills), all related to early study success directly or indirectly through expectancy and the quantity of instruction (i.e., time spent on self-study). Expectancy correlated with value and affect, and it contributed, beyond the factors derived from the educational productivity model, to explaining early study success. More factors predicted study success after the first semester than at its midpoint. Age, time spent on self-study, and program satisfaction were determinants of study success only after the first semester, not at its midpoint. During an academic year, as academic demands increase, differences in background characteristics and study behavior appear to become more important, and individual variability arises. Furthermore, students get a better sense of their studies and satisfaction with the program. This chapter thus offers the tentative conclusion that, among other factors, peer support or social interaction in small university groups enhances early study success through improved self-efficacy. Small group teaching may increase program satisfaction, which relates directly to early study success. Consistent with previous literature (e.g., Bruinsma & Jansen, 2007; McKenzie et al., 2004), Chapter 2 shows that prior

achievement is important for study success and should be taken into account in evaluations of small group teaching.

7.2.2. Social capital and a cognitive perspective on small group teaching

Chapter 3 studied two forms of small group teaching: learning communities and mentor groups. This chapter sought to investigate the relationships among peer and faculty (i.e., student-teacher/mentor) interactions, self-efficacy, and early study success using a natural design. In 2013, mentor groups were replaced by learning communities in the psychology and sociology study programs at a Dutch university, whereas pedagogical sciences kept still mentor groups until 2014. In learning communities, students attended all courses together during the first semester, whereas students in mentor groups met once a week. The key difference was that students in learning communities met more frequently and had more possibilities to collaborate, but another important difference involved the role of the mentor. In learning communities, the mentor acted as a teacher and coach; in mentor groups, the mentor was mainly a teacher. Learning communities seemingly should provide more possibilities to build social capital, as derived from peer and student-teacher interactions. Survey data came from 407 first-year social science students in the 2013–2014 cohort. The multilevel analyses showed that contact hours, peer interaction, and faculty interaction related positively to self-efficacy, and self-efficacy enhanced early study success. For students in learning communities, the positive effect of faculty interaction on self-efficacy was stronger than for students in mentor groups. These results suggest an important role for teachers and mentors, who can enhance peer and faculty interactions and self-efficacy and thereby exert small but important effects on study success. Peer and faculty interactions thus facilitate students' social capital, because the interactions contribute to the achievement of academic goals. This chapter also showed that independent of the form of small group teaching approaches applied, students' prior achievement and skills were highly related to study success and self-efficacy, respectively. Hence, the question arose about whether small group teaching is more beneficial for certain students in terms of their achievement level when they enter university. This question is addressed in the next chapters.

Chapter 4 focused on different forms of social capital while also specifying the role of the student's achievement level. In both primary and secondary education studies, social capital contributes to academic performance. In particular, parents contribute to students' social capital in primary school (Cemalcilar & Gökşen, 2014; Dufur, Parcel, & Troutman, 2013; Huang, 2009; Kao & Rutherford, 2007), but in higher education, students access different resources, such as faculty and peers. Few studies note the impact of different dimensions of social capital on study success in small group teaching in a higher education context though. Furthermore, students' achievement level seems important for building social capital, but previous findings are inconsistent (Arcidiacono & Nicholson, 2005; Cleland et al., 2005; Todres, Tsimtsiou, Sidhu, Stephenson, & Jones, 2012; Vaughan et al., 2015; Whannell & Whannell, 2014). This chapter therefore examined the extent to which social capital relates to study success for first-year university students and whether this effect differs for high-, average-, and low-achieving high school students. Survey and social

network data from 407 first-year university students in the Netherlands measured access to family, faculty, and peer capital. The measure of family capital used three dichotomous questions: whether parents or siblings were highly educated, whether students received financial support from their family, and whether students moved out of their parents' homes. Faculty capital was assessed with items about interactions with and received support from faculty, such as mentors, study advisors, or teachers. For peer capital, this study asked about peer support and the number of peers nominated as help or advice givers, preferred collaborators, and friends. In contrast with family capital, faculty and peer capital contributed to study success indirectly, through self-efficacy and friends (also part of peer capital), respectively.

