Open access • Journal Article • DOI:10.1037/0022-0663.98.2.438

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Published on: 01 May 2006 - Journal of Educational Psychology (American Psychological Association)

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Support for a Domain-Specific, Multilevel Homework Model

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Journal of Educational Psychology, *98*(2), Study 2, 448 – 456.

Anmerkung

„Study 2“ beschreibt Effekte der Fribourger Teilstudie (vgl. Resultate in Tab. 5)

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Abstract

To date, homework research has been only loosely tied to theories of educational psychology and has relied mainly on time-on-task measures. The two studies (414 and 1,501 eighth graders) presented in this paper provide support for a domain-specific, multilevel model that includes an expanded effort measure, motivational predictors (expectancy and value components), learning environment variables, parental behavior variables, and stable personal characteristics such as cognitive ability and conscientiousness. Homework effort was found to be positively related to achievement. Only moderate intercorrelations were observed between the corresponding constructs of homework motivation and behavior in math and English as a foreign language. Conscientiousness and homework motivation (expectancy and value components) proved to be the strongest predictors of homework effort in math, English, and French. Perceived homework quality varied considerably between classes and impacted on homework motivation and behavior.

Key words: Homework, Achievement, Motivation, Conscientiousness, Domain-Specificity, Multilevel Modeling

Predicting Homework Effort:

Support for a Domain-Specific, Multilevel Homework Model

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 (e.g., Cooper, 1989; Keith, 1986; Paschal, Weinstein, & Walberg, 1984), but it also has its downsides (e.g., Cooper, 2001). Most importantly, 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 (e.g., Cooper, 2001; Grolnick, 2003; Hoover-Dempsey et al., 2001; Warton, 2001).

This article sheds light on students' reasons for doing or not doing homework—an everyday problem of prime educational importance. Somewhat surprisingly, 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 propose and test a psychological model that is tailored to the homework process. The model combines elements of expectancy-value theory (e.g., Eccles, 1983; Eccles & Wigfield, 2002), research on learning and instruction (e.g., Boekaerts, 1999; Brophy & Good, 1986; Weinert & Helmke, 1995), and self-determination theory (e.g., Deci & Ryan, 2002; Grolnick & Slowiaczek, 1994). Furthermore, 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. Somewhat paradoxically, we will argue that homework research has neglected the domain-specificity of homework *and* ignored stable personality traits that enhance transsituational stability in homework behavior. In Study 1, based on the responses of 414 eighth graders to several

homework scales pertaining to math and English as a foreign language, we will juxtapose time on homework vs. 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. Using data from 1,501 eighth graders in 93 classes, we will show that perceived homework quality varies considerably between school classes and impacts significantly on homework motivation and effort.

The Relationship Between Homework and Achievement

Several reviews on the relationship between homework and achievement suggest that homework is associated with achievement gains (e.g., 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 non-experimental 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. One, a homework effect *at the class level* (or *homework assignment effect*) is found when students in classes with a higher quantity or quality of homework have more pronounced achievement gains than students in other classes (e.g., Trautwein, Köller, Schmitz, & Baumert, 2002). The other, a homework effect *at the student level* (or *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 (e.g., Cooper, Lindsay, Nye, & Greathouse, 1998). In this sense, homework is a classic example of the multilevel problem (e.g., Kreft & de Leuuw, 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. However, this perspective disregards the fact that Carroll's model predicts learning outcomes based on 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. Yet all sorts of distractions can have detrimental effects on students' homework behavior. If a student reports spending a lot of time on his or her homework, this is not necessarily a sign of great conscientiousness, but may reflect problems of motivation or concentration (see Trautwein & Köller, 2003a, for a critical account of the time on task variable).

Several recent studies that have separated the effects of homework assignment and homework completion (e.g., De Jong, Westerhof, & Creemers, 2000; Muhlenbruck, Cooper, Nye, & Lindsay, 2000; Trautwein, 2005; Trautwein & Köller, 2003b; Trautwein et al., 2002) indicate that students who spend more time on homework do not outperform their peers – in fact, some studies have shown these students to lag behind their peers in terms of achievement and achievement gains. Using a sample of 24,273 ninth graders who participated in the German extension to the *Programme for International Student Assessment* (OECD, 2001), for instance, Trautwein (2005) found a small positive effect of homework assignments on math 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 their classmates had lower math 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 only describes one aspect of homework behavior. The *effort* a student invests in homework is not necessarily related to homework time and might well have a positive impact on achievement gains. Indeed, in a longitudinal analysis, Trautwein (2005) found time spent on homework to be unrelated or even negatively related to achievement, whereas effort put into homework was consistently positively related to achievement and achievement gains (see also Schmitz & Skinner, 1993). Similarly, 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. Accordingly, 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, p. 87) noted that "homework probably involves the complex interaction of more influences than any other instructional device." Hence, a homework model will necessarily be complex. At same time, to be of theoretical and practical utility, it must be parsimonious. The homework model 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. Those elements of the model that are tested in the present research are printed in italics.

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 & Helmke, 1995) 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 (e.g., 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 groups are not independent of one another, they will likely be differentially related to achievement. We expect homework effort to be positively related to achievement, whereas—given the theoretical and methodological problems with the time-on-task variable—no such prediction is made for time spent on homework (for more detail, see Trautwein, 2005; Trautwein & Köller, 2003b). We expect a mixed pattern of results for learning strategies, owing to the difficulty in collecting data on learning strategies and the diversity of these strategies (e.g., 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 execute goal-oriented behavior successfully (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*)? Or 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, Kastens, & Lüdtke, 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 set (e.g., because they consider the exercises too easy or irrelevant). Similarly, it is possible that some students have a high mathematical self-concept, but are nevertheless unable to solve the mathematics problems they are set as homework.

