Predicting Homework Effort: Support for a Domain-Specific, Multilevel Homework Model

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According to the domain-specific, multilevel homework model proposed in the present study, students’ homework effort is influenced by expectancy and value beliefs, homework characteristics, parental homework behavior, and conscientiousness. The authors used structural equation modeling and hierarchical linear modeling analyses to test the model in 2 studies with 414 and 1,501 8th graders, respectively. In line with the authors’ assumptions, most intercorrelations observed between corresponding homework variables across 2 school subjects were small to moderate, conscientiousness and homework motivation proved to be strong predictors of homework effort, and perceived homework quality varied considerably between classes and predicted homework motivation and behavior. Findings highlight the need to take into account the domain specificity and multilevel character of homework variables when analyzing students’ homework behavior.

Keywords: homework, achievement, motivation, conscientiousness, domain specificity, multilevel modeling

In most countries around the world, homework represents a substantial amount of the time that students spend working on core subjects. Homework is believed to increase student achievement (Cooper, 1989; Keith, 1986; Paschal, Weinstein, & Walberg, 1984), but it also has its downsides (Cooper, 2001). Most important, teachers complain about students failing to complete their assignments, and students and parents grumble about lost time and stress at home caused by disagreements on whether, when, and how to do homework (Cooper, 2001; Grolnick, 2003; Hoover-Dempsey et al., 2001; Warton, 2001).

The present article sheds light on students’ reasons for doing or not doing homework—an everyday problem of prime educational importance. It is somewhat surprising that few psychologically sound and comprehensive models or empirical studies have focused explicitly on the assignment and completion of homework (cf. Cooper, 1989; Trautwein & Köller, 2003a; Warton, 2001). We therefore proposed and tested a psychological model that is tailored to the homework process. The model combines elements of expectancy-value theory (Eccles, 1983; Eccles & Wigfield, 2002), research on learning and instruction (Boekaerts, 1999; Brophy & Good, 1986; Weinert & Hembke, 1995a, 1995b), and self-determination theory (Deci & Ryan, 2002; Grolnick & Slowiaczek, 1994). Further, it includes stable personal characteristics such as basic cognitive abilities and conscientiousness (Costa & McCrae, 1992).

The research focus of this article is on the domain specificity and the multilevel nature of homework. We argue that homework research has neglected the domain specificity of homework and at the same time has ignored stable personality traits that enhance transsituational stability in homework behavior. In Study 1, on the basis of the responses of 414 eighth graders to several homework scales pertaining to mathematics and English as a foreign language, we juxtapose time on homework versus effort on homework measures, address the issue of domain specificity in the homework process, and clarify the role of conscientiousness in predicting homework behavior. In Study 2, we highlight the multilevel nature of homework. We use data from 1,501 eighth graders in 93 classes to show that perceived homework quality varies considerably between school classes and predicts homework motivation and effort.

The Relationship Between Homework and Achievement

Several reviews on the relationship between homework and achievement have suggested that homework is associated with achievement gains (Cooper, 1989; Paschal et al., 1984). Most notably, the classic review by Cooper (1989) found that homework contributed to achievement in a large number of both experimental and nonexperimental studies. However, Cooper cautioned that the studies were of mixed quality and not entirely consistent. This
critical appraisal of many homework studies was echoed in the review by Trautwein and Köller (2003a), who pointed to a number of limitations apparent in homework research and argued that the strength of the relationship between homework and achievement is still largely unknown.

First, homework can be related to achievement at two levels: (a) A homework effect at the class level (i.e., homework assignment effect) is found when students in classes with a higher quantity or quality of homework have more pronounced achievement gains than do students in other classes (Trautwein, Köller, Schmitz, & Baumert, 2002); (b) a homework effect at the student level (i.e., homework completion effect) is found when students in the same class who differ in their homework behavior (e.g., time spent on homework) show differential outcomes (Cooper, Lindsay, Nye, & Greathouse, 1998). In this sense, homework is a classic example of the multilevel problem (Kreft & de Leeuw, 1998; Raudenbush & Bryk, 2002), and it is of paramount importance to differentiate between teacher- and student-level effects in all studies that relate homework to achievement (Trautwein & Köller, 2003a).

Second, research has concentrated almost exclusively on time spent on homework. Rather than casting light on the relationship between homework and achievement, however, this measure may in fact obscure it. With reference to Carroll (1963), conscientious homework behavior is often equated with the time spent on homework, but Carroll’s model predicts learning outcomes on the basis of both time spent and time needed. Moreover, Carroll emphasized the role played by motivational and volitional factors (perseverance). In referring to time on task, Carroll in fact meant only the active time on task (all sorts of distractions can have detrimental effects on students’ homework behavior). When measuring homework time, total time and active time are typically conflated (see Trautwein & Köller, 2003a, for a critical account of the time on task variable). Thus, if a student reports spending a lot of time on his or her homework, this is not necessarily a sign of great studiousness but may instead reflect problems of motivation or concentration.

Several recent studies that have separated the effects of homework assignment and homework completion (De Jong, Westerhof, & Creemers, 2000; Muhlenbruck, Cooper, Nye, & Lindsay, 1999; Trautwein, 2005; Trautwein & Köller, 2003b; Trautwein et al., 2002) have indicated that students who spend more time on homework do not outperform their peers. In fact, some studies have shown that these students lag behind their peers in terms of achievement and achievement gains. For instance, with a sample of 24,273 ninth graders who participated in the German extension of the Programme for International Student Assessment (Organisation for Economic Cooperation and Development [OECD], 2001, Trautwein (2005) found a small positive effect of homework assignments on mathematics achievement at the class level (students in classes with time-consuming homework assignments had slightly higher achievement) but a large negative effect at the student level (students who spent more time on homework than did their classmates had lower mathematics achievement). These differential effects at the class and individual levels have been confirmed in longitudinal analyses. At the class level, a higher number of homework tasks (De Jong et al., 2000) and higher homework frequency (Trautwein, 2005; Trautwein et al., 2002) have proved to be associated with higher achievement gains, but more time spent on homework has not.

It needs to be reemphasized that time on task describes only one aspect of homework behavior. The effort that a student invests in homework is not necessarily related to homework time and might well have a positive impact on achievement gains. Indeed, in his longitudinal analysis, Trautwein (2005) found that effort invested in homework (sample item: “I do my best on my mathematics homework”) was positively related to achievement and achievement gains (see also Schmitz & Skinner, 1993), whereas time spent on homework was unrelated or negatively related to achievement. Likewise, in a study with more than 400 ninth graders, Trautwein and Köller (2003b) found a positive effect of homework effort on school grades but a negative effect of time spent on homework. The pattern of results remained stable when previous school grades, basic cognitive abilities, and gender were controlled. Thus, effort invested in homework is one of the central features of the homework model proposed in the following section, whereas time spent on homework plays only a minor role.

A Domain-Specific, Multilevel Homework Model

Cooper (1989) noted that “homework probably involves the complex interaction of more influences than any other instructional device” (p. 87). Hence, a homework model will necessarily be complex. At the same time, to be of theoretical and practical utility, it must be parsimonious. The homework model that we propose (Trautwein & Köller, 2003a, 2003b) aims to be both sufficiently complex and parsimonious. It takes into account the three major protagonists in the homework process (students, teachers, and parents) and covers six major groups of variables (achievement, homework behavior, homework motivation, student characteristics, parental behavior, and the learning environment). The model is depicted in Figure 1. The elements of the model that are tested in the present research are printed in italics in Figure 1.

Major motivational theories, such as expectancy-value theory (Eccles, 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2002; see also Pintrich & De Groot, 1990) and self-determination theory (Deci & Ryan, 2002), as well as theories of learning and instruction (Boekaerts, 1999; Brophy & Good, 1986; Weinert & Helmeke, 1995a, 1995b) provide the theoretical background to the model. Moreover, the model takes a multilevel perspective (Raudenbush & Bryk, 2002) and emphasizes the domain specificity of human motivation and behavior (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Pintrich, 2003).

In our model, homework behavior comprises three main elements: time on task, homework effort, and learning strategies (cognitive and metacognitive strategies). Although these three elements are not independent of one another, we hypothesized that they would likely be differentially related to achievement. We expected homework effort to be positively related to achievement, whereas given the theoretical and methodological problems with the time-on-task variable, no such prediction was made for time spent on homework (for more detail, see Trautwein, 2005; Trautwein & Köller, 2003b). We expected a mixed pattern of results for learning strategies, owing to the difficulty in collecting data on learning strategies and the diversity of these strategies (De Jong et al., 2000).