This chapter also addressed a separate question, namely, to what extent social capital exerted differential effects for various groups of students in terms of their achievement level. Compared with low-achieving students, for high-achieving students, friendship has a positive effect on study success during the first year. The more friends these students have, the higher their achievement. High-achieving students may become friends mostly with other high-achieving students; the same holds for low-achieving students (Lomi, Snijders, Steglich, & Torló, 2011). This effect could explain why the friends of high-achieving students benefit their academic achievement when high-achieving students indeed connect to other high-achieving students for academic support. Chapter 6 examined to whom students connect for their friendships in informal peer networks by using stochastic actor-based models, which enabled us to investigate the peer networks longitudinally and to take into account student characteristics and structural features of the network, such as similarity in characteristics between students. This provided more understanding of the underlying processes of the development of informal peer networks and the link with student characteristics (achievement, self-efficacy) and the formal small group setting. Overall, small group teaching seems beneficial for study success when it enhances students' social capital, in particular peer and faculty capital.

7.2.3. Peer networks and a cognitive perspective on small group teaching

Chapter 5 examined the role of cognitions in informal peer networks among 580 first-year bachelor and master's university students in seminar groups. These groups used an interactive learning approach to grant students opportunities to discuss and clarify study material that had been presented during the main lecture. Unlike learning communities, students meet during both the lecture and the seminars, but they do not participate in all courses with the same seminar groups. On average, mentor groups and learning communities include 12–14 students, whereas seminars have on average 24 students per group. In addition to self-efficacy, this chapter investigated growth mindsets and their relation to self-perceived and actual popularity in students' academic and social support networks. Growth mindsets and self-efficacy both suggest methods for dealing with challenges faced by students; growth mindsets likely make students more attractive as academic helpers, as indicated by their increased popularity among peers in academic support networks over time. Students with this cognition do not believe that help seeking is a result of incompetence or weak abilities but instead regard it as a useful strategy for

improving intellectual capabilities (Feeney & Collins, 2015; Pollack, Forster, Johnson, Coy, & Molden, 2015). Therefore, their optimistic perspective can motivate help seekers to devote more effort to the task and ask others for academic support, especially those other students who express a grow mindset. Self-efficacy might make students attractive as academic helpers. On the one hand, it can be appropriate to ask someone who signals high self-efficacy (Siciliano, 2016), but on the other hand, this cognition also could be perceived as threat that makes a help seeker feel unsure and worry about bothering the other student with requests for help (Nadler, 2015). Students' popularity, as indicated by fellow students (peer nominations), was contrasted with their self-perceived popularity (self-reports). For the academic support networks, students nominated all peers from the seminar groups whom they would ask for academic help and with whom they prefer to collaborate. For the social support networks, students indicated which fellow students they would approach to share personal issues and whom they regard as a friend. In academic support networks, members exchange study-related information and support, whereas the social support networks are based on sympathy and affection, and members exchange non-study-related, personal support (Nebus, 2006; Tomás-Miquel, Expósito-Langa, & Nicolau-Juliá, 2015; Zander, Kreutzmann, West, Mettke, & Hannover, 2014).

The actual popularity indices corresponded with indegree centrality, or the incoming nominations each student received from other students (Hanneman & Riddle, 2005; Wasserman & Faust, 1994), as calculated by Ucinet version 6.497 (Borgatti, Everett, & Freeman, 2002), for members of each network (Borgatti, Everett, & Johnson, 2013). This measure then was aggregated into two composite scores, for the academic or social support peer networks. To assess cross-lagged paths over time, this chapter looked at popularity in the academic support networks and its effect on popularity in the social support networks during the next measurement, and vice versa. When students help each other academically, it can enhance their feelings of sympathy and strengthen their popularity in the social support networks. When students like each other and provide social support, they also may feel comfortable asking for academic support (Lomi et al., 2011). Yet if students just like peers, they may not be perceived as competent enough to provide effective academic help (Nebus, 2006; Tomás-Miquel et al., 2015). According to a path model, growth mindsets predict, directly and positively, actual popularity in academic support networks. Although not hypothesized, growth mindsets also had a positive effect on actual popularity in the social support networks. Thus, the belief that intellectual capabilities and abilities can improve by effort is an optimistic perspective that makes these students attractive in the academic and social support networks; self-efficacy instead is a personal belief related to self-perceived popularity in the academic support networks, which makes the students attractive in the academic support networks too. Moreover, self-efficacy related to self-perceived popularity in the social support networks but not to actual popularity in the social support networks. In contrast, this study revealed a small, negative effect of self-efficacy on actual popularity in the social support networks. Unlike the effect of the self-perceived popularity of highly self-efficacious students, fellow students simply might not feel comfortable asking these students for social support. Furthermore, the cross-lagged paths showed that popularity in academic support networks in the first measurement predicted actual popularity in social support networks in the next

measurement, but actual popularity in social support networks at first did not predict actual popularity in academic support networks later.

