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Early Adolescents' Development of Academic Self-Concept and Intrinsic Task Value: The Role of Contextual Feedback

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In this study, we investigate the extent to which achievement-related feedback in two academic domains (mathematics and language) originating from two contexts (school and family) predicts early adolescents' domain-specific academic self-concept and intrinsic task values in Germany (N = 1,190, age range 10–13) and the United States (N = 1,953, age range 10–14). We examined the mediating role of both parents' competence perceptions and the early adolescents' academic self-concepts linking grades and intrinsic value. Within- and cross-domain effects were tested at each stage of the mediation. As predicted, in both countries the associations of grades with the academic self-concepts are mediated by the parents' competence perceptions. The association of academic feedback with intrinsic task value is mediated through the students' academic self-concepts.

Early adolescents' academic development is influenced by various sources. In this study, we investigate the possible influence of the achievement-related feedback provided by the school and parents on the academic self-concept and subjective task value. In early adolescence, a lot of changes take place. For instance, during secondary school transition, the feedback structures and frames of references in the school context change tremendously (for an overview see Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). As a consequence, academic beliefs and values have to be restructured (e.g., Cole et al., 2001; Eccles, 1993; Watt, 2004). Developmentalists have argued that transitions offer a unique opportunity to study developmental change because individuals experience many changes. Ruble (1994) argued that at these times of major transition there is an increased need for external information about own competencies in order to adapt to new context characteristics. Therefore, early adolescents should be more susceptible to contextual feedback during this time of an ecological transition (Bronfenbrenner, 1979) than in times of stable beliefs and values, for instance after the transition (Cole et al., 2001). Parents and academic grades are two common sources of such information at this developmental period.

One of the most influential theoretical approaches to the development of academic beliefs is the expectancy-value model (EVM) of Eccles and colleagues (e.g., Eccles, 2005) that suggests that achievement-related choices are influenced most directly by subjective task values (intrinsic, utility, and attainment values, and costs) and expectancies of success. In turn, task values are hypothesized to be influenced by the individual's general self-schemas, such as academic self-concept, as well as socializers' beliefs and behaviors. Moreover, the socializers' beliefs and behaviors as well as the students' academic experiences should also affect the academic self-concept. This study is based on these hypotheses (see Figure 1).

In particular, we investigate how early adolescents' development of academic self-concepts and intrinsic task values is associated with achieve-

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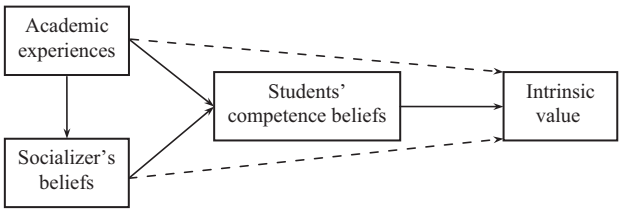

FIGURE 1 Conceptual framework.

ment-related feedback originating from two developmentally important contexts, namely the family (through parental competence perceptions) and the school (through grades). A long history of research has shown that parents' beliefs and behaviors as well as grade-related feedback predict changes in children's beliefs, motivation, and interests over time (e.g., Aunola, Viljaranta, Lehtinen, & Nurmi, 2013; Jacobs, Hyatt, Eccles, Osgood, & Wigfield, 1999; Kamins & Dweck, 1999; Leaper, Farkas, & Brown, 2012; Marsh, Köller, Trautwein, Lüdtke, & Baumert, 2005; Wigfield et al., 2006). In the subsequent paragraphs, we will review research on these feedback-related effects regarding the two main dependent variables of the study.

Academic Self-Concepts of Ability

The academic ability self-concept is the individual's knowledge about his or her own abilities and competences. Recent research suggests that students' academic self-concepts are influenced by achievement-related feedback (grades, test scores) from multiple academic domains (Chen, Yeh, Hwang, & Lin, 2013; Dickhäuser, 2005; Möller, Pohlmann, Köller, & Marsh, 2009). A prominent model addressing this line of thought is the internal-external frame of reference model (Marsh, 1986; Möller & Marsh, 2013). Within an academic domain, there is usually a strong positive relation between grades and academic self-concept due in part to external social comparison processes. In contrast, there is often a weak negative relationship between the grades in one subject area (e.g., mathematics) and individuals' ability self-concept in another subject area (e.g., language arts) due to internal comparison processes associated with between-subject area comparisons within a person. Thus, we predict a positive association between grades and academic self-concepts within a subject area and negative associations between grades and academic self-concepts across subject areas.

Parents' estimates of their children's competence are another source of self-concept–relevant information (Bouchey & Harter, 2005; Dai, 2002; Eccles, 1993). Parents communicate their views about the ability of their children through a variety of mechanisms. For example, parents provide different learning opportunities according to their views of the children's abilities and make differential attributions for their children's academic successes and failures (Eccles, 1993). This serves as feedback for the students' own appraisals of their academic competence. Thus, we expect positive associations between parental beliefs and their children's academic ability beliefs within an academic domain. As we expect the parents to be a valid source of domain-specific feedback for the adolescents, it seems likely that the same processes associated with cross-domain comparison discussed in the previous paragraph will also lead to a negative association between parental beliefs in one subject area and their children's ability self-beliefs in a different subject area. Therefore, we expect negative cross-subject area associations of parents' competence perceptions and the early adolescents' academic self-concepts. Other studies have shown that parents' estimates of their children's academic abilities are highly associated with their children's grades within a subject area (Dai, 2002) and that the association of grades with children's academic ability self-concepts are mediated by the association of grades with parents' perceptions of their children's abilities (Eccles, 1993). Accordingly, we hypothesize that the association of academic grades with students' self-concepts will be mediated through their parents' views of their relative competencies.

Intrinsic Task Values

The intrinsic value is the enjoyment the individual gets from performing a certain activity. Several theoretical perspectives, in addition to Eccles's EVM illustrated in Figure 1, predict that intrinsic task values are critical predictors of achievement (Cordova & Lepper, 1996; Deci & Ryan, 1985; Marsh et al., 2005). Research on the antecedents of intrinsic task values points to achievement-based feedback as one major influence. Grades or test scores positively predict intrinsic task value in various academic domains (Marsh et al., 2005; Wigfield et al., 1997). Supporting an internal-external frame of references perspective (Marsh, 1986), there is cross-sectional work suggesting negative grade to intrinsic task value associations between academic domains as well (Skaalvik & Rankin, 1995; Skaalvik & Skaalvik, 2005).

