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How Are Achievement Goals Associated With Self-, Co-, and Socially Shared Regulation in Collaborative Learning?

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Abstract

It has been suggested that self-organized study groups need to regulate their learning on three levels: the self-, the co-, and the socially shared level. Yet, little is known about how individual learner characteristics influence these regulation processes. In this study, we investigate how students' achievement goals are associated with regulation processes within groups. Two hundred and seventy-seven undergraduates were asked to imagine being part of a self-organized study group with comprehension-related and motivational problems and to name strategies they would apply to regulate their learning in this situation in an open-ended format. Achievement goals were measured using a standardized questionnaire. Results indicated that mastery- and performance-approach goals are positively associated with regulatory effort across all three levels of regulation. Performance-avoidance goals seem to have no significant relationship with regulatory effort.

Keywords: collaborative learning, self-regulated learning, achievement goals, socially shared regulation

How Are Achievement Goals Associated With Self-, Co- and Socially Shared Regulation in Collaborative Learning?

University students often deliberately choose to study in groups, for example, when preparing for exams. When conducted at a high level, participating in collaborative learning holds high promises for knowledge acquisition (Suthers, 2006). Yet unfortunately, groups often fail to raise the potential of collaborative learning (see e.g., Cohen, 1994). Typical problems are differences in personal priorities, styles of working and communication, team work, collaborative processes, and external constraints (Järvenoja et al., 2013). Failure of collaborative learning can be attributed to a group's inability to regulate its learning processes successfully (e.g., Järvelä & Hadwin, 2013).

Järvelä and Hadwin (2013) suggest differentiating between three social levels at which group learning can be regulated: the self-level, the co-level, and the socially shared level. First, learners may self-regulate for the sake of their own learning success and apply strategies that regulate their own learning, but not the learning of other group members or the group as a whole (such as monitoring their own understanding; self-level). Second, they may guide other group members or be helped by them (such as giving or receiving explanations to/from a colleague; co-level). Third, they may jointly develop an understanding of the topic and solve learning problems through mutual engagement, for example, by discussing ways to approach or solve a task (socially shared level).

Quite some research has taken up this differentiation over the past years, mostly observing groups during collaborative learning and investigating descriptively which regulation processes occur at the different levels (e.g., Järvenoja et al., 2013; Malmberg et al., 2015; Panadero & Järvelä, 2015). However, there is hardly any evidence on how regulatory processes in groups are influenced by individual learner characteristics. Yet, investigating the influence of individual learner characteristics on how groups regulate collaboration is an

important issue, as learners in a collaborative group are no blank slates. When individuals join a group, they bring a complex set of motivational orientations, traits, beliefs, skills, and further individual characteristics with them. These characteristics constitute, along with contextual conditions, the basis on which collaboration dynamically unfolds. Consequently, we try to methodologically isolate the starting point of collaborative regulation by investigating individual characteristics before the actual collaboration starts.

One learner variable that might have an impact on regulatory processes within groups might be the type of achievement goals that students prefer in learning and achievement settings (e.g., Hulleman et al., 2010). Theoretically, goals constitute the standard with which students measure their progress and at which they direct potential regulatory behavior (e.g., Pintrich, 2000). Empirically, research on self-regulation has repeatedly demonstrated that achievement goals affect regulatory behavior (e.g., Payne et al., 2007). Yet, it is still unknown whether these findings can be transferred to co- and socially shared regulation without adaptation. This is not a trivial issue, since the context of co- and socially shared regulation is different from the context of individual self-regulation: Instead of the whole class or complete solitude, students are surrounded by a small number of distinct peers who typically work towards a joint goal. This difference might affect the goal strivings for appearing competent to others, outperforming others, or increasing competence by, for example, utilizing others as knowledge and regulatory resources. Thus, in this article, we investigate to which extent regulation processes at the self-, co-, and shared level are associated with students' achievement goals.

The Regulation Process

When students encounter obstacles during collaboration, they need to regulate their learning process (Melzner et al., 2020, 2022). These obstacles can be categorized into comprehension-related, coordination-related, motivational, emotional and well-being-related,

and resource-related problems (e.g., Järvenoja et al., 2013; Koivuniemi et al., 2017; Melzner et al., 2020). In previous studies, comprehension-related and motivational problems have been the types of problems which have been reported as being most prevalent in collaborative learning (Koivuniemi et al., 2017; Malmberg et al., 2015; Melzner et al., 2020, 2022). Therefore, we focus on these types of problems in the current study.

Collaborative learners may tackle these problems with various types of regulation strategies. Based on established strategy typologies (Engelschalk et al., 2015; Friedrich & Mandl, 1992), we distinguish between (a) cognitive strategies (e.g., elaborating the learning content), (b) metacognitive strategies (e.g., planning and regulation of the learning process), (c) resource-oriented, motivational strategies (e.g., reward strategies), and (d) resource-oriented, non-motivational strategies (e.g., time management and coordination strategies). If the application of one or several of these regulation strategies is successful, the problem should (at least partially) be solved or circumvented so that learning can proceed as intended.