To provide a more nuanced picture of the links between academic and social support networks and to what extent these relationships depend on individual performance, cognition (self-efficacy), the learning community or the network structure, **Chapter 6** used stochastic actor-based modeling and investigated how students' achievement level, cognition (self-efficacy), and small group teaching contribute to the creation of informal peer networks. The stochastic actor-based models supported longitudinal investigations of the peer networks, taking into account both student characteristics and the structural features of the network, which thus clarified the processes by which informal peer networks develop. In particular, a central concept related to small group teaching is integration (Tinto, 1993), often defined from an individual perspective, whereas the role of the social structure has been largely overlooked. Although perceived integration from an individual perspective is useful, combining it with a social network perspective offers a more comprehensive conceptualization. A peer network perspective thus can provide useful insights into the group dynamics that contribute to integration. For example, degree centrality (number of relationships) can indicate structural integration, which may depend on individual characteristics and structural network features. Thomas (2000) was among the first to link integration to social networks; Smith (2015) more recently defined integration as the extent to which students are embedded in academic and social peer networks. Accordingly, this chapter addressed which peers students connect with, according to their achievement levels and cognition (i.e., self-efficacy). In organizational networks, willingness to provide help and expertise makes a colleague attractive as a helping resource (Cross & Borgatti, 2004). High grades might signal expertise, and self-efficacy relates closely to academic achievement (Brouwer, Jansen, Flache, & Hofman, 2016; Brouwer, Jansen, Hofman, & Flache, 2016b; Feldman & Kubota, 2015; Richardson et al., 2012), offering yet another signal of expertise. Therefore, help seekers might ask for help from someone with high levels of self-efficacy. As in the previous chapter, in challenging or unfamiliar situations, such as a new learning environment, students instead may feel more comfortable approaching someone with similar feelings or beliefs (Townsend, Kim, & Mesquita, 2014). Finally, willingness to provide support is critical, and it is more likely that a friend is willing to help (Nebus, 2006).

To explore how achievement and self-efficacy affect relationship choices in learning communities, Chapter 6 tested two competing hypotheses derived from different theoretical approaches. First, using Tinto's (1993) interactionalistic model and the homophily (similarity) principle in friendship formation (McPherson, Smith-Lovin, & Cook, 2001), an alignment hypothesis has been tested that students connect to similar-achieving and similarly self-efficacious friends for academic and social support. Social network research shows that students tend to become friends with others who are similar in their characteristics, behavior, and achievement, according to a similarity or homophily tendency (Flashman, 2012; McPherson et al., 2001). Friends thus may offer social support, but they might not provide the best academic advice if their academic capabilities are similar. Second, Vygotsky's (1978) social constructive theory suggests that when students ask slightly more capable peers for academic support, this should be most beneficial for

learning processes and performance (Alevén, Stahl, Schworm, Fischer, & Wallace, 2003; Vygotsky 1978; Wood, Bruner, & Ross, 1976). Thus with a duality hypothesis has been tested that, for academic support, students should connect to others who are dissimilar in their achievement and self-efficacy levels, but for social support, they turn to fellow students with similar achievement and self-efficacy levels. The tests of these hypotheses relied on longitudinal social network data collected from 95 first-year Dutch students in eight learning communities that measured both academic (help seeking, preference for collaboration) and social (friendships) relational choices, within and beyond the learning communities. The models, tested with stochastic actor-based modeling in the R-package SIENA (Simulation Investigation for Empirical Network Analysis; Ripley, Snijders, Boda, Vörös, & Preciado, 2016; Snijders, Van de Bunt, & Steglich, 2010) supported the alignment hypothesis rather than the duality hypothesis. Students ask help from their friends or friends prefer to collaborate with each other. Consistent with the homophily principle (McPherson et al., 2001), similarity in achievement level predicted relations, in both academic and friendship networks. Higher-achieving students also connected more to others to obtain academic help, noted more preferred collaborators, and established more friendships, especially with their fellow high-achieving students. Lower-achieving students instead identified other lower achievers primarily for academic help, collaboration preference, and friendship or social support.

