The Role and the Interplay of Classroom Goal Structures, Individual Motivation and General Intelligence for (Excellent) School Achievement in Elementary School Classrooms

Markus Dresel¹*, Michaela Fasching¹, Gabriele Steuer¹ and Valérie-D. Berner¹

Abstract: The present work addresses the roles of, and the interplay among, general intelligence, individual achievement motivation and the motivational characteristics of classroom learning environments (perceived classroom goal structures) with respect to the emergence of (excellent) performances in elementary school. We analyzed a dataset of 796 elementary school students from 18 third grade classrooms and 22 fourth grade classrooms who participated in a study conducted in the subject of German (first language for the majority of students). Results indicated that contextual influences and achievement motivation are of at least similar importance as general intelligence. Moreover, the results revealed that these influences are, to a large degree, independent of each other and that the influences of general intelligence as well as classroom goal structures are mediated through individual student motivation to a smaller degree. The assumption that individual motivation or the motivational characteristics of the learning environment moderate the effect of general intelligence on school achievement could not be supported with our data.

Keywords: excellent achievement, general intelligence, learning and achievement motivation, domain-specific self-concept, intrinsic motivation, learning environment, classroom goal structures, elementary school

Recent models of giftedness and achievement excellence also consider, in addition to individual gifts or talents (such as domain-specific or general cognitive abilities) non-cognitive aspects of the individual (in particular learning and achievement motivation) as well as characteristics of the learning environment (see Sternberg & Davidson, 2005, for an overview). It is assumed that positive expressions of non-cognitive aspects (e.g., an adequate to optimistic self-concept or a superior intrinsic valuation of learning activities) and supportive environmental characteristics (e.g., an environment which is challenging and fosters learning) encourage high quality learning processes and thus the transformation of individual talents into excellent achievements (e.g., Feldhusen & Hoover, 1986; Gagné, 1993; Heller, Perleth, & Lim, 2005). Dependant on the specific theoretical position, one can assume that (1) these factors are independent and have an additive effect on achievements and their development, (2) they moderate the relationship between talents and performances, (3) they mediate this relationship or (4) a combination of these mechanisms interact in the development and demonstration of excellent performances (see Heller et al., 2005).

However, there is still too little empirical evidence on the interplay of these factors, in particular with regard to environmental characteristics. This also applies to the fairly well investigated context of school education – whereby, particularly in this case, reliable findings would be of high practical relevance since they can be attributed a central importance for the development of talents and excellence in childhood and adolescence.

¹ University of Augsburg, Germany
* Corresponding author: Department of Psychology, University of Augsburg, Universitaetsstr. 10, 86135 Augsburg, Germany. Email: markus.dresel@phil.uni-augsburg.de

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Against the background of these research deficits, the present work addresses both the individual roles of, and interplay among, cognitive personality factors, motivational factors and characteristics of the learning environment in the prediction of (excellent) achievements in the context of elementary school education in the domain of native language instruction. On the basis of their (supposed) high degree of relevance, we assess general intelligence as a cognitive personality factor, self-concept and intrinsic motivation as motivational factors (both with respect to the domain under consideration) and classroom goal structures as characteristics of the learning environment.

The Role of Motivation

Research in the fields of talent development and giftedness increasingly focus on – aside from individual talents and intelligence – expressions of non-cognitive aspects of the individual, whereby the learning and achievement motivation of learners is frequently considered to be the most important factor (see Sternberg & Davidson, 2005). This perspective is founded, among others, on results obtained in expertise research which reveal that it is primarily effective and continuous learning processes (deliberate practice) that are responsible for the development of excellent achievement (see Ericsson, Charness, Feltovich, & Hoffman, 2006). With this perspective, researchers increasingly focus on the complete set of personal and social-contextual conditions of effective learning, while individual talent is still viewed as an important factor.

Beyond dispute is the point that learning and achievement motivation are counted among the key factors in determining effective learning processes. Empirically, this is evidenced by a now almost unmanageable array of findings produced in a variety of learning and performance contexts. These findings show that various motivational components substantially influence the initiation, maintenance, quality, regulation and evaluation of learning processes as well as their results in terms of performances (for an overview see Schunk, Pintrich, & Meece, 2008). Meanwhile, a rather differentiated view of learning and achievement motivation has been established in educational contexts, which maintains that this is not a uni-dimensional construct but one which is composed of a rather large number of components that are interconnected in a specific manner with learning and achievement performance (see also to Murphy & Alexander, 2000).

With respect to the field of giftedness research, two components receive a particularly large amount of emphasis (see Dai, Moon, & Feldhusen, 1998): First is the construct of domain-specific self-concept in terms of self-perceived competences or self-efficacy which is not only a – more or less accurate – reflection of the actual skills of learners, but one which also exercises an influence on subsequent learning and performance results (Dresel & Haugwitz, 2005; Feldhusen & Hoover, 1986; Marsh & Craven, 1997). It has been demonstrated, across different studies, that gifted students perceive their competences as higher than those of other students (for an overview see Dai et al., 1998). Second is the concept of intrinsic motivation, which is strongly linked to the application of cognitive and meta-cognitive learning strategies as well as a positive emotional experience (e.g., Gottfried, 1990; Meece, Wigfield, & Eccles, 1990). These two constructs, on which we focus in the present paper, represent the two primary construct clusters in recent expectancy-value-models of motivation (see Wigfield & Eccles, 2000). The relevance of domain-specific self-concept and intrinsic motivation is also underpinned with the findings of a recent study in the scholastic context conducted by Steinmayr and Spinath (2009). These authors demonstrated that domain-specific self-concept and values were, among several components of learners’ motivation, the strongest predictors of scholastic achievement above and beyond intelligence.

In accordance with the significance of learning and achievement motivation, it plays a central role in current theoretical models which define and explain giftedness and high achievement (see Sternberg & Davidson, 2005). In addition to the theoretical approach which conceptualizes a superiority in strivings and intrinsic valuation as an autonomous form of giftedness (called gifted motivation; Gottfried & Gottfried, 2004), some
researchers consider above average motivation to be a criterion for the definition of giftedness. Included here are the model developed by Renzulli (1978) and Mönks’ expansion of this model (1985), which postulates that task commitment (i.e., motivation) is, by definition, an essential element of giftedness. Multi-dimensional interaction models avoid confounding talents, motivation and achievement, whereby the Munich Model of Giftedness developed by Heller et al. (2005) embodies the most prominent representative of this genre. According to this model, a beneficial expression of motivation (or motivational components) is not considered to be constitutive for giftedness, but is understood as a moderator which – in addition to further internal and external moderators – is responsible for insuring that giftedness, in the sense of a potential for excellent achievement, does actually lead to excellent achievement.

