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

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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 & Koller, 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 & Helmke, 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 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 & Hembree, 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.

Figure 1. Schematic depiction of the homework model.
PREDICTING HOMEWORK EFFORT

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.

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\(^1\) 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).