To what extent does small group teaching facilitate relationship formation in these informal peer networks? In general, the probability was ten times greater that a student would establish a relationship with a specific fellow student in his or her own learning community than with a specific student outside of it. The density in the learning community networks thus is greater, by a factor of ten, than in the overall study program network. Learning communities thus function as cohesive subgroups within the study program. Over time, collaboration preferences remained mainly focused on their own group. No significant changes arose in terms of the number of friendships and academic help-seeking within versus outside learning communities from the first to the second semester.

7.3. General conclusions and discussion

Related to the three research questions, as well as the prediction that social capital and informal peer networks contribute to effective small group teaching and that cognitions relate to both social capital and informal peer networks, three aims guided this research. The first was to investigate the relatedness among three concepts: student characteristics (prior achievement, cognition), social capital, and study success. Self-efficacy mediated the relationship between social capital (peer interaction, faculty interaction) and early study success (after the first semester). When a focal student provided support to others (i.e., peer consideration, Chapter 2), it contributed to self-efficacy and thus early study success, as did receiving support from others during interactions with peers (Chapter 3). In contrast with family capital, faculty capital (interaction with and support from faculty) contributed to self-efficacy and study success after the first semester and thus to study success after the first year. A cross-sectional analysis showed that help seeking, collaboration preferences,

and support from fellow students contributed to the number of friends (but not to self-efficacy) and to study success after the first semester and first year. Thus, when other social capital variables, in addition to peer interactions or peer support, are taken into account, the number of friends becomes more important than self-efficacy in terms of contributing to study success (Chapter 4).

The second aim was to investigate the contribution of academic capabilities, measured by prior achievement, and cognition to informal peer connections. This thesis has revealed that self-efficacy is not only a mediating factor between social capital and study success but also an important determinant of self-perceived popularity in academic and social support peer networks. Self-perceived popularity in academic support networks contributed to actual popularity in academic support networks. Students with high levels of self-efficacy thus are more attractive to others as academic support resources, though this effect is indirect, through self-perceived popularity in the academic support network. Students who believe that intellectual capabilities can change with effort (growth mindsets) are more attractive to others as sources of academic support, but also as sources of social support (Chapter 5). The stochastic actor-based modeling in Chapter 6 revealed a more nuanced picture of the role of self-efficacy in the establishing and changing relationships in informal peer networks. Again, no direct effect of self-efficacy emerged from relationship changes, but an effect of academic capabilities emerged. The longitudinal analysis of complete social network data showed that higher achievers have more relationships in academic and friendship networks and connect in particular with other higher achievers. In turn, lower achievers connect with other lower achievers. For all students, it is more likely that students ask friends for academic support and prefer to collaborate with friends; in turn, when students prefer to collaborate, it is more likely that they become friends. If students ask their peers for academic help or advice though, it is not any more likely that they become friends—a finding that seems to contrast with the results in Chapter 5, in which cross-lagged paths showed that when students are popular in academic support networks, they likely become popular in social support networks too. The contrast can be explained according to the measures used though: Chapter 5 assessed popularity in academic support networks using a combined scale of academic help and collaboration preferences and measured social support with a combined scale of sharing personal issues and friendship; Chapter 6 instead relied on stochastic actor-based modeling and thus offered a more nuanced picture of network dynamics and the interrelatedness of different networks, rather than their combination.

The third aim was to investigate the contributions of formal, small student groups to establishing informal peer networks. In learning communities, which maintain a stable group composition during the first semester, the probability was ten times greater that a student would establish a relationship with a specific fellow student in his or her own learning community than with a specific student outside of it. Collaboration preferences remain within the own learning community during the first year. For friendship and help-seeking, no significant changes occur between the first and second semesters with regard to relationships within or outside the learning community. Learning communities contribute to both informal peer networks and social capital, derived from interactions with faculty. As

Chapter 3 showed, faculty interactions contributed to self-efficacy and thus to study success. This effect was stronger in learning communities than in mentor groups.

