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Academic self-efficacy, growth mindsets, and university students' integration in academic and social support networks

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ABSTRACT

Combining complete social networks and structural equation modeling, we investigate how two learning-related cognitions, academic self-efficacy and growth mindsets, relate to integration in support networks of 580 university students in 30 seminar groups. We assessed integration as popularity in academic support networks (being an academic helper and collaborator) and in social support networks (being a friend and resource for sharing personal difficulties). Perceived integration in both networks was measured with self-reports, whereas actual integration in both networks was measured with sociometric peer-reports. Structural equation modeling showed that students who were initially more integrated in academic support networks became more integrated in social support networks over time, but not vice versa. Students with higher academic self-efficacy perceived themselves to be an academic resource for others, which in turn enhanced peer-reported academic integration. Academic self-efficacy was related to growth mindsets and growth mindsets were related to actual integration in academic support networks.

1. Introduction

In most Western countries, including Germany, universities have added small group learning to their curricula to facilitate students' involvement in their study programs. An important form of small group learning is seminar groups where students acquire knowledge about various topics instructed by a teacher. Similar to other types of small group learning, such as learning communities, seminars aim to increase study success by fostering social and academic integration (Hatch & Bohlig, 2016; Pascarella & Terenzini, 2005; Springer, Stanne, & Donovan, 1999; Tinto, 1993, 2000). By creating opportunities for interaction and the exchange of resources among fellow students (e.g., Borgatti & Lopez-Kidwell, 2011; Lomi, Snijders, Steglich, & Torló, 2011), seminars can positively affect academic outcomes (Thomas, 2000; Tinto, 1975, 1993). Much research has shown that positive peer relations can enhance individual performance (e.g., O'Donnell, 2006; Pai, Sears, & Maeda, 2015; Webb, 1982), particularly when students form supportive peer networks with fellow students (Nebus, 2006; Smith, 2015; Tomás-Miquel, Expósito-Langa, & Nicolau-Juliá, 2015).

Yet, so far, little is known about individual differences in the extent to which students are able to establish these supportive networks in learning environments.

This study examines the relationship between social and academic integration and two learning-related cognitions as individual prerequisites for mastering the challenge of successful integration into these supportive peer networks: academic self-efficacy beliefs (Bandura, 1997; Chemers, Hu, & Garcia, 2001; Honick & Broadbent, 2016) and growth mindsets (Burnette, O'Boyle, Van Epps, Pollack, & Finkel, 2013; Dweck, 1999, 2006). A peer network in academia can be used to exchange resources in academic as well as personal matters (Song, Bong, Lee, & Kim, 2015). Following Thomas (2000) and Smith (2015), in this study social and academic integration is conceptualized as students' embeddedness in networks of social and academic relationships with fellow students. Social integration is not necessarily study-related, but associated with the exchange of personal matters, for example with friends (Buote et al., 2007; Zhu, Woo, Porter, & Brzezinski, 2013), whereas academic integration is study-related and associated with the exchange of academic matters (Nebus, 2006; Tomás-Miquel et al.,

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2015). We propose that two learning-related cognitions, i.e., academic self-efficacy and growth mindsets, are not only related to individual learning but also that they can explain students' appeal as supporters for other peers learning and thus facilitate their integration into students' support networks. Students with strong academic self-efficacy beliefs believe that they are capable of overcoming barriers and academic goals in educational settings (Elias & MacDonald, 2007; Honicke & Broadbent, 2016). Growth mindsets reflect a general, optimistic implicit theory that intellectual talent is malleable rather than innate and fixed. Students entertaining growth mindsets believe that people's intellectual talent can grow in times of difficulty through the investment of effort (Chen & Pajares, 2010; Dweck & Leggett, 1988; Yeager & Dweck, 2012). This leads to the general research questions: To what extent are self-perceived and actual integration in academic and social support networks related and what is the role of academic self-efficacy and growth mindset in students' integration in both networks?

1.1. Supportive peer networks

Research on social support has consistently found that knowing about the available support from others is related to adaptive outcomes (for a review on perceived social support, see Lakey & Orehek, 2011). Within and beyond academic settings, individuals seek out connections to others for support in their network, and others seek support of them (Brouwer, Flache, Jansen, Hofman, & Steglich, 2017; Heaney & Israel, 2008; Thomas, 2000; Zander, Kreutzmann, & Hannover, 2017). Social integration into supportive peer relations thus results from bidirectional interactions (Tinto, 1993).