This theoretical perspective and a multidimensional conceptualization are the key strengths of the model developed by Heller et al. (2005). Nevertheless, with a multi-dimensional conception of all factor groups and with the specification of diverse interactions between the factors, one must also address the problem that one cannot precisely predict which specific interactions function between specific talent factors and specific moderators. This is further complicated by the fact that, from a theoretical perspective, at least four forms of interaction between giftedness factors and motivational factors can possibly occur: First, one must presume an at least partial *additive coaction* among the factors, whereby abilities as well as specific motivational components provide independent contributions to the explanation of achievement performance. In support of this argument are the findings by Schick and Philipson (2009), which show that intellectual abilities and several components of student learning and achievement motivation correlate only at a weak degree. Second is to be referred to as the *moderator function in the strictest sense*, whereby positive motivation allows above average abilities to be manifested in above average achievements, in other words it “opens the floodgates”. Here, both above average abilities as well as positive motivation are each considered as necessary, but not sufficient conditions for excellent achievement, in that they are largely independent from one another. An interaction of this sort is particularly plausible for motivational components which are grounded in the “value cluster” in motivational models (e.g., intrinsic and extrinsic motivation, goals) and which are, aside from correlations with expectancy-related constructs, relatively independent of actual competences and talents (see Wigfield & Eccles, 1992). Third, for specific motivational components such as domain-specific self-concept, perceived competence, control expectations (i.e., components which are located on the “expectancy cluster” in motivational models), a *mediational function* can also be presumed. For example, according to this mechanism the effect of high skills on the quality of performance would be at least partly mediated by assumptions made by learners that they do in fact possess high skill levels (see Marsh & Craven, 1997). This manner of interaction presupposes that abilities and the corresponding motivational components are in fact not independent from one another. Finally, in case four, it can be argued that a *combination of these three mechanisms* may be at work, especially under a multidimensional perspective. Thus talent factor A and motivational component B may interact, qualitatively, in a different manner than talent factor C and motivational component D.

Empirical findings on interactions among talents, abilities and motivation have been primarily collected in the area of scholastic achievement, and do not specifically focus on the gifted population but commonly refer to general intelligence or specific intelligence factors as cognitive determinants of performance (for an overview see Helmke & Schrader, 2001). Frequently the focus is limited to the additive effects of motivation and intelligence (e.g., Steinmayr & Spinath, 2009), and does not extend to interactions in terms of moderation or mediation. Although the literature does indicate that cognitive and motivational factors each share unique proportions of variances with the achievement criterion (indicating independent additive effects on learning processes and their results), it has also been demonstrated that a substantial proportion of achievement
variance could only be collectively explained through cognitive and motivational factors (confounded variance), which refer to a multitude of (reciprocal) interactions of these factors (Helmke, 1992). In sum, the amount of information collected concerning interactions between cognitive and motivational factors in the development and demonstration of (especially excellent) achievement is too small.

The Role of the Learning Environment

The Munich Model of Giftedness (Heller et al., 2005) also specifies various conditions of the classroom and the familiar learning environments to be moderators whereby, analog to the internal moderators, it is assumed that favorable environmental conditions also contribute to the transformation of above average achievement potential into above average achievements. Similarly, dynamic and systemic models of giftedness and talent development with a strong focus on the persistence and the quality of learning processes incorporate environmental factors comprehensively (e.g., Haensly, Reynolds, & Nash, 1986; Ziegler, 2005; Ziegler & Perleth, 1997). Among others, instructional factors, climate factors, aspiration levels, richness of learning stimulations, and opportunities for continuing learning experiences are discussed as relevant environmental factors (cf. Plucker & Barab, 2005). Also, beyond models of giftedness and performance excellence, the significance of contextual factors is a direct result of the social-cognitive approach of motivation with its emphasis on social-contextual factors to determine learning and achievement motivation (see Dai et al., 1998; Schunk et al., 2008).

As a central feature of learning environments in classrooms, in the present paper we focus on the concept of classroom goal structures, which itself is ensconced in the social-cognitive tradition of achievement goal theory and in the literature is considered to be a promising concept in describing and explaining environmental influences on motivation and learning (see Meece, Anderman, & Anderman, 2006, for an overview). The classroom goal structure refers to the extent to which the learning environment allows for, or determines, the pursuit of mastery and performance goals among pupils (see Ames, 1992). A potent classroom mastery goal structure is present when the classroom environment is characterized by an intense focus on skill development, mastery, understanding and improvement which allows or encourages students to adopt mastery goals, i.e., the personal goal of mastering new skills and developing one's abilities. On the other hand, a strong classroom performance structure exists when classroom instruction is characterized by a predominant focus on the products of learning in terms of performance results and their evaluation, through competitive instructional and grading practices, public feedback practices, and ability grouping. In this case, the environmental goal structure leads to the adoption of performance goals among the pupils, i.e., the goal to demonstrate their own superior competences to others and the goal to prevent others from noticing their competence deficits. Student perceptions of classroom goal structures are considered to be the decisive link between instructional practices resulting in certain goal-structures on the one hand and the quantity and quality of learning processes on the other hand (see Meece et al., 2006).

Empirical investigations on classroom goal structures have revealed that classrooms can be systematically differentiated in accordance with pupils' perception of the goal structure in their classrooms (evidently also with varying instructional practices) and that students' individual goal orientations correspond with these perceived classroom goal structures (e.g., Dresel, Martschinke, & Kopp, 2009; Finsterwald, Ziegler, & Dresel, 2009; Kaplan, Gheen, & Midgley, 2002). Further studies have shown that a classroom mastery goal structure has rather positive effects and a classroom performance goal structure has rather negative effects on pupils' learning processes (e.g., with respect to cognitive and emotional aspects of learning, application of self-handicapping strategies, disruptive behavior), whereby these effects are mediated, in part, through components of individual motivation (e.g., Finsterwald et al., 2009; Kaplan et al., 2002; Wolters, 2004). Patterns of findings are largely consistent in that these effects can be attributed to both shared
perceptions, which differ systematically between classrooms, as well as the individual perceptions held by different students, which vary within classrooms (e.g., Kaplan et al., 2002; Wolters, 2004).

