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Chameleon Effects in Homework Research:

The Homework-Achievement Association Depends on the Measures Used and the Level of Analysis Chosen

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Abstract

Using a data set specifically tailored to homework research, with a sample of 1,275 students from 70 classes in Switzerland, the association between homework and achievement in French as a second language was tested at three levels (class level, between-student level, within-student level). The strength and direction of the homework-achievement association depended on the homework indicator chosen and differed to some degree across analytical levels. At the class level, achievement was higher in classes set frequent homework assignments and in classes where students reported low overall levels of negative emotions when doing homework. At the between-student level, high homework effort and low levels of negative homework emotions predicted favorable developments in French achievement, whereas high homework time predicted lower achievement. At the intraindividual level, high homework effort, high homework time, and low levels of negative homework emotions were statistically significantly associated with positive student evaluations of the specific assignment.

Keywords: homework; frequency; time on task; effort; achievement

Chameleon Effects in Homework Research: The Homework-Achievement Association Depends on the Measures Used and the Level of Analysis Chosen

Does homework enhance students' achievement levels? In their recent state-of-the-art meta-analysis, Cooper, Robinson, and Patall (2006) found mostly positive associations between homework time and achievement, leading them to state that "both within and across design types, there was generally consistent evidence for a positive influence of homework on achievement" (Cooper et al., 2006, p. 3). Although this conclusion adequately summarizes the existing body of research on the relationship between homework time and achievement, it may not fully reflect the complex relationship between homework and achievement (e.g., Cooper, Lindsay, Nye, & Greathouse, 1998; De Jong, Westerhof, & Creemers, 2000; Trautwein & Köller, 2003). In our view, definitive insights into the homework-achievement relationship are as yet precluded by the paucity of data collected specifically for purposes of homework research.

This article has two central goals. The first is to delineate the methodological challenges that must be overcome in order to draw valid conclusions about the strength of the homework-achievement association. We argue that this complex relationship can only properly be determined by (a) additionally including indicators of homework assignment and completion other than the time-on-homework variable, (b) distinguishing different levels of analysis (class level, between-student level, within-student level), and (c) using repeated-measurement designs. Our second goal is to document homework effects using a data set specifically tailored to homework research that was obtained from a large sample of eighth graders learning French as a second language.

The Homework-Achievement Association

The majority of reviews of homework research (Cooper, 1989; Cooper et al., 2006; Cooper & Valentine, 2001; Keith, 1986; Walberg, 1991) and, more generally, research on educational effectiveness (e.g., Hattie & Clinton, 2001) conclude that time spent on

homework is associated with achievement gains. In his classic review paper, Cooper (1989) used meta-analytical strategies to analyze 17 experimental and quasi-experimental studies and 50 nonexperimental studies. For the experimental studies, he found an overall effect of $d = .21$ favoring homework conditions over no-homework conditions. Likewise, he found a positive relationship between time spent on homework and achievement in 43 of the 50 nonexperimental studies reviewed, most of which studies worked with the variable "time spent on homework," operationalized as a global measure of homework load per week. Marked age effects were also documented, indicating that the association between time spent on homework and achievement was weaker in elementary school than in high school ($r = .02$ for grades 3 through 5, $r = .07$ for grades 6 though 9, and $r = .25$ for grades 10 through 12).

To update this classic review, Cooper et al. (2006) recently conducted a meta-analysis of homework studies reported between 1987 and 2003. Three types of study were distinguished. First, six (unpublished) studies had an experimental design; all reported positive effects of homework. Second, 30 studies used data from naturalistic, cross-sectional studies such as the National Education Longitudinal Study or the High School and Beyond database to relate homework time to achievement, statistically controlling for confounding variables. In the large majority of these studies, homework time was the only homework indicator implemented, and was positively associated with achievement. Third, 32 studies reported bivariate correlations between homework time and achievement; a weighted average correlation of $r = .24$ was calculated for these studies. In sum, the studies reviewed seem to support the idea of a positive homework-achievement association.