Eccles (1993) showed that parents' estimates of their children's ability in both mathematics and English predict children's interests in both academic domains, as suggested by the internal-external frame of reference model (Marsh, 1986). Thus, we expect both positive within-domain and negative between-domain feedback association of grades and parents' views of their children's abilities on the children's intrinsic task values.

Eccles's EVM suggests that these influences on students' intrinsic task values are mediated, in part, through the student's academic self-concepts. Studies linking both constructs suggest that competence beliefs positively predict intrinsic task values or subject-related interest within an academic domain (e.g., Marsh et al., 2005; Skaalvik & Skaalvik, 2005). Nagy et al. (2008) reported negative associations between the domain-specific academic self-concept and intrinsic task value across domains, pointing to contrasting dimensional comparisons. Thus, we expect positive within domain and negative between-domain associations between academic self-concepts and intrinsic task values. As suggested by Eccles's EVM and both cross-sectional work (Nagy et al., 2008) and longitudinal work (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Marsh et al., 2005), we expect that the associations of feedback sources (grades and parental beliefs) with intrinsic task values are mediated in part through adolescents' self-concept of ability.

The Present Study

The present study, based on a German and a U.S. longitudinal data set, is focused on the part of Eccles's EVM shown in Figure 1. As the literature review showed, there are pieces of this model that are partially supported by empirical evidence. This study aims to put these jigsaw pieces together and test the EVM assumptions in one comprehensive mediation model. Moreover, we extend the theoretical framework by bringing in the multidomain frame of reference perspective. Thus, we investigate the following mediational pathways: grades → parents' competence perceptions → self-concept → intrinsic task value. At each stage of this meditational pathway, we apply a frame of reference perspective by including two academic domains and their interrelations. This study goes beyond existing research in the following ways. First, the mediational pathway predicting how feedback is associated with the development of early adolescents' value and belief system, as indicated in the EVM, has not been tested comprehensively. Second, grades *and* parental competence beliefs have rarely been considered as feedback sources together even though they likely coexist for most children. Third, we investigate this mediational chain both within and across two major academic domains and thus provide insights into how feedback sources (school and family) as well as feedback domains (mathematics and language) jointly contribute to the development of early adolescents' academic self-concepts and task values. Fourth, we include both maternal *and* paternal data. Because most research on parental influences on adolescents' academic development is based on maternal predictions, very little is known about the paternal role in this area of study. According to a parent-equivalent model (O'Bryan, Fishbein, & Ritchey, 2004), we do not expect differences in the association patterns between mothers and fathers. Finally, by including two similar but yet different samples, we will both demonstrate the replicability of our findings and know more about the generalizability of the findings. Consistent with Robins (1978), we think that "In the long run, the best evidence for the truth of any observation lies in its replicability across studies" (p. 611).

Hypotheses

We hypothesize:

1. Positive within-subject area associations of academic grades with parental competence perceptions, early adolescents' academic self-concepts, and intrinsic task values.
2. Negative cross-subject area associations of academic grades with early adolescents' academic self-concepts and intrinsic task values.
3. Positive within-domain and negative cross-domain associations of parents' competence perceptions and academic self-concepts and intrinsic task values.
4. Mediation of the association of academic grades with academic self-concepts and intrinsic task values through parents' competence perceptions.
5. Positive within-domain and negative cross-domain associations of academic self-concepts with intrinsic task values.
6. Mediation of the association of both academic grades and parental beliefs with intrinsic task values through academic self-concepts.

METHOD

Sample

German sample. The German data set is comprised of two waves of data collection (2001 and 2002) of a longitudinal study conducted in the

German state of Thüringen as part of the Development in School Context Study (DISC). This study covered a broad range of motivation-related constructs and targeted family and school effects on academic development. Formal achievement-based tracking characterizes the organization of high schools in this federal state. There are two major school tracks: a high college-bound track (*Gymnasium*) and a low track (*Regelschule*). The first point of data collection was located at the very beginning of Grade 5. In this Eastern federal state of Germany, the transition from elementary to secondary school takes place after the fourth grade. The second data collection took place in the spring term of the sixth grade, about 1.5 years later.

At the first point of measurement, 1,190 early adolescents participated (1,014 in both waves). We consider an attrition rate of 14.7% as acceptable for a longitudinal study. The mean age of participants was 10.6 years (SD = 0.58, age range 10–13) at time one (T1) and 12.1 years (SD = 0.40, age range 11–13) at time two (T2). At T1, 49.1% of the participants were male; at T2 47.4%. Slightly more participants attended the higher school track (college-bound *Gymnasium*; T1: 57.4%; T2: 61.1%).

The students were contacted through the schools they attended. Those who agreed to participate completed the questionnaires at the first wave of data collection in class. Informed consent for the participation of all children in this study was given by parents, teachers, and school principals. The students were given questionnaires in class to take home to their parents. The questionnaires were returned in sealed envelopes to their schools. For the second wave of data collection, all questionnaires were sent to the schools by mail. Students completed their questionnaires in class. The procedure for the parental questionnaires was the same as in Wave 1. For both waves of data collection, we included self-reported data from 841 mothers (94.8% of T1 participation and 82.9% of participating students) and 708 fathers (91.8% of T1 participation and 69.8% of participating students).

In each school, two classrooms participated (total: 60 classrooms). As the 30 participating schools (15 low-track and 15 high-track high schools) were randomly selected from all low- and high-track schools in this federal state, the sample can be considered representative of this federal state with respect to the gender, school track, and social status (low- to high-income families participated, mean income: 28.000€ [25.000 $] per year; German Statistical Office, 2005).