Until now, a limited amount of research has examined the degree to which classroom goal structures are related not only to aspects of learning motivation and learning processes, but also to learning outcomes in terms of achievement (see Wolters, 2004). Moreover, no evidence exists to describe the manner in which classroom goal structures affect learning processes and the performances of pupils with above average cognitive abilities. In view of the positive effects that are associated with a classroom mastery goal structure, it is presumed that this will apply similarly to talented students (see Ziegler & Stoeger, 2008). In view of the consequences associated with a classroom performance goal structure, a direct transfer of similar negative effects to talented pupils is just one of two theoretical possibilities. In fact, it may well be the case that competitive instructional and grading practices and ability grouping, in other words a classroom performance goal structure, is beneficial, or at least not detrimental, for pupils with above average achievement potential. The former gains support from findings which show that talented pupils often show a preference for cooperative learning environments over competitive surroundings, research describing the effects of ability groupings speak rather for the latter (see Clinkenbeard, 1989; Feldhusen, Dai, & Clinkenbeard, 2000; Ross & Harrison, 2006).

Similar to the interaction between cognitive and non-cognitive personal factors in the emergence of excellent achievement, the interaction between environmental characteristics and personal factors can also result in the formulation of four different potential mechanisms on its consequences. Thus, a first theoretical possibility would imply an additive effect of environmental factors on achievement, which is independent of personal determinants. Second, environmental conditions could act as moderators, whereby specific features of a learning environment would allow for or prevent the transformation of above average abilities into above average achievements. For instance, it is conceivable that a strong performance goal structure in the classroom, with its detrimental effects on learning processes, may act to prevent extensive learning gains and, as a result, impede the attainment of excellence. Third, the effects of environmental characteristics on the quality of learning processes and achievement could be mediated through individual learning and achievement motivation. Thus, a strong classroom mastery goal structure may lead to a favorable constellation of motivational components for learning, which in turn would lead to positive learning processes and learning growth. Fourth, and finally, a combination of these three mechanisms is again conceivable. However, empirical evidence on which of these four theoretically plausible mechanisms may interact with another with regard to the concept of a classroom goal structure has not yet, to the best of our knowledge, been advanced.

**Research Questions and Hypotheses**

Our primary research question concerns the significance of, and interplay among, cognitive personality factors (i.e., general intelligence), non-cognitive personal factors (individual learning and achievement motivation, i.e., domain-specific self-concept and intrinsic motivation) as well as characteristics of the learning environment in the classroom (i.e., classroom mastery and classroom performance goal structures) with regard to the emergence of (excellent) school achievement in elementary school classrooms. To this end we focus on performance in native language instruction in elementary school.

Based on the above considerations, we have formulated several hypotheses which build on one another. Hypothesis 1 is our basis hypothesis and implies that all three of the characteristic groups in focus are associated with scholastic achievement. The remaining hypotheses represent different assumptions regarding the interplay of the three factor groups, namely an additive function (Hypothesis 2), a moderator function of individual motivation and contextual characteristics (Hypotheses 3a and 3b), and a mediational
function of individual motivation with respect to the effects of distal predictors of school achievement (Hypotheses 4a and 4b).

H1: School achievement among elementary school students depends on general intelligence, on individual motivation and on classroom goal structures.

H2: General intelligence, individual motivation and classroom goal structures each share unique proportions of variance with school achievement.

H3a: The effect of general intelligence on school achievement is moderated by individual motivation.

H3b: The effect of general intelligence on school achievement is moderated by classroom goal structures.

H4a: The effect of general intelligence on school achievement is mediated through individual motivation (at least partially).

H4b: The effect of classroom goal structures on school achievement is mediated through individual motivation (at least partially).

All hypotheses were formulated with respect to school achievement in general (i.e., in its whole variability existent in elementary school classrooms). Additionally, Hypotheses 1 to 3 were also formulated specifically with respect to excellent achievement in terms of superior performances.

Method

Procedure

In order to answer our research questions we used a dataset drawn from a larger research study concerning the personal and instructional influences on learning and achievement motivation among 3rd- and 4th-grade elementary school students (e.g., Dresel et al., 2009). This study was realized in the scholastic subject of German. It comprises two measuring points, realized over an interval of three months, at which several measurements were administered. The first measuring point (MP1) was scheduled closely after an interim progress report in March 2008, the second measuring point (MP2) near the end of the same school year (July 2008). All tests and questionnaires were administered by trained research assistants during regular classroom instruction in a group setting. Student participation was unsolicited and with parental agreement.

For the present analysis, we used data regarding the general intelligence of the students, their individual motivation (i.e., domain-specific self-concept and intrinsic value of the domain), their perceptions of goal structures in their classrooms as well as their school performances in terms of report card grades (all MP1) and the results from a standardized achievement test (MP2).

Participants

A total of 796 elementary school students from 18 third grade classrooms (45% of the students) and 22 fourth grade classrooms (55%) participated in the study at MP1. The classrooms were situated in 11 elementary schools located in the metropolitan area of Nuremberg, Germany. The average age of the students was 9.8 years (SD=0.74). For most of the children, German was their native language (72%). The proportion of female participants came to 54%.

Measurements

General intelligence. In order to measure general intelligence in the sense of Cattell’s (1963) general fluid ability, we used a subscale of the German version of the Culture Fair Intelligence Test (CFT 20; Weiss, 1988) in two test forms. We used subtest 1 of the first part
of the test, which contained 12 items on which students had to complete series of three figures. We selected the CFT 20 because it is characterized by good psychometric properties and in order to avoid, with the aid of its non-verbal test conception, a confounding with the degree of language competences of the students, which is the major criterion in the present study. Our economic measure of general intelligence was reliable to a sufficient degree (Cronbach’s $\alpha = .69$). In the analyses we used $T$-values based on standardizations within the sample (following area transformation, separately for grade level and test form).

