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Perceived quality of instruction: The relationship among indicators of students' basic needs, mastery goals, and academic achievement

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Background. Students' mastery goals are positively related to adaptive learning behaviour. Moreover, these goals often mediate the relation between perceived classroom characteristics and academic achievement. Research generally shows a decline of academic achievement and mastery goals after transition to middle school. Creating a learning environment at middle school according to students' basic needs for autonomy, competence, and social relatedness might help to reduce these declines. However, little is known about the relationship between perceived fulfilment of needs, mastery goals, and academic achievement.

Aims. We investigate the relationship between indicators of students' perceived fulfilment of needs and their graded performance to determine whether the connection is indirect via mastery goals.

Sample. We surveyed 2,105 students during the first year in middle school.

Methods. We assessed the amount of the students' perceived autonomy, recognition of competence and support from the teacher (as indicators of competence and social relatedness) in class, their mastery goals, and their grades. Multilevel models were calculated.

Results. Perceived fulfilment of needs correlated significantly with mastery goals and graded performance. Mastery goals predicted graded performance; however, when perceived fulfilment of needs and mastery goals were analysed simultaneously, the correlation between mastery goals and graded performance was no longer significant. There was no indirect relation between perceived fulfilment of needs and graded performance via mastery goals.

Conclusions. Results indicate that creating the learning environment according to the students' basic needs is positively related to their mastery goals and graded performance during the first year at middle school.

Transition from elementary school to middle school is considered a critical life event (Aust, 2010; Sirsch, 2003) which is often associated with a decline in students' academic achievement (Akos, Rose, & Orthner, 2015) and mastery goals (Anderman & Anderman,

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1999). The latter represent students' motivation to enhance their knowledge and skills in achievement situations (Elliot & Harackiewicz, 1996). It is assumed and shown by research findings that these achievement goals are positively related to students' learning behaviour and academic achievement (Pekrun, Elliot, & Meier, 2009).

The stage–environment fit theory postulates that the decrease in students' motivation after transition is due to a misfit between the students' basic needs for autonomy, social relatedness, and competence and the new learning environment (Eccles & Midgley, 1989). In order to meet the students' basic needs, the new learning environment should offer students opportunities to decide autonomously which actions to engage in (Fischer, 2006; Sauerwein, 2017) and teachers should provide adequate feedback and be supportive (Rakoczy, 2008; Sauerwein, 2017). Feeling socially related and autonomous have also been found to be positively related to students' mastery goals (Ciani, Sheldon, Hilpert, & Easter, 2011), and caring social relationships between the teacher and his/her students have been found to predict the students' academic achievement (Song, Bong, Lee, & Kim, 2015). Thus, creating learning environments at middle school according to students' basic needs might positively affect their motivation and ultimately their academic achievement after the transition.

So far, little investigation has been made into the relation between perceived fulfilment of needs and students' mastery goals (Duchesne, Ratelle, & Feng, 2017) – especially during the first year after transition to middle school. In this study, we determine whether designing fifth-grade[1] lessons according to students' needs is positively related to their mastery goals and academic achievement. Data were collected domain-specific for the subject German. The perceived amount of autonomy, recognition of competence, and social support students received from their teachers (as indicators of competence and relatedness) in German classes were assessed to determine perceived fulfilment of needs. Research shows that the relation between perceived characteristics of the learning environment and academic achievement is indirect via the mastery goals (Church, Elliot, & Gable, 2001; Song *et al.*, 2015). While Church *et al.* (2001) assessed engagement during lectures, focus of evaluations, and harsh evaluations as perceived classroom structures, Song *et al.* (2015) assessed teacher academic and social support as classroom characteristics. However, none of these studies took perceived fulfilment of needs into account. Based on data collected over three measurement points and using multilevel modelling, this study adds to the literature by shedding light on the relationship between students' perceived fulfilment of needs and their graded performance in German and whether this relationship is indirect via domain-specific mastery goals.