United States sample. Data for the U.S. sample comes from Waves 1 and 4 of the Michigan Study of Adolescent and Adult Life Transitions (MSALT; Wigfield et al., 1997). Participants completed questionnaires twice a year over this period. Wave 1 was conducted in the fall term of grade six (T1); Wave 4 data were collected in the spring term of the seventh grade (T4). The junior high school transition took place between sixth and seventh grade. Twelve school districts located in low- to middle-income communities participated (median income: 30.000–40.000 $ per year). Almost 90.8% of the students in these districts are of European American descent. All the teachers who taught mathematics to sixth-grade students scheduled to make a transition the next year to junior high were recruited for the first two waves of data collection; 95% of the teachers (117 classrooms) agreed to participate. All of these teachers' students were asked to participate in the study, and 79% agreed and received informed parental permission, yielding a sample of 1,953 students at T1. All of the Year 2 junior high school teachers agreed to participate in the study at Waves 3 and 4. There was an attrition rate of 6.7% in the students' sample, due mostly to students' families moving out of the school district, yielding a sample of 1,822 students who had completed surveys at both T1 and T4.

Participants' gender was approximately equally distributed (male T1: 47.3%; T4: 47.8%). The mean age was 11.11 years (SD = 0.43, age range: 10–13) at time one and 12.31 years (SD = 0.65, range 11–14) at T4. The parental data set contains self-reports of 1,672 mothers at T1 (85.6% of student participation) and 1,220 at T4 (73.0% of T1 participation).

The reason for choosing Waves 1 and 4 of the MSALT data set was the comparability to the German data set in student's age and time lag between the waves of data collection. The dependent variables in the German data set were measured in spring term of the sixth grade—roughly one and a half years after secondary school transition. The closest choice in MSALT was the Wave 4 data that was collected at the end of Grade 7, about 7 months after the junior high school transition. To keep the lag between both waves parallel, we chose the data of Wave 1 in MSALT, which was 1.5 years before Wave 4. Thus, in both data sets there was a 1.5-year time lag between the measurements analyzed in this study.

Differences between the samples. In Germany, there is a between-school ability-tracked system. After Grade 4, the students are divided into a col-

lege-bound track and a lower track based on their overall achievement. The upward mobility in this between-school tracking system is rather low. In the U.S. sample, a within-school tracking system for mathematics begins in Grade 7 with the choice between pre-algebra and general mathematics. In essence, this tracking corresponds with the college-bound stream versus other students. Thus, ability tracking takes place a little earlier in the German system. In both systems, the curriculums differ between school tracks or streams. More academic content is taught in the college-bound school track or stream.

We assume that the difference in the school systems might affect the mean levels of the variables of interest, but not the relations between them. There is cross-national empirical work indicating that this assumption holds (Nagy et al., 2010; Neuenschwander, Vida, Garrett, & Eccles, 2007). Therefore, we expect to find comparable patterns in both our samples.

Measures

The German and the United States studies were designed to tap a wide range of students' motivational constructs and competence-related beliefs. Therefore, parallel item formulation for the measurement of the self-concepts of ability and intrinsic task values in the domains of mathematics and German/English are available. But we had to rely on a limited number of parallel items. The limitations and consequences arising from that are discussed later.

German study. The students' academic self-concept in mathematics and German was measured by four items (adapted from Eccles, 1993; response format: 1 = *I totally disagree* to 4 = *I totally agree*): "I am bad in mathematics/German" (recoded), "In my classroom, I am one of the best in mathematics/German," "Mathematics/German is very easy for me," and "Compared to other subjects, mathematics/German is hard for me" (recoded). The Cronbach's alphas were good (mathematics T1: .75, T2: .77; German T1: .69, T2: .65). The items addressing the intrinsic task values were "Generally, I think mathematics/German is boring" (recoded) and "I like doing mathematics/German" (adapted from Wigfield, 1994; response format: 1 = *I totally disagree* to 4 = *I totally agree*). The Cronbach's alphas were good (mathematics T1: .79, T2: .80; German T1: .78, T2: .79). The parental competence perceptions in both domains were measured by three items (adapted from Eccles, 1993; response format: 1 = *I totally disagree* to 4 = *I totally agree*): "My child is good at mathematics/German," "My child finds mathematics\German difficult" (recoded), and "This year, my child will be doing well in mathematics/German." The internal consistencies of the parental competence perceptions turned out to be good (Cronbach's alphas for maternal reports: mathematics T1: .69, T2: .80; German T1: .72, T2: .80; Cronbach's alphas for paternal reports: mathematics T1: .72, T2: .75; German T1: .73, T2: .72). A confirmatory factor analysis (CFI) including all scales suggested a good fit of the hypothesized measurement model, χ^2 (530, n = 1190) = 831.93, $p < .01$, CFI = .98, Tucker-Lewis index (TLI) = .98, root mean square error of approximation (RMSEA) = .02, standardized root mean square residual (SRMR) = .04. The students' grades were obtained through self-reports referring to the end of the fifth grade. Research has shown that in the German school system self-reported grades can be considered as accurate and valid (Dickhäuser & Plenter, 2005).

United States study. The students' academic self-concept in mathematics and English was measured by four items: "How good at mathematics/English are you?" (response format: 1 = *not at all good* to 7 = *very good*), "If you were to rank all the students in your mathematics/English class from the worst to the best, where would you put yourself?"(response format: 1 = *the worst* to 7 = *the best*), "In general, how hard is mathematics/English for you?" (response format: 1 = *very easy* to 7 = *very hard*), and "Compared to most other school subjects you have taken or are taking, how hard is mathematics for you?" (response format: 1 = *my easiest course* to 7 = *my hardest course*). The *Cronbach's alphas* were good (mathematics T1: .76, T4: .81; English T1: .73, T4: .81). The intrinsic task values were measured by two items: "In general, I find working on mathematics/English assignments. . ." (response format: 1 = *very boring* to 7 = *very interesting*) and "How much do you like doing mathematics/English?" (response format: 1 = *a little* to 7 = *a lot*). Cronbach's alphas were good (mathematics T1: .84, T4: .87; English T1: .87, T4: .74). The maternal competence perceptions in mathematics and English were measured by three items: "In general, I believe that my child is. . ." (response format: 1 = *not at all good at mathematics/English* to 7 = *very good at mathematics/English*), "My child finds mathematics/English. . ." (response format: 1 = *very easy* to 7 = *very hard*), and "How well is your child doing in mathematics/English this year?" (response

format: 1 = *not at all well* to 7 = *very well*). The Cronbach's alphas were good (mathematics T1: .83, T4: .83; English T1: .83, T4: .83). A confirmatory factor analysis including all scales suggested that a good fit of the hypothesized measurement model, χ^2 (242, n = 1953) = 646.33, $p < .01$, CFI = .98, TLI = .97, RMSEA = .03, SRMR = .04. The final grades of the fall term of the seventh grade were obtained from the students' records. These grades were chosen aiming at comparability to the German sample, where students reported the first grades after secondary school transition. The first term after the secondary school transition in the MSALT sample was the fall term of Grade 7.