Integration can be assessed from different viewpoints: self-reported and peer-reported integration into academic and social support networks. On the one hand, a student can think that he or she is well integrated into a network with peers who can provide support for him or her. This *others-as-resource* perspective dominates in social support literature and is reflected in the assessments. For instance, researchers typically ask students to report the resources that are available to them. On the other hand, a student can think that he or she is well integrated into a network of peers who draw back on him or her for support. This approach, which we label the *self-as-resource-for-others*, namely, that most social resources are available to the people who themselves are popular in a given network (Lin, 1999). Given the strong tendency of reciprocity in peer networks (Gouldner, 1960; Heaney & Israel, 2008) it is likely that students who themselves are seen as providers of support by others in a learning context will be more effective in eliciting help and support from others when needed. Therefore, we reason that actual integration into support networks is more aptly reflected by the extent to which a student is integrated and recognized as a source of support by his or her peers. This can be done by asking a student's peers whether they would turn to this particular person for help, advice, or collaboration, i.e., a sociometric nomination procedure (Heaney & Israel, 2008; Smith, 2015). Hereby, the number of nominations by others, the so-called indegree centrality (Hanneman & Riddle, 2005) in a network of peers, serves as a proxy variable for integration. In the following, we therefore refer to peer-reported integration as actual integration.

In this research we seek an answer to the question whether actual integration in academic support networks precedes actual integration in social support networks, and vice-versa. Interactive seminars provide many opportunities to approach classmates, such as to clarify class content or obtain relevant material. We anticipate that being approached for academic support increases interactions, which in turn can enhance friendships and sharing personal issues over time. The proximity effect also tends to lead to friendships and sharing personal issues (Fehr, 1996; Katz, Lazer, Arrow, & Contractor, 2004; Van Duijn, Zeggelink, Huisman, Stokman, & Wasseur, 2003; Wimmer & Lewis, 2010). Even an interaction initially motivated by a search for academic

support can be altered by positive affect, increasing integration in the social support network (Chen, Wang, & Song, 2012). The potential relationship in the opposite direction, however, also seems plausible: Students who are approached for social support or regarded as friends might be regarded as academic helpers as well. Lomi et al. (2011) and Brouwer et al. (2017) show that friends often also serve as a source of academic support. We therefore examined the interrelation of actual integration in these two types of networks.

Self-perceived popularity in peer networks can be assessed by self-reports, reflecting a person's self-perceived integration with others in the small group (Mayeux & Cillessen, 2008), i.e., the extent to which a student thinks he or she is perceived as a source of support by others (Zander & Hannover, 2014). Self-perceived integration is inherently in the eye of the beholder and may be important for the actual integration in peer support networks. Several researchers demonstrate that networks are influenced by members' beliefs (Kilduff & Krackhardt, 1994; Kilduff, Tsai, & Hanke, 2006; Kwon & Adler, 2014), which can create self-fulfilling prophecies. For example, perceived access to support may cause students to ask others for support and thereby create even more support (Brands, 2013; Kilduff et al., 2006; Lin, 1999). To understand actual and perceived integration in peer networks better, the interplay of perceived integration and actual integration thus should be taken into account. The combination of both indegree centrality measures (Hanneman & Riddle, 2005) and self-perceived popularity (Mayeux & Cillessen, 2008) is a particularly appropriate method to uncover the dynamics of interpersonal relations and integration or popularity in peer networks (Reitz, Motti-Stefanidi, & Asendorpf, 2016).

1.2. Academic self-efficacy and growth mindsets

Academic self-efficacy is a person's perception that he or she will succeed in a certain task or domain (see Honicke & Broadbent, 2016 for a recent systematic review). Students' academic self-efficacy can enhance feelings of preparedness for university and facilitate successful transitions (Byrne & Flood, 2005) and is related to academic achievement (Brouwer, Jansen, Flache, & Hofman, 2016; Honicke & Broadbent, 2016; Richardson, Abraham, & Bond, 2012). While self-efficacy can be influenced by others (Siciliano, 2016; Usher & Pajares, 2008), it is still unclear whether highly self-efficacious students are more attractive as providers of academic support. On the one hand, students entertaining these optimistic "I-can-do-believes" (Kraft, Rise, Sutton, & Røysamb, 2005) can serve as models to overcome challenges. So asking for advice from a person who signals high self-efficacy (Siciliano, 2016) can be appropriate. On the other hand, in a new learning environment students may feel insecure. So rather than serving as a successful model, asking someone for support who expresses high self-confidence in his or her ability to master challenges could evoke threats and perceptions of incompetence in help- and support-seekers, and ultimately leading to avoidance (Nadler, 2015). In the latter case, students may prefer to approach someone with similar self-efficacy beliefs or feelings (Townsend, Kim, & Mesquita, 2014).