According to common models of self-regulation (Pintrich, 2000), learners set goals, monitor their learning process, control their learning process if necessary, and finally evaluate and reflect upon it. During learning, if learners encounter obstacles, that is, their monitoring indicates that their current learning progress does not match their goals and expectations, learners will control their learning by selecting and adapting regulation strategies. For this selecting process, learners need to activate (a) a broad repertoire of regulation strategies as part of their metacognitive strategic knowledge, (b) metacognitive conditional knowledge about which strategy to apply under which circumstances, and (c) need to be willing to make use of the potential of these strategies. This latter requirement is determined by the adoption of a suitable goal orientation, efficacy judgements, ease of learning judgements, and the activation of interest and task value. Building on Pintrich's model, we consider these aspects to be prerequisites for successful regulation also during collaborative learning. Throughout the rest

of this article, we, therefore, focus on the association between achievement goals and the intention to apply regulation strategies at different social levels as a result of strategic planning during the self-control process.

Achievement Goals

Achievement goals determine how a person is motivated in the academic learning and performance context. According to Elliot and Harackiewicz (1996), mastery goal-oriented students engage in learning because they strive to develop and improve their skills, competence, or knowledge. Learners with performance-approach goals strive to demonstrate their superior competence to others, whereas learners with performance-avoidance goals aim to avoid performance situations to hide their (actual or assumed) incompetence.

This trichotomous model was extended in several ways (e.g., Baranik et al., 2010; Elliot & McGregor, 2001; Hulleman et al., 2010). In particular, Elliot and McGregor (2001) introduced mastery-avoidance goals as a fourth type of achievement goal. Mastery-avoidance goals are focused on task-mastery and individual competence just like mastery-approach goals, yet they direct regulatory engagement towards avoiding mistakes or incompetence. Theoretically, mastery-avoidance goals should be especially relevant for competent persons who are able to excel at a task in principle and, thus, may fear to make a mistake or risk losing their once gained competence. When it comes to preparing for an exam, however, students typically come from a place of not knowing much about a subject matter and first need to grow their competence in order to succeed at the exam. For this reason, it is unlikely that they develop a fear of mistakes or to lose competence which they do not possess yet. Therefore, mastery-avoidance goals are not considered further in the remainder of this article.

Achievement Goals and Self-Regulation

Theoretically, a goal “can serve as a gauge against which to assess the operation of the system and then guide regulatory processes” (Pintrich, 2000). Task-specific goals (i.e., the

outcome a learner wants to achieve in a task, e.g., finishing a calculation without an error) are justified by purpose goals or goal orientations/achievement goals (i.e., the reason *why* a learner wants to reach the task goals, e.g., in order to develop competence). Thus, the specific goal setting depends on the kind of achievement goal a learner holds. Furthermore, as Pintrich (2000) has argued, the entire regulation process including goal setting, monitoring, control, and reaction/reflection phases can be affected by achievement goals. For example, while a learner with strong mastery goals might check for understanding and monitor comprehension, a learner with strong performance goals might primarily monitor the impression they leave during the (collaborative) learning process.

Empirical research has demonstrated that the orientation towards different achievement goals indeed correlates with a number of processes learners engage in during studying. In their meta-analysis summarizing 197 samples from 157 studies on adults in educational and occupational settings, Payne et al. (2007) investigated antecedents and proximal and distal consequences of achievement goals. They found that mastery goals are strongly connected with the use of learning strategies, whereas performance-approach goals are only loosely and performance-avoidance goals not at all associated with the use of learning strategies. In addition, Cellar et al. (2011) examined the relation between achievement goals and self-regulation more closely. In their meta-analysis of 102 studies on trait-like achievement goals in an adult population, they found mastery-approach goals to be positively and performance-avoidance goals to be negatively correlated with the self-regulation variables self-monitoring, self-evaluation, self-efficacy, and self-reactions. They consider mastery-approach goals as most desirable as they result in more frequent and persistent self-regulation activities.

In summary, mastery goals consistently correlate positively with different indicators of self-regulation across a large number of studies (Cellar et al., 2011; Payne et al., 2007).

Performance-avoidance goals consistently show negative correlations with self-regulation. Performance-approach goals, however, have shown no or mixed correlations with self-regulation.

Achievement Goals and Social Regulation

While there is considerable research on the relationship between achievement goals and self-regulation (i.e., in individual learning settings; e.g., Cellar et al., 2011) and on how groups regulate their learning at different social levels (Järvelä & Hadwin, 2013), studies that bridge the gap between these two research areas are still rare. In the following, we elaborate on how mastery goals, performance-approach goals, and performance-avoidance goals may play out in collaborative learning settings, with a genuine focus on consequences at the co- and at the shared level of regulation.

Mastery Goals

At a theoretical level, we assume that individuals with strong mastery goals are more likely to interpret a group learning situation as an opportunity to advance their knowledge than less mastery-oriented learners. Compared to individual learning settings, at least two more reasons should add to the appraisal of the situation as an attractive learning opportunity: Learners may regard (a) the presence of others as an additional knowledge resource (Newman, 2002; Ryan & Pintrich, 1997), and (b) the interaction with others as an additional means to learning (see Chi & Wylie, 2014).