The relationship between mastery goals and academic achievement

Mastery goals reflect an individual's aim to learn as much as possible in achievement situations (Dweck & Leggett, 1988). These goals are expected to result in a preference for demanding learning situations and positive affect towards such situations (Elliot & Harackiewicz, 1996). Students adopting mastery goals are assumed to be highly engaged learners and, thus, to perform well in achievement situations (Yeung, Craven, & Kaur, 2014). While some researchers argue that achievement goals such as mastery goals are

[1] *The study is based on data on middle school students in Germany. In 14 of the 16 German federal states, grade 5 is the first year of middle school.*

general tendencies in terms of learning (Köller, 1998; Nicholls, 1992), others claim they are domain-specific and should be assessed as such (Middleton & Midgley, 1997; Wigfield & Eccles, 1992). Thus, studies exploring the connection between mastery goals and academic achievement differ in addressing mastery goals specific to a certain domain or as general tendencies.

Numerous studies show that mastery goals and academic achievement correlate positively (Linnenbrink-Garcia *et al.*, 2008). Nonetheless, there are also studies that found no significant relationship between mastery goals and academic achievement (Pekrun *et al.*, 2009). Linnenbrink-Garcia, Tyson, and Patall (2008) show that the largest percentage of significant effects of mastery goals on academic achievement was found in studies of the effect on graded performance in terms of a specific lesson/course. Findings of Kriegbaum, Becker, and Spinath (2018) support this result as they indicate that the correlation between academic achievement and motivational variables is stronger when both variables are assessed specific to a certain domain. Overall, there are strong indications that lessons at school should aim to promote mastery goals.

The learning environment at middle school

Transition to middle school has been found to be connected with a decline in students' mastery goals (Anderman & Maehr, 1994; Anderman *et al.*, 1999; Middleton, Kaplan, & Midgley, 2004; Paulick, Waterman, & Nückles, 2013; Schwinger & Wild, 2006; Shim, Ryan, & Anderson, 2008). Middle school generally differs from primary school in terms of size, organizational structure, and instructional practices (Eccles & Wigfield, 2000). Furthermore, there often is an increase in control and rules, the school climate becomes more formal, and curricular requirements take precedence (Paulick, 2011). As a result, the student–teacher relationship generally is less caring and personal (Eccles & Wigfield, 2000). These contextual changes are also negatively related to students' graded performance (Paulick *et al.*, 2013) and scores on standardized tests (West & Schwerdt, 2012). According to stage–environment fit theory (Eccles & Midgley, 1989), these maladaptive developments result from a misfit between the students' basic needs (Ryan & Deci, 2000) and their learning environment at middle school.

Learning environments at school are described as interactive settings in which teachers provide opportunities to learn, and the effectiveness of learning environments depends on the students' perceptions and learning behaviour (Stecher, Klieme, Radisch, & Fischer, 2009). Therefore, students' perceptions often are used to assess characteristics of a learning environment. However, these characteristics can also be assessed at the school or class level as aggregated ratings from students at a specific school or in a specific class. Particularly in research on achievement goals, the multilevel structure of schools is often neglected. Ames (1992) argues that the social cognitive nature of the students' achievement goals demands to assess the students' individual perception of characteristics of learning environments. However, in research on characteristics of learning environments and their association with achievement goals, this might be problematic as students' ratings in terms of these variables are highly subjective. Moreover, Zhang, Zyphur, and Preacher (2009) underlined the importance of using multilevel modelling in analyses of nested data. Students are nested in classes, and shared perceptions of the students in the class are reflected as variance among classes (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009).

Perceived fulfilment of needs in the classroom

Self-determination theory postulates that a student's natural tendency to learn and develop can be stimulated if learning environments support his/her basic needs to feel competent, autonomous, and socially related (Ryan & Deci, 2000). Deci and Ryan (2000) postulated that all basic needs are equally relevant for human functioning and that none of the single needs can be compensated for in this context. Comprising the three needs to a general factor of perceived fulfilment of basic needs allows investigating their overarching impact. Deci *et al.* (2001) argue that the shared effect of all needs is properly addressed this way.

In the classroom context, the need for competence is assumed to be supported by challenging tasks that correspond to the students' skills combined with adequate feedback, which includes the recognition of competence from the teacher (Niemiec & Ryan, 2009). In order to promote the students' need for autonomy, lessons should correspond to their interests and offer opportunities to decide autonomously which actions to engage in (Fischer, 2006; Sauerwein, 2017). In order to support the need for social relatedness, teachers should try to take their students' perspectives and to be supportive in terms of academic issues as well as the students' lives outside of school (Rakoczy, 2008; Sauerwein, 2017).