Achievement. Pupil performance in the scholastic subject of German was assessed via two indicators, a standardized achievement test and by recording the most recent report card grades in this subject. As a standardized spelling test, the Hamburger Schreibprobe (HSP; May, 2002) was used because it has been proven to be a reliable and curricularly valid vehicle for assessing spelling skills. The restriction to the acquisition of spelling skills, which constitutes only a subset of the skills imparted in teaching German, was done for reasons of economy. The spelling test consisted of a selection of words with increasing difficulty. The test was administered in two different, grade level-appropriate versions: in 3rd grade classrooms the HSP3 version was used which contains 15 items, and in 4th grade classrooms the HSP4/5 with 16 items was used. Statistical analyses were performed using the percentage of words spelled correctly by the individual students. Internal consistencies were calculated separately for each grade level, for the third grade this came to $\alpha = .80$, and for the fourth grade to $\alpha = .83$. The most recent report card grades in the subject of German was obtained for each pupil. The German grading scale ranges from 1 (very good) to 6 (unsatisfactory). The resulting scale was recoded, whereby a higher score represented better achievement.

Individual Motivation. The domain-specific self-concept experienced by the students in the subject of German was assessed with a scale developed by Kammermeyer and Martschinke (2003). This scale was used to measure the perceived competences of the elementary school students with a total of nine item pairs, whereby three item pairs directly addressed each of the following three areas: reading skills, spelling skills and creative writing skills. Each item pair contained one statement associated with high skill levels and one with low skill levels (sample item pair: „Reading is really easy for me“ and „Reading is really hard for me“). The two statements represented the poles of a four step response scale. In our sample the scale proved to be reliable with $\alpha = .83$. The intrinsic value the pupils ascribe to the subject of German was assessed with a newly developed scale comprising three items („I enjoy German class a lot“, „German class is really fun“ and „I think German is interesting“). A four-point Likert-type scale was implemented to assess the responses these statements generated. An analysis of the internal consistency of the scale proved the scale, with a result of $\alpha = .91$, to be satisfactory.

Perceived Classroom Goal Structures. With regard to the implementation of goal structures in elementary school classrooms, two scales from the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000) which are applied to assess the presence of mastery goal structures and performance goal structures were expanded and translated into German. The scales were used to determine the degree to which pupils saliently understand various goals in the context of the classroom. In order to assess student perceptions of a classroom mastery goal structure, we used a total of eight items (sample item: “In our German class, how much you improve is really important”). The subscale on perceived classroom performance goal structure addressed both performance approach goals as well as performance avoidance goals and consisted of eleven items (“In our German class, getting right answers is very important“, “In our German class, showing others that you are not bad is really important”). Although the internal consistency for classroom performance goal structure was satisfactory ($\alpha = .89$), the internal consistency for the scale measuring classroom mastery goal structures was borderline satisfactory ($\alpha = .53$). Accordingly, conclusions drawn from this data are the result of cautious interpretations.
Item Non-response and Sample Dropout

With respect to item non-response, missing values were actually rare occurrences (no item showed a more than 3 percent non-response rate). These were imputed using the expectation-maximization algorithm (see Peugh & Enders, 2004). In order to reduce biases associated with the intelligence measures resulting from low test motivation, CFT-values for 38 students with extreme low test scores (lower than the 25%-quartile minus 1.5 interquartile range) were also imputed.

As in all longitudinal studies, the present study did experience sample drop-out: 53 students who were members of the MP1 sample didn’t participate in the MP2 survey (7%), which corresponds to a relatively modest sample drop-out rate. In order to reduce biases possibly connected to a non-random drop-out, MP2 values for the respective students were also imputed using the method named above (see Peugh & Enders, 2004).

Results

Descriptive Statistics

Descriptive statistics, bivariate correlations (regular and, due to varying internal consistencies, attenuation corrected), as well as estimates of classroom differences (proportions of between classroom variance on total variance; \( ICC_1 \)) can be taken from Table 1.

For the two performance indicators included in our investigation, spelling test performance and report card grade, substantial differences between school classrooms could be shown (significant and moderate to large \( ICC_s \)). These differences suggest that the characteristics of the classroom environment do play a significant role for the prediction of (excellent) performances. Regarding the two characteristics of classroom environments focused on in the study, it could be observed that students’ perceptions of classroom performance goal structures are associated with moderate to large differences between school classrooms, but not students’ perceptions of classroom mastery goal structures. The latter may be due to the fact that mastery goals among students are generally perceived as very salient in the classroom as indicated by a very high mean, one nearing a ceiling effect (such values are not uncommon in this age group; see Spinath & Spinath, 2005). All statistically significant classroom differences (see Table 1) also remained significant after controlling for grade level and proportion of non-native speakers.

Among the 796 pupils in our sample, 51 students (6%) earned the highest possible grade on their report cards for German; and 103 elementary school students were able to correctly spell all of the words on their spelling tests (13%). A total of 19 children (2%) were able to fulfill both criteria and, therefore, clearly exhibited excellent performances. On the other hand, 103 children could be classified on the basis of the short version of the CFT as gifted (70≤T; 16 children; 2%) or mildly gifted (60≤T<70; 87 children; 11%).

Relevance of General Intelligence, Individual Motivation and Classroom Goal Contexts for the Prediction of Achievement

In testing Hypothesis 1, according to which performances of elementary school students depend on general intelligence, individual motivation and classroom goal structures, we specified a multivariate regression model for each of the two achievement criteria which encompassed all potential predictor variables (Table 2). The results obtained for the two performance measures were actually quite similar.