Figure 7-1 summarizes these main findings, which can be used as a starting point for further research. Overall, this thesis suggests reasons to be optimistic in terms of the contribution of small group teaching to the impact of social capital and the establishment of informal peer networks.

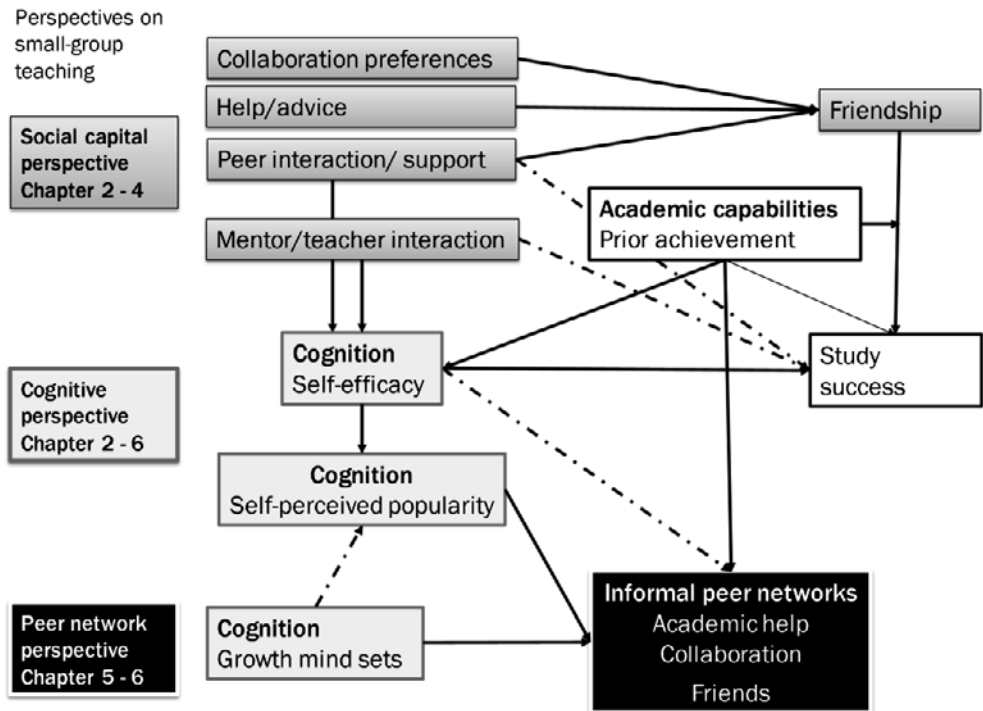


Fig. 7-1. Conceptual model of the thesis findings

Note. Dotted arrows indicate non-significant findings.

7.4. Scientific and methodological implications

This research contributes to extant literature in several ways, and in particular to research related to small group teaching in higher education. Relatively few studies investigate small group teaching in higher education from a network perspective (Hommes et al., 2012; Katz, Lazer, Arrow, & Contractor, 2004; Smith, 2015; Thomas, 2000). This thesis provides unique information about how social capital and informal peer networks spontaneously develop within a small group teaching environment, as well as how cognitions mediate the effect of social capital and contribute to the creation of informal peer networks. Informal peer networks can be part of students' social capital. By examining the role of individual

achievement differences, with regard to relationships with fellow students in academic peer networks and friendship networks, this thesis indicates the extent to which these relationships are valuable resources that contribute to academic success.

This research relied on three central perspectives, in line with its multidisciplinary character. The cognitive perspective is based on psychological theories and research (social cognitive theory; Bandura, 1986, 1997; implicit theories of intelligence; Dweck, 1999). The social capital and peer network perspectives are based on sociological theories (social capital; Coleman, 1990a; Lin, 1999; homophily-principle; McPherson et al., 2001). The perspective related to effective small group teaching and study success reflects theories and research from educational sciences and educational psychology (Tinto, 1993; Vygotsky, 1978). By investigating small group teaching from three different angles, this thesis has provided a nuanced picture of the mechanisms of effective small group teaching.