We expect homework motivation to be positively associated with homework effort. In the light of the theoretical and methodological problems with the time-on-task variable described above, however, we do 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. Based on earlier research (Cooper, 1989), we expect 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, this personality trait has attracted little attention in previous research on education (De Raad & Schouwenburg, 1996) and—more specifically—homework research, despite its apparent relevance. Conscientious persons are characterized as being industrious, systematic, and hard-working, 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, in press). Accordingly, we expect 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 to be critical components (see Figure 1). Several teacher-related aspects such as homework frequency, homework quality, and homework control are expected to impact on students' homework motivation and behavior and, subsequently, on their achievement. Very little empirical research has specifically focused 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; Weinert & Helmke, 1995). 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" (Weinert & Helmke, 1995, p. 138). The effects of teachers' homework control on students' homework behavior and motivation are largely unknown. Although it is reasonable to assume that students in classes where homework is controlled strictly are more likely to complete their assignments, they may also be more likely to copy from their classmates. Moreover, controlling environments are believed to undermine academic motivation and students' feelings of competence (see Deci & Ryan, 2002); hence, homework control might have a negative effect 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 Hoover-Dempsey et al., 2001, and Grolnick, 2003; 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 (e.g., Grolnick & Slowiaczek, 1994). Most importantly, 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). The effects of parental homework assistance on homework effort and time are also likely to be at least partly mediated by homework motivation (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 on 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 vs. Transsituational Stability

Traditionally, the potential of domain-specific analyses of homework behavior and its predictors has not been fully exploited in homework research (e.g., Keith, Diamond-Hallam, & Fine, 2004; OECD, 2001; see Cooper, 1989). In recent years, however, research has provided ample

evidence for domain-specific patterns in student motivation and behavior (e.g., 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. Accordingly, the homework model we propose covers domain-specificity in two ways. First, it is assumed that the correlations among student reports concerning their homework behavior, homework motivation, and perceptions of homework characteristics across different subjects will 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 expect the predictor variables included in the homework model to be relevant across subjects, it is assumed that their relative effects on student behavior might vary. For instance, the expectancy component has been shown to be a good predictor of achievement in many studies focusing on math (e.g., 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 impact on student motivation. Accordingly, high quality homework is likely to enhance students' expectancy of success in their assignments and to increase the perceived utility of homework. This again indicates the importance of taking into consideration the domain-specific nature of human motivation and behavior in homework research. Yet 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. Interestingly, 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., in press). 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 on 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, seen 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. 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. (in press) recently found a correlation of .26 between math 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 called for 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)? In order 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 (e.g., Hox, 2002; Raudenbush & Bryk, 2002). This may explain why there has, to date, 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 investigate the domain-specific, multilevel homework model thoroughly (see Trautwein & Köller, 2003a, b; Trautwein et al., 2005). The emphasis of Study 1—based on student questionnaire responses pertaining to two subjects (math 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—due to 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 examine whether students' perceptions of the quality and control of their homework differ across classes. Moreover, we analyze whether such differences impact on students' homework motivation and effort.

Study 1: Domain-Specificity of the Homework Model

In Study 1, three main questions are pursued. First, we examine the domain-specificity of the various elements of the homework model. To this end, we analyze mean differences as well as the pattern of correlations between corresponding constructs across the two subjects (math and English) under scrutiny. We expect 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 is

expected to be less pronounced.

Second, we examine the power of the various elements of the homework model to predict homework motivation and behavior across the two subjects under investigation (math and English). We expect to find support for the assumption that homework motivation has a direct, significant positive effect on homework effort (but not necessarily on homework time) and that effects of homework characteristics and parental behavior are at least partly mediated by homework motivation. Of additional interest in the current study is whether or not the effects of the domain-specific predictor variables vary across the two subjects.

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

Method

Sample

A total of 414 eighth graders (58.5% female; mean age: $M = 13.45$, $SD = 0.58$) from 20 classes took part in this study. Students were enrolled in state *Gymnasium* (academic-track) schools in Berlin, Germany. Student participation was voluntary, and written consent was collected from all parents. The study was conducted during regular school hours in intact classes during the first semester of the 2003/2004 school year.

Instruments

The instrument consisted of an assessment of basic cognitive abilities and a questionnaire section. Some questionnaire items were adapted from standard instruments (e.g., Cooper et al., 1998; Pintrich & De Groot, 1990). Strictly parallel wording was used for all domain-specific items; that is,

the items for math and English were exactly the same except for the word "math" or "English." A 4-point Likert-type scale (where 1 equaled *completely disagree* and 4 equaled *completely agree*) was used for all multi-item constructs.

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 by three variables (e.g., "I often copy math [English] homework from others"; reverse scored). Students high on homework compliance do their homework assignments carefully and do not copy from others. Internal consistency (Cronbach's alpha) was adequate for math (.78) and English (.71). *Homework concentration* was assessed using four items (e.g., "I often get distracted when doing my math [English] homework"; reverse scored; α = .79/.73). A single-item indicator measured the percentage of homework tasks attempted per week: "On average, what percentage of your math [English] homework do you seriously try to do?"[1]

Homework Time. Two questions pertained to the amount of time spent on homework. *Homework time* was measured by the following question: "On average, how many minutes do you spend on the math [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 (e.g., "If I make an effort, I can do all of my math [English] homework"; α = .85/.75). The *value* component comprised four items (e.g., "Our math [English] homework takes a lot of time and is of little use to me"; reverse scored; α = .82/.80) and focused on the facets of utility and cost.