First it could be shown that general intelligence positively and significantly predicted school achievement in the subject of German, also when individual motivation and perceptions of the classroom goal structure are controlled for. The greater the general
### Table 1. Descriptive Statistics, Proportions of Between Classroom Variance, and Bivariate Correlations

| Scale                                      | Min | Max   | M    | SD   | ICC   | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|--------------------------------------------|-----|-------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 Spelling test                            | 0–100 | 19    | 100  | 78.90 | 18.10 | .103*** | –   | .57 | .21 | .40 | .06 | .02 | -.23 |
| 2 Report card grades                       | 1–6  | 2     | 6    | 4.28  | .97   | .238*** | .52  | –   | .28 | .48 | .04 | .08 | -.28 |
| 3 General intelligence                     | T-values | 31    | 72   | 51.00 | 8.70  | .040**  | .16  | .23 | –   | .12 | -.16 | -.13 | -.23 |
| 4 Domain-specific self-concept             | 1–4  | 1.0   | 4.0  | 2.96  | .56   | .025*   | .33  | .44 | .09 | –   | .27  | .23 | -.05 |
| 5 Intrinsic Value                          | 1–4  | 1.0   | 4.0  | 3.17  | .80   | .074*** | .05  | .04 | -.13 | .23 | –    | .28  | .12 |
| 6 Perceived classroom mastery goal structure | 1–4  | 2.0   | 4.0  | 3.54  | .33   | .012    | .01  | .06 | -.08 | .15 | .19  | –    | .19 |
| 7 Perceived classroom performance goal structure | 1–4  | 1.0   | 4.0  | 2.62  | .65   | .167*** | -.20 | -.26 | -.18 | -.04 | .11  | .13  | –    |

Note. N=796 Students from 40 classrooms. ICC=Intraclass correlation (proportion of between classroom variance on total variance) accompanied with test results as to whether this variance proportion is significantly larger than zero (df=39). Observed Pearson correlations r are displayed below (all |r|≥.07: p<.05. |r|≥.10: p<.01. |r|≥.12: p<.001), attenuation corrected correlations r' above the diagonal. *** p<.001. ** p<.01. * p<.05.

### Table 2. Prediction of Two Performance Indicators (Spelling Test and Report Card Grades) from General Intelligence, Individual Motivation (Domain-specific Self-concept and Intrinsic Value), and Perception of Classroom Goal Structures

<table>
<thead>
<tr>
<th>Scale</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>Spelling test</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>Report card grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>General intelligence</td>
<td>0.21</td>
<td>0.07</td>
<td>.10**</td>
<td></td>
<td>0.02</td>
<td>0.01</td>
<td>.15***</td>
<td></td>
</tr>
<tr>
<td>Domain-specific self-concept</td>
<td>9.90</td>
<td>1.09</td>
<td>.31***</td>
<td></td>
<td>0.74</td>
<td>0.06</td>
<td>.42***</td>
<td></td>
</tr>
<tr>
<td>Intrinsic value</td>
<td>0.19</td>
<td>0.76</td>
<td>.01</td>
<td></td>
<td>-0.02</td>
<td>0.04</td>
<td>-.02</td>
<td></td>
</tr>
<tr>
<td>Perceived classroom mastery goal structure</td>
<td>-0.38</td>
<td>1.84</td>
<td>-.01</td>
<td></td>
<td>0.12</td>
<td>0.10</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>Perceived classroom performance goal structure</td>
<td>-4.48</td>
<td>0.91</td>
<td>-.17***</td>
<td></td>
<td>-0.33</td>
<td>0.05</td>
<td>-.22***</td>
<td></td>
</tr>
</tbody>
</table>

Note. N=796 Students from 40 classrooms. R²=.15 for the spelling test; R²=.28 for report card grades. *** p<.001. ** p<.01.
intelligence of the students was, the better were their achievements and their German spelling scores. Nevertheless, the effects were rather small.

Regarding performance predictions by the two components of the pupils' individual motivation included in the survey, it turns out that only domain-specific self-concept was a significant predictor. Here a moderate to large positive effect could be confirmed, whereby student performance – independent of general intelligence – was all the better, the higher they estimated their competences to be. This effect was even greater for report card grades than it was for the spelling test results. Contrary to our expectations, intrinsic value was not a significant predictor of schoolchildren's achievement.

The regression analyses showed that characteristics of the classroom learning environment are influential in predicting achievement. Thus perceived classroom performance goal structure proved to be a significant predictor of both achievement test results and report card grades. Specifically, this classroom goal structure served as a negative predictor, i.e., the more severely the pupils perceived that demonstration of superior performances and the avoidance of showing poor performances is of importance in the classroom context, the worse their performances were. The size of this negative effect of perceived classroom performance goal structure was small to moderate. However, perceived classroom mastery goal structure was not a significant predictor of performances in the subject of German.

Removing predictors or pairs of predictors from the regression model allowed for the determination of the unique proportions of criterion variance which could be traced to the three variable groups (semipartial $R^2$; see Cohen & Cohen, 1983, pp. 139–145). These proportions specify which incremental contribution the (pairs of) variables add to the prediction of achievement, contributions which are not included in any of the other predictors (Hypothesis 2). With regard to general intelligence, these analyses only appropriated a small proportion of the variance of the two achievement criteria, which they shared uniquely with this specific cognitive personality characteristic (spelling test: 1%; report card grades: 2%). For the group encompassing the two indicators of individual motivation, domain-specific self-concept and intrinsic value, the corresponding proportions were substantially higher (spelling test: 9%; report card grades: 16%). Finally, both perceptions of classroom goal structures shared uniquely 3% of the spelling test variance and 5% of the report card grades variance. All six unique proportions of variance were larger than nil ($p$s<.01).

**Moderator Analyses**

In order to test the moderator hypotheses (Hypotheses 3a and 3b), we expanded the regression models by four product terms (the products of general intelligence and each of the four remaining indices domain-specific self-concept, intrinsic value, perceived classroom mastery goal structure and perceived classroom performance goal structure). Neither for the results of the spelling test nor for report card grades did the inclusion of product terms result in the proportion of explained criterion variance being statistically increased ($p$s>.32). Furthermore, it was checked whether the effect of general intelligence on the two achievement measures varied from classroom to classroom, which would be an indication of a cross-level moderation effect of classroom characteristics (specification of random slopes of the intelligence predictor, tested with Mplus 5; Muthén & Muthén, 2007). This was not the case ($p$s>.50). A conditional effect of general intelligence on performance which is moderated by individual motivation or goal structures perceived in the classrooms could therefore not be confirmed.