According to the social capital perspective, peer and faculty interactions contributed to self-efficacy and study success. The effect of faculty interaction on self-efficacy was stronger in learning communities than in mentor groups. That is, when the role of the mentor is more prominent, the mentor can enhance students' self-efficacy. When more contact hours occur, students' self-efficacy also is slightly enhanced. According to the peer network perspective, building peer relationships depends on cognitions, and especially on the person's achievement level. Analyses of academic and social support networks provide insight into students' selections of others as source of help and to what extent it depends on social network structures. Higher-achieving students connect more often to others in all types of networks (help seeking, collaboration preferences, friendship), but in particular, they link with similar, higher-achieving students. According to the cognitive perspective, self-efficacy mediates between social capital and study success. Self-efficacy, growth mindsets, and self-perceived popularity are important antecedents of the selection of interaction partners in small group teaching and access to sources of support (social capital). Students' achievement level appears to moderate the creation of social capital.

As a methodological implication, this thesis shows that applying stochastic actor-based modeling can reveal different processes in network formation: interrelations between academic and social support networks, links between social network structures and personal attributes, and the formation of relationships within and outside the formal small group. Stochastic actor-based modeling initially was developed to investigate network dynamics and has been applied to several domains in social network research (e.g., Snijders et al., 2010). For example, Lomi et al. (2011) apply it to higher education; the current thesis extends this application in higher education, specifically, to small group teaching.

7.5. Practical implications

Students face academic and social challenges; small group teaching aims to help them meet the academic requirements of higher education while also encouraging them to build new social networks (Beyers & Goossens, 2002; Buote et al., 2007; Christie, Munro, & Fisher, 2004; Hattie, 2009; Rausch & Hamilton, 2006). This thesis has shown that students

benefit in various ways from the implementation of small group teaching, which suggests some optimism. Small group teaching contributed to the establishment of peer relationships, especially during the first semester. Interactions with and support from peers and faculty contributed to self-efficacy and thus to study success. When mentors go beyond a teaching role and build personal relationships with students during feedback meetings, as well as when students have more contact hours, the effect of faculty interactions on self-efficacy is stronger. Mentors thus should organize feedback meetings to provide students with tailored feedback that may contribute to students' self-efficacy and study success. Growth mindsets also are important for academic peer relationships. Mentors and teachers can foster growth mindsets through their feedback. A group norm then may develop, in which students believe that helping others contributes to the learning process and performance (Blackwell, Trzesniewski, & Dweck, 2007)

Although these results are encouraging, they also suggest that just forming small groups is insufficient to ensure that small group teaching benefits all students or prompts them to leverage the diversity of the group, in terms of intellectual abilities. Students mainly connect to fellow students with similar achievement levels. If this trend toward homophily is powerful, network segregation may emerge. On the one hand, the benefits for higher-achieving students support university initiatives to foster excellent students, but on the other hand, lower-achieving students seem to benefit less, in contrast with the overall initiative to improve academic performance rates and enhance education quality (Beerkens-Soo & Vossensteyn, 2009; OECD, 2012a). Achievement segregation also is not the only risk; Rienties, Héliot, and Jindal-Snape (2013) show that network segregation occurs by nationality in small student groups. Peer network features such as homophily make it more likely that small groups segregate themselves (Wimmer & Lewis, 2010). Just arranging students in small groups thus can lead to undesired outcomes, such that students never make use of one another's diverse perspectives or learn from students with different cultural backgrounds. Universities and teachers cannot take for granted that students will collaborate simply because they have been arranged in a group (De Hei, Strijbos, Sjoer, & Admiraal, 2015; Rienties et al., 2013).

The findings in this thesis suggest some ways to improve education quality and align with current trends in higher education though. Community building and fostering student engagement are popular options for improving the quality of higher education (Onderwijsraad, 2015; VSNU, 2016). Honors colleges, university colleges, and international classrooms are prominent examples of small group teaching. In addition to ambitions to meet the needs of diverse student bodies, enhance excellent students, widen participation, and welcome international students, it is important to arrange students in small groups while also recognizing their unique needs and guide relationship formation processes in academic networks. Small group teaching facilitates personal relationships between faculty and students, which can help provide tailored support. Universities should think about how all students might benefit from small group teaching and develop strategies, within small group teaching initiatives, to exploit the diversity of characteristics and abilities throughout their student bodies. This goal is even more important considering the trends of widening participation and increasing enrollment of international students, both of which will result in more diversity in the student population in terms of their needs, background characteristics,

and achievement levels (OECD, 2014; VSNU, 2016). Furthermore, increasing options related to online and flexible study programs might provide new routes for implementing small groups that provide academic support and group discussions, or else inform a blended learning environment. Still, it remains challenging to match students to ensure that they all benefit in their learning process (Vereniging Hogescholen, 2016; VSNU, 2016; Wimmer & Lewis, 2010). The findings thus identify the need for further research.