Academic self-efficacy is a self-perception or person's belief in his or her own capability to perform at designated levels even in the face of academic challenges (Honicke & Broadbent, 2016) and may be related to self-perceived integration in the academic peer network (e.g., Brands, 2013). The higher the levels of academic self-efficacy, the more students may perceive themselves as popular or integrated in the academic network. Since students with higher levels of self-efficacy may believe that they have the capabilities to help peers academically, they may expect that fellow students turn to them for academic support.

Another concept that may facilitate adaptive responses to challenges in educational settings is a growth mindset. Implicit theories of intelligence, also labeled as growth and fixed mindsets, form a framework that people can use to make attributions and interpret everyday

challenges in academic settings (Molden & Dweck, 2006; Yeager & Dweck, 2012). Students with fixed mindsets (entity theorists) assert that intellectual abilities are innate and cannot be changed. Students with growth mindsets (incremental theorists) believe that effort can improve intellectual abilities (see Dweck, 1999, 2006; Yeager & Dweck, 2012). When faced with academic challenges, students with fixed mindsets tend to believe that it is useless to put effort into the learning process once they feel they have reached a limit to their intellectual abilities (Blackwell, Trzesniewski, & Dweck, 2007). Alternatively, students with growth mindsets tend to be optimistic and motivated to learn, as they interpret difficulty as an opportunity to grow and built their intellectual abilities, which may facilitate their academic performance (e.g., Romero, Master, Paunesku, Dweck, & Gross, 2014).

Growth mindsets could positively affect students' willingness to provide academic help to others in their learning environment. For example, while students with growth mindsets might assume that both their own intellectual abilities and those of their peers can be changed through effort, students with fixed mindsets might regard requests for academic support as signals of incompetence. Students with growth mindsets might therefore provide more academic peer support, because they express the optimistic perspective that help seeking is crucial for growing and learning, and encourage help-seekers to use their support to build their competences. Indirect evidence for this argument can be derived from research in organizations: managers were more willing to provide support when growth mindsets beliefs are induced (Heslin & VandeWalle, 2008; Heslin, VandeWalle, & Latham, 2006). Beckmann, Wood, Minbashian, and Taberner (2012) investigated the impact of implicit theories on group learning. They found that group members who shared incremental beliefs discussed more openly and were more focused on the learning task, which could also facilitate the exchange of help and support. A growth mindset can therefore be an attractive implicit theory in a peer approach for both academic and social support. We propose that people turn to others for help when those others do not regard help and support seeking as an indication of poor competence but rather as an efficient strategy to grow and fully exploit one's intellectual abilities or talents. Students advocating for a growth mindset in learning groups can likely emerge as more approachable exchange partners to their peers, thus becoming more popular and actually integrated in both types of support networks. Additionally, previous research suggests that growth mindsets and academic self-efficacy should be related in that students with lower self-efficacy should believe that intellectual abilities are innate and unchangeable (Komarraju & Nadler, 2013).

1.3. The present study

In the present study we investigate the relationships between actual and perceived integration (i.e., popularity) and the role of the two learning-related cognitions in students' integration in peer support networks. For this we analyze complete social networks in seminar groups and look at the cross-lagged paths of integration in academic and social support networks. Particularly the mechanisms of how students become a valued part of an academic support network are less well understood (Song et al., 2015). We investigate self-perceived integration in a peer network as a self-belief that might mediate the effects of actual popularity in peer networks which is often overlooked in prior research (Brands, 2013; Zander & Hannover, 2014). Integration in academic and social support networks assessed by peer-perceived (actual) integration via sociometric peer reports and self-perceived integration via students' self-report enables us to better understand the mechanisms of students' integration into social learning environments. Furthermore, we will shed light on the role of the two learning cognitions for students' integration into academic peer groups in contrast to the psychological significance of self-efficacy beliefs and growth

mindsets that is well substantiated empirically for individual outcomes (e.g., Brouwer et al., 2016; Burnette et al., 2013; Komarraju & Nadler, 2013; Richardson et al., 2012).

Following the reasoning in the previous section, we tested the direct and indirect effects as shown in the conceptual model (Fig. 1), hypothesizing that: First, over time, actual integration in academic support networks should strengthen students' actual integration in social support networks, and vice versa. Second, the more students perceive themselves as a resource of support for others, the more they should become actually integrated in academic and social support networks. Third, students with higher self-efficacy beliefs should perceive themselves as more integrated in their academic support networks, given their confidence in their own ability to successfully overcome academic challenges at university. We controlled for the direct links of self-efficacy to the actual integration in both networks. Fourth, the higher students score on growth mindsets, the more they should become actually integrated in the academic networks after accounting for their baseline-integration at the beginning of the semester. We controlled for the direct link of growth mindsets to actual integration in social support networks.