Research supports the assumption that characteristics of the context correlate with perceived fulfilment of needs (Janke & Dickhäuser, 2018). Ciani *et al.* (2011) found that meeting students' need for autonomy and social relatedness indirectly predicted mastery goals via self-determined motivation. Similarly, numerous studies underline the importance of a positive student–teacher relationship in terms of predicting academic achievement (Hattie, 2009).

The relationship between perceived fulfilment of needs, mastery goals, and academic achievement

Ames (1992) described instructional practices that should help to promote the students' mastery goals. These practices are similar to those that are assumed to promote perceived fulfilment of needs. According to Ames (1992), tasks should be moderately challenging, correspond to the students' interests, and offer students choices to promote the adoption of mastery goals. Moreover, she assumed that the adoption of mastery goals is supported by evaluations of progress that are directed to personal improvement. Thus, learning environments in which the students' competence is recognized, with a supportive climate and where opportunities to choose different tasks are offered are likely to be positively related to the students' perceived fulfilment of needs and their mastery goals.

In accordance with the assumption that an individual's achievement goals determine his/her behaviour in achievement situations (Dweck & Leggett, 1988), Church *et al.* (2001) expected perceived classroom processes to lead to feelings and thoughts channelled by the student's achievement goals into various behaviours. Thus, perceived classroom processes were assumed to be rather distal predictors of academic achievement, while the relationship between mastery goals and academic achievement is more proximal. Hence, perceived fulfilment of needs should be positively related to the adoption of mastery goals which should lead students to be more engaged learners. It seems likely that this, in turn, is positively related to the students' academic achievement. Therefore, the relation between perceived characteristics of the learning environment and the students' academic achievement is likely to be indirect via the students' mastery

goals. Findings of various studies support this assumption (Janke & Dickhäuser, 2018). Church *et al.* (2001) found that perceived classroom structures are directly related to domain-specific mastery goals. However, the relation between classroom structures and graded performance was mediated by students' mastery goals. Midgley, Anderman, and Hicks (1995) and Roeser, Midgley, and Urdan (1996) obtained similar results for achievement goals assessed as general tendencies. Midgley *et al.* (1995) and Roeser *et al.* (1996) assessed classroom goal structures as determinants of perceived classroom processes. Church *et al.* (2001), however, assessed perceived engagement during lectures, focus of evaluations, and harsh evaluations. Patrick, Ryan, and Kaplan (2007) examined the relation between social support in class and self-regulation and task-related interaction and found it to be mediated by the students' mastery goals. Similarly, Song *et al.* (2015) reported that teacher academic and social support predicted mastery goal adoption, which, in turn, predicted academic achievement.

Research aims

The aforementioned research findings indicate that creating a learning environment according to the students' basic needs during the first year of middle school could be positively related to the students' mastery goals and academic achievement after transition from elementary school. In order to promote the students' need for competence, teachers should recognize their competence. Moreover, students' need for social relatedness should be supported if teachers try to be supportive. Therefore, we used the perceived recognition of competence and social support from the teachers as indicators of perceived competence and social relatedness. Perceived autonomy was assessed directly. In this study, we investigate whether mastery goals mediate the relation between perceived fulfilment of needs and academic achievement in first-year students of middle school. All variables are assessed in terms of German classes. Moreover, relations between the variables are analysed at the individual level and the class level. We investigate the following:

1. Does perceived fulfilment of needs in class correlate positively with students' mastery goals in fifth grade?
2. Do mastery goals predict graded performance in fifth grade?
3. Is graded performance in fifth grade predicted by perceived fulfilment of needs in class?
4. Do students' mastery goals mediate the relationship between perceived fulfilment of needs and graded performance in fifth grade?