Analyses

All major analyses were conducted using structural equation modeling (SEM) techniques with Mplus 5.21 (Muthén & Muthén, 2009). Missing data were handled by the full information maximum likelihood algorithm. Thus, cases with missing data were not excluded, but all model parameters were estimated based on the cases with complete data and the (conditional) missing values under the missing at random assumption. As compared to listwise deletion, this procedure does not lead to such common disadvantages as losing statistical power or biased parameter estimation (Graham, 2009). Moreover, the data were collected within classrooms, resulting in a nested data structure. Due to the violation of the independence of observation assumption for standard SEM, ignoring the data structure would lead to biased estimations of the standard errors (Raudenbush & Bryk, 2002). Therefore, the type=complex option implemented in the Mplus software was applied to correct the estimations.

All latent variables were estimated equivalently in both academic domains and for both measurement occasions. For the students' academic self-concepts, two item parcels (including two items, each) served as manifest indicators for one domain-specific latent variable. Both items addressing the students' intrinsic task value were used as manifest variables for each domain-specific latent variable. Finally, the domain-specific latent variables measuring parental competence perceptions used the three items as manifest indicators. In the error covariance matrix of the manifest variables, the diagonal and the covariances between the error terms of those manifest variables referring to parallel formulated items or item parcels across measurement occasions and academic domains were estimated to control for measurement variance (see correlated uniqueness (Marsh, Byrne, & Craven, 1992). In all models, the dependent constructs (intrinsic task value, self-concept of ability, parental competence beliefs in both academic domains) were predicted by control variables: students' gender (0 = boy, 1 = girl), parental education (mean of the parents' highest educational degree), school track (only German sample, 0 = low track, 1 = high track), ethnicity (only U.S. sample, 0 = Hispanic and African American, 1 = European American), and the premeasurements within (e.g., mathematics self-concept T1 → mathematics self-concept T2) and across academic domains (e.g., mathematics self-concept T1 → English self-concept T2).

For each parent–child dyad composition (mother–child in both samples; father–child in the German sample), one mediation model was specified, following the conceptual model (see Figure 1). All variables were entered for the mathematical and verbal domain in one model, testing within- and across-domain effects. Parental competence beliefs were predicted by both grades. The students' competence beliefs were regressed on the grades and the parental competence beliefs. The intrinsic values were predicted by the grades, the parental competence beliefs, and the students' academic self-concepts. All within- and cross-domain effects were included in the model. To test the mediations on significance, we examined (1) whether the direct effect of the independent variable (controlled for the mediator) is smaller than the total effect of the independent variable (without considering the mediator) and (2) whether the indirect effect is statistically significant (MacKinnon, 2008). If both conditions are met, the mediation can be considered significant. The total, direct, and indirect as well as the standard errors of the indirect effects were obtained through the MODEL INDIRECT option in Mplus.

Except for the premeasurements of the dependent variables and the grades, all entered predictors were the ratings of the most recent measurement occasion: T2 (German sample) and T4 (U.S. sample), respectively. The reason for choosing the last wave ratings for the predictors was the assumption that changes in the variables of interest (self-concept of ability and intrinsic task values) are influenced most directly by the most recent grades and parental views than by the parental competence perceptions one and a half years in the past. The grades used for predictions referred to the most recent report card (end of the fifth grade in the German sample; fall term of the seventh grade in the U.S. sample). Those

were obtained about 3–6 months before data collection for the last point of measurement used in the analyses. As the premeasurement of all dependent variables was controlled in this longitudinal design, the direction of effects still can be estimated.

RESULTS

In the subsequent paragraphs, the results will be organized by the dependent constructs. All reported mediation models yielded sufficient or good model fit indices, U.S. sample: χ^2 (346, n = 1,953) = 1134.60, $p < .01$, CFI = .964, TLI = .946, RMSEA = .035, SRMR = .044; German sample (maternal data): χ^2 (346, n = 1,190) = 545.50, $p < .01$; CFI = .985, TLI = .977, RMSEA = .022, SRMR = .035; German sample (paternal data): χ^2 (346, n = 1,190) = 514.19, $p < .01$; CFI = .986, TLI = .979, RMSEA = .020, SRMR = .037. In case of the German sample, all analyses were run twice: in a maternal and a paternal model. Therefore, there are two regression coefficients for each path in the models. All regression coefficients obtained in the maternal and paternal model (German data) will be reported as follows: $\beta_{maternal} \backslash \beta_{paternal}$. Correlations of the major constructs and the controls, the stabilities, and the intercorrelations are shown in Tables A1, A2, and A3 in the appendix. The regression coefficients obtained through the structural equation models are shown in Tables 1, 2, and 3. The effects of the control variables will only be reported in the tables.

Parental Perceptions of Students' Competence (PPSC)

We expected that within-domain grades would positively predict parental competence perceptions. In both samples, positive associations of within-domain grades and parental competence perceptions were found (U.S. sample: mathematics: β = .53**; English: β = .46**; German sample [$\beta_{maternal} \backslash \beta_{paternal}$]: mathematics: β = .51**\.43** German: β = .30**\.21**). Higher achievement went along with higher competence perceptions by the parents within an academic domain. In both samples, cross-domain grades showed no significant predictions for mothers. In the German sample, however, a small positive link of mathematics grades and the paternal competence perceptions in German language was found (β = .13*).

Students' Self-Concepts of Ability (SCA)

Within an academic domain, the predictions of students' self-concepts by the parental competence perceptions were positive (U.S. sample: mathematics: β = .52**; English: β = .27**; German sample: mathematics: β = .56**\.53**; German: β = .28**\.20*), supporting our hypotheses. The evidence for the expected negative cross-domain links was mixed. In the mathematics domain, these links were consistently found. Parental perceptions regarding language competence negatively predicted students' mathematical self-concept (U.S.