2. Method

2.1. Participants

Participants were 580 students (68.2% female, 31.8% male) enrolled either in the first year of a bachelor's educational science program ($n = 384$, 66.2%) or in the first year of a master's program for prospective teachers ($n = 196$, 33.8%) in a large German university's Department of Education and Psychology. The average age of the participants was 25.65 years ($SD = 5.26$). In conducting the study, we complied with the guidelines of APA and German Psychology Association (DGPs) that the ethical committee of our institution is committed to. According to these ethical regulations, participants were assured that their data would be processed anonymously. Students could withdraw from the study at any moment and gave informed consent regarding their participation.

2.2. Procedure

The survey data were collected in 30 seminars, conducted in parallel with the students' large-scale lectures from 2013 until 2015. In this sample, an average seminar group included 24 participating students ($SD = 7$). Each seminar group was assessed at two points in time starting with each new semester: at the beginning (T1) of the semester and at the end (T2) of the semester. One semester lasts 14 weeks in the summer and 16 weeks in the winter.

All students in the seminar were asked to participate in a study on students' experiences in the university context. Seminar instructors and research assistants explained the principles of voluntary participation, data protection, and anonymity. Because of ethical consideration (informed consent), students could only nominate others and could be nominated by others when they were present during the assessment. When students confirmed their participation, they provided their student code and got a randomly assigned cover name on a separate list, to ensure consistent identification across measurement points. While completing the paper-and-pencil survey during class, each participant posted this randomly assigned cover name in front of him or her, so fellow students could see the cover name of others while filling out the sociometric nominations. The assessments of survey and social network data took between 15 and 20 min, and the questions were provided in German. Finally, students could write down their e-mail address on a separate list if they were interested in receiving information about the study results.

Fig. 1. Conceptual model with the hypothesized relationships between actual and self-perceived integration (i.e., popularity) in academic and social support networks, academic self-efficacy, and growth mindsets.

Note. We controlled for the relationships between academic self-efficacy and actual popularity in social support and in academic support network as well as between growth mindsets and actual popularity in social support network, all at the second time point.

Table 1
Descriptive statistics, reliabilities, and bivariate correlations.

Scales ^c	Mean	SD	α (n items)	1	2	3	4	5	6	7	8
1. Actual integration in academic support networks T1 ^b	3.09	1.83	0.80 (2)	1.00							
2. Actual integration in academic support networks T2 ^b	3.23	2.03	0.78 (2)	0.61***	1.00						
3. Actual integration in social support networks T1 ^b	0.78	0.96	0.79 (2)	0.57***	0.39***	1.00					
4. Actual integration in social support networks T2 ^b	0.95	1.01	0.70 (2)	0.55***	0.63***	0.68***	1.00				
5. Self-perceived integration in academic support networks T2	3.26	0.59	0.75 (4)	0.23***	0.29***	0.19***	0.18***	1.00			
6. Self-perceived integration in social support networks T2	3.51	0.59	0.86 (3)	0.12*	0.16**	0.12*	0.08	0.56***	1.00		
7. Academic self-efficacy T2	3.81	0.53	0.77 (6)	0.06	0.13*	0.08	0.04	0.23***	0.14**	1.00	
8. Growth mindsets T2 ^a	3.57	0.66	0.78 (5)	0.03	0.11	0.09	0.10	0.05	0.11	0.21**	1.00
			0.74 (10)								

Notes.

^a The CFA indicated a 5-items construct of growth mindsets. The reliability improved from 0.74 (10 items) to 0.78 (5 items).

^b We use the term actual integration for peer-reported sociometric nominations.

^c Missing values ranging from 15% to 26%; growth mindsets T2 57%.

*** $p < .001$.

** $p < .01$.

* $p < .05$.

2.3. Measures

2.3.1. Peer-reports of actual integration in academic and social support networks

At both T1 and T2, we measured students' actual integration in academic support networks with the sociometric procedure described above, which constitutes the state-of-the-art procedure for peer popularity studies (Cillessen & Marks, 2011). On a roster, students could nominate all fellow students present in the assessment by placing a cross next to randomly assigned cover names which were placed as cardboard signs in front of each student. To maximize

comprehensiveness, we measured actual integration or popularity in academic support networks using two types of rosters in which students nominated all course mates whom they (a) would ask for academic help or advice during an assignment or for exam preparation and (b) preferred as collaborators. To obtain a proxy of actual integration into social support networks we similarly combined two name generators in which students nominated all course mates (a) whom they would approach to discuss personal difficulties and (b) whom they regard as friends. The Cronbach's alpha (α) revealed that the scales, based on individual's indegree centrality scores, at both time points were internally consistent, with a range from 0.70 to 0.80 (see Table 1).

