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Perceived Social Resources Affect Help-Seeking and Academic Outcomes in the Initial Phase of Undergraduate Studies

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First-year students are challenged cognitively and socially by the need to integrate into a new environment. This article investigates the role of peer students as a social resource for academic help-seeking to overcome knowledge-related difficulties. Receiving useful help may require close and regular contacts (social embeddedness) as well as awareness about peer's knowledge (group awareness). Hence, effects of social embeddedness and group awareness on academic success (i.e., achievement, satisfaction, and dropout intention) are expected to be mediated by academic help-seeking. First-semester students in science (n = 49) and engineering (n = 80) have been surveyed. Both study programs differ in occasions to form small groups, which may influence student's aggregation of social resources. Both social embeddedness (engineering only) and group awareness (both groups) predict successful academic help-seeking. Moreover, the effect of group awareness on student satisfaction and dropout intention is partially mediated by successful academic help-seeking (engineering only). Both social variables can contribute to help-seeking behavior and student's academic success. The results provide evidence to advice researchers and practitioners to improve academic help-seeking among students.

Keywords: higher education, first-year students, peer learning, academic help-seeking, social embeddedness, group awareness, STEM

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1 INTRODUCTION

During the first year at university, the student's successful adaption to the demands of higher education is a prerequisite for their retention and academic success (Tinto 1975). In STEM-subjects about 48% of enrolled students in the United States (Chen and Ho, 2012) and about 30% in Germany (Isphording and Qendrai, 2019) change their subject or leave postsecondary education without a degree. Successful transition to higher education comprises cognitive and social requirements, for example, meeting curricular demands and collaborating in teams (Gibney et al., 2011; Trautwein and Bosse, 2017). Research in the field of self-regulated learning has shown that asking peers for content-related and organizational information, so-called academic help-seeking (HS), may help overcoming knowledge-related difficulties and foster understanding (Nelson-Le Gall, 1985; Newman, 1998). Academic HS is a social learning strategy that helps students to meet these requirements (Richardson et al., 2012). However, HS for one requires peers to be available for inquiries, to be willing to provide help and third to have an appropriate level of competence to provide useful explanations (Makara and Karabenick, 2013). Although institutional personnel has more expertise than peer students,

establishing contact with institutional personnel usually requires more formal preparation which makes peers more available to provide help. Hence, peers that are available, willing to help, and relatively competent within one's social network may promote the success of HS. Accordingly social embeddedness among peers, understood as the availability of individual's close peer ties, may act as a resource for HS (Chiu et al., 2006). Additionally, peer's competence on a subject may affect the quality of the help provided (Webb et al., 2002). That is why students seeking help may benefit from knowledge about their peers. Thus, the state of being informed about peer's competencies, for example, characteristics of group members, so-called group awareness (GA), may influence the identification of appropriate helpers (Bodemer et al., 2018). Studies found a positive effect of HS on academic achievement but rarely focused on the preconditions for HS (Richardson et al., 2012). Thus, the present study investigates in how far social embeddedness or group awareness act as preconditions for successful academic HS from peers and how this subsequently influences academic success. The empirical findings may inform researchers and practitioners in how far social resources are beneficial for HS and second, whether these factors have a subsequent effect on academic success. The results could provide evidence for the implementation of social learning settings to support students during their initial semester in higher education.

1.1 Social Embeddedness Can Provide Accessibility to Peers For Help-Seeking

Academic help-seeking enables students to overcome knowledge-related difficulties. But little is known about how HS is affected by the availability of peers as social resources. Large cohorts of first-year undergraduate students usually share the same lectures. These cohorts are divided into smaller subgroups, for example, when working on cooperative tasks or assignments. Groups of students can be represented as social networks in which students are interconnected through ties among each other. In the research branch on social capital, the use of these social networks in terms of information exchange is investigated (Nahapiet and Ghoshal, 1998; Lin 1999). From this perspective, ties within one's own network (i.e., social capital) are a valuable social resource for students that they can leverage to overcome knowledge-related obstacles. There is evidence that social capital across enrolled classes predicts academic achievement (Gasevic et al., 2013). Most valuable for the exchange of knowledge are the resources that are accessible *via* high quality relations, called social interaction ties (i.e., high strength relation, a lot of time spent and regular interactions) (Chiu et al., 2006). Social interaction ties are expected to be reachable for providing elaborated academic help, due to reciprocity of a close relation (Stewart-Williams 2007). Moreover, social interaction ties are conducive to knowledge sharing within online learning communities (Chiu et al., 2006). Similarly, studying regularly with peers assessed as being nominated in someone's study network is positively associated with academic performance (Stadtfeld et al., 2019). In line with this argumentation, we understand social embeddedness as the availability of social interaction ties within one's own network (individual's social capital), which in turn can be leveraged to provide access to valuable knowledge held by individuals. Altogether, it can be hypothesized that individual social embeddedness is a precondition to successful academic HS from peers which in turn may increase academic success.

This perspective focusses on adapting to cognitive requirements through academic HS and is distinguished from the more emotional perspective of seeking social support (see Wilcox et al., 2005). Social embeddedness among first-year undergraduates may stem from formal or informal social interactions with peers, for example, cooperative learning during or after courses (Brouwer et al., 2016). It follows that, one precondition to seek help might be having social ties among peers that are available and willing to discuss questions. Another precondition may be the awareness about who is willing to and who is able to provide adequate help.

1.2 Group Awareness Can Improve the Selection of Peers For Help-Seeking

Within a large heterogeneous social network such as a cohort of first-semester undergraduates, learners may be challenged to find competent peers who are able and willing to provide useful help. Being aware of peer's cognition in a group is known as (cognitive) group awareness (GA) (Dehler et al., 2011). Thus, having GA about peer's competence might be of value for students when choosing helpers. Students gain GA during social interaction, that is, when they provide and process content information, for example, when discussing an assignment (Engelmann et al., 2009). Moreover, perceived cues during such interactions may facilitate assumptions about learners' characteristics (e.g., elaborated answers as indicator for high expertise). Such processes take place in both formal settings (e.g., tutorial sessions) and informal settings (e.g., self-organized study groups) in higher education. To sum up, recurring learning activities which require communication among peers may be beneficial to form GA. For this reason, it can be assumed that students interacting in lectures and even more so in small groups may enable them to form GA about their peers.

When a student needs help, it seems evident that a more accurate awareness about others (i.e., considering issue-related knowledge of known peers) should result in more successful help-seeking episodes. Thus, group awareness may make academic HS more effective which is in turn supposed to increase academic success. Research has shown that the provision of information to improve GA within dyadic collaborative learning scenarios can guide communicative acts such as explanations (Dehler et al., 2011) or can increase confidence in own answers (Schnaubert and Bodemer 2019). Hence, learner's GA about peers may affect the evaluation of available social resources, which in turn may improve the decision on peers to ask for help. Thus, it is hypothesized that GA improves the amount of successful HS requests, which subsequently may improve academic success. That is why, it is of interest to investigate, in how far GA facilitates academic success by supporting successful HS episodes.

1.3 Help-Seeking Can Improve Academic Success

During the transition to higher education, successful adaption to social as well as cognitive demands affects academic success and

proximal measures that are linked to it like student satisfaction, student dropout intention and academic achievement (Credé and Niehorster, 2012).