TABLE 1
Results of the Structural Equation Models for the United States Sample

	PPSC				*SCA*				*INVA*			
	MA		*ENG*		*MA*		*ENG*		*MA*		*ENG*	
	β	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Autoregression	.39**	.05	.42**	.04	.18**	.03	.22**	.03	.27**	.03	.29**	.03
Cross-autoregression	.02	.05	.06	.06	.09**	.03	.09*	.03	.13**	.03	.16**	.03
Gender	−.06*	.03	.03	.03	−.05*	.02	.05*	.03	.05*	.02	.08**	.02
Ethnicity	−.04	.03	.06*	.03	.00	.02	−.02	.03	.02	.03	−.04	.03
Parental education	−.04	.02	.02	.02	−.05*	.02	−.02	.03	.03	.02	−.02	.03
Mathematics grade	.53**	.04	−.02	.06	.27**	.06	−.14**	.05	−.12*	.05	−.04	.05
English grade	.02	.04	.46**	.04	−.09*	.05	.32**	.04	.03	.04	−.02	.04
PPSC mathematics					.52**	.07	−.05	.06	.19*	.07	−.09	.07
PPSC English					−.18**	.06	.27**	.05	−.18**	.06	−.07	.05
SCA mathematics									.41**	.04	−.07	.05
SCA English									−.01	.03	.55**	.03
R^2	.69		.66		.55		.36		.38		.44	

Note. PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value; Ma = mathematics, Eng = English; gender: 0 = male, 1 = female; ethnicity: 0 = Hispanic and African American, 1 = European American.
*$p < .05$; **$p < .01$.

TABLE 2
Results of the Structural Equation Models for the German Sample (Maternal Data)

	PPSC				*SCA*				*INVA*			
	MA		*GER*		*MA*		*GER*		*MA*		*GER*	
	β	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Autoregression	.34**	.06	.46**	.06	.21**	.04	.32**	.05	.21**	.05	.26**	.05
Cross-autoregression	.03	.06	.00	.05	.07	.04	.03	.05	.12*	.05	.02	.05
Gender	.01	.03	−.06	.03	−.11**	.03	−.03	.03	.08*	.04	−.07	.04
School track	−.01	.04	.01	.04	−.11**	.03	−.12*	.05	.07	.05	−.05	.05
Parental education	−.02	.04	−.01	.04	.04	.03	.02	.04	−.01	.03	.00	.04
Mathematics grade	.51**	.05	.10	.05	.27**	.05	.00	.06	−.12	.06	−.07	.07
German grade	.05	.04	.30**	.06	−.12*	.05	.37**	.07	−.09	.06	−.18*	.07
PPSC mathematics					.56**	.05	−.08	.05	−.20*	.09	.05	.09
PPSC German					−.10*	.05	.28**	.07	.03	.06	−.04	.08
SCA mathematics									.83**	.08	−.16*	.08
SCA German									−.09	.07	.65**	.07
R^2	.63		.55		.71		.54		.49		.41	

Note. PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value; Ma = mathematics, Ger = German; gender: 0 = male, 1 = female; school track: 0 = low school track, 1 = high school track.
*$p < .05$; **$p < .01$.

TABLE 3
Results of the Structural Equation Models for the German Sample (Paternal Data)

	PPSC				*SCA*				*INVA*			
	MA		*GER*		*MA*		*GER*		*MA*		*GER*	
	β	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Autoregression	.33**	.06	.60**	.06	.23**	.04	.32**	.06	.22**	.05	.26**	.05
Cross-autoregression	.15*	.06	−.07	.06	.07	.04	.03	.05	.12*	.05	.02	.05
Gender	.07	.04	.04	.04	−.09**	.03	.00	.04	.07	.04	−.07	.04
School track	−.02	.05	−.06	.06	−.09*	.03	−.13*	.06	.06	.05	−.05	.06
Parental education	.00	.04	−.01	.05	.06	.03	.03	.04	−.01	.03	.00	.04
Mathematics grade	.43**	.04	.13**	.05	.37**	.05	.00	.07	−.14*	.06	−.05	.07
German grade	.03	.05	.21**	.04	−.07	.05	.43**	.07	−.12*	.05	−.18**	.07
PPSC mathematics					.53**	.06	−.09	.09	−.16	.10	.06	.10
PPSC German					−.27**	.06	.20*	.10	.09	.07	−.04	.09
SCA mathematics									.79**	.08	−.18*	.08
SCA German									−.09	.06	.65**	.07
R^2	.60		.59		.68		.52		.49		.41	

Note. PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value; Ma = mathematics, Ger = German; gender: 0 = male, 1 = female; school track: 0 = low school track, 1 = high school track.
*$p < .05$; **$p < .01$.

sample: β = −.18**; German sample: β = −.10* \−.27**). No evidence for negative cross-domain contrasting relations of parental mathematics competence perceptions and students self-concept in the language domain was found.

As expected, the within-domain grade predictions of the students' competence beliefs were positive (U.S. sample: mathematics: β = .27**; English: β = .32**; German sample: mathematics: β = .27** \.37**; German: β = .37**\.43**). In all samples, these direct effects (controlled for PPSC) were smaller than the total effects (i.e., grade effects without considering the mediator): U.S. sample: mathematics: β = .59**; English: β = .48**; German sample: mathematics: β = .59**\.58**; German: β = .48**\.48**. In the mathematics domain, this was due to within-domain mediations (e.g., mathematics grade →mathematics PPSC → mathematics

SCA, indirect effects: U.S. sample: β = .28**; German sample: β = .28**\.23**). In the language domain, these within-domain mediations were only found for mothers (indirect effects: U.S. sample: β = .12**; German sample: β = .08**\.04). As hypothesized, the reductions in the within-domain grade effects point to mediations through the within-domain parental competence perceptions. In the verbal domain, the reduction in within-domain grade effects was not significant for fathers.

Regarding cross-domain grade effects, in both samples (maternal models only), small longitudinal relations of the language grades and the mathematical self-concept were shown (U.S. sample: β = −.09**; German sample: β = −.12**\−.07). These direct effect were smaller than the total effects (U.S. sample: β = −.15**; German sample: β = −.12*\−.12*). As indicated by the significant indirect effects (U.S. sample: β = −.08**; German sample: β = −.03*, β = −.06**) and supporting our assumptions, these predictions of the mathematics self-concepts by language grades were mediated through parental language competence perceptions. The expected cross-domain predictions of the language self-concept by the mathematics grades were only found in the U.S. sample (β = −.14**). This direct effect was slightly smaller than the total effect (β = −.16**), but the indirect effect was not significant. Therefore, this cross-domain mediation cannot be considered significant.