2.3.2. Self-perceived integration in academic support and social support networks

At T2, self-perceived integration or popularity in the academic support networks was measured using a self-developed measure. Students rated the extent to which they thought others regarded them as academic helpers or preferred collaborators on four items (e.g., “I think my fellow students in this course would contact me in case they have an academic problem”). On three additional items, students reported their self-perceived integration or popularity in the social support networks based on affection measures (e.g., “I can imagine that my fellow students in this course like me”). Students responded on a scale from 1 = “strongly disagree” to 5 = “strongly agree”. This self-developed measure seems to be valid: The correlations between the items of self-perceived integration in the academic and in the social networks and the total score appeared to be significant (see Table A1 Appendix A1). The self-perceived academic and social integration scales were internally consistent, respectively $\alpha = 0.75$ and $\alpha = 0.86$.

2.3.3. Academic self-efficacy

Academic self-efficacy beliefs were assessed for all participants at T2, with six items from a validated and commonly used German scale by Jerusalem and Schwarzer (1999). Two item examples are: “Regarding my studies I am able to deal with difficult situations and requirements, if I make an effort” and “When I am supposed to talk about a difficult subject in front of the seminar group, I think I can do it”. Students indicated their agreement on a five-point scale from 1 = “strongly disagree” to 5 = “strongly agree”. This measure is referring to the extent students believe they can accomplish study-related tasks and was internally consistent ($\alpha = 0.77$).

2.3.4. Growth mindsets

Growth mindsets were measured using six items (Dweck, 1999 as applied in Blackwell et al., 2007), for example “No matter who someone is, one can always work on his or her talent and change it”. Students indicated their agreement with these items on a five-point scale from 1 = “strongly disagree” to 5 = “strongly agree”. Four additional items from the German Assessment of Implicit Theories about Intelligence and Effort (Spinath, 2001) captured growth and fixed mindsets in higher education specifically (e.g., “Everyone who works hard enough could belong to the best in class or in a semester”). Six fixed mindset items were recoded, so that higher scores consistently indicated growth mindsets ($\alpha = 0.74$).

2.4. Statistical analysis

We combined analysis of complete social networks measured at two time points with path analysis. In our study social network analysis is based on students' nominations of peers in their seminar as either sources of academic or social support. The nominations of all student result in a social network which then can be analyzed in terms of various characteristics, such as the indegree centrality, i.e., the number of incoming nominations by other students in the seminar received by a particular student (see for more information Sweet, 2016; Wasserman & Faust, 1994). Indegree centrality, as a proxy of actual integration into either academic or social support networks (Hanneman & Riddle, 2005), was calculated in Ucinet version 6.497 (Borgatti, Everett, & Freeman, 2002) for each person in both types of networks (Borgatti, Everett, & Johnson, 2013).

Reliabilities of the scales, descriptive statistics, and bivariate correlations were calculated in SPSS version 23. To ensure that degree programme and gender differences did not impact the results, additionally independent sample *t*-tests were conducted. Some small significant differences existed between bachelor (ba) and master (ma) students regarding actual integration in academic support networks at

T1 ($M_{ba} = 2.64$, $M_{ma} = 3.31$; $t(488) = -3.83$) and self-perceived integration in social support networks ($M_{ba} = 3.59$, $M_{ma} = 3.47$; $t(431) = 2.15$). Also small differences existed between female (f) and male (m) regarding actual integration in social support networks at T2 ($M_f = 1.06$, $M_m = 0.70$; $t(348) = 3.98$) and academic self-efficacy ($M_f = 3.76$, $M_m = 3.91$; $t(419) = -2.63$). Since the effect sizes are small, in the range from Cohen's $d = 0.22$ to 0.39 , on only a few variables and because course and gender differences are beyond the scope of our research, we did not take this into account in further analysis.

A two-step approach for structural equation modeling was used to assess the validity and reliability of the constructs before including them in the full structural equation model with direct and indirect paths (Kline, 2011). These analyses were conducted in MPlus version 7.11 (Muthén & Muthén, 1998–2013). The measurement model was specified with a single-order confirmatory factor analysis (CFA). The CFA combined with reliability analysis (i.e., Cronbach's alpha) resulted in the final choice of the items in the scales. As indications of good model fit, we note a non-significant chi-square test, a root mean square error of approximation (RMSEA) < 0.06, standardized root mean square residual (SRMR) less than or equal to 0.08, and a confirmatory fit index (CFI) close to or > 0.95 (Hu & Bentler, 1999; Kline, 2011). To account for missing values, MPlus provides maximum likelihood estimation (Brown, 2015; Little & Rubin, 2002). Participant data were nested in seminar groups, so we controlled for dependence using the COMPLEX option to adjust the standard errors. This means that MLR (maximum likelihood with robust standard errors) estimation was used. For the indirect effects, we report bias-corrected bootstrapped confidence intervals (Shrout & Bolger, 2002).