Consequently, at the *co-regulation* level, mastery-oriented learners should be especially interested in taking advantage of these potentials of group learning and engage in corresponding co-regulation activities, such as help-giving, help-seeking, and feedback behavior. For example, asking others for help (especially instrumental help, i.e., hints fostering learning, Butler, 2006) should be beneficial to master a task or develop competence. Indeed, mastery goals are positively associated with help-seeking (e.g., Karabenick &

Gonida, 2018; Ryan & Pintrich, 1997). Furthermore, the more learners focus on competence development, the more they ask for feedback, which fosters incremental improvement (Cellar et al., 2011; Payne et al., 2007; VandeWalle & Cummings, 1997). However, these findings were derived from studies on "self-regulated learning in a social context" including student-teacher-interactions, not genuine collaborative learning.

At the *socially shared level*, the relation to mastery goals is even more direct. Socially shared strategies such as jointly constructing knowledge via asking and explaining to each other or elaborating on previous speakers' statements should be highly valued by mastery-oriented learners because they promise an in-depth understanding of the learning material (Chi & Wylie, 2014). This might also explain why mastery-oriented learners seem to be attractive learning partners for others, as Barrera and Schuster (2018) found that students preferred peers with mastery goals over peers with performance-approach goals as partners for collaborative learning. Moreover, two studies found even more direct evidence for the beneficial effects of mastery goals on socially shared regulation. Volet and Mansfield (2006) compared four students with positive attitudes towards group work with four students with negative attitudes and analyzed the relation between these attitudes and students' achievement goals. The students with strong performance goals and a negative attitude towards group work largely focused their regulatory efforts on the self-level, even at the expense of the group. In contrast, the students who held a combination of performance and mastery goals had a positive attitude towards group work and regulated more intensively at the co- and shared level to serve group functioning. In addition, Järvelä et al. (2008) reported on a mixed-methods study that qualitatively looked at the regulation processes within two groups. Both groups, who were shown to exhibit high mastery goals, perceived the group process as successful and engaged in social regulation as they were regulating motivation and

attention of the group. Taken together, mastery goals can be assumed to be highly beneficial not only for self-, but also co- and socially shared regulation.

Performance-Approach Goals

Learners with performance-approach goals also seem to appreciate learning with peers. In a study by Won et al. (2018), performance goals were positively associated with peer learning strategies. They might appreciate it because they can demonstrate their competence to their peers, which they can achieve in two different ways. On the one hand, they can contribute constructively to the group to appear competent or outperform others. On the other hand, they might try to only appear competent through impression management techniques or to exploit the situation when other group members have difficulties in order to feel superior to them. Both constructive and non-constructive approaches should be possible equally well at the co-level as well as the shared level of regulation.

At first sight, empirical research seems to be more in favor for the latter, non-constructive hypothesis. When the relationship with feedback and help seeking was investigated, no associations between performance-approach goals and achievement were found (Cellar et al., 2011; Payne et al., 2007; Senko & Dawson, 2017). Also, though VandeWalle et al. (2001) found an association of performance-approach goals with actual performance, this association disappeared after receiving feedback, suggesting that feedback on performance does not foster learning for those who are motivated by performance-approach goals. Further studies shed light on the mechanism even more directly. In a study by Ryan and Pintrich (1997), the maladaptive strategy of help-avoidance was positively associated with performance-approach goals, mediated by the perceived threat to self-worth. Moreover, Senko and Dawson (2017) found an association between performance-approach goals and a strategy focusing on the impression a learner leaves, namely self-handicapping.

This indicates that students who aim at appearing competent are more likely to engage in behaviors that harm their actual competence but help to protect their self-worth.

However, it has to be kept in mind that in these studies, the reference group whom the learners demonstrated their competence to or who they competed with was the whole class or study cohort, not a small study group. For example, help-giving, that is, one form of co-regulated learning which should be especially attractive to performance-approach oriented learners when a group struggles to overcome learning obstacles, was not a main focus of research interest yet. For this reason, it could still be likely that learners with performance-approach goals regulate constructively at a co- or socially shared level within a small group compared to the larger reference groups from the literature.

Performance-Avoidance Goals

Finally, *performance-avoidance-oriented learners* focus on preventing a deficit in competence becoming visible instead of actually overcoming an obstacle (Elliot & Harackiewicz, 1996). Thus, we assume that the robust finding of a negative correlation of performance-avoidance goals with self-regulation (e.g., Payne et al., 2007) should be replicated at the two social levels proposed by Järvelä and Hadwin (co and socially shared) as well, as the presence of others might make potential failure a public and therefore a more threatening one. Thus, the regulation-hindering effects of performance-avoidance goals might even be intensified for public forms of regulation. Indeed, studies that investigated the relationship of performance-avoidance goals with feedback and help seeking found negative (Payne et al., 2007) or no associations (Cellar et al., 2011).