Our model assumes homework behavior to be strongly influenced by homework motivation in the form of expectancy and value components (Eccles & Wigfield, 2002). The expectancy component reflects the student’s belief in being able to success-
fully execute goal-oriented behavior (see also Zimmerman, Bonner, & Kovach, 1996). The value component has several facets (cf. Eccles & Wigfield, 2002; Pintrich & De Groot, 1990): How important is it for someone to do well in the domain in question (attainment value)? Does he or she enjoy engaging in the activity (intrinsic value)? Does he or she expect any long-term benefit from the activity (utility value)? Does the activity involve an unreasonable amount of effort (cost)? Warton (2001) argued that the utility and cost components might be of specific importance for homework.

We suggest that these motivational variables are broken down into general and homework-specific components (see Trautwein, Lüdtke, Kastens, & Köller, 2005). It is conceivable, for example, that some young people consider mathematical knowledge to be important and useful for their future career plans but do not expect to benefit from doing the homework they have been assigned (e.g., because they consider the exercises too easy or irrelevant). Likewise, it is possible that some students have a high mathematical self-concept but are nevertheless unable to solve the mathematics problems they are assigned as homework.

We expect homework motivation to be positively associated with homework effort. In light of the theoretical and methodological problems with the time-on-task variable (described above), however, we did not expect to find any positive effect of homework motivation on time spent on homework.

As far as student characteristics are concerned, gender, cognitive abilities, and conscientiousness are incorporated in the model. Gender is believed to be associated with potential effects on both homework motivation and homework behavior. On the basis of earlier research (Cooper, 1989), we expected girls to report more effort on homework; however, the strength of these differences may vary depending on the subject and might be mediated by homework motivation. With respect to basic cognitive abilities, the model predicts a positive effect on the expectancy component (students with high cognitive abilities will be confident of being able to complete assignments); however, no a priori expectations are made regarding direct effects on homework behavior.

The homework model includes the Big Five personality trait of conscientiousness (see Costa & McCrae, 1992) as a further predictor of homework motivation and behavior. Somewhat surprisingly, despite its apparent relevance, this personality trait has attracted little attention in previous research on education (De Raad & Schouwenburg, 1996) and, more specifically, homework.
research. Conscientious persons are characterized as being industrious, systematic, and hardworking and are predicted to outperform persons scoring low on this factor in academic and professional domains (Barrick & Mount, 1991; Costa & McCrae, 1992; Digman, 1989; Lüdtke, Trautwein, Nagy, & Köller, 2004; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2006). Thus, we expected conscientiousness to predict homework behavior in different school subjects.

Regarding learning environments, in addition to more general characteristics of the instructional setting (e.g., quality and quantity of instruction, supervised in-school homework vs. out-of-school homework), the homework model defines teachers’ homework-related attitudes and behaviors as critical components (see Figure 1). Several teacher-related aspects, such as homework frequency, homework quality, and homework control, are expected to impact students’ homework motivation and behavior and, subsequently, their achievement. Very little empirical research has focused specifically on the effects of these kinds of homework characteristics on student homework completion and achievement (Trautwein & Köller, 2003a). Therefore, the homework model draws on the findings of research on learning and instruction in the classroom (see reviews by Brophy & Good, 1986; Weiner & Helmke, 1995b). In this sense, high-quality homework entails “carefully choosing appropriate tasks, continuously diagnosing each student’s learning progress and learning difficulties, and providing effective help through remedial instruction” (Weiner & Helmke, 1995b, p. 138). A major premise of the homework model is that the effects of homework quality are at least partly mediated by motivational variables. In other words, the effects of high-quality homework assignments on student homework effort are at least partly attributable to higher homework motivation.

In addition to homework quality, the extent of teachers’ homework control is of great interest. Some researchers have reported positive effects of homework control (see Paschal et al., 1984), but on the whole, little is known about the effects of teachers’ homework control on students’ homework behavior and motivation. Although it is reasonable to assume that students in classes where homework is controlled strictly are more likely to complete their assignments because teacher control increases the value of doing homework, these students may also be more likely to copy from their classmates. Moreover, controlling environments are believed to undermine academic motivation and students’ feelings of autonomy and competence (see Deci & Ryan, 2002). Hence, homework control might have both positive and negative effects on students’ motivation to complete their assignments.

Unlike teacher effects, the role of parents in the homework process has been investigated in several studies (see reviews by Grolnick, 2003; Hoover-Dempsey et al., 2001; see also Eccles & Harold, 1996; Englund, Luckner, Whaley, & Egeland, 2004; Pomerantz & Eaton, 2001). Although the relationship between family characteristics and homework motivation and behavior is not straightforward, it is fairly consistent with theoretical predictions made on the basis of self-determination theory (Deci & Ryan, 2002). Whereas more distal variables such as parental education and parent–child communication about school have been found to be positively related to positive outcomes, more proximal variables such as homework support and supervision have yielded mixed support for parental engagement in the homework process (Grolnick & Slowiaczek, 1994). Most important, at least in high school students, controlling homework behavior and repeated offers of unwanted help on the part of parents seem to be negatively associated with homework motivation and effort, whereas parents’ process-oriented, autonomy-supporting homework behavior tends to be associated with positive homework outcomes (Grolnick, 2003; Hoover-Dempsey et al., 2001; Pomerantz, Wang, & Ng, 2005; Warton, 2001). Hence, similar to the effects of teachers’ homework control, direct effects of parental engagement in homework might be complemented or weakened by indirect effects on students’ homework motivation. Hence, when probing for effects of parental homework assistance on homework effort and time, indirect effects of homework motivation on homework effort should also be taken into consideration (Hoover-Dempsey et al., 2001; Warton, 2001).

The model we propose is not static. Rather, it proposes feedback mechanisms taking several forms. For instance, it is assumed that high homework effort will increase students’ achievement scores. This is in turn likely to impact parental homework assistance, the homework (quantity, quality) that teachers assign, students’ perceptions of homework quality, and students’ homework motivation. For reasons of clarity, these feedback mechanisms are not detailed in Figure 1. Longitudinal designs (e.g., multilevel, cross-lagged panel analyses) are needed to test the postulated feedback mechanisms.

Domain Specificity Versus Transsituational Stability

In recent years, research has provided ample evidence for domain-specific patterns of student motivation and behavior (Jacobs et al., 2002; Nagy, Trautwein, Köller, Baumert, & Garrett, in press; Pintrich, 2003). There is now consensus that student motivation and behavior cannot be properly understood unless this domain specificity is taken into account. In homework research, the potential of domain-specific analyses of homework behavior and its predictors has not yet been fully exploited (Keith, Diamond-Hallam, & Fine, 2004; OECD, 2001; see Cooper, 1989). The homework model we propose covers domain specificity in two ways. First, we assumed that the correlations among student reports concerning their homework behavior, homework motivation, and perceptions of homework characteristics across different school subjects would be small to moderate. If this assumption is confirmed, it will indicate that homework variables should not be aggregated across different subjects, as is still done in many educational studies (e.g., OECD, 2001). Second, although we expected the predictor variables included in the homework model to be relevant across subjects, we assume that their relative effects on student behavior may vary. For instance, the expectancy component has been shown to be a good predictor of achievement in many studies focusing on mathematics (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005), but it is not clear whether this also holds for other subjects such as languages or sciences.

In motivational research, it is widely accepted that learning environments affect student motivation (Trautwein, Lüdtke, Köller, & Baumert, in press). Accordingly, high-quality homework is likely to enhance students’ expectancy of success in their assignments and to increase the perceived utility of homework. It is quite likely that students’ perception of homework quality varies across the different school subjects, again underlining the importance of taking the domain-specific nature of human motivation and behavior into consideration in homework research.
Still, does a domain-specific conceptualization tell the whole story? Teachers report that some students refuse to do any homework at all, irrespective of their ability levels or the quality of the assignments. It is interesting that recent educational theories place much emphasis on domain specificity but tend to neglect trait-like personality aspects, whereas the opposite is true of personality psychology (see Marsh et al., 2006). As described above, our homework model stresses the importance of a domain-specific operationalization of homework, but it also incorporates conscientiousness as a stable personality characteristic that is assumed to impact homework behavior. Conscientiousness is conceptualized as a rather stable personality trait (see Costa & McCrae, 1992) that affects behavior across a broad range of situations. Hence, from a theoretical point of view, conscientiousness describes consistent, focused behavior in a variety of situations. In fact, it might prove to be of particular relevance in situations in which the motivation to execute a specific action is low (see Trautwein et al., 2005). At the same time, conscientiousness might overlap with domain-specific constructs to a certain degree. For instance, it might be associated with higher performance in various domains and therefore lead to a higher self-concept of ability in those domains. Indeed, Marsh et al. (2006) recently found a correlation of .26 between mathematics self-concept and conscientiousness. Moreover, although empirical evidence to this effect has not yet been presented, it is likely that students high in conscientiousness tend to perceive higher utility in doing homework than do students low in conscientiousness. Hence, we speculate that the effects of conscientiousness are partially, but not fully, mediated by domain-specific motivational predictors. Overall, then, we argue that homework research should pay close attention to both the domain-specific aspects and the transsituational consistency of homework motivation and behavior.