3. Results

The Cronbach's alpha coefficients for all the scales indicated satisfactory internal consistency, with ranging from 0.70 to 0.86. Reliabilities, descriptive statistics, and bivariate correlations between the variables are shown in Table 1.

The first measurement model achieved the following fit indices: $\chi^2(406) = 794.86$, $p < .001$; RMSEA = 0.04; SRMR = 0.06; CFI = 0.90 (see Table A1 Appendix for the factor loadings and a complete overview of the scales). Non-significant and factor loadings below 0.40 from the growth mindsets construct were removed from the model (see Stevens, 2009). Following the modification indices, a correlation was added between one item of the self-perceived integration in academic support networks scale (SAI3: “I think many of my fellow students like working with me”) and one item of the self-perceived integration in social support networks scale (SSI3: “I think many of my fellow students like working with me”). The fit indices of the final measurement (CFA) model were the following: ($\chi^2(270) = 479.53$, $p < .001$; RMSEA = 0.04; SRMR = 0.05; CFI = 0.94). The χ^2 -statistic was significant, but this statistic is sensitive for sample size (Kline, 2011).

The structural equation model derived from the conceptual model and the conducted CFA fitted the data well, although the Chi-square test was also significant ($\chi^2(278) = 481.97$, $p < .001$; RMSEA = 0.04; SRMR = 0.05; CFI = 0.95). The final model with indirect paths (see Fig. 2; Table A1) was optimized by excluding non-significant paths and including two item correlations, i.e., between friendships and between preference for collaboration at two time points. The following fit indices were achieved: ($\chi^2(282) = 444.23$, $p < .001$; RMSEA = 0.03; SRMR = 0.05; CFI = 0.96). Cross-lagged analyses partly supported our first hypothesis: While actual integration as an academic helper at T1 was related to actual integration in social support networks at T2, we found no evidence for the opposite direction: Students popular as friends and helpers with personal problems did not become more popular as academic helpers over time. The second hypothesis was also partly supported: whereas self-perceived integration in academic

Fig. 2. Structural equation model of the cross-lagged paths of actual integration (i.e., indegree centrality or popularity) in academic support and social support networks at the beginning and end of the semester and the relationship with self-perceived integration in both networks, academic self-efficacy, and growth mindsets, showing standardized coefficients.

* $p < .05$; ** $p < .01$; *** $p < .001$.

support networks contributed indirectly to actual integration in academic support networks over time ($b^*_{\text{indirect}} = 0.03$ [0.01; 0.06]), we found no such mediated effect for integration in the social support networks. Additionally, self-perceived integration in the academic support networks was directly related to self-perceived integration in social support networks and vice versa. As predicted by our third research hypothesis, academic self-efficacy contributed to integration in academic support networks, indirectly via students' self-perceived integration as academic helper and collaborator ($b^*_{\text{indirect}} = 0.05$ [0.01; 0.09]). Students' academic self-efficacy was positively related to growth mindsets and, consistent with our fourth hypothesis, students' growth mindsets predicted students' actual integration into academic support networks. Growth mindsets were not related to their self-perceived integration in academic support networks.

4. Discussion

In the context of university seminars, the current study examined the relationship between actual and perceived integration in academic and social support networks and the role of two learning-related cognitions, i.e., academic self-efficacy and growth mindsets, in students' integration in these peer support networks by applying analysis of complete social networks and path modeling with cross-lagged paths. Integration into learning environments by forming supportive peer relations constitutes an important task and challenge for students in the beginning of their studies (Christie, Munro, & Fisher, 2004). Academic self-efficacy and growth mindsets are concepts that have been found to be strongly associated with adaptive individual management of challenges in educational context (Feldman & Kubota, 2015; Parker, Halgin, & Borgatti, 2016; Paunesku et al., 2015). Although integration has been linked to academic engagement and subsequent performance in

academic settings (Buote et al., 2007; Kuh, 2009; Smith, 2015), so far, little research has investigated learning-related cognitions, such as academic self-efficacy and growth mindsets, that might play a role in integration in peer-networks. In spite of their potential impact on social relationships, as catalysts of peer- and self-perceived integration in academic and social support networks their role has, to our knowledge, not yet been systematically investigated. Given the empirically meaningful distinction between academic and social support networks in learning environments (Song et al., 2015), we considered both types of networks.

