



Smart, confident, interested: Contributions of intelligence, self-concept, and interest to elementary school achievement[☆]



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ABSTRACT

Cognitive and motivational variables are significant correlates and predictors of scholastic achievement. In upper elementary school grade levels, intelligence seems to be more important compared to motivational variables. Regarding motivational variables, (competence) self-concept revealed higher path coefficients in reported grades than interest. Extending these findings to lower grade levels, the present study with $N = 858$ students that stemmed from grade levels 2, 3, and 4 ($n = 253/321/284$) revealed that, when all three predictors were jointly considered, self-concept and interest contributed substantially to the prediction of reported grades in mathematics and German beyond intelligence in all three examined grade levels, with the exception of interest of fourth graders in German. Self-concept was the numerically stronger motivational predictor. Significant grade level-related differences of the predictors were not evidenced. The importance of cognitive and motivational predictors for scholastic success in elementary school is discussed.

1. Introduction

Success in school as indicated by scholastic achievement has been and still is a major topic in educational and psychological research. Because of its relevance for success in life, it seems worthwhile to examine important determinants of scholastic achievement. Prominent and frequently discussed predictors are cognitive and motivational constructs like intelligence and academic self-concept. Although intelligence is a very good predictor of achievement in, for example, mathematics and native languages (e.g., Deary, Strand, Smith, & Fernandes, 2007; Jensen, 1998; Roth et al., 2015), there is a substantial amount of variance left unexplained. Previous research with a focus on fourth graders has shown that motivational constructs like students' competence self-concept or interest substantially add to the prediction of scholastic achievement above and beyond intelligence (Spinath, Spinath, Harlaar, & Plomin, 2006; Weber, Lu, Shi, & Spinath, 2013). However, for elementary school children below grade level 4, the simultaneous prediction of scholastic achievement by cognitive and motivational variables remains a rather open question. Due to a progression in cognitive development, self-concept formation processes, and increasing scholastic experiences in the elementary school years, grade level-related differences in the prediction of scholastic

achievement by cognitive and motivational variables might occur.

Scholastic achievement is typically assessed by reported grades or scholastic competence tests (Steinmayr, Meißner, Weidinger, & Wirthwein, 2014). Reported grades and competence tests usually correlate around $.40 \leq r \leq .60$ (Helmke & van Aken, 1995; Marsh, 2007), indicating substantial differences between both measures. Whereas test scores should merely reflect the performance of a student in a particular test, reported grades rely on a broader definition of achievement that additionally includes motivational aspects, volition, or effort (Willingham, Pollack, & Lewis, 2002). In contrast to competence test results, reported grades are typically well-known by (elementary school) students due to the immediate and salient feedback by teachers (e.g., overviews of reported grades after in-class examinations, report cards). They are also of high importance to students and their parents for the promotion to the next academic year.

Therefore, this study focused on the statistical prediction of scholastic achievement (assessed by reported grades in two core elementary school subjects, i.e. mathematics and native language) by intelligence, competence self-concept, and interest, especially taking specific and common variances into account. Additionally, differences across elementary school grade levels 2, 3, and 4 were examined.

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1.1. Cognitive variable: intelligence

Regarding cognitive variables, intelligence is considered to be one of the most relevant predictors of academic achievement (e.g., Deary et al., 2007; Jensen, 1998; Kuncel, Hezlett, & Ones, 2004). The mean correlation of $\rho = .45$ for elementary school students reported in a recent meta-analysis indicates that more intelligent students get better reported grades in school (Roth et al., 2015). Concerning different grade levels, the intelligence–reported grade correlations seem not to differ substantially across elementary school levels: By using identical assessments for intelligence (non-verbal reasoning) and reported grades in different elementary school grade levels and, thereby, supporting construct equivalence, Laidra, Pullmann, and Allik (2007) reported comparably high manifest correlations of $r = .54/.50/.53$ (corrected for range restriction) between intelligence and grade point average for second/third/fourth graders, respectively. Unfortunately, Laidra et al. (2007) did not test for measurement invariance among grade levels due to a manifest analysis strategy. To detect meaningful differences between respective grade levels, identical assessments and measurement invariance testing are desirable.

With regard to school subject-specific reported grades, Bullock and Ziegler (1997) found for third/fourth graders manifest intelligence–reported grade correlations of $r = .46/.49$ in mathematics and of $r = .36/.41$ in German as native language (general intellectual ability in 3rd grade, non-verbal reasoning in 4th grade). Other studies reported manifest correlations between reported grades and different intelligence factors of comparable magnitude for fourth graders (Spinath et al., 2006: $r_{\text{mathematics/English}} = .49/.44$ [general intellectual ability]; Spinath, Spinath, & Plomin, 2008: $r_{\text{mathematics/English}} = .44/.42$ [general intellectual ability]; Weber et al., 2013: $r_{\text{mathematics/German}} = .47/.36$ [non-verbal reasoning]). A numerically lower manifest correlation between reported grades and figural reasoning of $r = .23$ was found for German in third and fourth graders (Dresel, Fasching, Steuer, & Berner, 2010). However, analyses were not run separately for third and fourth graders and, thus, their interpretation might be impaired. To conclude, these results limit firm conclusions regarding comparisons across grade levels due to different operationalizations.