Supporting the hypotheses, in both academic domains and both samples, all within-domain grade effects on the students' competence beliefs were mediated through within-domain parental competence perception. The negative language grade effects on the mathematics self-concept were mediated through the parental verbal competence perception in both samples. The mediation results are schematically summarized in Figure 2.

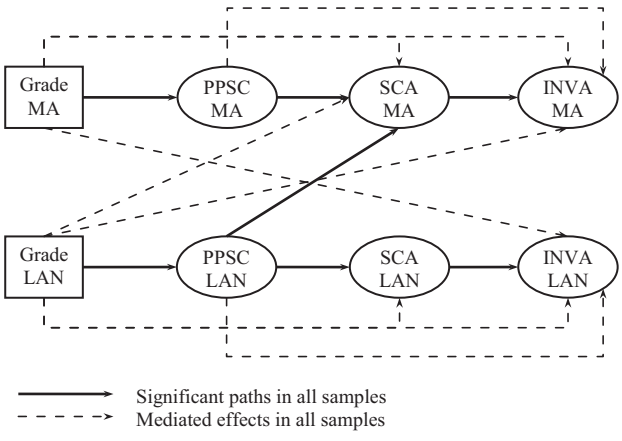

FIGURE 2 Summary of the consistent mediation results. MA = mathematics domain; LAN = language domain (English and German); PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value.

Intrinsic Task Value (INVA)

As hypothesized, the within-domain academic self-concepts positively predicted the intrinsic task values (U.S. sample: mathematics: β = .41**; English: β = .55**; German sample: mathematics: β = .83**\.79**; German: β = .65**\.65**). Although expected, negative cross-domain effects were only found in the German sample in the verbal domain. Here, the mathematics self-concept negatively predicted the students' intrinsic task value in German language (β = −.16*\−.18*).

Within an academic domain, small predictions of the parental competence perceptions were found (U.S. sample: mathematics: β = .19*; English: β = −.07; German sample: mathematics: β = −.20*\−.16; German: β = −.04\−.04). All these direct effects are smaller than the total parental effects (U.S. sample: mathematics: β = .42**; English: β = .14**; German sample: mathematics: β = .32**\.34**; German: β = .20*\.19*). These expected reductions are due to a mediation through the within-domain academic self-concepts (indirect effects: U.S. sample: mathematics: β = .21**; English: β = .15**; German sample: mathematics: β = .47**\.42**; German: β = .19**\.14*).

Regarding cross-domain parental effects, only a significant negative prediction of mathematics intrinsic task value by parental English competence perception in the U.S. sample was found (β = −.18**). As total effects, the expected negative cross-domain predictions were only found in the U.S. sample in both domains (PPSC English → INVA mathematics: β = −.22**, PPSC mathematics → INVA English: β = −.15**) and for German fathers in mathematics domain (PPSC German → INVA mathematics: β = −.15*). The cross-domain predictions of the mathematics intrinsic task value by the parental verbal competence perceptions was mediated through the mathematics academic self-concept (indirect effects: U.S. sample: β = −.07**; German sample: β = −.08*\−.07**). The reductions in the predictions of the students' English intrinsic task values by parental mathematics competence perception in the U.S. sample were not significant. Taken together, within- and between-domain parental effects on adolescents' task values were shown to be mediated through adolescents' competence beliefs, supporting our assumptions.

Small within-domain grade effects were found (U.S. sample: mathematics: β = −.12**; English: β = −.02; German sample: mathematics: β = −.12 \−.14*; German: β = −.18*\−.18**). All these direct effects are smaller than the total effects (U.S. sample: mathematics: β = .25**; English: β = .23**; German sample: mathematics: β = .32**\.31**; German: β = .20**\.19**). As hypothesized, the predictions by within-domain grades were mediated through the within-domain academic self-concept (indirect effects: U.S. sample: mathematics: β = .11**; English: β = .18**; German sample: mathematics: β = .23** \.18**; German: β = .24**\.27**).

There was only one significant cross-domain grade effect on the students' intrinsic values (U.S. sample: English grade →mathematics INVA: β = −.03; mathematics grade → English INVA: β = −.04; German sample: German grade → mathematics INVA: β = −.09\−.12*; mathematics grade → German INVA: β = −.07\−.05). Again, these direct effects were smaller than the total cross-domain grade effects (U.S. sample: English grade → mathematics INVA: β = −.10**; mathematics grade → English INVA: β = −.21**; German sample: German grade → mathematics INVA: β = −.20**\−.20**; mathematics grade → German INVA: β = −.14**\−.14**). As expected, the cross-domain predictions of mathematics intrinsic task value by English\German grades were mediated through mathematics academic self-concepts (indirect effects: U.S. sample: β = −.03*; German sample: β = −.09*\−.05*). In the U.S. sample, the cross-domain predictions of the English intrinsic task value by mathematics grades were mediated through English self-concept (indirect effect: β = −.08**). In the German sample, the prediction of the language task value by mathematics grade was mediated through the mathematics academic self-concept (indirect effect: β = −.05*\ β = −.04*).

Taken together, the feedback effects on the students' intrinsic task values were mediated though the students' competence beliefs. These beliefs were strongly linked to intrinsic task values. The result patterns that were consistent in all samples are summarized in Figure 2.

DISCUSSION

In this study, we investigated how competence-related feedback informs the development of early adolescents' academic self-concepts and intrinsic task values during and after the secondary school transition. This competence-related feedback can come in various forms. In this study, we considered academic grades and both parents' competence beliefs. Against the backdrop of Eccles's EVM (Eccles's, 2005; see Figure 1), we followed the transmission of feedback into intrinsic task values in the mathematics and language domains. We identified two steps: (1) the construction of the competence beliefs, and (2) the translation into intrinsic task values.

First, we presented evidence that the parents and the adolescents incorporated information from grades into their competence beliefs, replicating earlier results (e.g., Dai, 2002; Eccles, 1993; Wigfield et al., 1997). These results are consistent with the hypothesis that parents and their offspring interpret good grades as indicators of a high competence level within an academic domain. In contrast, the students, but not the parents, showed the predicted negative associations across subject areas between grades and academic ability self-concepts, at least for mathematics ability self-concepts.