**Prediction of Excellent Achievement on a Categorical Level**

In order to collect specific information concerning the conditions surrounding extraordinary achievement in German language acquisition, we analyzed the achievement data on a categorical level. Therefore, we performed a logistic regression
with a dummy variable indicating excellent achievement as an outcome variable (coded as 1 when students received the best report card grade and wrote all words correct; coded as 0 in any other case). As reported above, 2.4% of the students attained this excellence criterion. Analogous to the regression analyses with continuous achievement indicators, general intelligence, individual motivational components and perceptions of classroom goal structures were inserted as independent variables (z-standardized in order to enhance the interpretation of coefficients).

Correspondent to the preceding analyses, general intelligence \((b=0.69; \ SE=0.27; \ p<.01)\) and domain-specific self-concept \((b=1.96; \ SE=0.47; \ p<.001)\) proved to be positive predictors for the likelihood of the demonstration of excellent achievement in German class. Perceived classroom performance goal structure, again, was a negative predictor \((b=-0.92; \ SE=0.30; \ p<.001)\). It is of interest to consider the odd ratios \(\exp(b)\) of these effects, which quantify changes in the probability of demonstrating excellent achievement co-varying with changes in predictor variables. This inspection revealed that the likelihood of excellent achievement was higher by a factor of \(\exp(b)=7.1\) when the domain-specific self-concept was one standard deviation better. In contrast, an increase of one standard deviation in general intelligence only increased the likelihood to perform in an excellent manner by a factor of \(\exp(b)=2.0\). The effect exerted by the contextual characteristic was of a similar magnitude: An increase of one standard deviation in the perceived performance goal structure in the classroom reduced the likelihood of excellent achievement by a factor of \(\exp(b)=0.40\).

In addition, a check was made to determine whether any of the three factor groups, general intelligence, individual motivational components and classroom goal structures, could demonstrate unique predictive power also under the specific consideration of excellent performances. To this end the respective (pairs of) predictors were not included in the logistic regression until a second step. Significant model improvements could be isolated for all three factor groups \((ps<.001)\), and each improvement referred to unique improvements in the prediction of excellent performances.

Again, the regression model was expanded to include the four interaction terms named above in order to test the moderation hypotheses on a categorical level, which, again, did not lead to an improvement of the logistic regression model \((p=.29)\).

**Two-level Path Modeling**

In order to test the mediational hypotheses (Hypotheses 4a and 4b) and to account for the two-level structure of the addressed phenomena and data set (students nested in classrooms), two-level path models were estimated using Mplus 5. In a first step, models were separately estimated for both spelling test results and report card grades (Figure 1a). Classroom goal structures were separated in shared perceptions of all students in a classroom (averaged perceptions; variance in these variables refer to differences between classrooms) and individual perceptions of individual students in the classrooms (classroom mean centered; variance in these variables refer exclusively to perceptual differences within classrooms). In addition to direct paths from these, altogether, four components of classroom goal structures, the two components of individual motivation as well as general intelligence on the achievement criteria, we allowed for indirect effects of classroom goal structures and general intelligence on achievement mediated through domain-specific self-concept and intrinsic value. To this end, we specified paths from each of the classroom goal structures and general intelligence on these two components of individual motivation. In that neither of the moderator analyses revealed significant interactions, we didn’t specify moderator effects in the two-level path models.

For both spelling test results as well as for report card grades, the results obtained provided support for the assumption of additive effects of predictors and, partially, for a mediational functioning of individual motivation: General intelligence not only had a positive direct effect on scholastic achievement but also a positive effect on the domain-
Figure 1. Results of two-level path modeling (a) without control for prior performances (criteria: spelling test results or report card grades) and (b) with control for prior performances (criterion: spelling test results; control: report card grades)
specific self-concept. For its part, domain-specific self-concept was able to predict scholastic achievement in the elementary school subject of German. Using the specification of indirect effects in Mplus 5, it could also be statistically proven that the effect of general intelligence on the two achievement indicators is partially mediated by student self-concept ($p < .01$). Moreover, individual perceptions of classroom mastery goal structures predicted achievement measures via the domain-specific self-concept of the students ($p < .01$). The stronger students perceived that mastering a learning task is important in the classroom environment the more positive were their assumptions about their language skills in German and, subsequently, the better were their performances. Nevertheless, this mediational effect was limited to variations of individual perceptions within classrooms and could not be proven for variations of shared perceptions of classroom mastery goal structures (classroom means). With respect to perceptions of classroom performance goal structures, no mediational effect could be proven – nevertheless, the direct negative effect of the perceptions of this goal structure, which has already been confirmed above, could also be confirmed in the two-level model. Results revealed that this effect is also an effect of shared perceptions of classroom performance goal structures, indicating that variations between classrooms respecting the focus on performance results and their evaluation, competitive instructional and grading practices, public feedback practices, and ability grouping covary with achievement levels in the classrooms. Finally, it is well worth mentioning that the intrinsic value students ascribed to the subject of German is not dependent on general intelligence and is not predictive for achievement. Therefore, it is not involved in mediational effects. Merely, it was shown that intrinsic value is a function of individual perceptions of classroom mastery goal structures.

In a second step, a model was estimated in which report card grades (measured at MP1) were seen as indicator of prior achievement and spelling test performances (measured three months later at MP2) was specified as a criterion (Figure 1b). This was done in order to estimate the effects of general intelligence, individual motivation and classroom characteristics on the change of performances. In addition to the paths named above, paths were specified from prior performance to the two components of individual motivation and to performance on the spelling test as well as a path from general intelligence to prior performance.

The direct effects of individual motivation and classroom goal structures as well as the indirect effect of individual perceptions of a classroom mastery goal structure, which could be proven in the spelling test model in step 1, remained significant ($p < .01$). By contrast, however, the direct effect of general intelligence on spelling test performance was no longer significant. Rather, it becomes clear that the intelligence effect is mediated through prior performances ($p < .001$). Also the effect exerted by general intelligence on self-concept in German was mediated over the grade received on the report card ($p < .001$) – a direct effect could no longer be confirmed. Accordingly, the above described effect of general intelligence on achievement, mediated by self-concept, must be expanded to encompass prior achievement, and thus made more precise: The ability self-concept is generally nurtured by prior performances, which are much more salient in daily experiences made at school, but only indirect by general intelligence (only in association with the dependence of performances on cognitive personality characteristics). This comprehensive indirect effect incorporating four constructs could be statistically secured ($p < .01$).