There is evidence that student's satisfaction is negatively associated with withdrawal cognitions, which in turn determine dropout (Bean 1983; Mashburn 2000). Moreover, satisfaction with studies is predicted by perceived self-development through education, satisfaction with course's contents and grade point average (Bean 1983). Evidence regarding student's dropout intention indicates that it is attenuated by cognitive variables like general cognitive capabilities (Blüthmann et al., 2008), prior knowledge and mathematical knowledge (Fleischer et al., 2019) as well as social variables like social ties (Gasevic et al., 2013). Research regarding academic persistence gained broad evidence that perceived social integration is improving retention (Tinto 1975; Robbins et al., 2004; Bohndick 2020). Consistently, content-related peer support decreases the intention to dropout *via* increased sense of belonging to a particular institution (Fourie 2018). In the light of the previously stated evidence, it is expected that academic HS may reduce dropout intention and consistently may increase student's satisfaction.

Academic achievement can be assessed as performance on exams and is a key criterion for academic success (York et al., 2015). Richardson et al. (2012) found that academic HS predicts grades. In line with this, is the finding that the provision and reception of information within one's social network is conducive to learning outcomes (Hommes et al., 2012). Furthermore, Brouwer et al. (2016) found a mediating effect of peer capital on the relationship between prior achievement and first-year study success for high achieving students only. Moreover, blended learning environments utilizing help-seeking prompts successfully, actually foster student's participation which are positively associated with learning gains (Schworm and Gruber, 2012). Based on this evidence, it is expected that successful academic HS affects academic success, more precisely, it may foster student's satisfaction, decrease the student's dropout intention and improve academic achievement. Altogether, it is hypothesized that social embeddedness and group awareness may facilitate successful academic help-seeking, which in turn may increase academic success measures.

1.4 Empirical Focus and Hypotheses

The prior sections lay the foundation for the assumption of a mediation model. There is evidence from the research branch on social capital, that the accessibility of peers is valuable for information exchange. Moreover, research in collaborative learning suggests that being aware of peer's knowledge can guide communicative acts (Chiu et al., 2006; Dehler et al., 2011). Both concepts may lay the basis for successful academic HS behavior among peer students. In the prior sections we argued that social embeddedness provides access to social resources and that group awareness may improve the selection of social resources asked for academic help. Altogether, social embeddedness and group awareness might foster successful help-seeking episodes and increase the likelihood of receiving elaborated explanations. Based on the prior argumentation the present article investigates the following research questions:

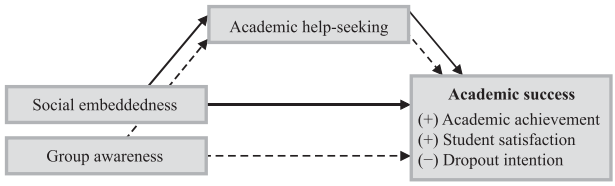

FIGURE 1 | Social variables (Social Embeddedness and Group Awareness) are expected predictors for academic success measures. Whereas academic help-seeking is expected to be a mediator.

- RQ-1: Does social embeddedness influence academic success by fostering successful academic help-seeking?
- RQ-2: Does group awareness influence academic success by fostering successful academic help-seeking?

Findings clarifying the association between social resources and successful HS behavior will provide evidence about what is needed to enable students to get more successful help. Moreover, evidence of an effect of help-seeking affecting academic success may provide evidence for the benefits of small group learning during the first semester.

The presented article examines whether the effects of these social variables on academic success are mediated by help-seeking behavior. The mediation model presented in this article is based upon a published framework model (Fleischer et al., 2019) which describes individual student's characteristics explaining academic success mediated by learning strategies. Our hypothesized model focusses on individual social resources that can be leveraged by learners for academic HS, which in turn may lead to academic success (see **Figure 1**). It is expected that the availability of social resources and their use *via* successful academic HS subsequently exert an influence on academic success measures, that is, academic achievement (AM), student's satisfaction (SF) and student's dropout intention (DI). A model proposed by Brouwer et al. (2019) follows a similar structure, but with a share of socio-emotional variables, in which belongingness (for example, perception of acceptance or understanding) predicts academic success mediated by interaction with peers. In the following the stated research questions are elaborated with the hypothesized mediation model and explicit hypotheses are derived.

1.4.1 Effect of Social Embeddedness on Academic Success Mediated by Help-Seeking

In reference to RQ-1 it is hypothesized that the degree of social embeddedness is a fundamental prerequisite for successful help-seeking episodes: The provision of elaborated help requires more effort from the helper than asking requires from the helpee, hence having close ties (being socially embedded) makes it more likely that this effort is undertaken and useful help is provided (Stewart-Williams 2007). It is expected that HS improves academic success (Richardson et al., 2012).

According to RQ-1, three direct effects from social embeddedness on academic success indicators are hypothesized (each prefixed with H). Additionally, it is hypothesized that each direct association is (partly) mediated *via* academic help-seeking.

The degree of *social embeddedness (SE)*. . .

- H-SE-c-AM: . . . positively predicts *academic achievement (AM)* after the first semester. . .
- H-SE-c-SF: . . . positively predicts *student's satisfaction (SF)* after the first semester. . .
- H-SE-c-DI: . . . negatively predicts *student's dropout intention (DI)* after the first semester. . .
- H-SE-ab-AM/H-SE-ab-SF/H-SE-ab-DI: . . . this relationship is (partially) mediated by the frequency of successful *help-seeking*.

If the relationship between social embeddedness and the respective academic success measure is mediated by successful HS behavior, it can be stated that: First, SE will be an observed precondition for HS behavior. Second, HS behavior will influence the academic success measure (thus explaining parts of the relationship between SE and the respective criterion).

1.4.2 Effect of Group Awareness on Academic Success Mediated by Help-Seeking

In reference to RQ-2 it is hypothesized that GA is a prerequisite for successful academic help-seeking. It is expected that the characteristics of the helper (e.g., competence) determine the elaboration of the help a helpee receives. Hence, the helpee's awareness of the helper's knowledge and competence may lead to better selections of helpers and thus is expected to be an antecedence for more successful HS episodes. As these episodes might be conducive for learning they may have an influence on academic success and measures linked to it. According to RQ-2 three direct effects from group awareness on academic success indicators are hypothesized. Additionally, it is hypothesized that each direct association is (partly) mediated *via* academic help-seeking.

The extent of *group awareness (GA)*. . .

- H-GA-c-AM: . . . positively predicts *academic achievement* after the first semester. . .
- H-GA-c-SF: . . . positively predicts *student's satisfaction* after the first semester. . .
- H-GA-c-DI: . . . negatively predicts *student's dropout intention* after the first semester. . .
- H-GA-ab-AM/H-GA-ab-SF/H-GA-ab-DI: . . . this relationship is (partially) mediated by the frequency of successful *help-seeking*.

Similarly, if the relationship between group awareness and the respective academic success measure is mediated by successful HS behavior, this effect will provide two conclusions: First, GA will be an observed precondition for HS behavior. Second, HS behavior will influence the academic success measure (thus likely explaining parts of the relationship between GA and the respective criterion).