Learning Environment. Two scales were used to describe perceived teacher characteristics. *Homework quality* (e.g., "Math [English] homework helps me to really understand the material covered"; four items; α = .81/.79) refers to well-prepared homework assignments, whereas *homework*

control (e.g., "If we haven't done our math [English] homework, we get into trouble with our teacher"; three items; α = .74/.85) describes the negative consequences of not doing homework.

Parental Homework Behavior. 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 math [English] homework?") and *homework control* ("Per 10 homework assignments, how often do your parents check that you've really done your math [English] homework?"). A response scale ranging from 0 (never) to 10 (always) was provided.

Basic Cognitive Abilities. The Figure Analogies subscale from the Cognitive Ability Test 4-12+R (Heller & Perleth, 2000), a German version of the CogAT by Thorndike and Hagen (1993), was used to tap *basic cognitive abilities*. The test consists of 25 items in multiple-choice format. Students first have to find out the relationship between two figures, and then to identify which of five figures given as answer alternatives relates to a third figure in the same way as 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 later analyses, five item parcels of five items each were created to reduce the complexity of the model. Parceling results in the estimation of fewer model parameters; 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 of items 2, 7, 12, 17, and 22, etc. The internal consistency (Cronbach's α) of the cognitive ability test was .90.

Conscientiousness. Conscientiousness was measured using the 12 conscientiousness items from the German version of the NEO personality inventory (Borkenau & Ostendorf, 1993; original version by Costa & McCrae, 1992). One item was discarded due to its low discrimination. For later analyses, four item parcels were created using the strategy applied to the cognitive ability 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 math and English were used as indicators of school achievement. The grades were coded such that high scores indicate good learning outcomes.

Statistical Analysis

In most studies conducted in school settings, individual student characteristics are confounded with those associated with classrooms or schools 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, but 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/or 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 impact on the student level (e.g., students' homework motivation and behavior). Study 2 focuses on this hierarchical perspective. In Study 1, however, due to the relatively small size of our sample, we had to restrict the analyses to the student level. 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. Apart from their limited power to find class-level effects, small samples run the danger of capitalizing on chance when class-level effects are found.

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

1998-2004). When the complex option is used, estimates of standard errors and covariances are automatically corrected for clustering effects (see Muthén & Satorra, 1995). When comparing the means for English and math constructs, we calculated the design effect (see Kish, 1987) for each construct and used this design effect to correct the degrees of freedom. The design effect was based on the average intraclass correlation coefficient 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).

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 [EM] algorithm implemented in SPSS 12.0.1).

Results

Preliminary Analyses: The Homework-Achievement Relationship

Although of 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. (2000) and Trautwein (2005) recommend the standardization of school grades and homework behavior in each school class ($M = 0$, $SD = 1$; also see 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 math and—in terms of homework concentration—in English, whereas time spent on homework was negatively related to achievement gains in math and English (see Table 1). Hence, in line with earlier findings (Muhlenbruck et al., 2000; Trautwein, 2005; Trautwein & Köller, 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 math and English) for all domain-specific homework constructs are reported in Table 2. There were six significant differences between math and English. With respect to homework behavior, students reported higher levels of concentration and spending more time on math 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 math homework was of more use. Finally, a higher amount of parental homework assistance and control was reported for math than for English homework.

Intercorrelations between the corresponding constructs for math and English are reported in the diagonal of Table 3. Note that correlations involving multi-item constructs are latent correlations. We followed the recommendation of Jöreskog (1979) and Marsh and Hau (1996) to include 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 math and English variables. In other words, although students who invested a lot of effort and time in their math 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' efficacy 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. Finally, the correlation for students' reports of homework quality was low, and the correlation for student perceptions of their teachers' homework control was moderate. The small correlation of $r = .11$ for perceived homework quality was expected given that English and math 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 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 math are potentially of high theoretical interest (e.g., lower homework expectancy and higher homework value in math than in English). Moreover, the intercorrelations found between most corresponding English and math homework constructs were small to moderate, the only exception being reported parental homework control. This small to moderate relationship between English and math constructs clearly indicates that, in order 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 have a crucial, mediating role in the homework process. Moreover, given that the current study focuses on the domain-specificity of homework, we were interested in whether the regression coefficients of the predictor variables would be similar across math 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 constructs (except, of course, homework behavior). All multi-item constructs were modeled as latent variables. Model fit was satisfactory for both math, χ^2 (580; N = 414) = 837.62, TLI = .944, RMSEA = .033, SRMR = .042, and English, χ^2 (580; N = 414) = 1051.84, TLI = .900, RMSEA = .042, SRMR = .049.

Table 4 reports the results (fully standardized regression coefficients and significance levels) of the full models. We first focus on gender, basic cognitive abilities, and the domain-specific variables; the effects of conscientiousness are reported in the next section. The regression coefficients for the motivational mediator variables (homework expectancy and value) are shown in the left part of the table; the regression coefficients for the five homework behavior variables, on the right. For mathematics, homework expectancy and homework value were positively predicted by perceived homework quality and parental homework control, with perceived homework quality having the strongest impact for both expectancy (.34) and value (.57). Furthermore, homework expectancy (but not homework value) was positively predicted by basic cognitive abilities and male gender, but negatively predicted by homework assistance. Thus, students with high scores on the basic abilities

test and male students felt more efficacious about math 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 significant predictors of homework effort. Time on homework was significantly predicted by just two variables: perceived homework quality (positive effect) and homework expectancy (negative effect). The amount of explained variance was considerable for homework compliance and concentration (.59 and .52), moderate for percentage attempted (.33) and rather small for time on homework and additional learning time (.17 and .07).