Method

Study design and sample

We analyse data from the study on the development of all-day schools[2] in Germany, in which 2,105 fifth-graders from 127 classes at 66 schools completed questionnaires at the beginning (T1), middle (T2), and end of fifth grade (T3). At T1, background variables were

[2] *The study on the development of all-day schools (Studie zur Entwicklung von Ganztagsschulen [StEG]) was funded by the German Federal Ministry on Education and Research (Bundesministerium für Bildung und Forschung [BMBF]). Analyses in this paper are based on data from StEG-S (Fischer, Decristan, Theis, Sauerwein, & Wolgast (2017)).*

assessed. At T2, students answered questions about the fulfilment of their needs in German class during the first half of fifth grade. Also, students stated whether they had adopted mastery goals for German and reported on their grades in German. At T3 – the end of grade 5 – students reported on their final grades in German.

At T1, the students were on average 10.4 years old (*SD* = 0.609), and 36% of the students claimed that at least one parent or the student himself/herself had been born outside of Germany. As shown in Table 1, approximately half of the students were female. The International Socio-Economic Index of Occupational Status (ISEI) was used to assess the students' socio-economic status. This index is used to determine the highest ISEI (HISEI; Ganzeboom, 2010). On average, the students had a HISEI of 44.5 (range: 60–90; *SD* = 20.65). In Germany, students generally can choose one of three tracks for middle school. One third of students in this sample were attending the highest school track, graduation from which enables students to attend university.

Measures

Academic achievement

Academic achievement was assessed in terms of graded performance in the domain of German at T2 and T3. In Germany, grading ranges from 1 (best) to 6 (worst). For the purpose of our analyses, this variable was recoded. Hence, 6 was the best and 1 the worst grade students could achieve. The mean and the standard deviation of all variables analysed are shown in Table 1. Results of analyses of variance (ANOVA) on repeated measures indicate that academic achievement decreased significantly during fifth grade ($F_{(1,\ 1,546)} = 4.860, p < .05$).

Perceived fulfilment of needs and mastery goals

The measures were developed by the authors in the purpose of the study. More information can be found in Fischer, Decristan, Theis, Sauerwein, & Wolgast (2017).

Perceived fulfilment of needs was assessed using students' self-reports on the amount of autonomy, recognition of competence (as an indicator of competence), and social support (as an indicator of social relatedness) they perceived to receive from their teachers in their German class during the first half of the school year. While perceived autonomy was assessed using six items (e.g., 'During German lessons I have the opportunity to make decisions'), perceived recognition of competence from the teacher

Table 1. Descriptive statistics of all variables included

	N (%)	*M* (*SD*)	ICCs	α
Perceived fulfilment of needs (T2)	1,819 (88.2)	3.09 (0.62)	.09	.91
Mastery goals (T2)[a]	1,877 (89.2)	3.25 (0.67)	.06	.87
Graded performance (T2)	1,916 (91.0)	4.54 (0.91)	.14	–
Graded performance (T3)	1,757 (83.5)	4.38 (0.91)	.12	–
N total	2,105 (100)	–	–	–

Note. Graded performance = grade in German; *M* = mean; *SD* = standard deviation; α = Cronbach's alpha; ICCs = intraclass correlation coefficients based on classes.

[a]We also assessed mastery goals at T3. However, as they were not included in further analyses, the descriptive statistics of mastery goals (T3) are not presented here.

was assessed based on students' responses to three items (e.g., 'During German lessons my teacher recognises my skills'). Concerning perceived social support from the teacher, the students responded to five items (e.g., 'My German teacher takes care of me'). All items were rated on a scale ranging from 1 (*not true*) to 4 (*true*).

Following the suggestions of Deci and Ryan (2000), we comprised the single needs to a higher order factor representing perceived fulfilment of the students' basic needs during German lessons. We performed a confirmatory factor analysis using Mplus (Muthén & Muthén, 1998–2012) to determine whether the three scales combined represented a higher order factor of perceived fulfilment of needs. To decide which model fit the data best, we compared the comparative fit index (CFI > 0.95), the root mean square error of approximation (RMSEA < 0.08), the standardized root mean square residual (SRMR ≤ 0.05), and the χ^2 values of the different models (Hu & Bentler, 1999). We compared a 1-factor model (CFI = 0.783/RMSEA = 0.167/SRMR = 0.092/χ^2 = 2,796.53, $p < .01$) to a higher order factor model (CFI =0 .976/RMSEA = 0.056/SRMR = 0.030/ χ^2 = 352.70, $p < .01$) where the three factors described above were modelled as latent factors and collectively used as determinants of the higher order factor perceived fulfilment of needs. As the higher order factor model had an acceptable fit, we summarized the three subscales and calculated an overlapping scale that represented perceived fulfilment of needs. All subsequent analyses were calculated using this higher order factor.[3] The mean and the internal consistency of this scale are shown in Table 1.