1.4.3 Effect Patterns Between Social Variables and Academic Success for Two Study Programs

Students studying in STEM programs are usually part of large cohorts. They may be provided supportive offers of institutions that either enable students to establish relations among peers (e.g., mentoring programs or social events) or implementing cooperative forms of learning (group assignments; Brouwer et al., 2016). How and how far these forms are implemented depends on the study program, possibly resulting in differing degrees of social interaction among students. Research regarding peer learning and HS provide evidence that seeking help from peers is more likely to happen in small groups (Newman 1998).

- RQ-3: What effect patterns become apparent when investigating study programs with differing institutional offers supporting small group learning?

Study programs differ in their institutional offers during the first semester. Hence, an exploratory description of social variables as well as a description of the effect patterns among the investigated constructs can provide insights complementary to the mediation model (see RQ-3). We decided to stick to the research question not qualifying a hypothesis as we expect study programs to differ in manifold characteristics and hence choose a comparative approach. Varying descriptive effect patterns may advise future research as well as institutional decisions on supportive offers institutions.

2 MATERIALS AND METHODS

2.1 Research Design

The research questions were addressed in a survey-based field study by assessing the constructs with questionnaires where the unit of analysis is the individual student. Responses were assessed in a science and in an engineering program. Both cohorts were chosen because they differ in their degree to which social forms of learning as well as formal events for socializing were institutionally offered to students (among other factors). Merely the study programs were chosen by the researchers, the offerings itself were not led by the researchers. This may lead to a difference of both subsamples regarding social embeddedness, group awareness and their relationship. Science students were offered weekly tutorial sessions in small groups (max. 15 students) over a period of 2 months in which basic information related to their study program were provided. Furthermore, they were exposed to more social forms of learning during the first semester, e.g., working in small groups within laboratories. It is expected that students establish relations with peers and gain awareness about them due to social interaction within small groups (see *Introduction* section). The regular tutorial sessions as well as the group work in the laboratory arranged the participating students into smaller groups and provided space for content-related social interaction. These institutional offerings are not specific for science courses *per se*, but for study programs where students are encouraged to work together in small groups. In contrast, civil engineering

TABLE 1 | Demographic information of the chemistry and civil engineering subsample.

	Chemistry	Civil engineering
Sample size	49	80
Participants among first-semester undergraduates	18%	25%
Age	*M* = 19.98 (*SD* = 5.15) range = 17–54	*M* = 20.23 (*SD* = 2.28) range = 18–31
Sex ratio	Female: 39%/Male: 61%	Female: 40%/Male: 60%
Percentage of first-generation students	33%	48%

students, did not have small-group tutorials and were predominantly exposed to large lectures. It is expected that lectures induce rather low levels of social interaction. From this perspective, the engineering students have less institutional guidance to establish and maintain small subgroups and therefore are expected to experience lower levels of social embeddedness and group awareness (see *Introduction* section). Results of both subsamples will be examined comparatively. The assessed social and behavioral variables were social embeddedness, group awareness, and successful academic help-seeking behavior (see section *Instruments and variables*). They were assessed weeks before the exams at the end of the first semester. Additionally, the academic success measures namely academic achievement, student's satisfaction and student's dropout intention were assessed after the exams at the beginning of the following semester.

2.2 Participants

First-semester undergraduate students in the winter term of 2018 were participating in the study. They were enrolled in the study programs *Chemistry* (Bachelor of Science: Chemistry and Biochemistry; Bachelor of Arts: Chemistry plus additional subject) and *Civil Engineering* (Bachelor of Science) at a German university. Participants were recruited either at a welcoming event for engineers or at a general chemistry lecture, which were both expected to address all first semester students in the respective study programs. Overall, ten students were excluded from data analysis due to highly suspicious data entries, i.e., participants provided the same answer in the last half of a test. Thus, the final chemistry subsample of consists of $n = 49$ students covering 18% of first-semester chemistry undergraduates overall (see **Table 1**). The civil engineering subsample consists of $n = 80$ students covering 25% of first-semester civil engineering undergraduates.

2.3 Instruments and Variables

Referring to our hypothesized mediation model, we assessed two predictors of academic success measures: social embeddedness and group awareness. Social embeddedness was assessed with a subscale of Social Interaction Ties (Chiu et al., 2006), adapted to the university-context using four items (closeness of relationship, amount of time spent together, knowledge on personal level and communication frequency) using a seven-point response format (expected to be equidistant), ranging from "*strongly disagree*" (1) to "*strongly agree*" (7) (Chemistry Cronbach's $\alpha = 0.92$; Civil engineering Cronbach's $\alpha = 0.89$). The items assess the quality of relations to peers, for example, "*I maintain close relations with some fellow students.*" (translated).

Group Awareness was assessed with the cognitive GA scale (Mock 2017), whose wording was slightly adapted to fit into the academic context. Participants answered three items using a five-point response (expected to be equidistant), from "*strongly disagree*" (1) to "*strongly agree*" (5) (Chemistry Cronbach's $\alpha = 0.86$; Civil engineering Cronbach's $\alpha = 0.79$). Items assess general awareness about peer's knowledge, for example, *"I have an overview about how far some of my peer students produce valuable contributions.*" (translated).

Referring to our hypothesized mediation model the mediator successful academic help-seeking behavior was assessed with an item for helpful among received support. The single item was answered on a five-point response (expected to be equidistant), ranging from "*very rarely*" (1) to "*very frequently*" (5). The frequency of successful help-seeking among requested help was assessed with the item *"How often was the content-related or organizational support, which you received during the past 2 weeks from peer students, actually helpful?"* (translated). Multiple studies have found that past behavior is a good predictor for future behavior (Ouellette and Wood, 1998). Similarly, work-related behavior is expected to be consistent over time (Wernimont and Campbell, 1968). For these reasons, HS behavior was assessed by asking for a rating of the past 2 weeks, assuming past behavior to be a predictor of future behavior makes it plausible to expect a similar tendency towards HS behavior even after the assessment.

Referring to our hypothesized mediation model we assessed three academic success indicators: students' satisfaction, students' dropout intention and academic achievement.

Students' satisfaction with their study situation (Westermann et al., 1996) was assessed as an aggregate of 12 items (partly recoded) comprising subscales *satisfaction with lectures*, *contents of study program*, *conditions of studying* and *coping with strain* on a four-point equidistant response format. Answers ranging from *"disagree"* (0) to *"agree" (3),* higher values indicate higher satisfaction (Chemistry Cronbach's $\alpha = 0.85$; Civil engineering Cronbach's $\alpha = 0.83$). Examples for such items are *"I really enjoy what I study."* (translated) or *"The external circumstances under which students in my subject study are frustrating."* (inverse item, translated).

Students' dropout intention was assessed with three items, two of them from Fellenberg and Hannover (2006) and one from Blüthmann et al. (2018) on a four-point equidistant response format, answers ranging from *"disagree"* (0) to *"agree"* (3), higher values indicate higher dropout intention (Chemistry Cronbach's

α = 0.91; Civil engineering Cronbach's α = 0.88). An example for such an item is *"I consider seriously to drop out of studies"* (translated).