The pattern of results for English homework showed both similarities and contrasts with the results for math. Perceived homework quality in English was closely associated with homework value (but not with homework expectancy). Parental homework assistance negatively predicted homework expectancy. No 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 significant effect of homework motivation was found on compliance. Furthermore, gender (with girls reporting higher compliance), teacher homework control, and parental homework assistance (positive effects on percentage attempted) were significant predictor variables. Time on homework was predicted by parental assistance (positive effect) and expectancy (negative effect). Parental homework control (positive effect) and expectancy (negative effect) were significantly associated with additional learning time. The amount of explained variance was highest for concentration (.59) and lowest for additional learning time (.11).

Taken together, in line with the homework model, homework motivation (expectancy and value components) was the most important domain-specific predictor of homework behavior; effects of

homework characteristics and parental behavior were partly mediated by these variables. Although the pattern of results for math and English was similar, there were also some differences that will be considered in more detail in the 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 math and English, high homework expectancy and value were significantly predicted by conscientiousness. Moreover, students with high conscientiousness scores reported high compliance, concentration, and percentage attempted. The regression coefficients for conscientiousness were of considerable size, particularly for English. They ranged between $\beta = .14$ ($p < .001$) for percentage attempted in math to $\beta = .45$ ($p < .001$) for concentration in English. Conscientiousness was also a significant predictor of additional learning time in both math and English. Students high on conscientiousness spent more free time on learning than did their peers with lower conscientiousness scores. No direct significant effect of conscientiousness was found on homework time.

Discussion 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 math and English as a foreign language, there was considerable intraindividual 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 mediator variables and reveal some domain-specific patterns in the

prediction of math and English homework motivation and behavior. Third, we found effects of conscientiousness on homework behavior that were largely consistent across math and English.

Study 1 was well-suited to test the domain-specificity of the homework model. Owing to the rather restricted sample size at the class level, however, we were unable to test assumptions about the multilevel nature of homework – we thus controlled for the hierarchical structure of the data set, but did not model the student and class level simultaneously. Because we believe the multilevel character of homework (see Trautwein & Köller, 2003a) to be of high theoretical, empirical, and educational importance, we will now present results from a second study focusing on the multilevel nature of homework assignments and completion.

In Study 1, the quantity of assistance and control were used as indicators for parental homework behavior. Based on self-determination theory, however, one might argue that it is less the quantity than the quality of parental homework assistance that matters. Accordingly, Study 2 uses 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 homework characteristics are associated with greater homework effort? Large-scale, multilevel studies with an explicit focus on homework are needed to address questions such as these. 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 is 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. Based on the homework model and the results of Study 1, we expected homework quality to have a positive effect on homework motivation and homework effort on both the student and the class level. No prediction was made for homework control. Moreover, we expected

homework motivation to have a significant direct effect on homework effort and to act as a mediator variable for the effects of homework characteristics and parental behavior. We again assumed conscientiousness to have a significant direct and indirect effect 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 the students' need for autonomy. Moreover, it may imply that parents do not feel confident in their child's ability to manage the homework alone which, in turn, may affect the students' competence beliefs. Hence, whereas non-intrusive 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

A total of 1,501 eighth graders (51.8 % female, mean age: $M = 14.7$, $SD = 0.49$) from 93 classes in three Swiss cantons participated in this study, which was conducted during regular school hours in intact classes at the end of the 2003/2004 school year. All participating students were taking compulsory lessons in French as a foreign language.

Instruments

Homework Effort. Homework effort was measured by a five-item scale; three of these items were also used in Study 1 (e.g., "I often copy French homework from others"; reverse scored). Internal consistency (Cronbach's alpha) was .79.

Homework Motivation. Ten items (five of which were also administered in Study 1) were used to assess the *expectancy* component (e.g., "If I make an effort, I can do all of my French homework"; $\alpha = .85$). The *value* component comprised six items (e.g., "Our French homework takes a lot of time

and is of little use to me"; 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* (e.g., "French homework really makes me think," "Everyone can learn from our discussions of the homework, no matter how good they are"; six items; $\alpha = .73$) refers to cognitively activating, well prepared and supervised homework assignments. *Homework control* (e.g., "If we haven't done our French homework, we get into trouble with our teacher"; 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 (e.g., "My parents help me with French if I ask them"; 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 (e.g., "My parents sometimes help me with French even when I don't need any help at all"; $\alpha = .80$) describes an 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 Ability Test 4-12+R (Heller & Perleth, 2000) were used to tap *basic cognitive abilities*. A total of 95 verbal items in multiple-choice format (finding analogies, similarities, opposites, and missing words in a sentence) were administered. The internal consistency (Cronbach's α) of the cognitive ability test was .89.

Conscientiousness. Conscientiousness was again measured using 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, should 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 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, provides a powerful methodology for handling hierarchical data, and was used in this study. Multilevel analyses were computed with the computer program HLM 6 (Raudenbush, Bryk, Cheong, & Congdon, 2004).

The HLM output does not report standardized regression coefficients. In order 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 class level to form an index of students' shared assessment of their teachers' homework practices (and were not re-standardized). All models reported are random-intercept models estimated by restricted maximum likelihood (REML), and all variables were introduced as uncentered variables.

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

Results

In preliminary analyses, we calculated the intraclass correlation coefficients ICC(1) and ICC(2) (see Bliese, 2000; Snijders & Bosker, 1999) for the homework characteristics variables. 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. In the present study, the ICC(1) was .18 for homework quality and .29 for homework control. These values indicate that there were considerable differences between school classes in how homework assignments were perceived. The ICC(2) is used to evaluate the reliability of the aggregated student ratings at the class level; it can be interpreted in a similar way to the well-known Cronbach's alpha measure used for individual data. In the present study, the ICC(2) was .77 for homework quality and .87 for homework control. This clearly indicates that homework characteristics were reliably assessed at the class level.