The Multilevel Nature of Homework

An in-depth analysis of class-level homework effects calls for a multilevel perspective—both conceptually and methodologically. This is clearly demonstrated by the differential relationships between time spent on homework and achievement gains at the class and student levels (Trautwein, 2005; Trautwein et al., 2002). However, a multilevel perspective is also appropriate when the effects of certain characteristics of homework assignments on students’ homework motivation and behavior are to be examined. Two questions are of primary interest. First, do students from different classes differ in their homework behavior and motivation as a result of varying levels of homework quality and control across teachers (class-level perspective)? Second, within each class, how different are the students’ perceptions of their homework, and what are the consequences of varying perceptions (student-level perspective)? To examine the multilevel nature of homework assignments and completion, large data sets covering a variety of homework indicators are needed. Typically a minimum of 30 to 50 school classes are needed to have sufficient statistical power to detect class-level effects (Hox, 2002; Raudenbush & Bryk, 2002). This may explain why, to date, there has been very limited multilevel research on the effects of homework assignments on homework motivation and behavior (see Trautwein & Köller, 2003a).

The Present Investigation

The present study is part of a research program designed to thoroughly investigate the domain-specific, multilevel homework model (see Trautwein & Köller, 2003a, 2003b; Trautwein et al., 2005). The emphasis of Study 1, which is based on student questionnaire responses pertaining to two subjects (mathematics and English as a foreign language), is on the domain specificity of the homework model and the role of conscientiousness as a potential predictor of achievement-related behavior. Whereas, given its restricted sample size of 20 classes, Study 1 focuses on the student level, Study 2 concentrates on the multilevel nature of homework assignments and completion. In this study with 1,501 students from 93 classes, we examined whether students’ perceptions of the quality and control of their homework differ across classes. Moreover, we analyzed whether such differences predict students’ homework motivation and effort.

Study 1: Domain Specificity of the Homework Model

In Study 1, we focused on three aspects of the homework model. First, we examined the domain specificity of the various elements of the homework model. To this end, we analyzed mean differences and patterns of correlations between corresponding constructs in the two subjects under scrutiny (mathematics and English). We expected to find rather moderate correlations between homework behavior, motivation, and students’ perceptions of the learning environment across different subjects. The domain specificity of students’ reports about their parents’ homework support and supervision was expected to be less pronounced.

Second, we examined the power of the various elements of the homework model to predict homework motivation and behavior across the two subjects under investigation. We expected to find support for the assumption that homework motivation has a direct, statistically significant, positive effect on homework effort (but not necessarily on homework time) and that effects of homework quality are at least partly mediated by homework motivation.1 We also examined whether the effects of the domain-specific predictor variables on homework effort vary across the two subjects.

Third, some emphasis is placed on the role of conscientiousness as a predictor of homework behavior. We hypothesized that conscientiousness would positively predict homework effort in both English and mathematics beyond what can be explained by motivational predictors. In other words, we assumed conscientiousness to have a direct effect on homework effort in addition to any indirect effects mediated by motivational predictor variables.

Method

Sample

Four hundred and fourteen eighth graders (58.5% female; age: M = 13.45 years, SD = 0.58 years) from 20 classes in eight Gymnasium (academic-track) schools in Berlin, Germany, took part in this study. The vast majority of students were Caucasian (＞95%). Almost one quarter of the students (24.6%) were from families with an immigration background.

1 In the empirical part of our study, we use the term effect to denote predictive effects, not causal effects, because the use of a single-administration survey cannot establish causality (see also the Discussion section).
(i.e., at least one parent was not born in Germany), but most students reported speaking German with at least one of their parents (93.5%), or with both parents (87.2%), most of the time. Reflecting the typical student composition of state Gymnasium schools, roughly half of the parents (52.7% of mothers and 54.3% of fathers) had qualified for college education (i.e., obtained the Abitur certificate), indicating that their educational level was relatively high.

Procedure

The study was conducted during the first semester of the 2003–2004 school year. Student participation was voluntary, and written consent was collected from all parents. The study, which lasted 45 min, was administered to intact classes selected by the respective head teachers on the basis of availability of testing time. Trained research assistants administered the materials during regular lesson time. In most classes, teachers were not present during the study. On the occasions where they were present, teachers were given written information about the study; they did not communicate with their students during the session and did not assist in the data collection. All materials were combined in one test booklet. Two versions of the booklet were used, with the homework assignment and parental support items presented in two different orders. Preliminary analyses showed no effect of this variation in item ordering.

Instruments

The instrument consisted of an assessment of basic cognitive abilities and a questionnaire section. Some questionnaire items were adapted from standard instruments (Cooper et al., 1998; Pintrich & De Groot, 1990). Strictly parallel wording was used for all domain-specific items; that is, the items for mathematics and English were exactly the same except for the word mathematics or the word English. A 4-point Likert-type scale ranging from 1 (completely disagree) to 4 (completely agree) was used for all multi-item constructs. All multi-item homework scales are reported in the Appendix.

Homework effort. Homework effort was measured in terms of three overlapping constructs: homework completion compliance, concentration, and percentage of tasks attempted. Homework compliance was measured with three items. Students high in homework compliance do their homework assignments carefully and do not copy from others. Internal consistency (Cronbach’s alpha) was adequate for mathematics (.78) and English (.71). Homework concentration was assessed with four items (α = .79/.73). A single-item indicator measured the percentage of homework tasks attempted per week: “On average, what percentage of your mathematics [English] homework do you seriously try to do?”

Homework time. Two questions pertained to the amount of time spent on homework. Homework time was measured with the following question: “On average, how many minutes do you spend on the mathematics [English] homework you are set?” A second question tapped voluntary additional learning time: “In a normal week, how many minutes do you work on mathematics [English] in your own time in addition to your homework?”

Homework motivation. Five items were used to assess the expectancy component (α = .85/75), and four items were used to assess the value component (α = .82/80), which focused on the facets of utility and cost.

Learning environment. Two scales were used to describe perceived teacher characteristics. Homework quality (α = .81/.79) refers to well prepared homework assignments; homework control (three items; α = .74/.85) describes the negative consequences of not doing homework.

Parental homework assistance. Two single-item indicators were used to tap parental homework behavior: homework assistance (“Per 10 homework assignments, how often do your parents help you with your mathematics [English] homework?”) and homework control (“Per 10 homework assignments, how often do your parents check that you’ve really done your mathematics [English] homework?”). A response scale ranging from 0 (never) to 10 (always) was provided.

Basic cognitive abilities. The Figure Analogies subscale from the Cognitive Abilities Test 4 + 12 + R (Heller & Perleth, 2000), a German version of Thorndike and Hagen’s (1993) Cognitive Abilities Test, was used to tap basic cognitive abilities. The test consists of 25 items in multiple-choice format. Students first have to determine the relationship between two figures and then identify which of five figures given as answer alternatives relates to a third figure in the same way as does the second figure to the first. The Figure Analogies subscale is considered to be a test of reasoning that is relatively free of environmental effects. For the subsequent analyses, five item parcels consisting of five items each were created to reduce the complexity of the model (i.e., five scores were used, each representing the average of five items). Parceling means that fewer model parameters are estimated; this in turn results in a better ratio of variables to sample size and more stable parameter estimates (Bandalos, 2002; Kishton & Widaman, 1994). Parcel 1 consisted of items 1, 6, 11, 16, and 21; Parcel 2 consisted of Items 2, 7, 12, 17, and 22; and so on. The internal consistency (Cronbach’s alpha) of the cognitive ability test was .90.

Conscientiousness. Conscientiousness was measured with the 12 conscientiousness items from the German version of the NEO Five Factor Inventory (Borkenau & Ostendorf, 1995; original version by Costa & McCrae, 1992). One item was discarded because of its low discrimination. For later analyses, four item parcels were created by using the strategy applied to the cognitive abilities test. Internal consistency (Cronbach’s alpha) was satisfactory (α = .84).

School grades. Grades awarded on the last report card (end of Grade 7) and the mean grades of last two class tests in mathematics and English were used as indicators of school achievement. The grades were coded such that high scores indicate desirable learning outcomes.

Statistical Analysis

In most studies conducted in school settings, individual student characteristics are confounded with classroom or school characteristics because individuals are not randomly assigned to groups. For instance, the homework effort of a specific student might be affected by individual-level variables, such as intelligence, and also by class-level variables, such as teacher expertise. The class-level variable introduces a clustering effect and, in turn, problems related to appropriate levels of analysis, aggregation bias, and heterogeneity of regression. When the hierarchical nature of a data set is not taken into account, the estimation of standard errors of means and beta coefficients is typically downwardly biased (Raudenbush & Bryk, 2002).