Academic achievement was assessed as self-reported grades from written exams at the end of the first semester (lower grades indicate better performance). In these study courses, students receive a grade for each passed course. The estimated amount of work for the respective course is translated into credits points. Civil engineering students received up to five grades (29 credits in sum) and chemistry students were graded up to three grades (19 credits in sum; data of an additional 4 credit practical course was not available), based on the recommended plan of studies. Academic achievement is calculated by available grades for each participant which were weighted by their respective credit value. Weighting grades by respective credit takes the scheduled workload for a class into account for achievement. Previous calculations covering samples of $n = 31$ and $n = 43$, conducted by partner's projects within the Research Unit, showed at least *substantial agreement* (Cohen's κ; Landis and Koch 1977) between self-assessed and received grades based on comparable samples.

2.4 Procedure

Students were informed in person from the conducting researcher about the aim of the study and the schedule for the surveys. All participants gave their informed consent offline before answering the surveys partly online from home. Students of both study programs were offered monetary compensation for participating in the study. Data from chemistry students was acquired partly in a general chemistry tutorial and partly online. Data from civil engineering students was assessed in an optional course on educational psychology and partly online. They received credit points for attending the course. Data was assessed in winter term 2018/2019, 2 weeks before examinations; success measures were assessed and at the beginning of summer term 2019. The study was conducted adhering to high ethical standards and is approved by the local ethics committee (ID: 2108PFSC5731).

2.5 Data Analyses

We conducted a separate mediation analysis for each of the two subsamples to investigate our hypotheses predicting academic success measures either by social embeddedness or by group awareness *via* successful help-seeking. Each variable was z-standardized before model estimation. Mediation models were calculated with bootstrapped confidence intervals for indirect effects based on 5.000 bootstrap samples utilizing the *mediate* function of the *psych*-package in R statistics (Preacher and Hayes 2004; Revelle 2020). Statistical tests were conducted two-sided with an alpha level of 5%.

3 RESULTS

Descriptive statistics of all variables are reported for both subsamples in **Table 2**. Depending on whether normal distribution of the dependent variable could be assumed, either Wilcoxon Rank Sum Test (non-normally distributed) or Welch's *t*-Test (normally distributed) was estimated for between subsample comparisons. Homogeneity of variance between both subsamples has been approved for each dependent variable by Levene's test. Central dependent variables were compared between both subsamples. According to RQ-3 we examine whether the subsamples differ with regard to central dependent variables. Thus, both subsamples were compared by a Wilcoxon Rank Sum Tests (see **Table 2**). They revealed that chemistry students and civil engineering do not differ regarding reported social embeddedness. However, chemistry students have reported higher group awareness as well as more successful academic help-seeking than civil engineering students (RQ-3).

Next, we estimated bivariate correlations of central dependent variables (see **Table 3**). For the chemistry sample (below the diagonal in **Table 3**), students' satisfaction is associated with both social embeddedness as well as HS; moreover, dropout intention is associated with none of the predictors. For the civil engineering subsample, we have identified that students' satisfaction is associated with both social embeddedness as well as group awareness, the same applies to dropout intention. Furthermore, successful help-seeking is linked to both expected predictor variables. For the chemistry subsample, we have identified that students' satisfaction is associated with social embeddedness and GA. Furthermore, successful help-seeking is linked to students' satisfaction. In the following, the discovered associations of expected predictors and expected outcomes are tested for the hypothesized mediating effects. We have tested each hypothesized mediation model and will report key findings regarding the (in-)direct effects. In case a significant effect for either of the group has been found we included an additional visualization of a mediation model indicating beta coefficients. Otherwise, such a visualization with extensive model values can be found in the supplementary material.

3.1 Predicting Academic Achievement

In hypothesis H-SE-c-AM it is assumed that social embeddedness influences academic achievement (i.e., performance), which is (partly) mediated by successful academic help-seeking behavior (see H-SE-ab-AM). A bootstrapped mediation analysis for social embeddedness predicting academic achievement mediated by successful academic help-seeking has been conducted and there were no significant effects found (see H-SE-ab-AM).

For chemistry students there was no total effect ($c = 0.048$, $SE = 0.146$, $p = 0.745$), no bootstrapped indirect effect [product a and $b < 0.001$, $SE = 0.05$, CI95% (−0.10; 0.12)] and hence no direct effect ($c' = 0.068$, $SE = 0.150$, $p = 0.650$). The comprehensive results for this mediation model can be found in the supplementary material.

For engineering students there was no total effect ($c = 0.051$, $SE = 0.113$, $p = 0.652$), no bootstrapped indirect effect [$ab = -0.005$, $SE = 0.053$, CI95% (−0.11; 0.11)] and hence, no direct effect ($c' = 0.060$, $SE = 0.126$, $p = 0.644$). The comprehensive results for this mediation model can be found in the supplementary appendix. To sum up the results of both models provide evidence to test the hypotheses H-SE-c-AM and H-SE-ab-AM. For both study programs, there was neither a total effect from social

TABLE 2 | Descriptive statistics of dependent variables compared by study program.

	Chemistry *M (SD)*	Civil engineering *M (SD)*	Test
Social Embeddedness [1–7]	5.08 (1.30)[a]	4.91 (1.21)[a]	W = 2,135, p = 0.396
Group Awareness [1–5]	3.86 (0.69)[a]	3.60 (0.77)[a]	W = 2,383.5, p = 0.036
Acad. Help-Seeking [1–5]	4.10 (0.90)[a]	3.58 (0.96)[a]	W = 2,616.5, $p \leq 0.001$
Average Grade CP-weighted	2.55 (0.85)	2.58 (0.67)	$t(71.29) = -0.206$, p = 0.837
S. satisfaction [0–3]	1.94 (0.50)	1.77 (0.49)	$t(99.79) = 1.87$, p = 0.065
S. dropout intention [0–3]	0.59 (0.84)[a]	0.79 (0.88)[a]	W = 1,629.5, p = 0.097

[a]*Non-normally distributed.*
Note. Variances of all dependent variables are homogenous for both groups.

TABLE 3 | Bivariate spearman correlations between constructs. Values below the diagonal are for chemistry sample and above for civil engineering.

Variables	SE	GA	HS	SF	DI	AM
Chemistry sample (n = 49)/Civil engineering sample (n = 80)						
(1) Social Embeddedness	—	0.34**	0.38***	0.27*	−0.22*	0.08
(2) Group Awareness	0.37**	—	0.48***	0.39***	−0.40***	0.01
(3) HS Behavior	0.14	0.18	—	0.03	0.01	0.05
(4) Satisfaction	0.36*	0.23	0.28*	—	−0.53**	−0.10
(5) Dropout Intention	−0.16	−0.09	−0.10	−0.61***	—	−0.04
(6) Achievement	0.10	−0.04	0.02	−0.05	0.15	—

Note. 1) Social Embeddedness (SE) 2) Group Awareness (GA) 3) Help-Seeking Behavior (HS) 4) Students' Satisfaction (SF) 5) Students' Dropout Intention (DI) 6) Academic achievement/ Weighted Average Grade (AM).
*p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.*

embeddedness on academic achievement (H-SE-c-AM) nor an indirect effect of academic help-seeking found (H-SE-ab-AM).

In hypothesis H-GA-c-AM it is expected that group awareness influences academic achievement, which is mediated by successful academic help-seeking behavior.