**Illustration of Effects**

In order to illustrate the environmental effect of the classroom performance goal structure on achievement in elementary school German instruction in relation to the effect of general intelligence (additional model), we calculated average achievement scores for students with average general intelligence ($40 \leq T \leq 60$) and for students with above average general intelligence ($T > 60$) separately for each of the 40 classrooms in the sample. We did that for both of the performance criteria as well as with residuals of the regression of
spelling test results on report card grades – the latter in order to account for prior performances and achievement changes (analogous to the two-level path model in step 2). In Figure 2, average achievement scores are displayed for classrooms with weak vs. strong performance goal structures (below vs. above mean in the sample of classrooms). It is obvious that the performance-inhibiting environmental effect of an intense classroom performance goal structure is, in comparison to the positive effect of general intelligence, similar in magnitude. This was particularly true for our measure of (relative) performance growth, the residualized spelling test results. On the descriptive level, the values indicate that the inhibitory goal structure effect is only somewhat stronger for average intelligence students. It is also substantial for students with above average intelligence. This complies with the above-reported non-significant interactions between general intelligence and perceived classroom goal structures, which in turn indicate that a preferably weak performance goal structure is, independently from the individual extent of intelligence, connected with positive achievement and positive learning growth.

Figure 2. Mean achievement scores of students with average general intelligence (40 ≤ T ≤ 60) and above average general intelligence (T > 60) in classrooms with weak vs. strong performance goal structures (below vs. above mean in the sample of classrooms) for (a) spelling test results, (b) report card grades and (c) residuals of regressing the spelling test results on report card grades.

**Discussion**

The present study focused on the roles of, and interplay between, general intelligence, individual motivation of learners and contextual goal structures as characteristics of the learning environment for predicting achievement excellence and achievement in the context of elementary school instruction in the domain of native language education. Reports of results concerning excellence in school achievement in the domain of native language instruction, such as those in the present study, are rather rare in excellence research. Nevertheless, this domain is important from several perspectives: First, the achievements investigated here apply to the basic language skills that are relevant for a variety of performance areas in which extraordinary accomplishments can be demonstrated later in life. Second, scholastic performance is often of great significance for the students themselves, whereby native language instruction is a subject of primary importance. Third, it is well worth mentioning that the context under investigation here, regular classroom instruction, is of paramount relevance itself because it is the most important social learning context for most children and adolescents. In this respect, the present research does complement prior research literature on conditions of excellent achievement by providing highly relevant findings.
Contrary to other work in this field, we didn't compare a selective sample of high intelligent students with a sample of average students. Instead we applied a multivariate correlational approach among students attending regular public schools. With a multilevel approach, we adequately accounted for the nested data structure typically found in social learning environments (several learners learning together in a shared learning environment). We were able to identify a substantial proportion of children with high general intelligence and also a number of students with excellent achievement in both achievement criteria. Moreover, in our sample of classrooms, we found a relatively large degree of variability, not only with respect to achievement, but also in terms of student perceptions of their classroom performance goal structures, i.e., their perceptions of the extent to which competitive instructional and grading practices as well as the necessity to demonstrate superior performances and to conceal ability deficits prevail (see Meece et al., 2006). Therefore, our results allow for ecological valid conclusions concerning the relationships between cognitive, non-cognitive and environmental determinants of achievement and achievement excellence in regular scholastic contexts. Nevertheless, it may well be the case that other types of relationships apply in social learning environments designed for gifted populations – for this reason, future research should aim to replicate the present results in such environments.

All three of the factor groups included, general intelligence, individual motivation, and contextual goal structures, proved to be significant in the explanation of both report card grades and standardized achievement test results. This was also the case when excellent achievement was considered exclusively. Thus, we can accept our basis hypothesis that (excellent) school achievement among elementary school students depends on general intelligence, on individual motivation and on classroom goal structures. We must however note that general intelligence only exerted a slight effect on school achievement, one that could no longer be maintained in the two-level prediction of spelling test performances when prior achievement is controlled for (a point which does comply with previous findings, namely that prior achievement and prior knowledge are better achievement predictors than general measures of cognitive abilities; see Helmke & Schrader, 2001). Also, the bivariate correlation between intelligence and school achievement turned out to be lower than average correlations previously reported in the literature (see Gustafsson & Undheim, 1996). In fact, the weak correlations with intelligence may be attributed to the fact that an abridged version of the single, nonverbal intelligence indicator (general intelligence in the sense of Cattell’s, 1963, general fluid ability) was applied - this choice was made in order to avoid confounding intelligence and achievement. Nevertheless, these results on the weak relationship between school achievement and general intelligence (which were also not considerably higher following attenuation correction) could be interpreted as evidence to support our basic assumption, that the origins of (in particular excellent) achievement are to be primarily sought in the quantity and quality of learning processes and the conditions which facilitate them (see Ziegler & Perleth, 1997; Ziegler, 2005). Among the conditions which promote effective learning processes one must include not only intellectual (and other) abilities and gifts, but also a wide range of personal and context-related factors (see Feldhusen & Hover, 1986; Gagné, 1993; Heller et al., 2005).

In contrast to intelligence, a greater contribution to the explanation of achievement and achievement excellence was provided by learning and achievement motivation. A positive domain-specific self-concept, i.e., students’ beliefs that they have high German language competences, proved to be a predictor of good and excellent achievement in the subject of German, also when prior achievement is controlled for. The likelihood of obtaining both the highest possible report card grade in the subject of German, as well as passing the spelling test without making any errors, was seven times higher when self-concept was raised by one standard deviation. This finding not only emphasizes that an optimistic self-concept is an advantageous condition for securing effective learning processes, in that it encourages the initiation of learning activities and persistence when
difficulties materialize and reduces thoughts that are not relevant to the present action (see Marsh & Craven, 1997). Furthermore it demonstrates that this is equivalently true for the demonstration of excellent achievements and, therefore, the domain-specific self-concept (as well as related constructs in the “expectancy cluster” of motivational models) has been justifiably accorded the role of a central motivational factor in recent conceptions of giftedness and talent development (see Dai et al., 1998; Ziegler, 2005). Our results obtained with two-level path-modeling, where prior achievement was controlled for, provide support for the view that self-concept and achievement influence one another reciprocally. In accord with this view, good performances lead to an optimistic view of one’s own abilities, which in turn – mediated through the above named processes – encourage learning processes, learning growth and achievement (Guay, Marsh, & Boivin, 2003). In contrast to the self-concept of own language skills, the intrinsic valuation of the domain did not prove to be a significant predictor of achievement. In a similar vein, previous studies in which learning behavior and achievement were predicted simultaneously through values and expectancies (perceived competences) indicated that value often plays a less significant role, at least when a large selection is not available such as a range of elective courses (see Schunk et al., 2008, for an overview).