The homework model under examination postulates a multilevel structure of the homework process. For instance, it is assumed that variables at the class level (e.g., homework quality, teachers’ control of assignments) will affect the student level (e.g., homework motivation and behavior). Study 2 focuses on this hierarchical perspective. In Study 1, however, because of the relatively small size of our sample, we had to restrict the analyses to the student level.2 Given the complexity of the model, the Study 1 sample of 20 classes is not big enough for relationships at the class level to be examined.

Nevertheless, it is important to take the clustering effect into account in our analyses to prevent a biased estimation of standard errors of both means and regression coefficients. Hence, we controlled for cluster effects.

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2 Snijders and Bosker (1999) reasoned that “the sample size at the highest level is usually the most restrictive element in the design. For example, a two-level design with 10 groups, that is, a macrolevel sample size of 10, is at least as uncomfortable as a single-level design with a sample size of 10. Requirements on the sample size at the highest level, for a hierarchical linear model with q explanatory variables at this level, are at least as stringent as requirements on the sample size in single-level designs with q explanatory variables” (p. 140).
in all statistical analyses. In analyses based on covariances, the “type=complex” option in Mplus 3.1 was used to adjust the resulting standard errors for clustering effects (L. K. Muthén & Muthén, 1998–2004). When the complex option is used, estimates of standard errors and covariances are automatically corrected for clustering effects (see B. O. Muthén & Satorra, 1995). When comparing the means for English and mathematics constructs, we calculated the design effect (see Kish, 1987) for each construct by using Kish’s (1987) formula:

\[ n_{SRS} = \frac{n}{1 + \rho(b - 1)} \]

with \( n_{SRS} \) denoting the effective sample size (Simple Random Sample), \( n \) the real sample size, \( b \) the average class size, and \( \rho \) the intraclass correlation coefficient (ICC(1)) of a variable. The ICC(1) indicates the proportion of the total variance that is located between school classes; the higher the ICC(1), the more similar the homework ratings of the students in a class. The design effect is largely determined by the average ICC(1) for each construct and the average number of students within the classes (see Bliese, 2000; Snijders & Bosker, 1999). Design effects were smallest for parental homework behavior (design effect = 1.0; ICC(1) = 0.00) and largest for students’ perceptions of homework quality in their class (design effect of 5.84; ICC[1] = 0.25). The use of the effective sample size (instead of the uncorrected sample size) considerably reduced the sample size in the analyses reported and led to a more conservative test of the mean-level differences.

There were few missing values (<5% for all questionnaire items). Wherever possible, we dealt with these by using the missing values estimator implemented in Mplus 3.1. Mplus applies a model-based approach to missing data, which builds on a full information maximum likelihood estimation (see Allison, 2001, for more details on missing data). For descriptive (mean-level) analyses, single imputation was used (specifically, the expectation-maximization algorithm implemented in SPSS 12.0.1).

Results

Preliminary Analyses: The Homework–Achievement Relationship

Although of only tangential interest in the present context, we first examined the relationship between homework behavior and achievement as evidenced by school grades. Because school grades are typically assigned on a norm-referenced basis, Muhlenbruck et al. (1999) and Trautwein (2005) recommended the standardization of school grades and homework behavior within each class (\( M = 0, SD = 1 \); see also Marsh et al., 2005). Following this suggestion, we found homework effort to be positively related to current school grades and grades at the end of Grade 7, whereas homework time was unrelated or negatively related to achievement (see Table 1). To probe for effects on change in achievement, we conducted a series of regression analyses in which current grades were regressed on grades at the end of Grade 7, basic cognitive abilities, gender, and one of the homework indicators (a separate regression analysis was conducted for each homework indicator). The resulting standardized regression coefficient can be interpreted as the effect of the specific homework indicator on change in achievement after controlling for the effects of gender and basic cognitive abilities.

Homework effort was associated with a positive change in achievement in mathematics and—in terms of homework concentration—in English, whereas time spent on homework was negatively related to achievement gains in mathematics and English (see Table 1). Hence, in line with several recent findings (Muhlenbruck et al., 1999; Trautwein, 2005; Trautwein & Koller, 2003b), homework effort proved to be associated with higher achievement, but homework time did not.

Domain Specificity: Means and Intercorrelations

We next turn to the domain specificity of the homework variables. Means, standard deviations, and paired-samples \( t \) tests (contrasting mathematics and English) for all domain-specific homework constructs are reported in Table 2. There were six statistically significant differences between mathematics and English. With respect to homework behavior, students reported higher levels of concentration, and more time spent, on mathematics homework than on English homework. A disparate pattern of results emerged for homework motivation: Students were more confident of being able to do their English assignments but believed that mathematics homework was of more use. In addition, students reported more parental homework assistance and control for mathematics homework than for English homework.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Mathematics</th>
<th>English</th>
<th>Change in achievement*</th>
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<tbody>
<tr>
<td></td>
<td>End of Grade 7</td>
<td>Current grade</td>
<td>End of Grade 7</td>
</tr>
<tr>
<td>Compliance</td>
<td>.39***</td>
<td>.39***</td>
<td>.20***</td>
</tr>
<tr>
<td>Concentration</td>
<td>.29***</td>
<td>.33***</td>
<td>.26***</td>
</tr>
<tr>
<td>Percentage attempted</td>
<td>.34***</td>
<td>.35***</td>
<td>.15**</td>
</tr>
<tr>
<td>Time on homework</td>
<td>-.23***</td>
<td>-.30***</td>
<td>-.11*</td>
</tr>
<tr>
<td>Additional learning time</td>
<td>-.18***</td>
<td>-.09</td>
<td>-.15**</td>
</tr>
</tbody>
</table>

Note. \( N = 414 \). All variables were standardized within each class prior to data analysis.

* Regression of current grade on homework indicators (separately for each homework indicator), controlling for grades at the end of Grade 7, gender, and basic cognitive abilities; standardized regression coefficients.

* \( p < .05 \). ** \( p < .01 \). *** \( p < .001 \).
Intercorrelations between the corresponding constructs for mathematics and English are reported in the diagonal of Table 3. Note that correlations involving multi-item constructs are latent correlations. As recommended by Jöreskog (1979) and Marsh and Hau (1996), we included correlated uniquenesses between items with parallel wording. If correlated uniquenesses are not specified, the parallel wording of the items might lead to an inflated estimation of the correlation between the two latent factors.

With respect to homework behavior, there was a moderate relationship (.40 < r < .55) between mathematics and English variables. In other words, although students who invested a lot of effort and time in their mathematics homework tended to do the same for English, the relationship was by no means perfect. Homework motivation showed a high degree of domain specificity (r = .11 for expectancy, r = .22 for value), indicating that students’ expectancy and utility beliefs regarding the two subjects were only loosely connected. With respect to students’ reports of their parents’ homework behavior, an interesting difference was found between homework assistance and control. Whereas parental control was highly consistent (r = .84) across the two subjects, only a moderate correlation emerged for homework assistance. Also, the correlation for students’ reports of homework quality was low, and the correlation for student perceptions of teachers’ homework control was moderate. The small correlation of r = .11 for perceived homework quality was expected given that English and mathematics were taught by different teachers in all sampled classes. The moderate correlation (r = .45) for homework control, however, is somewhat surprising. It may reflect a general tendency of certain students to perceive teachers as more or less controlling.

Taken together, the analyses reported thus far clearly support the call for a domain-specific approach to be taken in homework research. The mean-level differences found between the corresponding constructs for English and mathematics are potentially of high theoretical interest (e.g., lower homework expectancy and higher homework value in mathematics than in English). Moreover, the intercorrelations found between most corresponding English and mathematics homework constructs were small to moderate, the only exception being reported parental homework control. This small-to-moderate relationship between English and mathematics constructs clearly indicates that, to better understand the homework process, it is vital to take account of the domain-specific nature of central homework variables.

Predicting Homework Behavior: The Issue of Domain Specificity

We next tested the power of our homework model to predict homework behavior. We expected homework motivation to play a crucial role in the homework process. Moreover, given that the present study focuses on the domain specificity of homework, we were interested in whether the regression coefficients of the predictor variables would be similar across mathematics and English. For both domains, structural equation models were specified in which homework behavior (compliance, concentration, percentage attempted, time on homework, time on additional learning activities) was regressed on homework motivation (expectancy and value components), homework quality, teacher control, conscientiousness, basic cognitive abilities, gender, and parental assistance and control. The expectancy and value components were specified as mediator variables; that is, they were regressed on all other predictor variables (except, of course, homework behavior). All multi-item constructs were modeled as latent variables. The fit of the full model was satisfactory for both mathematics, χ²(580, N = 414) = 837.62, Tucker–Lewis index (TLI) = .944, root-mean-square error of approximation (RMSEA) = .033, standardized root mean square residual (SRMR) = .042, and English, χ²(580, N = 414) = 1051.84, TLI = .900, RMSEA = .042, SRMR = .049. To examine the direct and indirect effects of the exogenous variables (homework quality, teacher control, conscientiousness, basic cog-
Table 3 reports the results (fully standardized regression coefficients and significance levels) of these analyses. The regression coefficients for the motivational mediator variables (homework expectancy and value) are shown in the left-hand part of the table; the regression coefficients for the five homework behavior variables are shown in the right-hand part of the table, separately for the complete models (labeled M2) and the models without homework motivation (labeled M1). We start by examining the effects of gender, basic cognitive abilities, and the domain-specific variables; the effects of conscientiousness are reported in the next section.