For chemistry students there was no total effect ($c = -0.019$, $SE = 0.146$, $p = 0.899$), nor a bootstrapped indirect effect [$ab = -0.021$, $SE = 0.057$, CI95% (−0.15, 0.09)] and hence no direct effect ($c' = 0.007$, $SE = 0.153$, $p = 0.966$).

For engineering students there was no total effect ($c = -0.009$, $SE = 0.113$, $p = 0.939$), nor a bootstrapped indirect effect [$ab = -0.004$, $SE = 0.059$, CI95% (−0.11, 0.12)] and hence no direct effect ($c' = 0.008$, $SE = 0.128$, $p = 0.951$).

To sum up the results of both models provide evidence to test the hypotheses H-GA-c-AM and H-GA-ab-AM. For both study programs, there was neither a total effect from group awareness on academic achievement (H-SE-c-AM) nor an indirect effect of academic help-seeking found (H-SE-ab-AM).

3.2 Predicting Students' Satisfaction

3.2.1 Social Embeddedness on Students' Satisfaction Through Help-Seeking Behavior

In hypothesis H-SE-c-SF it is assumed that social embeddedness influences students' satisfaction, which is expected to be mediated by successful HS (see H-SE-ab-SF). A bootstrapped mediation analysis for social embeddedness predicting student satisfaction mediated by successful academic help-seeking has been conducted and results are reported below (see **Figure 2**).

Regarding the chemistry subsample there was a total effect of social embeddedness on student satisfaction (see path *c* in **Table 4**; see H-SE-c-SF). Moreover, there is no effect of social embeddedness on successful academic HS (see path *a*). Additionally, successful academic HS has no effect on students' satisfaction (see path *b*). Thus, there is no indirect effect mediated through successful academic HS (see product *a* and *b*; H-SE-ab-SF).

Regarding the civil engineering subsample there was a total effect of social embeddedness on student satisfaction (see path *c* in **Table 4**; H-SE-c-SF). Moreover, social embeddedness affects successful academic HS (see path *a*). However, successful academic HS again does not predict students' satisfaction (path *b*). That is why there is no indirect effect mediated through successful academic HS (see product *a* and *b*; H-SE-ab-SF).

In conclusion the found effect pattern are summarized for both groups (see RQ-3). Students' social embeddedness leads to higher student satisfaction for both subsamples (total effects; see H-SE-c-SF). For the engineering subsample a higher degree of social embeddedness facilitates helpful academic HS, but helpful HS in turn does not result in higher student satisfaction (no indirect effects; see H-SE-ab-SF). Interestingly, the value of the coefficients for path *b* is descriptively indicating a different gradient for each subsample: a non-significant positive tendency of successful HS on satisfaction for chemistry; a non-significant negative tendency of successful HS on satisfaction for engineering (see RQ-3).

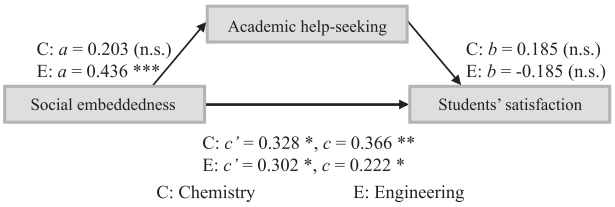

FIGURE 2 | Mediation model of the relationship between social embeddedness and student's satisfaction *via* academic help-seeking. Note. $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$.

3.2.2 Group Awareness on Student Satisfaction Through Help-Seeking Behavior

In hypothesis H-GA-c-SF it is assumed that group awareness influences student satisfaction, which is expected to be mediated by successful help-seeking (see H-GA-ab-SF). A bootstrapped mediation analysis for group awareness predicting student satisfaction mediated by successful academic help-seeking has been conducted and results are reported below (see **Figure 3**).

For the chemistry subsample, group awareness has a total effect on student satisfaction (see path *c* in **Table 5**; see H-GA-c-SF). Moreover, group awareness has a significant effect on successful academic HS (see path *a*), but there is no effect of successful academic HS on students' satisfaction (see path *b*). That is why there is no indirect effect mediated through successful academic HS (see product *a* and *b*; H-GA-ab-SF).

Regarding the civil engineering subsample, group awareness has a total effect on student satisfaction (see path *c* in **Table 5**; H-GA-c-SF). Moreover, group awareness significantly affects successful help-seeking (see path *a*) and successful academic help-seeking is a significant predictor lowering students' satisfaction (see path *b*). There is a significant (negative) indirect effect mediated through successful academic help-seeking (see product *a* and *b*) and furthermore a complementary (positive) direct effect (see path *c'*). For civil engineering students, the effect of group awareness on students' satisfaction (see H-GA-c-SF) is partly mediated through successful academic help-seeking (see H-GA-ab-SF).

In conclusion, the found effect patterns are summarized for both groups (see RQ-3). For both subsamples, group awareness facilitates successful academic help-seeking. For the chemistry sample, group awareness directly increases students' satisfaction (whereas significance criterion is reached narrowly). For the civil engineering sample, academic HS mediates the effect of group awareness on students' satisfaction (see H-GA-ab-SF and H-GA-c-SF). This model incorporates academic help-seeking for explaining the association between group awareness and students' satisfaction: it reveals that group awareness facilitates successful help-seeking behavior which in turn affects students' satisfaction. Interestingly, again the influence of help-seeking on students' satisfaction, that is, coefficients for path *b*, are descriptively indicating a different gradient for each subsample, positive for chemistry (non-significant) and negative for civil engineering (significant predictor).

3.3 Predicting Students' Dropout Intention

3.3.1 Social Embeddedness on Students' Dropout Intention Through Help-Seeking Behavior

In hypothesis H-SE-c-DI it is assumed that social embeddedness has an effect on students' dropout intention, which is expected to be mediated by successful HS (see H-SE-ab-SF). A bootstrapped mediation analysis for social embeddedness predicting students' dropout intention mediated by successful academic help-seeking has been conducted.

For chemistry students there was no total effect ($c = -0.218$, $SE = 0.142$, $p = 0.133$), no bootstrapped indirect effect [product of a and $b = -0.030$, $SE = 0.050$, CI95% (−0.23; 0.02)] and hence, no direct effect ($c' = -0.188$, $SE = 0.145$, $p = 0.202$). The comprehensive results for this mediation model can be found in the supplementary material.

For engineering students there was no total effect ($c = -0.107$, $SE = 0.113$, $p = 0.344$), no bootstrapped indirect effect [$ab = 0.040$, $SE = 0.040$, CI95% (−0.05; 0.17)] and hence, no direct effect ($c' = -0.149$, $SE = 0.125$, $p = 0.239$). The comprehensive results for this mediation model can be found in the supplementary material.

To sum the results up, there was no direct effect from social embeddedness on dropout intention for neither of both programs (see H-SE-c-DI). Additionally, there was no indirect effect of help-seeking found for neither of the programs (see H-SE-ab-DI).

TABLE 4 | Detailed results of the mediation analysis between social embeddedness (predictor), successful academic help-seeking (mediator) and students' satisfaction (criterion).