Gaps in Previous Research

Most of the literature reported above (except for the two qualitative studies, Järvelä et al., 2008; Volet & Mansfield, 2006) focused on students who engage in regulation efforts to ensure that *their own* learning would be successful. From a perspective of socially shared

regulation (Järvelä & Hadwin, 2013), this focus ignores two other levels at which students may regulate (or not regulate) their learning processes when they study in groups: the co-level and the socially shared level. At the co-level, students engage in regulating the learning process of other group members, and at the socially shared level, the whole group jointly regulates their learning through interactive activities such as negotiating or argumentation.

How regulation intentions at these social levels are affected by achievement goals is relatively unknown yet, especially in the following aspects: First, it is unclear to what extent findings from qualitative case-studies with small samples sizes can be generalized to larger populations of students. Second, the previous studies did not investigate how achievement goals are differentially related to intentions to regulate at specific social levels. Third, the specific effects of each kind of achievement goals on intentions to socially regulate controlling for the other kinds of achievement goals were not investigated yet. The last aspect is relevant because achievement goals typically are interrelated, which makes controlling for covariations between goals necessary in order to determine the unique contribution of each kind of goal to regulation intentions.

Research Questions and Hypotheses

In light of these research gaps, our study looks at the associations of different achievement goals with students' intended regulation at the self, the co-, and the shared level when studying in a self-organized group.

Self-organized groups provide a well-suited opportunity to study the effects of goals on regulation intentions: There are no teachers to set goals or provide any external incentives. Hence, students need to set their goals themselves. In addition, students' behavior should depend more on their goals compared to regular classroom settings as there are fewer external scaffolds to guide them. However, strategic planning processes normally occur during ongoing collaboration. Then, only students' behavior is visible but not their internal

processes. In order to assess the individuals' preparedness for actual regulation more directly without interactive processes interfering with the measurement of individual characteristics, our study investigates self-reported, open-ended responses to a vignette depicting a case of collaborative studying in a group for an upcoming exam. This approach also allows to define what the problem is which needs to be regulated, which facilitates to interpret associations between goals and regulation intentions. For this study, we propose the following hypotheses:

First, we hypothesized mastery goals to be positively associated with the intention to regulate at the self-, co-, and shared levels of regulation (H1). Second, we assumed performance-approach goals to be associated with the intention to regulate at the self-, co-, and shared levels of regulation (H2). According to the argumentation above, we propose an non-directional hypothesis here. And finally, we expected performance-avoidance goals to be negatively associated with the intention to regulate at the self-, co-, and shared levels of regulation (H3).

Method

Sample and Procedure

Educational science and pre-service teacher students from a German university (N = 277) voluntarily participated in a paper-pencil-survey that was administered during a regular lecture in their early semesters of studies (M = 3.40, SD = 1.70). They received no reward for participation. Participants were between 18 and 37 years old (M = 21.48, SD = 2.58). Due to technical problems, gender could only be measured for a subgroup of n = 193 students. There, the distribution was 76.7% female and 21.8% male.

Participants were asked to imagine studying in a group for an upcoming exam. The group was described as exhibiting little prior knowledge and low motivation towards dealing with the subject matter (see supplemental material for a full depiction of the vignette). Open-ended questions then asked participants to mention the regulation strategies they would use in

this case. The scenario of collaborative exam preparation was chosen because of its widespread use, so students would be able to relate to it easily. The term “low motivation” refers to the very familiar student experience of being (extrinsically) motivated to learn in principle because one wants to pass the exam, but nevertheless finding no impulse to overcome inertness in the very moment of a specific learning situation.

The data for the present analysis were drawn from a larger study (Melzner et al., 2022) in which four different scenarios including the one above were investigated in a within-design (see supplemental material for details), examining the effects of low and high prior knowledge and low and high motivation on frequencies regulation strategies. Since the present study focuses on the relations between achievement goals and intended strategy use in situations in which groups experience problems, we only selected the vignette in which comprehension-related and motivational problems were present. Nonetheless, we provide the analyses of the additional vignettes in the supplemental material.

Measures

Intended Regulation Strategies

The vignette was followed by three different questions on what the participants would do in case the proposed situation was real (sample question: “Do you personally do anything in this situation to ensure the high quality of your own learning?”). Each of the three different questions focused on one of the three levels of regulation: self (“your own learning”), co (“learning of individual others”), and socially shared (“learning of group as a whole”). Co-regulation theoretically also covers the support of the regulation of self by others which was not included here in order to keep it balanced how much effort the participants were prompted to invest into the description of each level of regulation.

After each question, participants could either check a box saying “Yes, what exactly?” or a box described with “No, why not?” (the latter was not analyzed). If participants decided

to act to ensure learning, they were instructed to describe in an open answer format what exactly they would do. Examples of student answers were “I repeatedly recapitulate the subject matter” (self-level), “I motivate the others to recapitulate as well” (co-level), and “we recapitulate together” (shared level). After each question, participants were presented with three sentence starters (“I...” for the self- and co-levels; “We...” for the shared level), each followed by two printed lines onto which they were supposed to write down their answers.