A series of four multilevel models was run (see Table 5). In the first model, homework expectancy was the dependent variable. Class-average perception of homework characteristics (homework quality and homework control) as well as stable personality traits (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 5, homework characteristics had a significant effect on whether students expected to be able to solve the assigned tasks at both the class level and the student level. For homework quality, a positive effect 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. Moreover, within the classes, 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 and class levels 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 their peers reported higher homework expectancy beliefs.

Conscientiousness and basic cognitive abilities also had significant effects on homework expectancy. As expected, conscientious students and those with high basic cognitive abilities reported higher homework expectancy beliefs. Finally, 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.

In the next model (see Table 5), homework value was substituted as the dependent variable. Four variables had a significant effect on homework value. In line with our hypotheses, there was a significant positive association between homework quality and homework value at both the class and the student level. Moreover, conscientiousness had a positive effect. Finally, males reported a significantly lower homework value scores.

We next turn to the prediction of homework compliance. We first specified a model without the motivational mediator variables (see Table 5). In this model, homework quality again had the expected positive effect at both the student and the class level. Perceived homework control was positively associated with homework compliance at the student level, though the negative regression coefficient at the class level was not significant. Conscientiousness strongly predicted homework compliance. Parental provision of help positively predicted homework compliance, but 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 (see Table 5). As expected, both variables significantly predicted homework compliance. Moreover, also in line with our assumptions, the effects of homework quality were partly mediated by the motivational mediator variables. Whereas the class level effect of

homework quality was no longer significant once homework expectancy and value were included, the effect at the student level decreased (from $b = .19$ to $b = .11$), but remained significant. The positive effect of homework control at the student level was only slightly reduced (from $b = .14$ to $b = .12$). The regression weight of conscientiousness decreased from $b = .40$ to $b = .33$, but the change in the regression coefficient found for parental provision of help was rather small (from $b = .09$ to $b = .07$).

Discussion of Study 2 Results

Study 2 simultaneously examined class-level 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 and the class level. A perception of high teacher control significantly predicted homework compliance at the student level only. However, the utility of applying the multilevel perspective to homework control was demonstrated by the differential effect 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 the homework characteristics and of conscientiousness. Finally, results for the parental homework variables supported the view that—in order to be effective—parental homework behavior has to be non-intrusive (providing help when asked rather than imposing it).

General Discussion

The present studies were designed to explore homework effects using a domain-specific, multilevel homework model that takes into account the three major protagonists in the homework process (students, teachers, and parents) and that is based on major educational and motivational theories. Empirically, we found support for both the domain-specificity and the multilevel character of homework. In the following, we discuss these two aspects of the homework model, before turning

to the limitations of the present research and the educational implications of our results.

Domain-Specificity and Consistency Across Subjects

Despite growing consensus that student behavior at least partly follows domain-specific patterns, several homework studies have continued to rely on domain-independent measures or on measures aggregated across domains (e.g., OECD, 2001). This is sometimes unavoidable because domain-specific data are not available (e.g., Keith et al., 2004); moreover, aggregation is sometimes theoretically desirable or justifiable (e.g., when overall homework time is related to overall achievement). However, there are two potential limitations to this approach. First, on a intraindividual basis, students may have quite different attitudes to and exhibit quite different behavior in different school subjects. A student who puts a lot of effort into his or her math homework will not necessarily do the same in English. Indeed, the relationships we found between English and math were mostly moderate in size, with some notable exceptions: the correlations for homework motivation and the perception of homework quality were particularly low, whereas high consistency in the frequency of parental control was reported.

Second, to gain a better understanding of what leads to high or low effort being invested in homework in different school subjects, it is necessary to examine whether the processes leading to high homework effort are the same across these different domains. The most important difference between math and English as a foreign language pertains to the role of the expectancy component. To start with, the mean level difference between the corresponding constructs for math and English was largest for the expectancy component. Moreover, the variation in homework expectancy among students was larger in math (SD = 0.73) than in English (SD =0.54). This indicates that math homework is perceived as "difficult," at least by some students. If, however, there is a great deal of latitude in students' sense of accomplishment regarding math homework assignments, the chances of identifying math homework expectancy as a significant predictor of homework behavior in math

increase. Indeed, homework expectancy was found to be a major predictor of effort on homework in math and in English, but the effects in math were stronger and more consistent. Furthermore, perceived homework quality was significantly related to homework expectancy in math, but not in English. Taken together, the more prominent role of homework expectancy in math than in English is likely to be (at least partly) attributable to the perception of math as a difficult subject. Given that the expectancy component was high in English as a foreign language, whether or not students complete homework assignments in this subject might have more to do with whether they see any use in doing them (i.e., the value component). The results of Study 2 for French seem to confirm the relative importance of the value component over the expectancy component as a predictor of homework compliance in foreign language classrooms.

Expectancy-value theory was originally developed and applied to predict academic choices in "hard" 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 math and English show 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 the significantly lower mean value for the expectancy component in math than in English? Why do students attach higher value to math than to English homework?

These questions cannot readily be answered on the basis of the present data. It seems important for future research to analyze whether the differential importance of the expectancy component can be attributed to different traditions of teacher training in the two subjects, different attitudes to homework among math and language teachers, or different underlying learning mechanisms in the two subjects. Moreover, future studies should cover several school subjects (e.g., physics, biology,

history, languages, math).