For mathematics, homework expectancy and homework value were positively predicted by perceived homework quality and parental homework control, with perceived homework quality showing the strongest correlations with both expectancy (.34) and value (.57). Further, homework expectancy (but not homework value) was positively predicted by basic cognitive abilities and male gender but negatively predicted by parental homework assistance. Thus, students with high scores on the basic abilities test and male students felt more efficacious about mathematics homework, whereas parental assistance was associated with less positive expectancy beliefs.

With respect to homework effort, homework expectancy (positive effect on compliance and concentration), homework value (positive effect on compliance and percentage attempted), and gender (negative effect of being male on compliance) were statistically significant predictors of homework effort. Time on homework was statistically significantly predicted by just two variables: perceived homework quality (positive effect) and homework expectancy (negative effect). The effect of perceived homework quality on homework effort (see M1) was fully mediated by the homework motivation variables (see M2). The amount of explained variance was considerable for homework compliance and concentration (.59 and .52, respectively), moderate for percentage attempted (.33), and rather small for time on homework and additional learning time (.17 and .07, respectively).

The pattern of results for English homework shows both similarities and contrasts with the results for mathematics. Perceived homework quality in English was closely associated with homework value (but not with homework expectancy). Parental homework assistance negatively predicted homework expectancy. No statistically significant effects on homework motivation were found for basic cognitive abilities, gender, or parental homework control. With respect to homework effort, expectancy had a positive effect on concentration, and value had a positive effect on percentage attempted; however, no statistically significant effect of homework motivation was found on compliance. Further, gender (with girls reporting higher compliance), teacher homework control, and parental homework assistance (positive effects on percentage attempted) were statistically significant predictor variables. The effects of homework quality were again fully mediated by homework motivation. Time on homework was predicted by parental assistance (positive effect) and expectancy (negative effect). Parental homework control (positive effect) and expectancy (negative effect) were statistically significantly associated with additional learning time. The amount of explained variance was highest for concentration (.59) and lowest for additional learning time (.11).

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Note. N = 414. Correlations involving multi-item constructs are latent correlations. The Mplus option ‘type = complex’ was used to correct for clustering effects; hence, the significance test for the reported correlations takes into account the hierarchical data structure. Correlations between corresponding constructs in mathematics and English are shown in boldface type in the diagonal.

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Note. N = 414. Correlations involving multi-item constructs are latent correlations. The Mplus option ‘type = complex’ was used to correct for clustering effects; hence, the significance test for the reported correlations takes into account the hierarchical data structure. Correlations between corresponding constructs in mathematics and English are shown in boldface type in the diagonal.
Taken together, in line with the homework model, homework motivation (expectancy and value components) was the most important domain-specific predictor of homework behavior; the effects of homework characteristics and parental behavior were partly mediated by these variables. Although the pattern of results for mathematics and English was similar, there were also some differences that will be considered in more detail in the General Discussion section.

Table 4
Predicting Homework Motivation and Homework Behavior in Mathematics and English as a Foreign Language: Results From Structural Equation Modeling Fully Standardized Regression Coefficients, Significance Level, and Variance Explained

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Expectancy</th>
<th>Value</th>
<th>Compliance</th>
<th>Concentration</th>
<th>Percentage attempted</th>
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<td>M2</td>
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<tr>
<td>by teacher</td>
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<td>M2</td>
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<td>Value</td>
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<td>R²</td>
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<td>.32</td>
<td>.59</td>
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| English             |            |       |            |               |                      |                  |                  |
| Homework quality    | .07        | .55***| .20*       | .07           | .14*                 | .08              | .21**            |
| Homework control    | - .07      | .06   | .09        | .08           | -.03                 | -.02             | .13*             |
| by teacher          |            |       | M1         | M2            |                      |                  |                  |
| Conscientiousness   | .47***     | .23** | .42***     | .33**         | .63***               | .45***           | .28***           |
| Basic cognitive      |            |       |            |               |                      |                  |                  |
| abilities           | .01        | - .05 | -.11       | -.09          | -.11                 | -.10             | .10              |
| Gender: Male        | .03        | - .04 | -.17**     | -.17**        | .01                  | -.01             | - .11            |
| Parental assistance | -.25**     | - .04 | -.07       | -.09          | -.09                 | -.01             | .06              |
| Parental control    | - .01      | .09   | -.01       | -.03          | .04                  | .03              | .03              |
| Expectancy          | .06        | .34***| .10        | - .34***      | - .13*               |                  |                  |
| Value               | .24        | .09   | .22*       | .09           | .05                  |                  |                  |
| R²                  | .32        | .48   | .35        | .38           | .50                  | .59              | .23              |

Note. N = 414. The Mplus option “type = complex” was used to correct for clustering effects; hence, the significance test for the reported regression coefficients takes into account the hierarchical data structure. M1 = models without homework motivation; M2 = complete models.

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

Taken together, in line with the homework model, homework motivation (expectancy and value components) was the most important domain-specific predictor of homework behavior; the effects of homework characteristics and parental behavior were partly mediated by these variables. Although the pattern of results for mathematics and English was similar, there were also some differences that will be considered in more detail in the General Discussion section.

Predicting Homework Behavior: The Role of Conscientiousness

The domain-specific variables in the homework model are complemented by conscientiousness as a global, domain-independent predictor of homework effort. It is assumed that conscientiousness has a positive direct effect on homework effort above and beyond its possible influence on homework motivation. The results shown in Table 4 clearly support this assumption.

In both mathematics and English, high homework expectancy and value were statistically significantly predicted by conscientiousness. Moreover, students with high conscientiousness scores reported high compliance, concentration, and percentage attempt. The regression coefficients for conscientiousness were of considerable size, particularly for English, ranging between β = .14 (p < .001) for percentage attempted in mathematics to β = .45 (p < .001) for concentration in English. Conscientiousness was also a statistically significant predictor of additional learning time in both mathematics and English. Students high in conscientiousness dedicated more free time to learning than did their peers with lower conscientiousness scores. No direct, statistically significant effect of conscientiousness was found on homework time. When the homework motivation variables were included, the direct effects of conscientiousness decreased but remained substantial.

Summary of Study 1 Results

We found support for several basic assumptions of the homework model. First, as documented by mean-level differences and the generally low-to-moderate intercorrelations between the corresponding homework constructs for mathematics and English as a foreign language, there was considerable intrasubject variability in the perception of homework, homework motivation, homework behavior and, to a lesser degree, perceived parental homework behavior in the two subjects. Second, the results of structural equation models confirm the importance of the expectancy and value components as predictor variables and reveal some domain-specific patterns in the prediction of mathematics and English homework motivation and behavior. Third, we found effects of conscientiousness on homework behavior that were largely consistent across mathematics and English.
Study 1 was well suited to test the domain specificity of the homework model. Because of the rather restricted sample size at the class level, however, we were unable to test assumptions about the multilevel nature of homework. Thus, we controlled for the hierarchical structure of the data set but did not model the student level and class level simultaneously. Because we believe the multilevel character of homework (see Trautwein & Köl ler, 2003a) to be of high theoretical, empirical, and educational importance, we now present results from a second study focusing on the multilevel nature of homework assignments and completion. Another difference between Study 1 and Study 2 is the operationalization of parental homework support. In Study 1, the quantity of assistance and control were used as indicators for parental homework behavior. On the basis of self-determination theory, however, one might argue that it is less the quantity than the quality of parental homework assistance that matters. Thus, in Study 2, we used indicators of the quality of parental homework assistance.

Study 2: The Multilevel Nature of Homework

How strongly does the quality of homework differ across classes? Which features of homework are associated with greater student effort? Large-scale, multilevel studies with an explicit focus on homework are needed to address such questions. In Study 2, we present the results of a study with 1,501 eighth graders from 93 classes learning French as a foreign language.