Early adolescents also appeared to include the feedback information inherent in their parents' perceptions of their children's competence into the construction of their own academic self-concepts, replicating prior work on parents as an interpreters of reality (e.g., Bouchey & Harter, 2005; Dai, 2002; Eccles, 1993). This information serves as an independent and domain-specific source of information for the adolescents. Within domain, these positive effects were shown in both the mathematics and the language domains. The predicted negative cross-domain effects were mainly found in the mathematics domain. Here, parents' estimates of their child's language competence negatively predicted changes in the early adolescents' mathematics ability self-concept. Thus, these findings are consistent with our hypothesis that both sources of domain-specific achievement-related feedback are integrated into the students' competence beliefs in the mathematics domain. Parents can communicate their beliefs to their children in several ways (Eccles, 1993): (1) directly by encouraging them to do better in school or praising them for good grades and (2) indirectly through their behaviors such as helping with schoolwork or organizing private tutoring. Those assumptions on the mechanisms should be investigated in future research.

Second, we documented the predicted association between achievement-related feedback and developmental changes in early adolescents' intrinsic task values both within and between academic domains. Academic grades and parental competence perceptions predicted students' intrinsic task valuing in a manner parallel to their prediction of

academic self-concepts. These feedback effects were mediated through early adolescents' competence beliefs.

This study provides new insights into the development of academic self-concepts and intrinsic task values during early adolescence. The relevance of our results is based on the integrative description of the theoretical line of argument starting with the achievement-based feedback and showing the transmission of this information through both parents and students' competence perceptions to the intrinsic task value in two academic domains. This study contributes to the understanding of how feedback information might be transformed into motivation-relevant values. There is strong evidence that these values, in turn, mediate effects of academic self-concepts and values on subsequent achievement (Roeser & Eccles, 1998). Despite the differences between the samples, school systems, and contexts in which the studies were conducted, the patterns of associations and mediation and in most cases even the effect sizes were by and large parallel for both samples and in both maternal and paternal models. Thus, we think that we can generalize the reported results to other samples, but this remains to be shown empirically. The processes feeding into the formation and stabilization of academic self-concepts and the intrinsic task values seem to be similar in both contexts and feedback sources.

The parents' perceptions of their children's abilities seem to be particularly important as mediator of school-based feedback, building on previous research (e.g., Cooper, Cooper, Azmitia, Chavira, & Gullatt, 2002; Eccles, 1993; Leaper et al., 2012). In this respect, our study can be seen as an application of Bronfenbrenner's ecological model (Bronfenbrenner, 1979). Our findings suggest that the microsystem family as represented by the parents and the microsystem school as represented by its provision of academic marks to both children and parents likely influence the development of academic self-perceptions and values in both direct and indirect ways. In addition, mesosystemic influences are evident in the fact that the impact of the academic marks provided by schools appears to be mediated, in part, by their association with parents' perceptions of their children, perhaps through parents' role as interpreters of reality in the construction of children's and adolescents' academic self-concepts. Parents' perceptions of their children's competence can serve as a filter for the adolescents' own competence belief constructions and, in the end, the development of the children's intrinsic task values. On the one hand, inconsistencies between parents' perceptions and teachers' feedback may confuse students, making the formation of accurate ability self-concepts more difficult. Thus, a cooperation of parents and schools that provides parents with the information needed to build accurate beliefs about their child's academic competences is called for. Direct teacher feedback for the parents on their children's achievement might increase accuracy. On the other hand, positive information from one of these two sources may help to protect students' ability self-concepts from negative feedback from the other source. This compensatory effect might be particularly important in cases where teachers stereotype students and base their grading and their teaching practices accordingly.

Equally important, the way parents communicate their beliefs may be crucial in the development of adolescents' academic values and motivation (see Eccles, 1993; Mueller & Dweck, 1998; Tenenbaum & Leaper, 2003). Each of these scholars has shown that parents' stereotypes, causal attributions, and mind sets relate first to the specific ways in which parents interpret their children's academic performances for them and second to the way information and parental support is provided. This possibility is especially important for understanding gender biases in children's self-concepts of their mathematics ability. In both samples, the parents rated their daughters as being better in English than they did their sons at the zero-order correlational level. Coupled with the fact that the only consistent cross-domain association between parents' perceptions and changes in their early adolescents' ability self-concepts occurred for language perceptions to mathematics ability self-concepts, these findings suggest that the competence-related information parents provide is at least partially responsible for the sex difference in their children's mathematics ability self-concepts (e.g., Crowley, Callanan, Tenenbaum, & Allen, 2001; Tenenbaum & Leaper, 2003). It is interesting to note that no between-parent differences in the effect patterns were found. Thus, the processes seem to be the same for mothers and fathers. If gender differences arise from parental stereotypes, mothers and fathers have to hold similar stereotypes and provide the same information for their offspring. To test this assumption, mixed- and same-gender dyads have to be compared in

future research to rule out the possibility that the dyad composition moderates these processes.

Parents' perceptions of their children's competencies might also affect academic motivation through changes in their parenting (Eccles, 1993). In case of negative perceptions, parents might, for instance, limit their children's autonomy in response to poor grades (Deci & Ryan, 1985). Each of these practices can, in turn, influence the ways in which school performance feedback is incorporated into children's own ability self-concepts, academic ability mind sets, subjective task value, and motivation. However, further research is needed to provide support for these assumptions.

Throughout the reported chain of mediations, no consistent patterns of cross-domain effects were found for language-related competence beliefs or values. The fact that this difference in patterns for mathematics versus language arts occurred in both countries suggests that what is going on is different across these two subject areas. One explanation can be that the definition of what is a correct answer or a successful performance is more objective in mathematics than in language arts. It is likely that grades in mathematics are more directly related to clearly defined performance criteria than are grades in the language arts. This interpretation is supported by the result that both parents' and students' competence perceptions were more closely associated with grades in the mathematics domain than in the verbal domain (for parents, see Dai, 2002; for students, see Möller et al., 2009). It could also be due to the greater focus played in the elementary school years in both countries on reading than on mathematics, perhaps leading to a more stable set of beliefs related to the language arts than to mathematics by the end of Grade 5.