	Chemistry subsample				Civil engineering subsample			
	Coeff.	***SE***	**Test**	***p***	**Coeff.**	***SE***	**Test**	***p***
a	0.203	0.143	$t(47) = 1.14$	0.162	0.436	0.102	$t(78) = 4.28$	<0.001
b	0.185	0.136	$t(47) = 1.36$	0.180	–0.185	0.121	$t(78) = -1.53$	0.131
*a*b*	0.044	0.063	[–0.05; 0.21]	—	–0.082	0.071	[–0.24; 0.03]	—
c'	0.328	0.133	$t(46) = 2.09$	0.034	0.302	0.109	$t(77) = 2.42$	0.015
c	0.366	0.134	$t(48) = 2.72$	0.009	0.222	0.110	$t(79) = 2.02$	0.047
	$R^2_a = 0.041$, $F(1, 47) = 2.015$, $p = 0.162$				$R^2_a = 0.190$, $F(1, 78) = 18.32$, $p = 0.053$			
	$R^2_{bc}' = 0.167$, $F(2, 46) = 4.596$, $p = 0.015$				$R^2_{bc}' = 0.08$, $F(2, 77) = 3.203$, $p = 0.046$			

Note. *The coefficient* a *refers to the path from social embeddedness to successful academic help-seeking. The coefficient* b *refers to the path from successful academic help-seeking to students' satisfaction. The indirect effect is indicated by the interaction of* a *and* b*. The coefficients* c' *(direct effect) and* c *(total effect) refer to the effects from social embeddedness on students' satisfaction.*

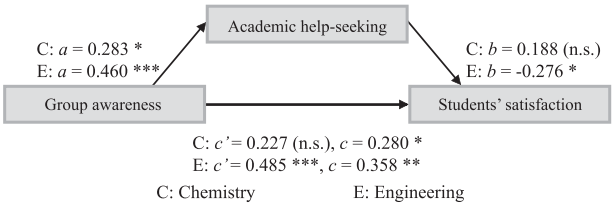

FIGURE 3 | Mediation model of the relationship between group awareness and student's satisfaction *via* academic help-seeking. Note. $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$.

The comprehensive results for this mediation model can be found in the supplementary appendix.

3.3.2 Group Awareness on Students' Dropout Intention Through Help-Seeking Behavior

In hypothesis H-GA-c-DI it is assumed that group awareness has an effect on students' dropout intention, which is expected to be mediated by successful help-seeking (see H-GA-ab-DI). A bootstrapped mediation analysis for group awareness predicting students' dropout intention mediated by successful academic help-seeking has been conducted and results are reported below (see **Figure 4**).

For the chemistry subsample, group awareness has a negative total effect student's dropout intention (see path *c* in **Table 6**; see H-GA-c-DI). Moreover, group awareness significantly predicts successful academic help-seeking (see path *a*). However, successful academic help-seeking does not predict students' dropout intention (see path *b*), hence there was no indirect effect (see product of *a* and *b*). Based on this evidence there is a direct effect of group awareness on student's dropout intention (see H-GA-c-DI), but there is no mediating effect of academic help-seeking (see H-GA-ab-DI).

For the engineering subsample, group awareness has a positive direct effect on student's dropout intention (see path *c* in **Table 6**; see H-GA-c-DI). Moreover, group awareness significantly affects successful academic help-seeking (see path *a*), which in turn significantly increases students' dropout intention (see path *b*). The effect of group awareness on students' dropout intention is partially mediated by successful academic help-seeking (see product of *a* and *b*) reducing the direct effect of group awareness on dropout intention (see path *c'*). This means that successful academic help-seeking behavior is a notable mediator explaining shares in the relationship of group awareness predicting students' dropout intention (H-GA-ab-DI).

In conclusion, social embeddedness does not predict dropout intention for both subsamples (see H-SE-c-DI). Similarly, for chemistry students, group awareness does not have an effect on dropout intention (see H-GA-c-DI). However, for civil engineering students, academic help-seeking mediates the relationship between group awareness and dropout intention (see H-GA-ab-DI). Hence, increased group awareness does not solely affect students' dropout intention, but when it is accompanied with increased academic help-seeking behavior.

4 DISCUSSION

In the present study we examined the effect of social resources (either social embeddedness or group awareness) on academic success measures and in how far this effect is mediated by successful help-seeking behavior. We expected that occasions to gather and learn in groups may facilitate building both social ties and awareness about peer knowledge. Moreover, we have reported results from two study programs: a chemistry program which offered these occasions (i.e., small group tutoring and working in a lab) and a civil engineering program with less of these institutional offers. Beside these differences, both subsamples might additionally differ in intentional and motivational factors that influence the decision on a study program (example for self-selection bias; Heckman 2010). In the following, the results for the mediation model are discussed. Moreover, patterns of effects differing for both groups are interpreted and finally the discussion is closed with a detailed clarification on the study's limitations.

4.1 Summary and Interpretation of the Main Results

In the following the main findings of the study addressing the effects in the mediation model are summarized and discussed.

TABLE 5 | Detailed results of the mediation analysis between group awareness (predictor), successful academic help-seeking (mediator) and students' satisfaction (criterion).

	Chemistry subsample				Civil engineering subsample			
	Coeff.	***SE***	**Test**	***p***	**Coeff.**	***SE***	**Test**	***p***
a	0.283	0.140	$t(47) = 2.02$	0.049	0.460	0.101	$t(78) = 4.57$	<0.001
b	0.188	0.143	$t(47) = 1.31$	0.197	–0.276	0.115	$t(78) = -2.40$	0.018
*a*b*	0.052	0.064	[–0.04; 0.21]		–0.129	0.077	[–0.30; –0.001]	
c'	0.227	0.138	$t(46) = 1.59$	0.112	0.485	0.102	$t(77) = 4.01$	<0.001
c	0.280	0.139	$t(48) = 2.02$	0.049	0.358	0.105	$t(79) = 3.41$	0.001
	$R^2_a = 0.080$, $F(1, 47) = 4.083$, $p = 0.049$				$R^2_a = 0.212$, $F(1, 78) = 20.92$, $p = 0.018$			
	$R^2_{bc}' = 0.333$, $F(2, 46) = 2.866$, $p = 0.067$				$R^2_{bc}' = 0.188$, $F(2, 77) = 8.934$, $p < 0.001$			

Note.*The coefficient* a *refers to the path from group awareness to successful academic help-seeking. The coefficient* b *refers to the path from successful academic help-seeking to students' satisfaction. The indirect effect is indicated by the interaction of* a *and* b*. The coefficients* c' *(direct effect) and* c *(total effect) refer to the effects from group awareness on students' satisfaction.*

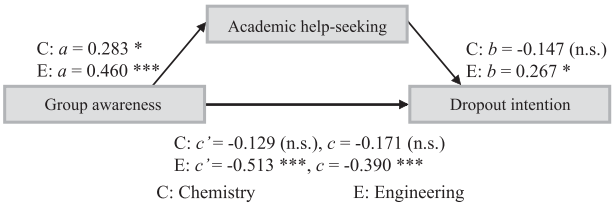

FIGURE 4 | Mediation model relationship between group awareness and student's dropout intention *via* academic help-seeking. Note. $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p \leq 0.001$.