Mastery goals were assessed using five items (e.g., 'When I read in class, it is important to me to learn something new'[4]) that students rated on a scale ranging from 1 to 4. In the purpose of this study, items developed by Rakoczy *et al.* (2005) were adapted and complemented. The students' goals were assessed at T2 and T3. An ANOVA with repeated measures indicated that the students' mastery goals decreased significantly during grade 5 ($F_{(1,\ 1,663)}$ = 59.62, $p < .01$). The descriptive statistics are displayed in Table 1. The intraclass correlation coefficients for all dependent variables based on classes indicate that 6–14% of the variance in perceived fulfilment of needs, mastery goals, and graded performance is explained by differences among the classes. Table 2 shows the bivariate

Table 2. Correlations among all variables included in the analyses

	(1)	(2)	(3)	(4)	(5)
(1) Perceived fulfilment of needs (T2)	1	.54*	.40*	.21*	.18*
(2) Perceived fulfilment of needs (T3)		1	.27*	.16*	.21*
(3) Mastery goals (T2)			1	.06*	.09*
(4) Graded performance (T2)				1	.64*
(5) Graded performance (T3)					1

Note. Graded performance = grade in German.
*$p < .05$.

[3] *We also calculated all models for the three needs separately. The analyses produced almost identical results, meaning that the single needs are similarly related to mastery goals and the development of graded performance. Moreover, the degree of explained variance stays stable. Therefore, we decided to report on the results of the analyses using the higher order factor in the Results section. Observed differences between these results and the results of the analyses for the separate needs are reported under the tables.*

[4] *An important part of the curriculum for grade 5 German is promoting students' reading comprehension (Naumann, Artelt, Schneider, & Stanat, 2010). Thus, these items are used as determinants of students' mastery goals for German.*

correlations among all variables included in the analyses. A significant positive correlation was found among all variables.

Analyses

Analyses were conducted using Mplus 7 (Muthén & Muthén, 1998–2012) and a robust maximum likelihood (MLR) estimator to deal with non-normality and non-independence of observations. To control for the multilevel structure of the school system, we calculated a 1-1-1 unconflated multilevel model (Preacher, Zyphur, & Zhang, 2010). In the unconflated model, individual effects were modelled at level 1 (within-level) and class effects at level 2 (between-level). Hence, within-group and between-group effects were clearly separated (Preacher, Zhang, & Zyphur, 2011). All variables were assessed at level 1. At level 2, we included the variables aggregated according to class (group means) in the model. The scales of perceived fulfilment of needs and mastery goals were group-mean-centred (Preacher *et al.*, 2010). In Model 1, we investigated the cross-sectional relationship between perceived fulfilment of needs and mastery goals. Subsequently, we analysed the relationship between graded performance and prior achievement (Model 2). In Model 3, we added mastery goals, and in Model 4, we added perceived fulfilment of needs instead of mastery goals. Thus, the relationship among mastery goals, perceived fulfilment of needs, and graded performance was investigated over time in these models. In Model 5, we determined whether there was an indirect relationship between perceived fulfilment of needs and graded performance via mastery goals.

Results

The relationship between perceived fulfilment of needs and mastery goals

In Model 1, we investigated whether perceived fulfilment of needs during the first half of grade 5 was correlated with mastery goals at the end of the first half of grade 5. Results, presented in Table 3, indicate that perceived fulfilment of needs was significantly correlated with mastery goals at the individual level and the class level. At both levels, a significant proportion of variance was explained by the variables included in the model.

Table 3. The relationship between perceived fulfilment of needs and mastery goals[a]

	Mastery goals T2 Model 1 *B* (*SE*)
Individual level	
Perceived fulfilment of needs (T2)	.466 (.039)*
Variance	.322 (.015)*
Class level	
Perceived fulfilment of needs (T2) (agg.)	.365 (.112)*
Variance	.055 (.007)*

Note. *B* = unstandardized beta coefficient; *SE* = standard error; (agg.) = the variable was aggregated according to class and represents the class mean of the variable.