The main goal of Study 2 was to simultaneously test for class-level and student-level effects of homework characteristics on homework motivation and behavior. To our knowledge, it is the first study to systematically examine the multilevel effects of homework assignments on homework motivation and behavior. On the basis of the homework model and the results of Study 1, we expected homework quality to have a positive effect on homework motivation and homework effort at both the student level and the class level. Moreover, we expected homework motivation to have a statistically significant, direct effect on homework effort and to mediate the effects of homework quality. We again assumed conscientiousness to have statistically significant, direct and indirect effects on homework effort. Finally, we used parental provision of help and unwanted parental help as two indicators of the quality of parental homework assistance. Parents who offer help when help is needed express interest, warmth, and affiliation; such behavior should have positive effects on homework motivation and behavior. In contrast, unwanted parental help undermines students’ need for autonomy. Moreover, it may imply that parents do not feel confident in their children’s ability to cope with their homework alone, which in turn may affect the students’ competence beliefs. Hence, whereas nonintrusive offers of help are expected to be associated with more positive homework motivation and behavior, unwanted parental help is likely to interfere with students’ need for competence and autonomy.

Method

Sample

One thousand five hundred and one eighth graders (51.8% female; age: $M = 14.7$ years, $SD = 0.49$ years) from 93 classes (27 schools) in three Swiss cantons participated in Study 2, which is part of a larger study conducted as a collaborative project by researchers at the Max Planck Institute for Human Development in Berlin, Germany, the University of Applied Sciences, Fribourg, Switzerland, and the University of Fribourg, Switzerland. Of the participating students, 92.6% were born in Switzerland, and 92.1% reported speaking German with their parents. The largest group of immigrant students was from the former Yugoslavia (2.9% of students). The student sample is largely representative of the three cantons; thus, the educational and socioeconomic background of the students reflects the average family background in the respective cantons.

Procedure

The study was conducted during regular lesson time in intact classes during the 2003–2004 school year. The test of basic cognitive abilities was administered in August/September 2003, and the questionnaire was administered in May/June 2004. All participating students were taking compulsory lessons in French as a foreign language. The instruments were administered by their regular French teacher, who was given detailed written instructions on data collection. Immediately after testing (which lasted 45 min), all materials were mailed to the researchers.

Instruments

A 4-point Likert-type scale ranging from 1 (completely disagree) to 4 (completely agree) was used for all multi-item constructs.

Homework effort. Homework effort was measured with a five-item scale; three of the items were also used in Study 1 (see Appendix). Internal consistency (Cronbach’s alpha) was .79.

Homework motivation. Ten items (5 of which were also administered in Study 1) were used to assess the expectancy component ($\alpha = .85$). The value component comprised six items (reverse scored; $\alpha = .82$), four of which were used in Study 1.

Learning environment. Two scales were used to describe perceived teacher characteristics. Homework quality ($\alpha = .73$) describes cognitively activating, well prepared, and well supervised homework assignments. Homework control (five items; $\alpha = .79$) describes the negative consequences of not doing homework. Three of these items were also administered in Study 1.

Parental homework behavior. In contrast to Study 1, Study 2 focused on the quality of parental homework behavior rather than its quantity. The parental provision of help scale (three items; $\alpha = .81$) indicates whether parents are available to help their children with homework if asked to do so, whereas the five-item unwanted parental help scale ($\alpha = .80$) describes intrusive parental homework behavior. The construction of these two scales was informed by self-determination theory (Deci & Ryan, 2002; Grolnick, 2003).

Basic cognitive abilities. The verbal subscales of the Cognitive Abilities Test 4 – 12 + R (Heller & Perleth, 2000) were used to tap basic cognitive abilities. Ninety-five verbal items in multiple-choice format (finding analogies, similarities, opposites, and missing words in a sentence) were administered. Internal consistency (Cronbach’s alpha) was .89.

Conscientiousness. Conscientiousness was again measured with the 12 conscientiousness items from the German version of the NEO personality inventory (Borkenau & Ostendorf, 1993; original version by Costa & McCrae, 1992). Internal consistency (Cronbach’s alpha) was satisfactory ($\alpha = .78$).

Statistical Analyses

According to the homework model, homework characteristics, such as perceived homework quality and homework control, can be considered at both the student level (e.g., those students in a class who perceive homework assignments to be of high quality should put more effort into completing them than their peers) and the class level (e.g., classes in which most students think highly of their homework assignments should be characterized by a high mean level of effort on homework). The juxtaposition of the effects of homework characteristics at the student and class
levels is inherently a multilevel issue that cannot be represented properly at either the individual level or the classroom level.

We therefore performed multilevel regression analyses to predict homework motivation and homework effort. Multilevel modeling, a special form of regression analysis that was used in the present study, provides a powerful methodology for handling hierarchical data. Multilevel analyses were computed with the HLM 6 (Raudenbush, Bryk, Cheong, & Congdon, 2004) computer program.

The HLM 6 output does not report standardized regression coefficients. To enhance the interpretability of the resulting regression coefficients, we standardized (\(M = 0, SD = 1\)) all continuous variables before performing the multilevel analyses. Dichotomous variables were retained in their original metric. The two learning environment variables (homework quality and homework control) were aggregated at the classroom level to form an index of students’ shared assessment of their teachers’ homework practices (and were not restandardized). In educational psychology, aggregation of Level 1 variables to form an indicator of the classroom environment is a standard procedure used to obtain general information about the learning environment (e.g., Lüdtke, Köller, Marsh, & Trautwein, 2005; Ryan, Gheen, & Midgley, 1998). Given sufficient homogeneity among the students’ ratings, aggregation yields a reliable estimation of class-level variables (Bliedeker, 2000). By including both the individual perception and the aggregated perception of the classroom environment, researchers are able to separate two different aspects of the learning environment. At the individual level, student ratings represent the individual student’s perception of the learning environment. Scores aggregated to the classroom level reflect perceptions of the shared learning environment (corrected for individual idiosyncrasies).

All models reported are random-intercept models. Hence, the random part of the intercept was freely estimated to reflect between-classroom differences in homework behavior. Because we had no a priori hypotheses concerning between-classroom differences in the predictive power of the predictor variables, we did not estimate the random parts of the slopes. Restricted maximum likelihood estimation was used in all models, and all predictor variables were introduced as uncentered variables.

There were very few missing values (<3% for all instruments used). Single imputation was applied (specifically, the expectation-maximization algorithm implemented in SPSS 12.0.1) to estimate these missing values.

**Results**

In preliminary analyses, we calculated the ICC(1) and ICC(2) (see Bliedeker, 2000; Snijders & Bosker, 1999) of the homework variables. The ICC(1) was .18 for homework quality and .29 for homework control, indicating that there were considerable between-class differences in how homework assignments were perceived. The ICC(2) is used to evaluate the reliability of the aggregated student ratings at the class level. Whereas the ICC(1) indicates the reliability of an individual student’s rating, the ICC(2) provides an estimate of the reliability of the class-mean rating. In the present study, the ICC(2) was .77 for homework quality and .87 for homework control, indicating that the class-level assessment of homework characteristics was reliable.

Intercorrelations of the variables included in Study 2 are reported in Table 5. A series of four multilevel models was run (see Table 6). In the first model, homework expectancy was the dependent variable. Class-average perception of homework characteristics (homework quality and homework control) and stable person characteristics (conscientiousness, basic cognitive abilities, and gender) and variables describing the quality of parental help (unwanted help, provision of help) were used as predictor variables.

As documented in Table 6, homework characteristics had a statistically significant effect on whether students expected to be able to solve the assigned tasks at both the class level and the student level. A positive effect of homework quality was found at both levels. Classes in which the average student perception of homework quality was high reported a higher overall level of homework expectancy. Within the classes, moreover, students with higher scores on homework quality reported higher homework expectancy beliefs. Both effects are in line with our hypotheses.

For homework control, the results at the student level and the class level varied considerably. There was a negative effect at the class level, indicating that students in classes where the teacher was perceived as controlling reported low expectancy beliefs. However, when the class-average effect was controlled, individual students who had a stronger perception of teacher control than did their peers reported higher homework expectancy beliefs.

Conscientiousness and basic cognitive abilities also had statistically significant effects on homework expectancy. As expected, conscientious students and those with high basic cognitive abilities reported higher homework expectancy beliefs. The indicators of the quality of parental homework assistance had the assumed effects. Whereas parental provision of help was positively associated with homework expectancy beliefs, unwanted help had a negative effect.

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Intercorrelations of Study 2 Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>1</td>
</tr>
<tr>
<td>1. Gender: Male</td>
<td></td>
</tr>
<tr>
<td>2. Cognitive abilities</td>
<td>.00</td>
</tr>
<tr>
<td>3. Conscientiousness</td>
<td>.12***</td>
</tr>
<tr>
<td>4. Homework quality (student)</td>
<td>-.07**</td>
</tr>
<tr>
<td>5. Homework quality (class)</td>
<td>-.01</td>
</tr>
<tr>
<td>6. Homework control (student)</td>
<td>.00</td>
</tr>
<tr>
<td>7. Homework control (class)</td>
<td>.03</td>
</tr>
<tr>
<td>8. Parental provision of help</td>
<td>.01</td>
</tr>
<tr>
<td>9. Parental unwanted help</td>
<td>.19***</td>
</tr>
<tr>
<td>10. Expectancy</td>
<td>-.11***</td>
</tr>
<tr>
<td>11. Value</td>
<td>-.12***</td>
</tr>
<tr>
<td>12. Homework effort</td>
<td>-.11***</td>
</tr>
</tbody>
</table>

Note. N = 1,501.