Moreover, different effect patterns for both study programs are discussed. The summary of the results begins with social embeddedness addressing research question 1 and continues with group awareness addressing research question 2:

First, SE does neither affect academic achievement nor dropout intention (e.g., see H-SE-c-AM), but it influences students' satisfaction and is an antecedent for successful HS for engineering students. However, the effect of SE on students' satisfaction (or any measured outcome) is not mediated by successful HS behavior (e.g., see H-SE-ab-SF).

Second, GA has no effect on academic achievement. However, GA predicts both students' satisfaction as well as successful academic HS for both subsamples Moreover, academic HS mediates the effect of GA on students' satisfaction and students' dropout intention for the engineering subsample (see H-GA-ab-SF).

On the contrary, for the chemistry subsample no significant effect of successful HS on students' satisfaction/students' dropout intention has been found (see RQ-3). Indeed, the data rather indicates a non-significant positive tendency for students' satisfaction/students' dropout intention (which is in line with research).

Considering the negative effect for one subsample and the non-significant (positive) tendency for the other, the discrepancy between both subsamples warrants further investigation. Although, the predictor variables and the mediator (SE, GA, and HS), were measured about 12 weeks before the criterion variables (SF, DI, AM), they show considerable predictive power at least on satisfaction and dropout intention.

The found effects lead to conclusions that are of theoretical and practical matter: Based on the identified direct effects of GA on student's dropout intention it can be concluded that interventions can directly contribute to reducing drop out. When discussing the mediating effect of HS behavior we will begin highlighting its antecedences and then it's effect on outcomes. Focusing on the antecedences, SE as well as GA support successful academic HS. Hence, HS benefits from the availability of peers as well as one's awareness about their knowledge. This mechanism reveals that interventions which aim to increase knowledge-related communication may also improve successful academic HS behavior. Hence, practitioners are advised to foster knowledge related exchange among peer students, e.g., by encouraging them to summarize their understanding, by letting them present differing approaches for an assignment or by formulating questions during tutorial sessions.

Focusing on the outcomes, we can conclude that students' satisfaction is predicted by SE as well as GA. Similarly, dropout intention is predicted by GA. Additionally, successful academic HS mediates some of these associations (positively and negatively) and provides evidence that successful academic HS affects students' satisfaction and dropout intention. Even if we did not find evidence for HS among peers improving achievement, a broad body of research suggests that HS is conducive to academic achievement and learning. Richardson et al. (2012) have additionally taken institutional sources of help into account when estimating the effect and go beyond our focus of peer students. The mediating effect of HS provides evidence for the assumption that HS behavior that involves social resources affects academic success measures. The priorly presented findings confirm the expected mechanism that students' social resources contribute to successful HS behavior. Moreover, it was unexpected that HS behavior subsequently affects academic success in ways that diminishes retention. As the analysis revealed a mediating effect only for one of the programs, we discuss expected mechanisms in more detail in the following section.

TABLE 6 | Detailed results of the mediation analysis between group awareness (predictor), successful academic help-seeking (mediator) and students' dropout intention (criterion).

	Chemistry subsample				Civil engineering subsample			
	Coeff.	***SE***	**Test**	***p***	**Coeff.**	***SE***	**Test**	***p***
a	0.283	0.140	$t(47) = 2.02$	0.049	0.460	0.101	$t(78) = 4.57$	<0.001
b	−0.147	0.150	$t(46) = -0.978$	0.333	0.267	0.114	$t(77) = 2.34$	0.022
*a*b*	−0.050	0.072	[−0.24; 0.04]		0.128	0.066	[0.02; 0.278]	
c'	−0.129	0.150	$t(46) = -0.86$	0.394	−0.513	0.114	$t(77) = -4.493$	<0.001
c	−0.171	0.144	$t(47) = -1.19$	0.241	−0.390	0.104	$t(78) = -3.74$	<0.001
	$R^2_a = 0.283$, $F(1, 47) = 4.083$, $p = 0.049$				$R^2_a = 0.212$, $F(1, 78) = 20.920$, $p < 0.001$			
	$R^2_{bc}' = 0.049$, $F(2, 46) = 1.182$, $p = 0.316$				$R^2_{bc}' = 0.209$, $F(2, 77) = 10.140$, $p < 0.001$			

Note. *The coefficient* a *refers to the path from group awareness to successful academic help-seeking. The coefficient* b *refers to the path from successful academic help-seeking to students' dropout intention. The indirect effect is indicated by the interaction of* a *and* b*. The coefficients* c' *(direct effect) and* c *(total effect) refer to the effects from group awareness on students' dropout intention.*

4.2 Effect Patterns For Science and Engineering Students

For research question 3 we investigated central dependent variables quantitatively, the effect patterns comparatively and contrasted each of them between both study programs (see RQ-3). On the one hand, both groups did not differ as expected regarding the degree of SE, on the other hand chemistry students reported higher GA regarding peers and sought systematically more help compared to civil engineering students. This is in line with the argument that the chemistry students may benefited from the weekly tutorials and social forms of learning which in turn may have induced study-related communication what has finally led to higher GA and more HS behavior. Additionally, these findings are in line with the observation of the present study that GA fosters successful HS. Furthermore, successful HS has a negative effect on students' satisfaction and an increasing effect on students' dropout intention for civil engineering students. For chemistry students, we did not confirm this effect. Rather we found a non-significant positive tendency. This observation needs to be investigated in future studies as it needs further evidence. Up until know the difference between the study programs is rather descriptive in nature and needs to be further investigated. Thus, the role for academic HS on academic success is still ambiguous and further research should investigate potential differences between study programs.

These presented results indicate that successful HS behavior is not necessarily beneficial for learning but can decrease student's satisfaction. The factors leading to the negative outcome could not be investigated in the present study. That is why in the following we present two mechanisms on how HS may decrease satisfaction. HS evidently can lead to frustration, in case the expected help cannot be provided, that is, in case the problem is not solved. However, we want to point out that in the present study, we investigated successful HS behavior that has been evaluated as sufficient *per se*.

Following on from that, the first expected mechanism focusses on HS episodes which may induce self-evaluative processes in the students that are accountable for changes in their attitude towards studying. When supposing that some students interpret HS as dependent behavior an increasing amount of HS episodes may threaten their self-esteem (Nelson-Le Gall, 1985), which may lead to negative self-perceptions and hence reduce satisfaction. The learner's reflection may depend on the learning context for example, learner's values, prevalent HS attitudes among the cohort or expectations raised by lecturers (Makara and Karabenick, 2013). As one example, Bohndick et al. (2018) found a negative effect on student's satisfaction when students appraise that academic demands do not match their abilities.

The second mechanism involves the competence to evaluate successful HS. Asking for help in a way that enables the helpee to construct a solution on his/her own, is a performance-fostering skill that requires development (Nelson-Le Gall, 1985). As first-year students are rather unexperienced in seeking help on complex subjects, they may ask predominantly for solutions (that is, seek lower quality of help) which reduces the necessary effort to seek help. Hence, they maybe value simple solutions over explanations (that is, seeking executive help) that would enable them to solve the problem on their own (that is, seeking instrumental help). These simple solutions may be perceived as successful help, but as they are less beneficial for learning they may lead to frustration. Following this argument, perceived successful help-seeking is not necessarily for sustainable learning or academic success (instrumental HS vs. executive HS; Karabenick and Knapp 1991). Because only the civil engineering subsample was compensated with money and credit points, it seems plausible that this compensation might have disproportionately attracted students that aim for comparatively easy credits. Among these there may have been a disproportionately high tendency to seek executive help more frequently, which may in turn lead to more episodes perceived as helpful that were in fact contributing little to academic success. This could be one explanation for the negative effect of HS on students' satisfaction for civil engineering. Accordingly investigating HS intentions and perceived usefulness of HS may help to assess the characteristics of HS episodes more objectively (Parnes et al., 2020). Future studies may additionally assess performance- and mastery-goal orientation as they are predictors for the quality of help sought (Gonida et al., 2014); possibly enabling a clearer differentiation of the use of HS behavior despite being perceived as helpful.