[a]Calculating separate models for each need produced identical results, with one exception: At the class level, perceived social support from the teacher did not correlate significantly with mastery goals.
*$p < .05$.

Table 4. The relationship among mastery goals, perceived fulfilment of needs, and graded performance[a]

	Graded performance (T3)		
	Model 2 *B* (*SE*)	Model 3 *B* (*SE*)	Model 4 *B* (*SE*)
Individual level			
Graded performance (T2)	.671 (.025)*	.670 (.025)*	.664 (.026)*
Mastery goals (T2)	–	.065 (.029)*	–
Perceived fulfilment of needs (T2)	–	–	.095 (.035)*
Variance	.501 (.037)*	.501 (.036)*	.499 (.036)
Class level			
Graded performance (T2) (agg.)	.723 (.059)*	.723 (.059)*	.709 (.060)*
Mastery goals (T2) (agg.)	–	.011 (.103)	–
Perceived fulfilment of needs (T2) (agg.)	–	–	.116 (.092)
Variance	.072 (.012)*	.072 (.012)*	.071 (.011)*

Note. *B* = unstandardized beta coefficient; *SE* = standard error; (agg.) = the variable was aggregated according to class and represents the class mean of the variable.

[a]Calculating separate models for each need produced identical results, with one exception: In Model 4, autonomy did not significantly predict graded performance at the individual level.

*$p < .05$.

Regressing perceived fulfilment of needs and mastery goals on graded performance

In Table 4, Models 2, 3, and 4 are shown. Results of Model 2 indicate that prior performance significantly predicts graded performance at T3. Mastery goals, assessed at T2, predicted graded performance at T3 at the individual level (Model 3). The same holds true for perceived fulfilment of needs at T2 (Model 4). Prior performance was the strongest predictor in all models. At the class level, graded performance at the end of grade 5 was merely predicted by the latter. In all models, a significant proportion of variance was explained at the individual and classroom levels.

The indirect relationship between perceived fulfilment of needs and graded performance via mastery goals

In Model 5, we investigated the relationship between perceived fulfilment of needs, graded performance, and mastery goals simultaneously. Figure 1 shows the individual regression paths modelled to analyse the associations under investigation. Significant paths are bold. At the individual level, perceived fulfilment of needs still significantly predicted mastery goals and graded performance. However, after including perceived fulfilment of needs in the model, the relationship between mastery goals and graded performance was no longer significant. Furthermore, the indirect relationship between perceived fulfilment of needs and graded performance via mastery goals was not significant. At the class level, perceived fulfilment of needs significantly predicted mastery goals. There was no significant relationship, however, among perceived fulfilment of needs, mastery goals, and graded performance. Similar to the models previously presented, prior performance was the strongest predictor of graded performance at T3 at the individual and class levels.