Nowadays peer relationships and interactions are considered as crucial for enhancing the quality of education and student learning (Topping & Ehly, 2009). This study informs the current scientific debate on the importance of peer relations in academic settings with three major aspects. First, by investigating the longitudinal links between integration in academic and social support networks and showing that integration as an academic helper contributes to the integration as a provider of social support but not vice versa. Considering people's fundamental need to belong and feel competent (Baumeister & Leary, 1995; Ryan & Deci, 2000), our results suggest that appearing helpful to others from the start is an advantageous route to being accepted in a new and challenging environment: The more students are perceived as helpful and preferred as collaboration partners (i.e., academic support) by many others at the beginning of the semester, the more they are approached for discussing personal issues or for friendship (i.e., social support) at the end of the term. The more students perceived themselves as helpful in the academic support networks, the more they were also perceived as academically supportive by others. Second, academic self-efficacy beliefs contributed to students' integration as help givers, but only indirectly. Students with higher levels of academic self-efficacy at the end of the semester perceived themselves to be more integrated

in academic support networks, and this perception, in turn, was positively related to their actual integration in academic support networks. This finding is consistent with evidence that meta-perceptions, such as the perception of one's own integration, are often based on egocentric projections of self-views, rather than grounded in assessments of environmental information (Wallace & Tice, 2012). Third, the more students perceived themselves as capable to overcome future academic challenges (i.e., those with higher self-efficacy beliefs) the more they believe that intellectual talent is malleable through effort. Students with growth mindsets, in turn, were more popular as helpers and collaborators in their academic support networks.

4.1. Limitations and future directions

Although this research examined a large sample of university students in real-world social contexts over the course of a semester, several limitations need to be acknowledged. First, a full longitudinal design would offer a more detailed exploration of the mechanism and makes causal inferences possible and the application of full cross-lagged models. Longitudinal data can test sequential paths and it is possible that strong support networks foster self-efficacy and growth mindsets over time. Siciliano (2016) found, for example, that networks of teachers influenced teacher self-efficacy beliefs.

Another limitation of the present study needs to be tackled in future research. Our dataset does also not allow us to examine what exactly makes students with higher levels of self-efficacy to be more integrated in academic support networks. Because we did neither measure students' views on help seeking nor the frequency or content of actual help exchanges and cooperative responses, we can only presume that students with higher levels of self-efficacy perceived themselves as more integrated in the academic support networks and subsequently, were more frequently selected as helping partners. They might be showing self-confidence in their academic abilities and therefore seen as having the knowledge necessary for understanding and explaining topics addressed in the course (Borgatti & Cross, 2003). Studies that include qualitative data addressing the underlying reasons for selection in peer networks will be valuable to inform educational practitioners regarding strategies for help seeking and collaboration in new learning environments. This also applies for the identified link between growth mindsets and actual integration in academic help networks: we can only presume that students with a growth mindset were more frequently selected as helping partners because they did not react in a negative or competence-threatening manner, refrained from social comparisons of the self and others, or provide effort-related (rather than ability-related) feedback when asked for help. Such behaviors can be subtle cues that convey to others that they consider help-seeking as essential for the learning process (Nadler, 2015), discuss more openly or show more on-task learning behavior (Beckmann et al., 2012). Studies including measures of actual network involvement will be valuable to inform educational practitioners regarding useful strategies for peer collaboration in learning environments.

Also, this study was conducted in a bachelor's and master's degree program within social sciences; it might be useful to replicate this study in other academic settings to generalize the results. We also did not take into account group differences in terms of background characteristics, such as gender, nationality and age. It might be interesting to investigate actual and perceived integration and learning related

cognitions in different groups of students in terms of background characteristics.

Finally, in our study growth mindsets were investigated as one continuous variable. Recently, it has been argued that growth and fixed mindsets do not form a perfect dichotomy (Hass, Katz-Buonincontro, & Reiter-Palmon, 2016). Rather, a person can have varying levels of both (e.g., a person can believe that they have an upper limit, but also believe that they can work hard to get there). Including both mindsets as continuous predictors in future research design can ameliorate our understanding of the mechanisms of how growth mindsets catalyze students becoming a part of academic support networks.