In interpreting the results of the study, some limitations should be kept in mind. First, the number of items measuring intrinsic task value was very small. This was due to the restriction to parallel items in both data sets. Still, the results obtained with the parsimonious indicators were largely comparable to other studies. Thus, we can assume that we have captured the relevant variables to a sufficient extent in both data sets. Second, in the German sample, there was a slight overrepresentation of students attending the college-bound school track. There might be different within-family processes that could influence the results. However, we have controlled for the attended school track in all models. Thus, we can rule out the possibility of school track–related third variable effects regarding the reported results. Moreover, the proportion of students attending the higher school track in the sample roughly parallels the proportion in the population in this German federal state. Third, the study is limited to mathematics and English/German language as academic domains. Including more academic domains could increase generalizability of the results of future research. Fourth, the samples used in this study differed in the timing of the secondary school transition. In the U.S. sample, the transition took place between the measurement occasions, while in the German sample the students already attended secondary schools. On the one hand, this fact makes the samples less comparable. On the other hand, it strengthens our claim of general processes, because although the samples are not perfectly comparable, the result patterns are very similar. Fifth, maternal and paternal data in the German data set are not independent. Therefore, mother–father differences have to be referred to the German data set. To draw general conclusions about between-parent differences, data on U.S. fathers would have been needed. Finally, in the reported analyses, concurrent measures of dependent and independent variables ratings were used. We deliberately deviated from the common procedure of cross-lagged modeling as we expected short-term processes to operate. As the premeasurements of the dependent variables were controlled in each analysis, changes in student's perceptions and values were predicted by the independent variables. We suggest interpreting the respective paths in terms of directed effects as specified in our hypotheses. Although this procedure cannot be considered a test of causal effects, it clearly goes beyond cross-sectional approaches to the questions of concern.

Taken all together, we think that this study provides new insights into the translation process of achievement-related feedback into intrinsic task values. Feedback regarding two academic domains that was obtained in two developmentally important contexts is, in a first step, integrated in early adolescents' academic self-concepts. In a second step, these competence beliefs inform the development of intrinsic task values. Our longitudinal data provided us with the opportunity to interpret our results as directed effects. As comparable effects were shown in two independent samples, we consider our findings as strong evidence for the working of general processes. For further research, it seems appropriate to consider the complex interplay of various sources of information on different academic domains when investigating motivation and achievement in educational settings.

APPENDIX

TABLE A1
Correlations of the Major Constructs (T2) With Control Variables, Stabilities, and Intercorrelations in the United States Sample

	Students' Gender	Ethnicity	Parental Education	Stability[a]	Grade		PPSC		SCA		INVA	
					MA	ENG	MA	ENG	MA	ENG	MA	ENG
Grade MA	.10**	.07	.21**	—	1							
Grade ENG	.20**	.05	.19**	—	.66**	1						
PPSC MA (Mother)	−.01	.01	.13**	.71**	.75**	.56**	1					
PPSC ENG (Mother)	.22**	.10*	.20**	.70**	.51**	.71**	.49**	1				
SCA MA	−.08	.00	.06*	.48**	.59**	.32**	.70**	.24**	1			
SCA ENG	.19**	.02	.09**	.38**	.25**	.49**	.25**	.53**	.19**	1		
INVA MA	−.02	−.02	.01	.43**	.26**	.12**	.39**	.06	.52**	.07**	1	
INVA ENG	.20**	−.07*	−.01	.43**	−.03	.14**	−.04	.19**	−.03	.53**	.22**	1

Note. PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value; MA = mathematics, ENG = English; gender: 0 = male, 1 = female; ethnicity: 0 = Hispanic and African American, 1 = European American.
[a]Stability: zero-order correlation between measurement occasions.
*$p < .05$; **$p < .01$.

TABLE A2
Correlations of the Major Constructs With Control Variables (T2), Stabilities, and Intercorrelations in the German Sample (Maternal Model)

	Students' Gender	School Track	Parental Education	Stability[a]	Grade		PPSC		SCA		INVA	
					MA	GER	MA	GER	MA	GER	MA	GER
Grade MA	−.01	.18**	.09*	—	1							
Grade GER	.25**	.27**	.14**	—	.53**	1						
PPSC MA (Mother)	.01	.22**	.10*	.66**	.73**	.45**	1					
PPSC GER (Mother)	.25**	.26**	.12**	.68**	.42**	.62**	.57**	1				
SCA MA	−.20**	.05	.08*	.58**	.67**	.25**	.76**	.28**	1			
SCA GER	.19**	.09	.09*	.59**	.32**	.63**	.31**	.58**	.31**	1		
INVA MA	−.12**	.05	.04	.45**	.29**	0	.36**	.08	.61**	.12*	1	
INVA GER	.07	−.05	.01	.43**	.04	.19**	.03	.22**	.00	.54**	.20**	1

Note. PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value; MA = mathematics, GER = German; gender: 0 = male, 1 = female; school track: 0 = low school track, 1 = high school track.
[a]Stability: zero-order correlation between measurement occasions.
*$p < .05$; **$p < .01$.

TABLE A3
Correlations of the Major Constructs With Control Variables (T2), Stabilities, and Intercorrelations in the German Sample (Paternal Model)

	Students' Gender	School Track	Parental Education	Stability[a]	Grade		PPSC		SCA		INVA	
					MA	GER	MA	GER	MA	GER	MA	GER
Grade MA	−.01	.18**	.09*	—	1							
Grade GER	.25**	.27**	.14**	—	.53**	1						
PPSC MA (Father)	.04	.25**	.05	.67**	.67**	.43**	1					
PPSC GER (Father)	.16**	.32**	.06	.72**	.44**	.57**	.71**	1				
SCA MA	−.20**	.05	.08*	.58**	.67**	.25**	.67**	.29**	1			
SCA GER	.19**	.09	.09*	.59**	.32**	.63**	.31**	.51**	.31**	1		
INVA MA	−.12**	.05	.04	.45**	.29**	0	.34**	.13**	.61**	.12*	1	
INVA GER	.07	−.05	.01	.43**	.04	.19**	.02	.20**	.00	.54**	.20**	1

Note. PPSC = parental perception of student's competence; SCA = student's self-concept of ability; INVA = student's intrinsic task value; MA = mathematics, GER = German; gender: 0 = male, 1 = female; school track: 0 = low school track, 1 = high school track.
[a]Stability: zero-order correlation between measurement occasions.
*$p < .05$; **$p < .01$.

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