Our study can contribute to the literature, particularly with respect to the effects of classroom goal structures, i.e., the effects of the learning environment. With the single exception of a study by Clinkenbeard (1989), who conducted an experimental investigation of the effects of competitive vs. noncompetitive situations on gifted students, to the best of our knowledge, no other research has yet been conducted in which the concept of contextual goal structures was systematically related to achievement excellence and learners with high abilities. Furthermore, not many researchers have focused on goal structures in elementary school classrooms and their interdependencies with achievement in general (see Meece et al., 2006). We were able to demonstrate that a strong performance goal structure in the classroom has a negative effect on school achievement, which is reflected in both report card grades and performance on standardized achievement tests. This applies to pupils with average general intelligence in the same manner it does for pupils with above average intelligence. The point that this negative effect of a classroom performance structure applies to all students is supported by the fact that it could also be confirmed in the logistic regression on excellent performance. In other words, no indications could be found which imply that high achieving students or students with high abilities would profit from a competitive instructional and feedback practice or from a focus on performance evaluation, i.e., a dominance of performance goals in the classrooms. Rather, in contrast, it appears as though they suffer in much the same way pupils with average or below average cognitive preconditions do, in terms of both learning gains and knowledge acquisition. This is in agreement with prior evidence reported by Clinkenbeard (1989), and implies that the widespread naive assumption that high achieving and high ability students would profit from competition should be laid to rest.

In contrast to classroom performance goal structures, no direct effect on achievement could be confirmed for classroom mastery goal structures, although there were correlations with both indicators of individual motivation, domain-specific self-concept and intrinsic value. The lack of effects on performance could be due to the fact that no substantial differences could be shown between the elementary school classes under investigation, in fact there was a strong presence of this more advantageous goal structure in the classrooms (at least according to pupils’ perceptions). In addition, the modified PALS scale proved to be relatively inconsistent and imprecise. Future studies should clarify the effects of a classroom mastery goal structure for students with high abilities and high achieving students.

With regard to the interplay between the achievement conditions under investigation, it could be shown that a relatively large proportion of the explained achievement variance is shared uniquely within a specific predictor group. About 80% of the variance of both
achievement criteria, which could be explained with individual motivation (i.e., with the domain-specific self-concept as significant predictor), was uniquely linked to this factor and was not simultaneously included in the other factors. With regard to classroom goal structure this proportion came to about 60%, for general intelligence the figure was about 40%. This is a clear indication that cognitive and non-cognitive personal factors as well as contextual factors coact, to a large degree, additively in the demonstration of (excellent) achievement (Hypothesis 2). Moreover, our results revealed evidence that individual motivation plays a mediation role (Hypotheses 4a and 4b). Accordingly, the influences of general intelligence and individual perceptions of classroom goal structures (varying within classrooms) were mediated through the domain-specific self-concepts of the elementary school students. Here it is important to note that prior achievement acts as a further mediator between general intelligence and domain-specific self-concept. Hence, our results underpin the conclusion that students' perceptions of their own competences function as important mediators of the relationships between distal personal and contextual factors on the one hand and achievement on the other (see Marsh & Craven, 1997). However, evidence supporting the moderator hypothesis, according to which only a favorable motivation and/or supportive learning environment will enable the translation of abilities into achievement, could not be confirmed (Hypotheses 3a and 3b). This may be due to the somewhat macroscopic approach applied in the present study, in which the majority of constructs were conceptualized on a habitual level and with respect to one complete domain. Moderating effects may be more discernible in conjunction with specific learning activities, which can be considered from a more dynamic perspective. This would be a commendable perspective for future research.

Notes

1 An ICC of .05 is considered a small effect and an ICC of .20 is considered a large effect (Snijders & Bosker, 1999).

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**The Authors**

Prof. Dr. Markus Dresel is a Professor in the Department of Psychology at the University of Augsburg, Germany, and head of this department. His research interests include learning motivation and self-regulated learning in various educational contexts, gender issues in education, instructional research and learning with digital media. His current research focuses on the interplay between individual and contextual conditions of motivated and self-regulated learning as well as on the promotion of learning motivation and self-regulated learning.

Mag. Michaela Fasching studied psychology at the University of Vienna, Austria, with an emphasis on educational psychology as well as on research methods and evaluation. Until February 2009 she acted as a student research assistant at the Institute of Economic Psychology, Educational Psychology and Evaluation at the Faculty of Psychology at the University of Vienna. Since April 2009 she has been working as a scientific research assistant in the Department of Psychology at the University of Augsburg, Germany. Her research interests focus on interrelations between teacher's motivation, their instructional behaviour and students' motivation and learning.

Dipl. Psych. Gabriele Steuer passed a diploma study in psychology at the Otto-Friedrich-University of Bamberg, with a special focus on applied psychology and behaviour modification. Her master thesis examined the self-presentation schemata and the structure of needs of mate seeking persons in the internet. She is currently working as scientific research assistant in the Department of Psychology at the University of Augsburg, Germany. Her research interests include on the one hand the handling of failure at school and on the other hand heterogeneity and its relation to educational success.

Dipl. Päd. Valérie-D. Berner studied science of education, sociology, and psychology with a concentration in counselling and diagnostics. Moreover she completed additional qualifications in cross-cultural education and political science as optional subjects at the University of Augsburg, Germany, and at the University of Valladolid, Spain. In 2008 she received her diploma degree. She is currently working as a scientific research assistant in the Department of Psychology at the University of Augsburg and is in her first year of a doctoral programme. Her research interests include learning and motivation of students, school and family integration, heterogeneity and school achievement.