4.2. Practical implications

At this point it is interesting to consider practical implications. As found in social network research, every additional relationship offers more opportunities for interaction and information exchanges (Borgatti & Lopez-Kidwell, 2011; Hanneman & Riddle, 2005), and thus, to learn. Implementation of small group learning with more contact hours provides the possibility to interact and integrate in academic and social support networks (Brouwer et al., 2017). Peer-learning and peer-tutoring has repeatedly been demonstrated to be a very effective form of acquiring various academic skills (Hattie, 2009; Lueg, Lueg, & Lauridsen, 2016; O'Donnell, 2006), increasing student integration and participation (Zhao & Kuh, 2004). In addition to facilitating peer network building, universities should pay closer attention to students' individual differences in learning prerequisites. Particularly in seminar groups, professors and teaching assistants can provide opportunities, for example during group assignments, to experience the individual and social benefits of providing each other with academic support. Self-efficacy can be enhanced by positive and constructive feedback from teachers as well as peers (Parker et al., 2016; Usher & Pajares, 2008). Parker et al. (2016) showed that positive feedback can result in an increase in utilizing their social relationships for reaching personal goals. Future research in university settings might consider the impact of feedback from instructors and peers on students' self-efficacy and growth mindsets. Our finding that growth mindsets directly and academic self-efficacy indirectly contribute to students' integration in academic support networks make it a worthwhile goal for instructors to enhance the levels of their students' self-efficacy and growth mindsets and increase awareness for the benefits of providing help in academic networks among freshmen.

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Appendix A

Table A1
Confirmatory factor analysis of the scales.

Abbreviation		CFA ¹	SEM ²	
	Academic self-efficacy (SE; T2)	Factor loading ¹	Factor loading ²	
SE1	Regarding my studies I am able to deal with difficult situations and requirements, if I make an effort.	.621***	.622***	
SE2	I find it easy to understand new contents/topics in my studies.	.632***	.633***	
SE3	When I am supposed to talk about a difficult subject in front of the seminar group, I think I can do it.	.661***	.661***	
SE4	Even if I was sick for a longer period of time, I can still achieve a good outcome in my studies.	.599***	.598***	
SE5	Even if the instructor doubts my competence, I am still sure I will effect good performance.	.571***	.571***	
SE6	I am sure that I can still achieve my desired outcome in case I got a bad grade.	.463***	.462***	
	Growth mindsets (GMS; T2)			
GMS1	No matter who someone is, one can always work on his her talent and change it.	.585***	.577***	
GMS2R	*In order to be good in different subjects at school or at university, one needs to be intelligent (fixed; R).			
GMS3	*Some pupils or students will never be good in certain subjects, even if they try hard (fixed; R).			
GMS4R	*Some pupils or students cannot effect good performance in any subject (fixed, R).			
GMS5R	*To be honest, one cannot truly change how much talent someone has (fixed, R is recoded).	.763***	.764***	
GMS6	One can change someone's intelligence significantly.			
GMS7R	*Everyone has a certain amount of talent, and there isn't anything one can truly change about that (fixed, R).	.651***	.652***	
GMS8R	*Talent in a certain field is something one cannot change very much (fixed, R).	.626***	.630***	
GMS9	Everyone who works hard could belong to the best in class or in a semester.			
GMS10	I think someone can change the basic level of one's talent significantly.	.616***	.617***	
	Self-perceived integration in academic support networks (SAI; T2)			Correlation of items with total score ³
SAI1	I think my fellow students in this course would contact me in case they have an academic problem (question on exam preparation or a presentation).	.602***	.603***	.80***
SAI2	I think my fellow students in this course believe I could give them good advice in case they have a problem.	.736***	.734***	.79***
SAI3	I think many of my fellow students like working with me.	.562***	.563***	.66***
SAI4	I think my fellow students reckon I am competent.	.662***	.663***	.76***
	Self-perceived integration in social support networks (SSI; T2)			
SSI1	I can imagine that my fellow students in this course like me.	.897***	.896***	.91***
SSI2	I think my fellow students in this course think I am nice.	.928***	.929***	.92***
SSI3	I think many of my fellow students like me.	.595***	.595***	.82***
	Sociometric nominations			
	Actual integration in academic support networks T1			
HELP T1	Help or advice seeking (popularity)	.895***	.911***	
COL T1	Preference for collaboration (popularity)	.743***	.727***	
	Actual integration in academic support networks T2			
HELP T2	Help or advice seeking (popularity)	.862***	.874***	
COL T2	Preference for collaboration (popularity)	.739***	.725***	
	Actual integration in social support networks T1			
PERS T1	Discussing personal issues (popularity)	.725***	.761***	
FRIEND T1	Friendship (popularity)	.893***	.852***	
	Actual integration in social support networks T2			
PERS T2	Discussing personal issues	.678***	.719***	
FRIEND T2	Friendship	.775***	.729***	

Notes.

¹Standardized factor loadings derived from the single order confirmatory factor analysis (CFA). Items in grey were excluded from the final models because of non-significant factor loadings or below 0.40 which can be considered as too low (Stevens, 2009).

²Standardized factor loadings derived from the final structural equation model (SEM); see Fig. 2.

³Validation of the self-developed measurement.

*** $p < .001$.

** $p < .01$.

* $p < .05$.

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