Somewhat paradoxically, we call for a domain-specific approach to homework research but, at the same time, include the stable personality trait of conscientiousness (Costa & McCrae, 1992) as an additional predictor in our homework model. In our opinion, however, these two aspects are not contradictory, but complementary. If homework behavior were determined exclusively by expectancy and value components, it would be highly domain-specific. We found a moderate level of consistency across math and English, however, and a more general personality trait such as conscientiousness might prove to be a central determinant of 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 impact on both homework effort and additional learning time. It is also interesting to compare the impact of conscientiousness and basic cognitive abilities. Although the effects of basic cognitive abilities on achievement are well established, their impact on homework motivation and behavior was negligible compared to that 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). The limited interest in conscientiousness may partially be attributable to the popular conception of personality being stable (e.g., Costa & McCrae, 1992) and essentially immune to pedagogical influences. During childhood and adolescence, in particular, 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 way students deal with these assignments might also impact on personality development. Indeed, proponents of homework assignments have always emphasized that homework does not just help

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). However, to our knowledge, the present investigation is the first study 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 different classrooms, at least when operationalized in terms of students' perceptions. Second, homework quality and control impact on students' homework motivation and behavior. Taken together, the findings reported here clearly 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 behavior were concerned. A non-significant negative effect emerged at the class level, indicating that high homework control does not lead to higher overall class effort on homework. At the student level, however, teacher homework control had a significant positive effect; hence, those students in a class who perceived a higher degree of homework control than their classmates reported higher homework compliance. This differential effect at the student and class level might be responsible for the non-significant 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. Although our operationalization of the model covered a large number of variables, other potentially relevant variables had to be left out. 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.

Moreover, studies with just one measurement point should be complemented by longitudinal studies that are able to examine the feedback mechanisms specified in the homework model. A longitudinal analysis would seem to be particularly important with respect to parental behavior. For instance, we found that the frequency of parental assistance and a high level of unwanted parental help predicted low expectancy beliefs in both math and English. Based on the present study, however, the causal direction of this effect cannot be determined. Although negative effects of intrusive parental help have been documented in several studies (e.g., Deci & Ryan, 2002; Grolnick, 2003; Pomerantz et al., 2005), there is also evidence for the reverse causal direction, implying that parents respond to low student performance by offering increased homework assistance (see Grolnick, 2003; Helmke, Schrader, & Hosenfeld, 2004; Pomerantz & Eaton, 2001). Longitudinal or experimental analyses are necessary to disentangle these two effects and to gauge their relative strength.

It is also important to emphasize that we studied only one age group (eighth graders). As described by Muhlenbruck et al. (2000), 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., 2000). 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 (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 compliance and a negative effect on homework expectancy at the class level. Similarly, 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).

Based on expectancy-value theory and our results, we would like to 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 over-involvement of parents have negative consequences on homework motivation.

What can be done to counter such negative effects? As our results indicate, high-quality

homework assignments have an overall positive 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 experienced academic failure lately. 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, Bonner, and Kovach (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.

To conclude, 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.

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Footnotes

[1] This item is similar to one used by Muhlenbruck et al. (2000): "On average, how much of your homework do you actually finish?" In contrast to Muhlenbruck et al., however, to avoid confoundation with prior knowledge, we only asked students about homework they *tried* to do, and not about homework they actually finished.

Table 1.

Relating Homework Behavior to Achievement and Change in Achievement: Results from Zero-Order Correlations and Regression Analyses

	Achievement (Zero-Order Correlations)				Change in Achievement[a]	
	Mathematics		English		Mathematics	English
	End of 7	Current Grade	End of 7	Current Grade	β	β
Compliance	.39***	.39***	.20***	.19***	.19***	.05
Concentration	.29***	.33***	.26***	.20***	.18***	.09*
Percentage Attempted	.34***	.35***	.15**	.16**	.12**	.03
Time on Homework	-.23***	-.30***	-.11*	-.14**	-.12***	-.11**
Additional Learning Time	-.18***	-.09	-.15**	-.16**	.06	-.09*

Note. $N = 414$. All variables were standardized at the class-level prior to data analysis. [a] Regression of current grade on homework indicators (separately for each homework indicator), controlling for grade at the end of grade 7, gender, and basic cognitive abilities; standardized regression coefficients.

*** $p < .001$; ** $p < .01$; * $p < .05$

Table 2.

Homework in Math and English: Means, Standard Deviations, and Results from Paired-Samples T-Tests

	Mathematics		English				
	M	*SD*	*M*	*SD*	*t*	*df* [a]	*p*
Effort							
Compliance	3.15	0.71	3.11	0.65	0.85	177	*ns*
Concentration	2.83	0.70	2.69	0.62	3.05	231	< .001
Percentage Attempted	79.11	23.16	76.53	22.47	1.47	169	*ns*
Time							
Time on Homework	22.53	15.12	19.95	15.28	2.27	185	< .05
Additional Learning Time	25.58	39.59	23.22	40.59	1.23	392	*ns*
Motivation							
Expectancy Component	2.91	0.73	3.16	0.54	4.50	227	< .001
Value Component	2.97	0.67	2.84	0.64	2.22	202	< .05
Learning Environment							
Homework Quality	2.66	0.73	2.57	0.69	0.83	69	*ns*
Homework Control	2.53	0.64	2.69	0.76	-1.59	82	*ns*
Parents							
Homework Assistance	2.60	2.63	2.05	2.32	3.97	314	< .001
Homework Control	2.25	3.30	2.04	3.14	2.34	413	< .05

Note. $N = 414$. [a] Degrees of freedom calculated on the basis of the effective sample size for each construct.

Table 3.