In light of this (seemingly) consistent support for a positive homework-achievement relationship, another homework study may seem surplus to requirements. However, it may yet be too early to draw any definitive conclusions about the positive effects of homework. In fact, despite the high consistency of the studies reviewed, Cooper et al. (2006) warned that "all studies, regardless of type, had design flaws" (p. 3). Indeed, there are several potential threats to the validity of the non-experimental studies on the homework-achievement

relationship reviewed by Cooper et al. (2006). First, homework can be related to achievement at several analytical levels (see Trautwein & Köller, 2003). 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., De Jong et al., 2000; Trautwein, Köller, Schmitz, & Baumert, 2002). A homework effect at the *between-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 et al., 1998). Finally, researchers can also test whether homework compliance is positively related to achievement at the *within-student* level. For instance, relative to their own baseline, do students understand the lesson better after doing their homework assignments conscientiously? Taken together, homework is a classic example of the multilevel problem (e.g., Elawar & Corno, 1985; Kreft & de Leeuw, 1998; Raudenbush & Bryk, 2002), and it is essential to differentiate between effects at the class level and the between-student level (and, perhaps, the within-student level) in all studies that relate homework to achievement. Unfortunately, almost none of the studies reviewed by Cooper et al. (2006) attended to this aspect.

A second major issue in several homework studies is that they either do not control for the role of confounding variables or overlook some potentially important confounding factors. For instance, students attending an advanced mathematics course or an elite school might spend more time on mathematics homework than students enrolled in a basic course or a lower level school (see Keith & Cool, 1992). Likewise, teachers in high-quality schools attended by students from privileged backgrounds might set more homework. The finding of a positive relationship between homework and achievement might thus be attributable to a common cause (i.e., course level, school quality, or gender) rather than to time on homework per se. In a related vein, the majority of studies reviewed by Cooper et al. (2006) are single-measurement studies that did not control for prior achievement. Questions pertaining to the directionality of homework effects cannot be readily answered on the basis of such designs.

Does homework time affect later achievement or does achievement affect homework time—or do both effects coexist? Designs that control for prior knowledge are needed to address this question.

Third, the studies included in the meta-analysis focus almost exclusively on *time* spent on homework. This measure may in fact obscure the relationship between homework and achievement, rather than elucidating it. With reference to Carroll (1963), time spent on homework is often equated with conscientious homework behavior. However, Carroll's model in fact predicts learning outcomes based on both time spent and time needed. Time needed is higher in students with low cognitive abilities and/or low prior achievement. 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, 2003, and Trautwein & Lüdtke, 2007, for a critical account of the time on task variable).

Multilevel Studies on Homework

A small number of European homework studies that did not fit the inclusion criteria specified by Cooper et al. (2006) for their review (i.e., studies conducted in the United States and reported between 1987 and 2003) are of relevance to the present investigation. In general, these studies found only limited support for the association between homework time and achievement. Schmitz and Skinner (1993) conducted a diary study spanning a 4-month period. Based on daily measurements, they analyzed the relationship between time spent on homework and achievement at both the between-student and the within-student level. Schmitz and Skinner also asked students to rate the "subjective effort" they put into their homework (i.e., their perception of effort expended). In the between-student analysis, a negative correlation of r = -.43 was found between the time needed to complete homework

assignments and achievement. In other words, students who reported less study time than their peers had higher achievement scores. At the same time, subjective effort was positively related to performance. In their within-student analysis, Schmitz and Skinner again found a negative correlation between time spent on homework and achievement—students needed more time for assignments they found difficult. When controlling for task difficulty, the relationship between time on homework and achievement became more positive.

De Jong et al. (2000) examined homework effects on the development of mathematics achievement in a sample of 1,394 students (56 classes from 28 schools) in their first year of junior high school. A repeated measurement design was used, with separate measures of prior knowledge and intelligence. Homework data were obtained from students (homework time, homework problems, homework study tactics, and the role of parents), teachers (homework amount), and observers (homework assignment, discussion of homework). Several variables showed statistically significant correlations with achievement gains. For instance, there was a negative correlation of r = -.15 between time spent on homework and math achievement (but the correlation was no longer significant when prior knowledge and intelligence were taken into account). The authors interpreted this finding as indicating that students with less knowledge need more time to complete their homework. Homework amount was the only homework variable that explained a significant amount (2.4%) of the variance when included in a multilevel analysis. De Jong et al. operationalized homework amount as the absolute number of tasks assigned to a class in the school year (i.e., as a class-level variable).

Another study using multilevel analyses to address homework effects was reported by Trautwein et al. (2002). Repeated measurement data collected from 1,976 German 7th graders in 125 classes were analyzed to investigate the role of homework in enhancing mathematics achievement. Trautwein et al. controlled for prior knowledge, intelligence, socio-economic background, motivation, and type of secondary school. Three homework variables were used: homework frequency, frequency of teachers' monitoring of homework completion, and time typically spent on homework per day. Homework frequency and frequency of monitoring

were aggregated at the class level, whereas time spent on homework was introduced as both a student-level and a class-level variable (the latter being dubbed “homework length”). At the class level, the frequency of homework assignments statistically significantly positively predicted Time 2 math achievement, whereas lengthy homework assignments had a negative, albeit non-significant, effect. At the individual level, time spent on homework statistically significantly negatively predicted Time 2 achievement.