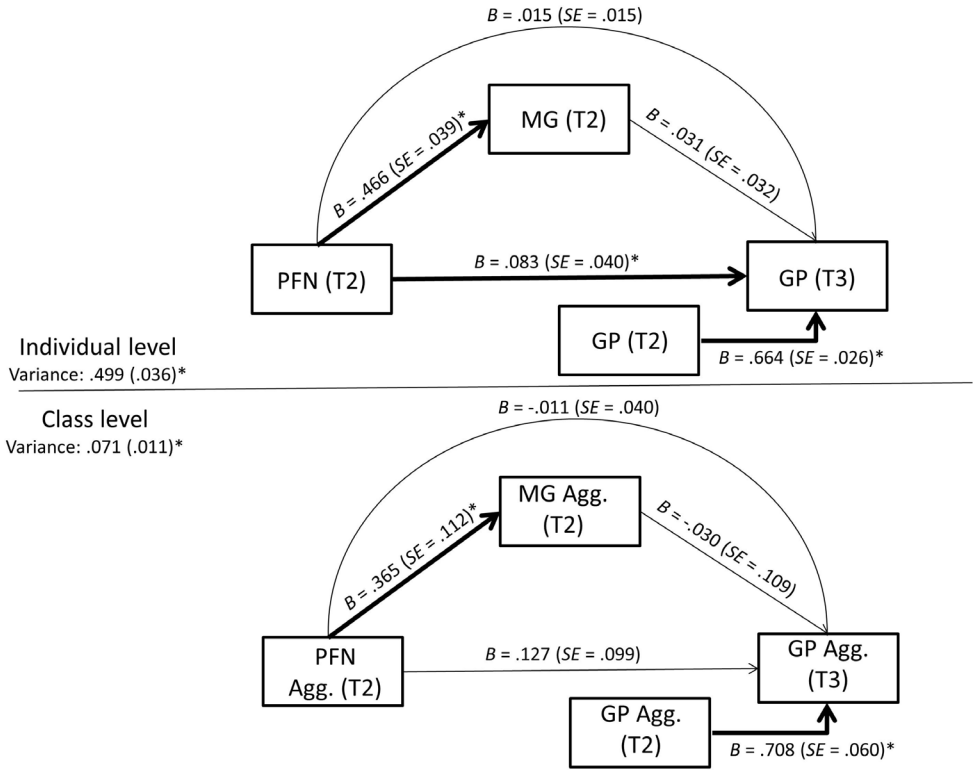

Figure 1. Model 5: testing the indirect effect of mastery goals.
Note. *B* = unstandardized beta coefficient; *SE* = standard error; (agg.) = the variable was aggregated according to class and represents the class mean of the variable; PFN = perceived fulfilment of needs; MG = mastery goals; GP = grade point average. *$p < .05$.

Discussion

Perceived fulfilment of needs, students' motivation, and academic achievement during the first year at middle school

All in all, the motivation and academic achievement of the students in this study decreased during the first year of middle school. Our findings support Eccles *et al.* (1993) claim that creating a learning environment at middle school according to the students' needs is positively related to the students' motivation after transition: Students' ratings about their perceived autonomy and the perceived recognition of competence (as an indicator of perceived competence) and support (as an indicator of perceived social relatedness) from the teacher in German class during the first half of grade 5 are positively related to mastery goals for German at the end of the first half of their school year (at the individual and class level). Moreover, at the individual level, perceived fulfilment of needs during the first half of grade 5 predicts higher grades at the end of grade 5. Thus, our findings support Eccles and Wigfield's (2000) assumption that students should be encouraged to participate in decision-making processes in the classroom, and teachers should build and maintain respectful and caring relationships with their students, recognizing their capabilities.

In this study, the aggregated effect of all basic needs on mastery goal adoption was investigated. While, for example, Deci *et al.* (2001) argue that the shared effect of all needs

is properly addressed this way, this approach provides no information about the relation between the individual needs and student outcomes. The acceptable fit of the higher order factor to the data indicates that students of the sample under investigation rated perceived fulfilment of their needs in German lessons similarly. On the one hand, this might be due to the fact that classroom practices simultaneously correspond to, for example, the students' need for competence and autonomy. On the other hand, it has rarely been investigated if younger students (i.e., elementary school students) actually differentiate between different characteristics of the learning environment (Fauth *et al.*, 2014). In the future, it might be worthwhile to test if a higher order factor of perceived fulfilment of needs can also be found in older students.

The relationship among perceived fulfilment of needs, mastery goals, and graded performance

Mastery goals for German at the end of the first half of fifth grade were significantly related to grades in German at the end of fifth grade when perceived fulfilment of needs was not included in the model. This finding corresponds to that of Paulick *et al.* (2013), who found that mastery goals predicted graded performance. Findings of Anderman and Midgley (1997) suggest that the relationship between mastery goals and academic achievement varies depending on the domain. Earlier studies often neglect the effect of characteristics of the learning environment. Our results suggest that perceived fulfilment of needs is more strongly related to academic achievement than students' mastery goals. Perceived fulfilment of needs is likely to depend on characteristics of the teacher. Similarly, research findings indicate that the teachers' ratings of the student's achievement depend on the students' mastery goals (Shraw & Aplin, 1998). However, the relation between teacher ratings and the students' mastery goals varies between teachers (Shraw & Aplin, 1998). Thus, perceived fulfilment of needs and the relation between mastery goals might be confounded as both depend on individual teacher characteristics. If this were the case, using standardized tests instead of graded performance might produce different results.