Intercorrelations for Mathematics (above the Diagonal) and English (below the Diagonal). Correlations between Math and English are Reported in the Diagonal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Gender: Male	-	-.13 **	-.16 **	.10	.05	-.08	.13 *	.26 ***	.08	-.05	.15 *	-.03	-.10 *	-.01
(2) Basic Cognitive Abilities	-.13 **	-	.07	.03	-.04	-.09 *	-.12 *	.13 *	-.01	.07	.04	.15 *	-.11	-.07
(3) Conscientiousness	-.16 **	.07	-	.15 *	.04	-.04	.06	.26 ***	.32 ***	.48 ***	.41 ***	.32 ***	-.07	.12
(4) Homework Quality	.01	-.16 **	.33 ***	**.11**	-.30 ***	-.04	.07	.42 ***	.62 ***	.34 ***	.36 ***	.34 ***	-.06	.04
(5) Homework Control	.04	.13 *	-.02	.03	**.45** ***	.03	.03	-.10 *	-.17 **	-.11	-.08	-.09	.08	-.03
(6) Parental Assistance	-.01	-.08 *	.04	-.01	.10	**.51** ***	.36 ***	-.25 *	-.09	-.12 *	-.24 ***	.00	.22 ***	.15 **
(7) Parental Control	.17 ***	-.10	.10	.13 *	-.05	.35 ***	**.84** ***	.06	.14 *	.05	.03	.07	.08	.20 **
(8) Expectany	-.05	.04	.48 ***	.22 **	-.10	-.24 **	-.03	**.11**	.69 ***	.65 ***	.66 ***	.44 ***	-.37 ***	-.05
(9) Value	-.04	-.11 *	.42 ***	.65 ***	.06	.01	.16 **	.39 ***	**.22** *	.63 ***	.55 ***	.52 ***	-.23 ***	.05
(10) Compliance	-.23 ***	-.07	.50 ***	.36 **	.08	.10 *	.05	.30 ***	.47 ***	**.51** ***	.75 ***	.67 ***	-.12	.04
(11) Concentration	-.08	-.08	.67 ***	.38 ***	-.06	-.05	.10	.60 ***	.48 ***	.49 ***	**.40** ***	.46 ***	-.29 ***	-.02
(12) Percentage Attempted	-.15 *	.10	.38 ***	.30 ***	.14	.09 **	.07	.27 ***	.40 ***	.61 ***	.37 ***	**.50** ***	-.04	.04
(13) Time on Homework	-.06	-.06	-.10	.00	.13 *	.27 *	.11	-.35 **	-.02	.12 *	-.12 *	.07	**.48** ***	.14 *
(14) Extra Learning Time	.01	-.02	.19 ***	.13 *	.02	.12 **	.26 **	-.02	.14 **	.10 *	.09 *	.08	.07	**.55** ***

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 the hierarchical data structure into account.

*** $p < .001$; ** $p < .01$; * $p < .05$

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

	Homework Motivation		Homework Behavior				
Predictors	Expectancy	Value	Compliance	Concen-tration	Percentage Attempted	Time on Homework	Additional Learning Time
Mathematics							
Homework Quality	0.34***	0.57***	-0.05	0.05	0.04	0.16**	0.01
Homework Control	-0.01	-0.02	-0.04	-0.01	0.00	0.07	-0.05
Conscientiousness	0.22***	0.24***	0.27***	0.25***	0.14***	0.02	0.14*
Basic Cognitive Abilities	0.12*	-0.03	-0.02	-0.05	0.11	-0.06	-0.04
Gender: Male	0.24***	0.03	-0.14**	0.05	-0.06	-0.03	0.02
Parental Assistance (Frequency)	-0.22***	-0.10	0.03	-0.10	0.09	0.10	0.07
Parental Control (Frequency)	0.09*	0.11**	-0.02	-0.01	-0.02	0.06	0.16
Expectancy			0.47***	0.48***	0.16	-0.34***	-0.12
Value			0.26**	0.09	0.36***	-0.08	0.06
R^2	0.34	0.46	0.59	0.52	0.33	0.17	0.07

English							
Homework Quality	0.07	0.55***	0.07	0.08	0.08	0.00	0.04
Homework Control	-0.07	0.06	0.08	-0.02	0.12*	0.09	0.02
Conscientiousness	0.47***	0.23***	0.33**	0.45***	0.19*	0.01	0.19***
Basic Cognitive Abilities	0.01	-0.05	-0.09	-0.10	0.11	-0.04	0.00
Gender: Male	0.03	-0.04	-0.17**	-0.01	-0.10	-0.09	0.00
Parental Assistance (Frequency)	-0.25***	-0.04	0.09	-0.01	0.09*	0.17*	0.00
Parental Control (Frequency)	-0.01	0.09	-0.03	0.03	0.01	0.04	0.23*
Expectancy			0.06	0.34***	0.10	-0.34***	-0.13*
Value			0.24	0.09	0.22*	0.09	0.05
R^2	0.32	0.48	0.38	0.59	0.27	0.18	0.11

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 the hierarchical data structure into account.

*** $p < .001$; ** $p < .01$; * $p < .05$

Table 5.

Predicting Homework Motivation and Homework Behavior in French as a Foreign Language: Results from Hierarchical Linear Modeling

	Homework Motivation				Homework Compliance			
	Expectancy		Value		Without Mediators		With Mediators	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Class Level								
Homework Quality	0.28 *	0.11	0.44 ***	0.08	0.19 **	0.06	0.06	0.06
Homework Control by Teacher	-0.19 **	0.06	-0.03	0.06	-0.07	0.06	-0.04	0.06
Student Level								
Conscientiousness	0.27 ***	0.02	0.20 ***	0.02	0.40 ***	0.03	0.33 ***	0.02
Basic Cognitive Abilities	0.09 ***	0.02	-0.02	0.02	-0.02	0.02	-0.03	0.02
Gender: Male	-0.09	0.06	-0.14 **	0.05	-0.08	0.04	-0.04	0.04
Homework Quality	0.09 **	0.03	0.33 ***	0.03	0.19 ***	0.02	0.11 ***	0.02
Homework Control by Teacher	0.07 *	0.03	0.03	0.03	0.14 ***	0.03	0.12 ***	0.03
Parental Provision of Help	0.11 ***	0.03	0.01	0.03	0.09 ***	0.02	0.07 **	0.02
Unwanted Parental Help	-0.15 ***	0.03	0.02	0.02	-0.04	0.03	-0.03	0.02
Expectancy							0.11 ***	0.02
Value							0.22 ***	0.03
R^2	0.24		0.34		0.39		0.43	