4.3 Limitations

In the following sections, general limitations regarding the research design and the sampling are discussed. Further, conceivable mechanisms of mutual interference between the dependent variables are described.

A general limitation to this study is that the data was assessed in a field survey and thus neither systematic variation has been done nor could the influence of external variables be ruled out. Hence, further confounding variables may have had an impact on the results. It is important to note that results are not generalized regarding the study program, but regarding the effect of opportunities to have content-related interactions in small groups. According to the missing opportunity for experimental manipulation these generalizations need to be interpreted with caution. Participants' study program determined their group in the study, which means that both conditions were not randomly sampled. As the decision for a study program underlies various influences (e.g., psychological and social) each condition represents a different population and the mechanisms of these differences are yet to be detected.

Participants were compensated either with money (both groups) and additionally with credit points (civil engineering), which may have led to a selection bias of the sample. Furthermore, the sample of first-semester students is prone to attrition which means that students with an initially high dropout intention may have left before answering the final survey at the end of the semester. Consequently, further studies in experimental settings enable researchers to draw randomized samples, systematically manipulate independent variables and control for additional external factors. Manipulating the predictors (e.g., group awareness) increase the internal validity of the conclusions about their influence on academic success.

First attempts of interventions on GA in students with GA tools aiming to support HS did reveal challenges in the implementation of such studies (Schlusche et al., 2019). GA tools have repeatedly been shown to support targeted peer to peer interaction (Dehler et al., 2011; Erkens and Bodemer, 2019). In the following, more considerations specific to the constructs are discussed.

4.3.1 Challenges Measuring Help-Seeking Behavior

The strengths and drawbacks of the chosen measurement of HS behavior requires a critical discussion. The HS item was assessed as a retrospective self-report addressing the past 2 weeks. It was assessed weeks before the exams and still has predictive power for student's satisfaction after the exams. First, when considering that HS behavior is dynamic over time and increases as the exams come closer, it can be questioned in how far the 2 weeks timeframe assessed weeks before the exams is a generalizable measure. More HS episodes are expected a few days before an exam compared to the assessed number of episodes weeks earlier. Accordingly, more frequent subjective and objective measure points would be of interest for future studies. This approach accounts for the dynamics in the number of HS episodes and may reach higher precision, but on the downside, due to an increased effort for the participants it is likely to lead to an increased experimental mortality, especially for the subset of students struggling. From this perspective future studies may focus on the timeframe few weeks before the exams and are advised to assess HS behavior with more measure points over time.

Second, it can be questioned in how far students can properly assess their HS behavior for a timeframe of 2 weeks. Self-reported behavior may underlie cognitive biases and hence are expected to be less accurate. Nevertheless, self-reports on behavior are an efficient measurement considering the low costs of assessing, the gain of information and its scalability on large samples. In the presented model we accept that the HS measure may not be precise compared with multiple measurements in a shorter timeframe, but we still expect the HS measure to be an appropriate (albeit somewhat rough) indicator of actual behavior.

4.3.2 Conceptual Interrelations Between Social Embeddedness, Group Awareness and Help-Seeking

Although, GA and SE are considered as separate constructs, both concepts are likely to be affected by social interactions which come along with underlying communication processes (see section *Introduction*). Communication between students may contribute to both GA as well as SE among students (Gasevic et al., 2013). Additionally, successful academic HS behavior is one instance of social interaction and relies inherently on study-related communication between both agents. Thus, HS may have an influence on GA as well as SE, which subsequently improve future HS episodes (as expected in this article). This reciprocal idea is the reason why we discuss HS behavior to affect SE or GA after each successful episode. An illustrating example of a similar two-fold perspective can be found in Brouwer et al. (2019): They modeled the effect of behavior on attitude (i.e., peer interaction on belongingness) and separately modeled the effect of attitude on actual behavior (i.e., belongingness on peer interaction).

Social interaction among first semester students may contribute to GA and simultaneously to SE. Especially study-related discussions with peers enable the processing of relevant cognitive information and may foster establishing GA. Similarly, when study-related or private conversations take place repeatedly with the same peers, these conversations may strengthen the ties among peers and increase SE. Both these mechanisms may also apply to HS as it is one instance of study-related social interaction.

In conclusion and based on these considerations, we assume that all constructs are (at least to some degree) interrelated in their development during social interaction processes (esp. academic HS). The expected interrelatedness has consequences on the interpretation of the results: SE, GA, and HS were assessed at the same time. This lack of temporal order diminishes the causal strength of the deduced conclusions (Gelfand et al., 2009). However, in the HS process, the question of *whom to ask* precedes the *actual solicitation of help* (Makara and Karabenick, 2013). At this point we acknowledge a loss of causal strength for the presented results, but nevertheless it seems reasonable that social resources are not beneficial for academic success *per se*, but instead their use is contingent on whether these resources are leveraged for HS behavior. For this reason, further research is advised to examine these factors in experimental designs to investigate the reciprocal effects of HS, GA, and SE.

4.4 Implications

The present study reveals that the investigated social variables directly affect academic success. Hence, based on the findings it can be concluded that improving SE or GA is worthwhile to reduce students' dropout rates (see RQ-1 and RQ-2). Our results allow to deduce a mechanism approaching the high dropout in STEM: fostering GA reduces students' dropout intention. Hence, practitioners are advised to foster GA, for example by enabling small group learning. Moreover, SE and GA improve successful HS. Hence, HS seems to benefit from available cognitive information about peer students, which are exchanged during content-related communication. Furthermore, we found that GA increases successful academic HS, which subsequently affects academic success measures. For this reason, supporting GA among first-year undergraduate students has the potential to improve successful academic HS as well as subsequent academic success measures. This mechanism involving HS provides further potential to support students in their first semester: From a practitioner's point of view, these findings underline the importance of content-related communication with peers during the first year in higher education. Interventions creating contexts of open exchange of content-related communication are contributing to successful help-seeking. The findings reveal the potential (especially) of GA and academic HS to reduce dropout and increase student satisfaction. More research is needed to further investigate the associations between the investigated constructs. The discussed results may inspire future researchers and practitioners to support first-year undergraduate students on their transition to higher education.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics commitee of the Computer Science and Applied Cognitive Sciences at the Faculty of Engineering of the University of Duisburg-Essen. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. All authors were involved in material preparation. Data collection and analysis were performed by CS. The major part of the manuscript was written by CS who took main responsibility for the writing process. All authors wrote on the article. DB and LS commented on previous versions of the manuscript, LS proofread previous versions of the manuscript. All authors read and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2021.732587/full#supplementary-material

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