Two trained coders independently categorized the reported regulation strategies (Gwet’s AC1 = .73, calculated for 10% of the data) into five different types of strategies, one “other” category for non-specific strategies (e.g,, “I learn more”, “We learn together”), and one category for answers that did not constitute a strategy at all (e.g., “I think that collaboration is important.”). The coding scheme was based on established strategy typologies (Engelschalk et al., 2015; Friedrich & Mandl, 1992) and differentiated between (a) deep learning cognitive strategies (i.e., strategies that foster deep learning beyond memorizing, including elaboration and organization, such as connecting learning content to prior knowledge, giving constructive feedback, or asking for explanations), (b) surface-oriented cognitive strategies (i.e., strategies to achieve knowledge about facts and memorizing information, such as repeating content, learning by rote, writing index cards), (c) metacognitive strategies (i.e., strategies to plan, monitor, evaluate, and regulate the learning process or outcomes, such as developing a learning schedule, talking about learning tactics, quizzing each other), (d) resource-oriented, motivational strategies (i.e., strategies to plan, monitor, or regulate motivation to learn which orient learners towards goals or make the environment pleasant, such as rewarding each other by eating out afterwards, thinking of positive outcomes, forcing oneself), and (e) resource-oriented, non-motivational strategies (i.e., strategies to plan, monitor, and regulate processes related to attention, effort, and time, such as scheduling recurring appointments for learning, dividing subject matter among group

members to save effort, investing extra time into learning alone without the group). For the purpose of this article, the frequencies of strategies at each of the three levels of regulation (not doing anything and segments coded as "no strategy" counted as zero, which was the case for 1.4% of segments), were used as dependent variables for subsequent analyses.

Achievement Goals

To measure achievement goals, we used the well-established Scales for the Assessment of Learning and Performance Motivation (SELLMO; Spinath et al., 2012), which distinguish between mastery-approach, performance-approach, and performance-avoidance goals. Each item was supposed to be answered on a six-point Likert scale ranging from 1 (*not at all true*) to 6 (*completely true*). Cronbach's alphas were between .84 and .94. Sample items are "In my studies, it is important for me to learn as much as possible" (for mastery-approach goals; 8 items), "In my studies, it is important for me that I perform better than others" (performance-approach goals; 7 items), "In my studies, it is important for me to conceal if I know less than others" (performance-avoidance goals; 8 items). We chose the sentence starter "In my studies," as it best matches the level of abstraction used in the scenario (Baranik et al., 2010; Sparfeldt et al., 2015), which referred to the preparation for an exam. The exam content was not specified to keep it equally relatable for all participants. Very few values were missing (only 1-2 values for 5 cases). Thus, scale means and parcels could be calculated for every participant.

Statistical Analyses

To compare frequencies of regulation strategies as a preliminary analysis, we calculated a single linear mixed effects model (with the R-package lmerTest, Kuznetsova et al., 2017, in version 3.1-2) to account for paired measurements and avoid multiple testing.

Next, we estimated a multivariate structural equation model (calculated with the R-package lavaan, Rousseel, 2012, in version 0.5-23.1097). Since the measurement model of

the latent variables is of no particular interest in the present study, indicator variables were parceled according to the reasoning and procedure of Little et al. (2002). We calculated parcels as mean scores of three to four indicator items each. In order to achieve item-to-construct-balanced parcels, we first calculated several single factor models and used the factor loadings to guide the parceling. The two highest loading items were assigned to two different parcels, then the next two highly loading items were added to these parcels but in reversed order so that the lower loading item would be associated with the highest loading item from Step 1. This was repeated until all items were assigned. As Little et al. (2002) argue, the model using parcels instead of single indicators is more parsimonious and the measurement model has better psychometric properties, both making model misspecifications due to an erroneous measurement model less likely and increasing the stability of the parameter estimates. Through a series of simulation studies, Rhemtulla (2016, p. 365) confirmed this recommendation: "[O]nce the goal is to estimate structural parameters and/or to test a theory instantiated in a structural model, parceling is recommended". Parameter estimation was done with weighted-least-squares-algorithm because of skewness of some variables.

Results

Table 1 shows the descriptive statistics and bivariate correlations for all variables. Frequencies of regulation strategies significantly differed from level to level: A linear mixed effects model indicated significant differences between regulation strategies at the self- and the shared level, $b = 0.37$, $t(552) = 4.96$, $p < .001$, as well as between the co- and the shared level, $b = -0.65$, $t(552) = -8.67$, $p < .001$. As the mean frequency of shared regulation is between those of self- and co-regulation, the difference between self- and co-regulation can logically be inferred as significant as well. Regarding bivariate correlations, mastery goals correlated positively with performance-approach goals, but not with performance-avoidance

goals, whereas performance-approach goals were associated positively with performance-avoidance goals. Regulation at different levels was moderately correlated. The correlations between goals and regulation strategies were mostly significant but low for mastery and performance-approach goals, and not significant for performance-avoidance goals.