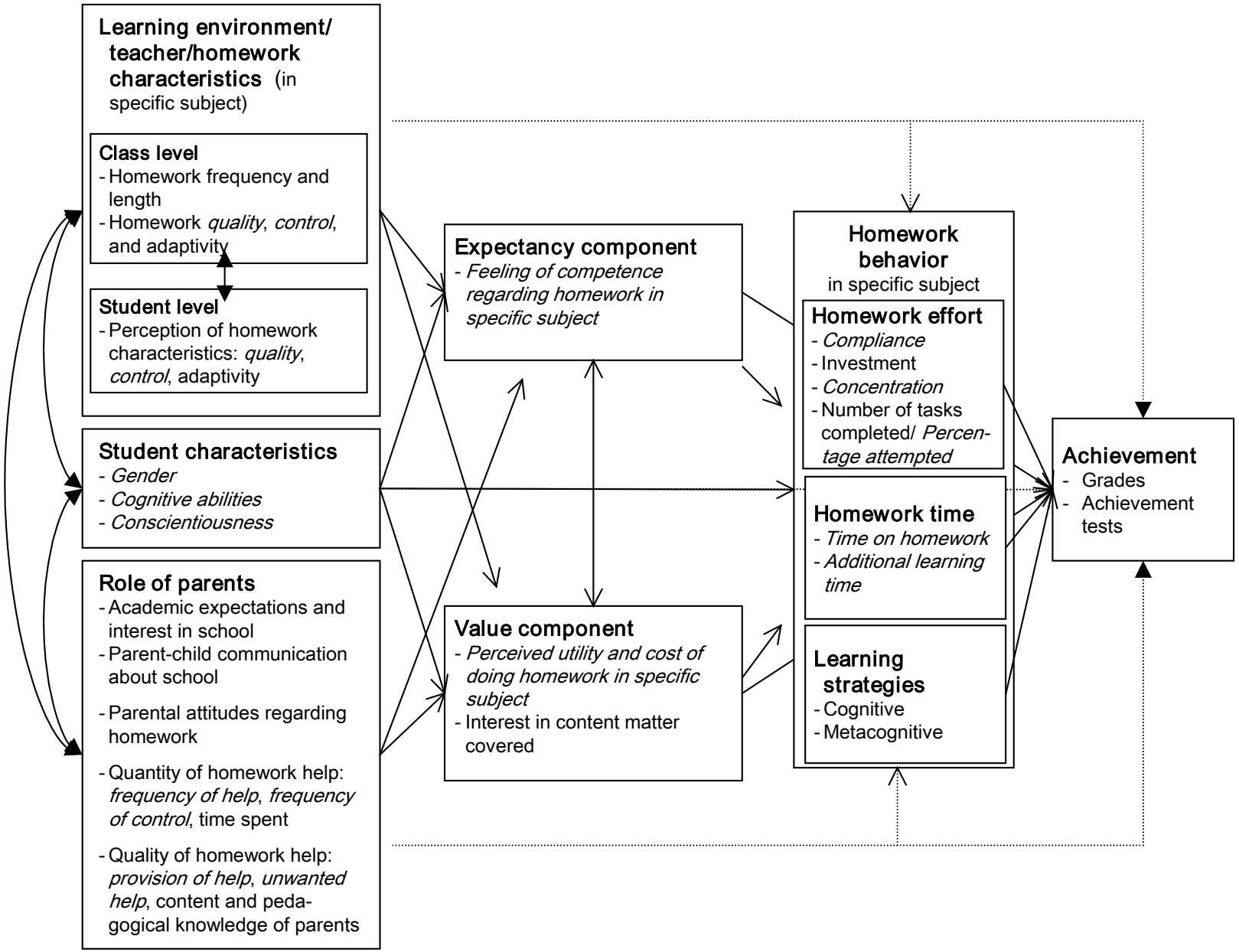
Note. N = 1,501 from 93 classes. b = unstandardized regression coefficient. *SE* = standard error of b.

*** $p < .001$; ** $p < .01$; * $p < .05$

Figure Captions

Figure 1.

Schematic Depiction of Homework Model


Learning environment/ teacher/homework characteristics (in specific subject)
Class level
- Homework frequency and length
- Homework *quality*, *control*, and adaptivity
Student level
- Perception of homework characteristics: *quality*, *control*, adaptivity
Student characteristics
- *Gender*
- *Cognitive abilities*
- *Conscientiousness*
Role of parents
- Academic expectations and interest in school
- Parent-child communication about school
- Parental attitudes regarding homework
- Quantity of homework help: *frequency of help*, *frequency of control*, time spent
- Quality of homework help: *provision of help*, *unwanted help*, content and pedagogical knowledge of parents
Expectancy component
- *Feeling of competence regarding homework in specific subject*
Value component
- *Perceived utility and cost of doing homework in specific subject*
- Interest in content matter covered
Homework behavior
in specific subject
Homework effort
- *Compliance*
- Investment
- *Concentration*
- Number of tasks completed/ *Percentage attempted*
Homework time
- *Time on homework*
- *Additional learning time*
Learning strategies
- Cognitive
- Metacognitive
Achievement
- Grades
- Achievement tests