1.2. Motivational variables: competence self-concept and interest

Whereas intelligence is substantially related to reported grades, explaining mostly around 25% of the reported grade variance in mathematics or native language, a substantial amount of variance is left unaccounted for. Additionally, motivational constructs contributed substantially to the prediction of reported grades beyond intelligence (e.g., Steinmayr & Meißner, 2013; Steinmayr & Spinath, 2009). Salient motivational variables with close relations to scholastic achievement are competence self-concept and interest. Whereas competence self-concept refers to students' self-perceived ability and reflects the expectancy component within the well-elaborated expectancy-value model (e.g., Eccles (Parsons) et al., 1983; Wigfield & Eccles, 2000), interest is a more subjective and intrinsic motivational-affective variable that is considered to be part of the value component. In some studies in the tradition of self-concept literature dealing with its formation, structure, and assessment (e.g., Arens, Yeung, Craven, & Hasselhorn, 2011; Marsh, Craven, & Debus, 1999), the term “affect self-concept” was used basically as a synonym for interest. For example, affect self-concept items of the well-established *Self Description Questionnaire I* (SDQ I; Marsh, 1992) like “I am interested in [subject]” were used to measure interest (e.g., Schroeders, Schipolowski, Zettler, Golle, & Wilhelm, 2016).

Both, self-concept and interest, are domain-specifically structured even in early grades (e.g., Arens, Yeung, et al., 2011; Eccles, Wigfield, Harold, & Blumenfeld, 1993). Correspondingly, convergent and divergent relations of domain-specific self-concepts or interests with

domain-specific academic achievements were repeatedly reported (e.g., Arens, Trautwein, & Hasselhorn, 2011; Skaalvik & Skaalvik, 2002). Self-concept and interest are usually substantially correlated within one domain (Arens, Trautwein, et al., 2011; Arens, Yeung, et al., 2011; Arens & Hasselhorn, 2015; Marsh et al., 1999; Möller, Pohlmann, Köller, & Marsh, 2009), but show differential relations to outcome variables: Self-concepts revealed a stronger relation to scholastic achievement, whereas interests were usually stronger related to effort or choice-related behaviors. Accordingly, the relations between interests and reported grades were numerically lower than self-concept–reported grade correlations (e.g., Arens, Yeung, et al., 2011; Eccles et al., 1993; Jansen, Lüdtke, & Schroeders, 2016; Spinath et al., 2006).

Regarding differences between elementary school grade levels, self-concept/interest–reported grade correlations are usually of higher magnitude in higher grade levels. For example, increasing manifest self-concept–reported grade correlations were reported for 2nd/3rd/4th graders of $r = .35/.40/.52$ for mathematics and $r = .37/.41/.50$ for native language (Helmke, 1997a). Considering eagerness to learn as an indicator of interest, the manifest interest–reported grade correlations were numerically smaller compared with the self-concept–reported grade correlations, but also numerically increasing for mathematics ($r = .26/.32/.35$) and native language ($r = .19/.31/.33$). For the relations of self-concept/interest with reported grades, comparable correlation patterns were found for native language in a sample of third and fourth graders (Weidinger, Spinath, & Steinmayr, 2015). The progression in cognitive development, increasing scholastic experiences, and the onset or increase of social and dimensional comparisons with increasing age should result in more realistic self-concepts and interests (Harter, 1999; Helmke, 1999; Weidinger et al., 2015; Wigfield & Eccles, 2000; Wigfield et al., 1997). Thus, the correlation between self-concepts or interests and reported grades should increase and their predictive power on reported grades should be of higher magnitude in higher elementary school grades.

1.3. Prediction of reported grades by intelligence, self-concept, and interest

Studies examining the simultaneous prediction of reported grades by cognitive and motivational variables, such as intelligence, self-concept, and interest in elementary school are sparse. To predict reported grades in fourth graders, some authors used conglomerates of various cognitive and motivational variables. For example, reported grades in mathematics were numerically stronger predicted by cognitive variables (conglomerate of intelligence [non-verbal reasoning] and working memory; $\beta = 0.59$) compared to motivational variables (conglomerate of self-concept and intrinsic value; $\beta = 0.41$; Weber et al., 2013). For German (native language), motivational variables turned out to be the numerically better predictor than cognitive variables ($\beta = 0.67$ vs. $\beta = 0.34$). Both, conglomerates of cognitive and motivational variables, explained $R^2 = .71$ of the reported grade variance in mathematics and $R^2 = .75$ in German. Helmke (1997b) reported numerically lower coefficients for both sets of predictors of reported grades (cognitive predictors: prior knowledge, intelligence [non-verbal reasoning], ability to concentrate; motivational predictors: self-concept, attitudes toward subjects, test anxiety, further variables concerning volitional and learning-related aspects): Cognitive variables ($\beta_{\text{mathematics/German}} = 0.22/0.22$) were numerically stronger predictors compared to motivational variables in mathematics and German ($\beta = 0.06/0.05$; for German contrary to Weber et al., 2013). Within these manifest analyses, both predictors explained $R^2_{\text{mathematics/German}} = .59/.57$ of the total reported grade variance. Using intelligence (verbal and non-verbal reasoning) and academic self-concept (Schicke & Fagan, 1994), intelligence accounted for 48% of the variance in reported grades ($R^2 = .48$) and academic self-concept contributed only a small amount of variance beyond intelligence ($\Delta R^2 = .07$).

So far, only one study investigated intelligence, self-concept, and interest simultaneously as separate predictors of academic achievement

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