Table 1

Descriptive Statistics and Bivariate Correlations for Achievement Goals and Frequencies of Regulation Strategies at Different Levels

Variable	Mean	*SD*	Range	1	2	3	4	5
1 Mastery goals	4.64	0.70	1.5–6					
2 Performance-approach goals	3.33	0.97	1.14–6	.30***				
3 Performance-avoidance goals	2.93	1.11	1–6	.01	.48***			
4 Strategies at self-level	1.87	1.16	0–5	.15*	.18**	.07		
5 Strategies at co-level	0.85	1.03	0–4	.07	.12*	.05	.37***	
6 Strategies at shared level	1.50	1.24	0–4	.14*	.15*	.02	.45***	.41***

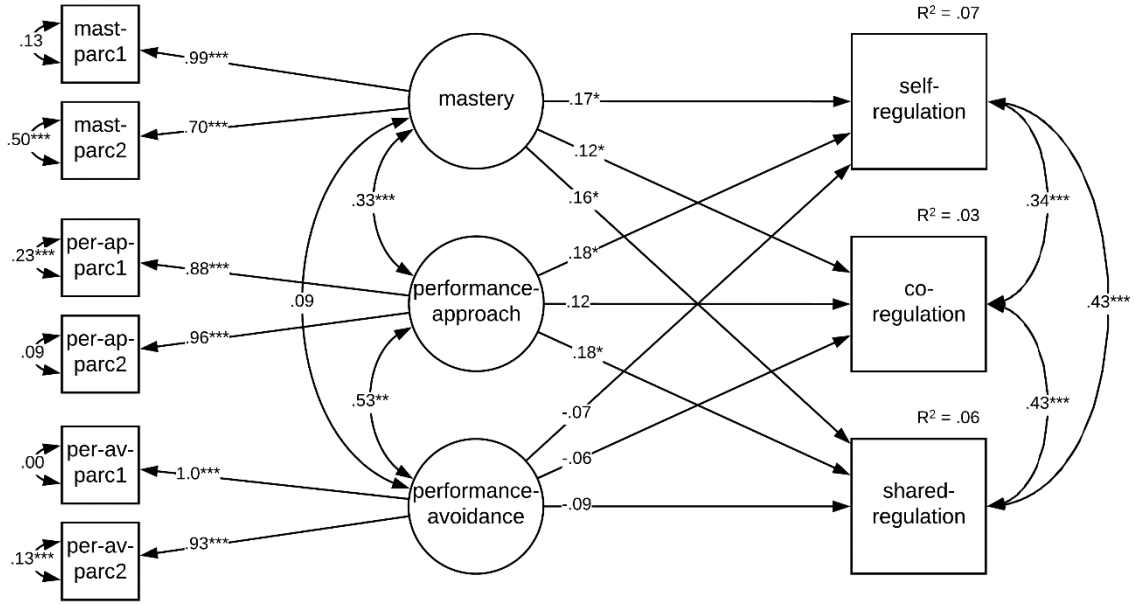
Note. $N = 277$.

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

Next, we calculated a structural equation model (see Fig. 1). The resulting model fit can be considered good according to Hu and Bentler's criteria (1998), χ^2 (17) = 25.06, $p > .05$, $\chi^2/df < 3$, CFI = .98, TLI = .96, RMSEA = .04, SRMR = .06.

Figure 1

Structural Equation Modelling the Effects of Achievement Goals on the Number of Strategies on Self-, Co- and Socially Shared Level



Note. Statistics are standardized coefficients. Abbreviations: mast = mastery, per = performance, ap = approach, av = avoidance, parc = parcel

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

With regard to our first hypothesis (H1), the model revealed that mastery goals predicted the number of regulation strategies positively at all three levels of regulation. The more mastery-oriented the students were, the more regulation strategies they mentioned. This means that the more students were interested in gaining competence, the more different kinds of strategies which could be applied to increase motivation to learn and to improve comprehension of the subject matter they produced. This was true for strategies that serve their own learning (self-level), the learning of other group members (co-level), and the learning of the group as a whole (shared level). Thus, H1 was supported.

Regarding Hypothesis 2 (H2), results showed that performance-approach goals were positively related to the report of regulation strategies at the self- and at the shared level but not at the co-level of regulation. Thus, the more students wanted to show their competence and outperform others, the more strategies they described how they would regulate their own

learning and the learning of the whole group but not the learning of other individual group members. Thus, H2 was supported for two out of three levels.

Finally, with respect to Hypothesis 3 (H3), performance-avoidance goals did not predict the number of regulation strategies at any of the three levels (although related generally negatively on the descriptive level). Consequently, H3 had to be rejected.

The analyses of the case vignettes not presented in this article are available in the supplemental material. These analyses yielded similar results, supporting the pattern of associations between achievement goals and regulation presented here.

Exploratorily, we investigated potential differences between the structural regression coefficients. Therefore, we calculated a restricted model with all regression paths from goals to regulation strategies set to be equal. The restricted model explains the data equally well as the unrestricted model, $\Delta\chi^2(8) = 14.40$, $p = .072$.