Earlier studies indicate that the relationship between perceived characteristics of the learning environment and academic achievement is indirect via the students' mastery goals (Church *et al.*, 2001). Our results are not in line with these findings. Gollob and Reichardt (1991) argued that the effect of a mediator might vary depending on the period between the measurement of the mediator and the dependent variable. Moreover, the variation in results might be due to differences in terms of sample, study design, and/or indicators of perceived characteristics of the classroom.

Effects at the class level

In our data, a maximum of 14% of the variance across the variables can be explained by differences among classes. Our findings indicate that perceptions shared by students in a class concerning perceived fulfilment of needs correlate positively with the mean of mastery goals of the students in the class. In line with this finding, Fischer and Theis (2014) found cross-level interactions between the perceived amount of challenge and social support during extracurricular activities at the school level and the development of mastery goals at the individual level. Participation in extracurricular activities correlated positively with the development of students' mastery goals at schools when extracurricular activities were rated as challenging and students perceived a high amount of social

support during those activities. In summary, the findings indicate that the effect of shared perceptions should be considered when investigating the relationship between characteristics of the learning environment and students' motivation. A high mean of perceived fulfilment of needs in the learning environment correlated positively with the mean of students' mastery goals in this learning environment. At the individual level, mastery goals have been found to correlate with adaptive learning behaviour (Elliot & Harackiewicz, 1996). Hence, promoting mastery goals at the class level might have a positive effect on learning processes at the individual level.

Limitations

Results of this study should be interpreted with caution, as it suffers some limitations. First, graded performance was an indicator of academic achievement. While standardized tests are believed to be more objective measures than grades (Paulick *et al.*, 2013), Eccles and Wigfield (2000) argued that grades are the most important source of students' perception of their competence. Moreover, grades reflect students' cognitive competencies, motivation, engagement, and behaviour in the classroom and generally determine their educational future (Klieme *et al.*, 2016). Nonetheless, investigating the relationship among perceived characteristics of the classroom, mastery goals, and achievement using standardized tests might be worthwhile.

Second, as the relation between perceived fulfilment of needs and mastery goals was measured cross-sectionally, we are unable to draw conclusions about the long-term effect of perceived fulfilment of needs on mastery goals. Because we investigated perceived fulfilment of needs during the first half of the school year after transition to middle school, we assessed it retrospectively at T2. However, mediation analysis might provide different results in a longitudinal design, where perceived fulfilment of needs would be assessed at T1, mastery goals at T2, and graded performance at T3.

Third, self-report measures were used to assess characteristics of the learning environment. Fauth *et al.* (2014) found that student ratings were a useful source of information about processes in the classroom. Nonetheless, video-based observations might provide information about classroom processes from an additional perspective. Combining both measures might yield valuable information. Moreover, the items used to assess fulfilment of needs partially concentrate on perceived teacher behaviour towards the students. This procedure is theoretically justified as adequate feedback, which contains the recognition of the students' capabilities, and respectful, caring relations with significant others are key features to support an individuals' need for competence and social relatedness. Still, this way merely some aspects of the needs are assessed and using measures that directly assess the single needs might provide more precise information.

Finally, effects found in this study were rather small. However, small effects are common in studies based on large samples (Lortie-Forgues & Inglis, 2019) and Lanahan *et al.* (2005) argue that school settings are complex, and even with regard to achievement measures, effects of .10 and below are common in educational research and should be considered nevertheless.

Conclusion

This study shows that mastery goals and graded performance are positively related to indicators of perceived fulfilment of the students' basic needs during the first year at

middle school. Moreover, our findings indicate that perceived characteristics of the learning environment should be considered when investigating the relationship among mastery goals and academic achievement. However, we found no indirect relationship between perceived fulfilment of needs and academic achievement via students' mastery goals. Moreover, although the associations under investigation partially were less strong and consistent than expected, the study is one of the first that provides insights about the association between perceived fulfilment of needs, mastery goals, and academic achievement in the classroom and helps to understand motivational processes at individual and classroom levels. Our findings indicate that teachers should try to include students in the decision-making processes, to maintain respectful and caring relationships with the students, and to provide adequate feedback in order to promote the students' motivation to enhance personal competence and their graded performance.

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