7.6. Directions for further research

Because this thesis investigated a real-world, higher education context, it was necessary to balance the aims of the educational process and the aims of the research. Therefore, it was not possible to collect the data in the same way simultaneously in all study programs, nor was it possible to use quasi-experimental designs (e.g., including a control group) to obtain insights into the effectiveness of different forms of small group teaching. In today's educational practice, it is virtually impossible to find a control group program that does not feature any form of small group teaching. However, the comparison of different forms of small group teaching in different educational programs provides some valuable insights. In particular, it reveals that students mainly connect with peers from their own small group (i.e., learning community) in their first semester. The insights are limited to relationship changes between the first and second semesters; ideally, the studies would collect data before the official start of the academic year (e.g., during an orientation week). Such a method could offer a picture of changes in peer relationships during the first complete year. It is plausible that a student's own group is critical at the start of the first year, a prediction that could be investigated by research that takes an initial measurement before the start of the academic year.

The small group teaching environment is intended to create peer groups focused on learning, but some unintended consequences arise simultaneously (e.g., Jaffee, 2007). Group dynamics can hamper learning if the predominant cognitions in the group interfere with learning, such as when students attribute performance to innate capabilities instead of effort or support. If all members of the group exhibit similar capabilities, such that better performers who might contribute to learning outcomes are not available, it also might hinder learning (Aleven et al., 2003). This thesis focuses on achievement and cognitions at the individual level, but research in teacher education suggests that collective efficacy also has an important impact on individual achievement (Moolenaar, Slegers, & Daly, 2012; Takahashi, 2011). Similarly, in small group teaching settings, collective efficacy and average achievement levels might make a difference for individual performance. It thus may be useful to include group-level variables in the models.

Notably, this research includes cognitions that could be influenced by others or have an impact on relationships with others, as well as cognitions that are important for dealing with academic challenges. On the basis of theoretical reasoning and previous research, the central focus was on three cognitions that are pertinent to learning and relevant for building social capital and peer networks. These cognitions help explain social capital and peer networks in small group teaching. The studies described in the chapters revealed important

findings, though in many cases with small effect sizes. Such outcomes are common in education research (e.g., Dweck, 1999; Hattie, 2009; Pajares, 1996; Richardson et al., 2012; Robbins et al., 2004), but might be still relevant for the individual student. Hattie (2009) suggests that when teachers and students collaborate, while encouraging growth mindsets throughout the group, individual achievement expectations improve. Similarly, when teachers raise the level of students' self-efficacy, rather than focusing on grades, it can enhance learning and study success. Both cognitions can prompt a group norm of providing peer support, which is key to the success of small group teaching.

The findings also raise some new questions that further research can tackle. In particular, group processes appear to emerge spontaneously in formal small group teaching settings. Consistent with Osman, Duffy, Chang, and Lee (2011), achievement level plays a role in establishing relationships in small group teaching. Yet in Figure A6-2 in the Appendix of Chapter 6, one group includes relatively more low achievers. During the first semester, however, students connect to peers in their own group, and this first semester is important for their first-year study success. Therefore, it is essential to form groups that can contribute to the learning potential of all students, from the start of the academic year. Further research thus should determine how to arrange groups, in terms of students' achievement level and other characteristics, to ensure the most beneficial effect on individual and collective achievement levels. Ethical concerns prevent some forms of investigation; it is not appropriate to assign students to potentially "good groups" and potentially "bad groups" in terms of achievement. One solution would be to turn to simulation studies, which model individual and group characteristics over time, then determine the effects for individual and collective success. With agent-based modeling, the dynamics of peer networks can be modeled according to theoretical assumptions about the mechanisms of partner selection and social influence. Such mechanisms in turn can be based on results from empirical studies using stochastic actor-based modeling, as in Chapter 6. Recent work also indicates that such models can be used to assess the extent to which it is possible to replicate the structural features of empirically observed networks and the observed effects of group composition on network structures (Snijders & Steglich, 2015; Stark, 2011). Examples also can be derived from theoretical studies related to the development of exchange support networks of actors who differ in their capabilities and need for help (Flache, 2001; Flache & Hegselmann, 1999). In addition to accounting for the characteristics and behavior of students and their changing relationships over time, simulation studies could model the impact of the mentor simultaneously. Finally, simulation studies offer an advantage, in that they can capture group dynamics and changes on a smaller time scale than is possible with empirical data. Using these theoretical models, it is possible to predict the consequences of different group compositions when the models appear in a real-life context. The derived hypotheses then should be tested empirically, in lab studies or artificial small student groups.