Discussion

Goals provide the direction for individuals navigating collaborative learning (Pintrich, 2000). Consequently, plenty of research investigated the relation of achievement goals and self-regulation (e.g., Payne et al., 2007). Also, self-regulation in collaborative contexts is a common theme to research (e.g., Cellar et al., 2011; Karabenick & Gonida, 2018). Yet, how achievement goals affect regulating at co- and socially shared levels (Järvelä & Hadwin, 2013) is only rarely investigated, although different mechanisms might provoke differential effects (see theoretical section of this article). For this reason, the idea of this article was to gather empirical evidence on the extent to which achievement goals are associated with the intention to use regulatory strategies at different social levels during collaborative learning. To this end, students were asked to describe their intended general social regulation at self-, co-, and shared levels of regulation. The general finding is clear: mastery and performance-approach goals predicted regulation strategies at the self-, co- (co- only for mastery goals),

and shared level, whereas performance-avoidance goals did not predict intended regulatory effort at any of the three levels.

Even though the associations between different goals and regulation are equal in effect size, theory supposes different causal mechanisms to explain these associations. The positive effects of mastery goals are in line with a strong base of research that established a clearly positive link between mastery goals and self-regulation (Cellar et al., 2011; Payne et al., 2007) and, more specifically, between mastery goals and social forms of self-regulation (e.g., Karabenick & Gonida, 2018; Ryan & Pintrich, 1997). It also is in line with the findings of the qualitative studies of Järvelä et al. (2008) and Volet and Mansfield (2006) who found mastery goals to correspond with functional group regulation.

However, this effect has not been shown, at least to our knowledge, for the co- and socially shared level of collaborative regulation while controlling for the other achievement goals in a quantitative study. We argue that this effect is likely to be due to the appraisal of the study group as an attractive learning opportunity for those who strive for mastery goals. Thus, they should be motivated to overcome obstacles to learning which in turn would lead to increased intention to invest regulatory effort.

Self- and shared level of regulation were positively linked to performance-approach goals. This might be explained as follows: First, especially for learners who are concerned with performance (Elliot & Harackiewicz, 1996), there might be an urgent need for action just before an upcoming exam, especially if the group struggles with understanding the material and its own learning motivation. Accordingly, learners with performance-approach goals are likely to be motivated to overcome the comprehension-related and motivational barriers to learning. Second, the situation in the study group itself can be seen as an opportunity to prove their own competence and to show performance. Even more, this is especially easy to achieve when the group as a whole has little prior knowledge and

motivation. The alternative hypothesis that performance-motivated students might not be interested in actually regulating the learning process, but invest in impression management instead, is not supported by our data. This finding exceeds previous research (e.g., Cellar et al., 2011; Payne et al., 2007) that did not consider group context as a potential moderator of the influence of performance-approach goals on intention to regulate yet.

An additional detail might support to assume different causal mechanisms explaining the effects of mastery and performance-approach goals on regulation intentions. As described, mastery goals were not correlated with co-regulation on a bivariate level but had a significant beta coefficient in the multivariate analysis. Possibly, mastery and performance-approach goals explain different parts of variance in co-regulation indicating that they might influence the intention to regulate on different causal routes. On the one hand, mastery-oriented learners might help others to ensure that the group is able to engage in competent dialogue in order to benefit from others' knowledge. On the other hand, learners with performance-approach goals might help group members as a means to demonstrate their competence or to show that their knowledge is superior to the knowledge of their colleagues.

Performance-avoidance goals had only insignificant relationships with regulation strategies, and model comparison even showed all goal types to be equally related with regulation strategies. This is in contrast to previous research that found a consistent negative contribution of performance-avoidance goals to regulation and achievement (Cellar et al., 2011; Payne et al., 2007). It might be that study group members do not elicit fear of a lack of competence being revealed because everyone in the group knows each other well, is of equal status, and has equally low prior knowledge and motivation to study—in other words, a safe environment. Future research should confirm this hypothetical mechanism with real groups who are actually collaborating.

The pattern that performance-avoidance goals did not predict intention to regulate whereas performance-approach goals did is reversed to what is known from research on individual self-regulation (Cellar et al., 2011; Payne et al., 2007). This might be explained by differentiating performance goals more fine-grained into normative, appearance, and evaluative goals (Hulleman et al., 2010). A normative-approach goal is "the goal of performing better than others". Appearance-approach goals are defined as aiming at "appearing able or competent to others". At last, evaluative-approach goals are considered a combination of both aspects, that is, wanting to show to others that one is performing better than others. Normative goals were positively related with performance outcome measures, while appearance/evaluative goals were negatively associated with performance (Hulleman et al., 2010). The instrument used here (SELLMO) apparently mostly measures appearance goals. Taking this into account, the current findings are even more surprising: Senko and Dawson (2017) found normative goals to be associated with adaptive regulation strategies (general self-regulation, deep strategies, and adaptive surface strategies) and not associated with maladaptive (socially-directed) self-regulation behaviors (self-handicapping and help-avoidance). Appearance goals were associated with maladaptive regulation strategies but not with adaptive regulation strategies. In our study, it should therefore be more likely that participants with high appearance-approach goals focus on impression management instead of actual performance, which, in turn, might reduce intentions to invest regulatory effort. In contrast, we found the opposite: The stronger (appearance-)approach goals were, the stronger the intentions to regulate, and (appearance/evaluative-)avoidance goals were not related to intentions to regulate socially.