* p < .05.  ** p < .01.  *** p < .001.
In the next model, homework value was substituted as the dependent variable, with four variables proving to have a statistically significant effect. In line with our hypotheses, there was a statistically significant positive association between homework quality and homework value at both the class level and the student level. Moreover, conscientiousness had a positive effect. Males reported statistically significantly lower homework value scores.

We next turn to the prediction of homework effort. We first specified a model without the motivational mediator variables. In this model, homework quality again had the expected positive effect at both the student level and the class level. Perceived homework control was positively associated with homework effort at the student level, but the negative regression coefficient at the class level was not statistically significant. Conscientiousness strongly predicted homework effort, as did parental provision of help. The negative effect of unwanted help did not reach the significance level.

Finally, we specified the full model by adding homework expectancy and homework value as motivational mediator variables. As expected, both variables statistically significantly predicted homework effort. Moreover, the effects of homework quality and conscientiousness were partly mediated by the motivational mediator variables. Whereas the class-level effect of homework quality was no longer statistically significant when homework expectancy and value were included, the effect at the student level decreased (from \( b = .19 \) to \( b = .11 \)) but remained statistically significant. The regression weight of conscientiousness decreased from \( .28, \) the change in the regression coefficient found for parental provision of help was rather small (from \( b = .09 \) to \( b = .07 \)).

**Summary of Study 2 Results**

Study 2 simultaneously examined class-level effects and student-level effects of homework characteristics on homework motivation and behavior. In accordance with the homework model, we found homework quality to have a positive effect on homework motivation and homework effort on both the student level and the class level. A perception of high teacher control proved to be a statistically significantly predictor of homework effort at the student level only. However, the utility of applying the multilevel perspective to homework control is demonstrated by the differential effect of homework control on homework expectancy at the student and class levels. Taken together, the results substantiate the multilevel nature of homework as postulated in the homework model. Moreover, as expected, homework motivation proved to partially mediate the effects of homework quality and conscientiousness. Finally, results for the parental homework variables support the view that, to be effective, parental homework behavior has to be nonintrusive (providing help when asked rather than imposing it).

**General Discussion**

The present studies were designed to explore homework effects with a domain-specific, multilevel homework model that takes into account the three major protagonists in the homework process.

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Table 6

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Homework motivation</th>
<th>Homework effort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Expectancy</td>
<td>Value</td>
</tr>
<tr>
<td>Class level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework quality</td>
<td>.28**(p &lt; .001)</td>
<td>.44**(p &lt; .001)</td>
</tr>
<tr>
<td>Homework control by teacher</td>
<td>-.19**(p &lt; .001)</td>
<td>-.03</td>
</tr>
<tr>
<td>Student level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.27**(p &lt; .001)</td>
<td>.20**(p &lt; .001)</td>
</tr>
<tr>
<td>Basic cognitive abilities</td>
<td>.09**(p &lt; .001)</td>
<td>-.02</td>
</tr>
<tr>
<td>Gender: Male</td>
<td>-.09</td>
<td>-.14**</td>
</tr>
<tr>
<td>Homework quality</td>
<td>.09**(p &lt; .001)</td>
<td>.33***</td>
</tr>
<tr>
<td>Homework control by teacher</td>
<td>.07**</td>
<td>.03</td>
</tr>
<tr>
<td>Parental provision of help</td>
<td>.11***</td>
<td>.03</td>
</tr>
<tr>
<td>Unwanted parental help</td>
<td>-.15***</td>
<td>.02</td>
</tr>
<tr>
<td>Expectancy</td>
<td>-.11***</td>
<td>.02</td>
</tr>
<tr>
<td>Value</td>
<td>.22***</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. \( N = 1,501 \) from 93 classes. \( b \) = unstandardized regression coefficient. \( SE \) = standard error of \( b. \)

* \( p < .05 \). ** \( p < .01 \). *** \( p < .001 \).
Expectancy-value theory was originally developed and applied to predict academic choices in difficult school subjects and subsequently expanded to predict academic choices and achievement in a variety of educational fields (for reviews, see Eccles & Wigfield, 2002; Wigfield & Eccles, 2002). The present study indicates that central ideas of expectancy-value theory also hold for homework effort. However, the differences we found between mathematics and English indicate that it might prove fruitful to analyze in detail the opportunity structures and challenges associated with homework in different school subjects. What are the reasons for mean expectancy being lower in mathematics than in English? Why do students attach higher value to mathematics homework than to English homework?

Despite calling for a domain-specific approach to homework research, we include the stable personality trait of conscientiousness (Costa & McCrae, 1992) as an additional predictor in our homework model. In our view, domain specificity and cross-domain consistency are not contradictory; they are complementary. If homework behavior was determined exclusively by expectancy and value components, it would be highly domain specific. We found a moderate level of consistency across mathematics and English, however, and the introduction of a more general personality trait such as conscientiousness might help to explain this moderate (but by no means perfect) relationship. Empirically, conscientiousness consistently predicted homework motivation and behavior in both studies. Moreover, unlike all other predictor variables in Study 1, it had a positive predictive effect on both homework effort and additional learning time. It is also interesting to compare the effects of conscientiousness and basic cognitive abilities. The effects of basic cognitive abilities on achievement are well established, but their predictive effects on homework motivation and behavior proved to be negligible compared with those of conscientiousness.

Despite the evident predictive power of conscientiousness, educational psychologists have devoted very little attention to this variable in past years (for exceptions, see De Raad & Schouwenburg, 1996; Lüdtke et al., 2004). One reason for this may be the popular conception of personality as being stable (Costa & McCrae, 1992) and essentially immune to pedagogical influences. During childhood and adolescence, however, personality traits are still developing and are open to environmental impact (Roberts & Pomerantz, 2004). As such, the instructional environment that students encounter daily may not be irrelevant to their personality development. In this respect, homework assignments and the manner in which students deal with these assignments might also impact personality development. Indeed, proponents of homework assignments have always emphasized that homework not only helps students to acquire knowledge but also shapes their learning styles, self-regulation, and personality (see Cooper, 1989; Warton, 1997). It is therefore important to include conscientiousness in any comprehensive homework model, to test its predictive power, and
in the long run, to examine whether change in conscientiousness is also influenced by homework variables.

The Multilevel Nature of Homework

An in-depth analysis of class-level homework effects calls for a multilevel perspective, both conceptually and methodologically (Trautwein & Köller, 2003a). Class-level homework effects on achievement have been investigated by de Jong et al. (2000) and Trautwein (2005; Trautwein et al., 2002). To our knowledge, however, the present investigation is the first to systematically examine the effects of certain characteristics of homework assignments on students’ homework motivation and behavior. There are two main results. First, homework quality varies across classrooms, at least when operationalized in terms of students’ perceptions. Second, homework quality and control predict students’ homework motivation and behavior. Taken together, the findings reported here support the multilevel nature of the homework model.

The utility of the multilevel perspective was perhaps most clearly visible where the effects of teacher homework control on homework effort were concerned. A statistically nonsignificant negative effect emerged at the class level, indicating that high homework control does not predict higher overall class effort on homework. At the student level, however, teacher homework control had a statistically significant, positive effect on homework effort; in other words, those students in a class who perceived a higher degree of homework control than did their classmates reported putting more effort into their homework. This differential effect at the student level and class level might be responsible for the nonsignificant effect of homework control in Study 1, in which the small sample size at the class level prohibited the use of multilevel modeling.

Limitations and Future Research

The present research provides initial support for our multilevel, domain-specific homework framework, but it remains a preliminary, rather than a comprehensive, test of this model. First, although our operationalization of the model covered numerous variables, other potentially relevant variables had to be omitted. With respect to the value component, for example, we concentrated on the facets of utility and, to a lesser extent, cost. Although this approach is theoretically (Warton, 2001) and empirically (Trautwein & Köller, 2003b) justified, broader approaches are also possible. Likewise, our measure of teachers’ homework control emphasized teachers’ negative emotional and behavioral responses to the noncompletion of homework. This is only one aspect of homework control, however. Measures that tap whether teachers tend to be aware of who has or has not completed homework assignments or that assess their homework collection and grading practices might produce somewhat different results.

Second, we were not able to satisfactorily address the issue of causation. Our homework model implies causation; for instance, we assume that the way teachers assign and deal with homework affects students’ homework motivation and behavior. However, the present research should be regarded only as a first step in the validation of these assumptions. Our study suffers from a limitation facing practically all nonexperimental research: the possibility of third-variable explanations. Other predictor variables might have had an effect on homework effort had we included them. Unfortunately, there is no ideal solution to this third-variable problem in the present research (or indeed in nonexperimental studies in general).