The peer network analysis also raises the question of whether lower-achieving students connect with other lower-achieving students because they prefer that link or because higher-achieving students are not available to them. Perhaps higher-achieving students do not have time left, after they have helped other higher-achieving students, or perhaps they are unwilling to help, because they do not expect any valuable returns from lower-achieving students. Social exchange theory proposes that people take an instrumental approach and provide support only

if they expect a positive return for their investment (e.g., Blau, 1964; Cook & Rise, 2003; Homans, 1961). The question is whether higher achievers expect some positive return when they help lower achievers. Further research could investigate why students connect, perhaps using a combination of qualitative (e.g., interviews) and social network approaches. A mixed method design also can provide valuable insights into the experiences and perceptions of small group teaching and the extent to which it suits students' learning styles. As previous research shows, achieving the desired outcomes of small group teaching requires student involvement and the distribution of intellectual capacities in a group (Osman et al., 2011).

The research contexts in this thesis establish small groups in which students follow lectures or seminars together, but they must be active in initiating relationships within the formal small groups. The finding suggests that higher-achieving students benefit more from small group teaching than lower-achieving students and raises the possibility of a Matthew effect, analogous to Merton's (1968) descriptions of scientists. That is, well-known scientists receive relatively more appreciation for their work than less-known scientists, resulting in even more opportunities for the well-known scientists. Similarly, in small group teaching, relatively better performing students seem to benefit more from the division into small groups than do lower performing students, because relatively better performing students have more connections with their fellow students and they may have more access to social capital. More research and social network analysis could examine whether higher-achieving students benefit more in terms of achievement; co-evolution models could use study success as an outcome variable, rather than the network.

The interaction between students and faculty also makes a difference in the effect on self-efficacy, according to the comparison of learning communities and mentor groups. But what factors lead to this difference, and how should the role of the teacher be defined, in terms of teaching tasks or providing personal support? Lueg, Lueg, and Lauridsen (2016) propose reciprocal peer tutoring, in which each student functions as a tutee and a tutor, which may lead to deeper learning than solely instruction from the teacher. Further research could consider how to match students according to their achievement level, such that the match leverages diversity in achievement and other student characteristics. Other studies also might address how teachers can provide support and enhance self-efficacy and growth mindsets. Video observations in the small groups might reveal group processes and provide valuable insights about how students interact, as well as reveal the role of the mentor or teachers and how interactions take place between students and mentors or teachers within formal small groups (Leech & Onwuegbuzie, 2007).

Finally, this research was conducted within social science programs; it would be useful to replicate this research in other study settings to generalize the results. Replications in international classrooms, honors programs, and university colleges—for which admission is highly selective and small group teaching is embedded in the curricula (OECD, 2014; VSNU, 2016)—also might provide more detailed insights.

7.7. Concluding remarks

This research has provided new understanding of small group teaching, using a (theoretically and methodologically) multidisciplinary approach. It details the impact of social capital and how informal peer networks develop spontaneously as groups form. Overall, this research supports the expectation that small group teaching contributes to build social capital and peer networking. Small group teaching thus can be beneficial, but as this investigation has shown, there is still insufficient insight into the dynamics of social relations within small learning groups and how they support, but also interfere with, learning and study success. More understanding is needed into how these dynamics might be influenced to leverage the potential of small group teaching.

I hope this research line continues, in collaboration with researchers from different fields, to investigate how small group teaching can be improved and ensure that all students can reach their learning potential by making use of all the available resources.