Consequently, our results imply that performance-approach goals might play a more positive role for achievement in regulating group behavior than when individuals study on their own. A group meeting has different characteristics than a usual, more public

examination context: a) Competencies can be demonstrated with a high likelihood of receiving positive feedback from others, and b) demonstrating a lack of competence might be less threatening than in contexts with less familiar people or authority personnel. Thus, a familiar study group might be a context in which learners might be able to benefit from appearance goals without having to bear the costs of appearance goals such as being prone to anxiety (Hulleman et al., 2010).

Limitations

Of course, this study is not without limitations. First, while our approach gave us the opportunity to investigate internal planning processes while learners perceived a constant problem, it is also limited since our results are based on self-reports (Spörer & Brunstein, 2006). On the other hand, we argue that the questions related to regulation strategies used an open-answer format should have been less subject to bias than self-report Likert-scale items. Nevertheless, it is possible that the associations between achievement goals and actual behavior may deviate from our findings if objective data on regulation processes would be used.

Second, though we used a well-established instrument to measure achievement goals in this study, it did not provide us with the opportunity to differentiate between different mastery, performance-approach, and performance-avoidance goals. Future studies should thus use more recent instruments (such as the one from Daumiller et al., 2019) to enable a more fine-grained analysis.

Third, the situation studied here was hypothetical. This methodological approach allowed for isolating individuals' motivation effects without the social dynamic of actual collaboration interfering. Actual collaboration is not only influenced by individual conditions but also shapes them. Furthermore, existing problems are not always obvious or explicitly

stated as such. This complexity makes it difficult to pinpoint specific effects of individual characteristics. On the other hand, our approach did not allow for studying these dynamics.

Fourth, it should be noted that effect sizes of the interrelations between goals and intentions to regulate were rather low. This might be a consequence of the vignette-based approach that might not have allowed for the elaboration of special strategies tailored to specific problems resulting in only "standard solutions" being mentioned and thus decreasing the total number of mentioned strategies. Additionally, participants had to write out strategies by hand, which probably is experienced as effortful, and the available space for this was limited, which both might have further reduced the number of reported strategies. Thus, the identified effect should probably be interpreted as a lower bound of the true effect sizes. In addition, achievement goals were measured with respect to the learners' studies in general, not the specific exam scenario. Determining an association between this more distal measure with a more specific scenario might have contributed to lower the effect sizes as well. With real groups, future research could use a more situated measurement of achievement goals.

Fifth, the intended co-regulation was only measured with respect to oneself helping others (i.e., *other-regulation*, Hadwin & Oshige, 2011), but not with respect to oneself being supported by others for balance reasons.

Sixth, the gender proportion in our sample was typical for the majors included. Yet, this might reduce generalizability of our findings to other subjects or populations with different gender proportions.

Implications and Conclusions

Despite these limitations, our results are in line with the assumption that achievement goals are associated with the intention to regulate learning in group contexts. From the perspective of models of self-regulated learning (Pintrich, 2000), achievement goals determine, especially in self-organized groups, which target goals were set. These goals serve

as a gauge for the monitoring process to determine if a discrepancy between current state and target exists. If the monitoring process detects a discrepancy, learners select which strategies they want to apply. Therefore, goals constitute the basis not only for self-regulated but also collaborative learning.

More specifically, this study provides additional evidence why collaborative learning is a learning method which has the potential to engage students more than individual learning. Not surprisingly, mastery goals which have been proven to be beneficial for individual learning seem to be beneficial in collaborative learning as well. However, additional goals might also have positive effects that they do not have in individual learning (i.e., appearance-approach goals), and other goals do not have the detrimental effect they regularly have (i.e., performance-avoidance goals). For this reason, collaborative learning might be able to draw on more sources of motivation than individual learning, which explains its powerful potential to motivate.

Additionally, our results suggest that achievement goal theory might reflect more systematically in which context which goals are a) more likely and b) more adaptive. Though goal structures are already considered (e.g., Bardach et al., 2020), the effect of the presence of other learners without a teacher has not been studied systematically so far, at least to our knowledge. Peers seem to constitute a different audience than a typical class context. Here, appearance-approach goals seem to play a more positive role and appearance-avoidance goals a less negative role compared to individual or classroom learning.

Yet, besides goals, other motivational and individual constructs (e.g., basic needs, expectancies, attitudes, beliefs, and competencies regarding collaborative learning) influence strategic planning and later collaboration, too. This is reflected in the fact that achievement goals explain a rather low proportion of variance of the intended strategies only. Future research might also investigate how effects are moderated by individual variables such as

prior experience with collaborative learning or extraversion, and group-level variables such as study subject.

To sum up, at least when students imagine collaborating in order to study for an upcoming exam, the relationships with intended regulatory effort seem to be different than what would be expected from the literature on individual regulation. Future research should seek to replicate the beneficial role of appearance goals for real study groups and actual behavior. If our findings persist under these conditions, future achievement goal research might consider characteristics of the social situation in which the learner's competence is supposed to be demonstrated as a potential moderator for the effects of appearance goals.

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