The cautionary note regarding causation also applies to our assumptions of mediation. Care must be taken in making causal assumptions about mediational effects based on correlational data need (e.g., Baron & Kenny, 1986). Although longitudinal correlational data may address some of the problems inherent in correlational studies (Cole & Maxwell, 2003), there is no ultimate solution to the issue of causality in nonexperimental research (Winship & Sobel, 2004). Nevertheless, correlational designs are one of the essential methodological approaches in psychology. In fact, mediational analyses are very common in this research tradition, and the majority of these mediational analyses are based on single-administration designs. The most critical aspect of any mediational analysis (based on single-administration or longitudinal data) is the availability of a strong theoretical model (see Baron & Kenny, 1986). We believe that our theoretical model permits mediational hypotheses to be specified (see the theory section). Nevertheless, mediational effects should always be interpreted with caution.

This applies particularly to situations that involve the possibility of transactional influences (Sameroff & MacKenzie, 2003). Our homework model postulates feedback loops. For instance, homework motivation might have positive effects not only on homework effort but also on some of the predictor variables. Hence, the predictive effects on homework motivation we reported for some of the predictor variables might in fact partly reflect effects of homework motivation on this variable. This is most evident with respect to parental behavior. For example, we found that frequency of parental assistance and a high level of unwanted parental help predicted low expectancy beliefs in both mathematics and English. With the present data, however, the causal direction of this effect cannot be determined. Although negative effects of intrusive parental help have been documented in several studies (Deci &Ryan, 2002; Grolnick, 2003; Pomerantz et al., 2005), there is also evidence for the reverse causal direction, indicating that parents respond to low student performance by offering more help with homework (see Grolnick, 2003; Helmke, Schrader, & Hosenfeld, 2004; Pomerantz & Eaton, 2001). Longitudinal or experimental analyses are needed to disentangle transactional effects and to gauge their relative strength, thereby complementing single-administration panel studies.

The third major limitation is that we studied only one age group (eighth graders). As described by Muhlenbruck et al. (1999), age effects are quite likely in homework research. For instance, teachers might assign different homework for different reasons in lower and upper grades, and the relationship between homework completion and achievement might be stronger in upper grades (Cooper, 1989; Muhlenbruck et al., 1999). It can also be speculated that conscientiousness has a less pronounced effect in lower grades.

Educational Implications

For students, teachers, and parents, homework all too often represents one of the most negative and disappointing aspects of school life (Cooper, 2001; Larson & Richards, 1991). Homework takes time to complete and is not always fun to do, it leads to arguments in many families, and it costs teachers time to prepare.
and review in class. Homework thus deserves the attention of both researchers and educators.

Faced with incomplete homework assignments, teachers might be tempted to increase their level of homework control, and parents might increase the frequency of homework assistance and control. Hence, both teachers and parents might be inclined to target students’ homework behavior. As our results indicate, however, this may not be the single best approach. Indeed, homework control by teachers was only weakly related to homework effort. It had no effect on homework effort and a negative effect on homework expectancy at the class level. Likewise, a “more-is-better” view is not necessarily the best approach to parental involvement in the homework process. Many teachers encourage parents to become involved in their children’s homework. However, parental homework assistance does not automatically result in the desired outcomes. In fact, we found that the frequency of parental homework control was only loosely related to homework effort; moreover, students who perceived parental help with homework to be intrusive reported lower homework expectancy beliefs (see also Grolnick, 2003; Pomerantz et al., 2005).

On the basis of expectancy-value theory and our results, we emphasize that both teachers and parents should be aware of the consequences of their behavior on student motivation in the short and the long run. The role of the expectancy and value components as motivational predictors of homework effort, especially in difficult school subjects such as mathematics, should be taken into account in attempts to enhance homework effort. As our results show, strict homework control by teachers (class level) and the overinvolvement of parents can have negative consequences on homework motivation.

What can be done to counter such negative effects? As our results indicate, high-quality homework assignments have a positive overall effect on students’ homework motivation and effort. High-quality homework was measured in terms of well prepared, cognitively engaging tasks of varying difficulty and careful class discussion of homework assignments. We further suspect that individualized homework can help students to develop higher homework expectancy and value beliefs, particularly when they have recently experienced academic failure. Finally, systematic approaches to improving students’ effort on homework may imply the use of standardized programs. Classroom-based training programs have been developed recently by Zimmerman et al. (1996) and Perels, Gürtler, and Schmitz (2005). These programs are compatible with our homework model in that they focus on enhancing students’ homework motivation and self-regulation instead of raising the level of parental engagement or parental or teacher control.

We hope that the proposed domain-specific, multilevel homework model, with its emphasis on motivational mediators, will prompt further research and help researchers, educators, and parents to better understand the positive outcomes and negative side effects of homework assignments and homework completion.

References
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stätzung und Schulleistungen ihrer Kinder [Parental support and students’ school achievement]. Bildung und Erziehung, 57, 251–277.


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**Appendix**

**Items From the Multi-Item Homework Scales**

**Homework completion compliance/homework effort**
- I've recently been doing my [subject] homework to the best of my ability. (S1, S2)
- I do my best on my French homework. (S2)
- I always try to finish my French homework. (S2)

**Homework concentration**
- I often get distracted when doing my [subject] homework. (R, S1)
- It often takes me longer than necessary to do my [subject] homework because my mind’s not on it. (R, S1)
- I do my [subject] homework in one go without interruptions. (S1)
- I concentrate hard when I do my [subject] homework. (S1)

**Expectancy beliefs**
- If I make an effort, I can do all my [subject] homework. (S1, S2)
- I often feel completely lost in my [subject] homework. (R, S1, S2)
- When I’m trying to do my [subject] homework, I often think I’ll never understand it. (R, S1, S2)
- Whether or not I do my French homework, I don’t understand a thing in the lesson anyway. (R, S2)
- I concentrate hard when I do my [subject] homework. (S1)
- I always do my French homework. (S2)
- I always try to finish my French homework. (S2)
- I always do my French homework. (S2)
- I often feel completely lost in my [subject] homework. (S1, S2)
- When I’m trying to do my [subject] homework, I often think I’ll never understand it. (R, S1, S2)
- Whether or not I do my French homework, I don’t understand a thing in the lesson anyway. (R, S2)
- I concentrate hard when I do my [subject] homework. (S1)
- I always do my French homework. (S2)
- I always try to finish my French homework. (S2)

**Value beliefs**
- Our [subject] homework takes a lot of time and is of little use to me. (R, S1, S2)
- I always do my French homework. (S2)
- I don’t learn much from our [subject] homework. (R, S1, S2)
- There is no point in my doing [subject] homework. (R, S1, S2)
- [Subject] homework helps me understand the material covered in the lesson better. (S1, S2)
- I always do my French homework. (S2)
- It makes barely any difference to me whether I do my French homework or not. (R, S2)

**Homework quality**
- Our [subject] teacher knows what homework to give us so that we understand the material covered in the lesson. (S1)
- Our [subject] teacher almost always chooses homework assignments really well. (S1)
- Our [subject] teacher often sets homework without really putting much thought into it. (R, S1)
- I sometimes have the feeling that our [subject] teacher only sets homework because it’s expected of him/her. (R, S1)
- Everyone can learn from our discussions of the homework in French, no matter how good they are. (S2)
- In French, our discussions of the homework often help us to really understand the assignments. (S2)
- There is a lot of drilling and repetition in French homework. (S2)
- French homework really makes us think. (S2)
- Our French teacher varies the difficulty of homework assignments. (S2)
- It is important to do our French homework because we often refer back to it in class. (S2)

**Homework control**
- If we haven’t done our [subject] homework, we get into trouble with our teacher. (S1, S2)
- Our [subject] teacher gets really angry if we haven’t done our homework. (S1, S2)
- If someone hasn’t done their [subject] homework, there will be negative repercussions. (S1, S2)
- Our French teacher insists that we do our homework properly. (S2)
- Our French teacher checks to make sure that we’ve all done the homework. (S2)

**Parental provision of help**
- My parents help me with French if I ask them. (S2)
- My parents always help me if I get stuck with my French homework. (S2)
- I can always ask my parents if I don’t understand something in French. (S2)

(Appendix continues)
Appendix (continued)

Items From the Multi-Item Homework Scales

Unwanted parental help
My parents sometimes help me with French even when I don’t need any help at all. (S2)
My parents often interfere when I’m doing my French homework. (S2)
My parents often ask me if I need help with French. (S2)
My parents often offer to do French with me. (S2)
My parents regularly help me learn French vocabulary. (S2)

Note.  R = item was reverse scored; S1 = used in Study 1; S2 = used in Study 2.