Recently, Trautwein (2007) reanalyzed homework data from two international student assessment studies. His study was prompted by findings from the Programme for International Student Assessment (PISA; Organization for Economic Co-operation and Development [OECD], 2001), which suggested that longer homework times are associated with higher achievement. Using the German extension of the PISA data set, Trautwein controlled for potential common causes of homework time and achievement, and applied multilevel modeling to disentangle student-level and school-level effects. The multilevel analyses indicated that the relationship between homework time and achievement was moderate at the school level and negative at the individual level. In a second study using a longitudinal extension to the Third International Mathematics and Science Study (TIMSS; Beaton et al., 1996) and distinguishing homework frequency from homework time, Trautwein (2007) corroborated and extended these findings. First, homework frequency—but not homework time—was a significant predictor of achievement at the class level. Second, homework time was negatively related to achievement and achievement gains at the student level. These findings indicate that lengthy homework times are more likely to reflect motivational problems or problems of understanding than they are to be a sign of high student motivation or effort. Third, when important additional predictor variables such as school type and prior knowledge were not controlled, the effects of homework variables were artificially inflated.

The Present Investigation

This article reports results from a large study that was specifically designed to test homework effects. The study has several distinguishing characteristics. First, we used a

multilevel research model as a conceptual framework to separate the effects of homework assignment and homework completion. Second, we included measures of homework frequency, homework effort, and negative emotions when doing homework as additional predictor variables. Third, we used a repeated measurement design that included a diary component. Fourth, we studied homework effects in French as a second language; very few prior studies have tested homework effects on second language learning.

The article is split into three subsections for the sake of easier readability, but all three parts are based on the same student sample. In the first part, we consider both the class level and the between-student level. Do classes set frequent and/or lengthy assignments show higher achievement gains? Are classes with high homework morale more successful? And do students in classes who put more effort into their homework perform better than their classmates? In the second part, we examine homework completion effects at the between-student level. Compared with their classmates, are students who invest more effort and/or time in their homework more successful? Finally, in the third part, we again test for homework completion effects, but at the within-student level. When do students think they have benefited from their homework assignments: When they put more time and/or effort into their completion?

Part 1

In almost all of the non-experimental studies included in the Cooper et al. (2006) review, researchers tested the association between a "time on homework" measure and an achievement indicator. Some studies controlled for confounding variables (e.g., Keith & Cool, 1992), but very few disentangled homework assignment and homework completion effects (see Cooper et al., 2006). In Part 1, we focus on separating these effects; furthermore, we test the relationship between track level and homework.

The research questions addressed in Part 1 were as follows. First, based on our prior studies (Trautwein, 2007; Trautwein et al., 2002), we expected to find a positive association between the frequency of homework assignments and achievement. No such effect was

expected for homework length. Moreover, we hypothesized that classes with high homework morale (high average effort on homework) and low levels of negative homework emotions would be characterized by favorable achievement levels. Second, again based on our earlier research, we expected homework effort to positively predict achievement at the student level, but time on homework and high levels of negative homework emotions to be negatively related to achievement. Third, we expected the size of these associations to decrease considerably when controlling for prior knowledge and track level.

Method

Sample

The sample considered here derives from a large study (e.g., Trautwein, Lüdtke, Schnyder & Niggli, 2006) on homework in French as a second language conducted in collaboration between researchers at the University of Teacher Education in Fribourg, Switzerland, and the Max Planck Institute for Human Development in Berlin, Germany. More than 90% of all eighth-grade classes with German as the language of instruction in two Swiss cantons (Fribourg and Valais) participated in the study; a small number of classes from a third canton (Lucerne) were also included. The total sample was highly representative of students in these cantons, consisting of 112 eighth-grade classrooms with 93 teachers and a total of 1,915 students. For the present analyses, one special education class was discarded. Moreover, because we were interested in naturally occurring homework effects, we excluded 20 teachers and their classes who participated in a teaching effectiveness program while the present study was in progress. In addition, we excluded all classes that missed one of the two administrations of the student questionnaire or achievement test. The remaining sample consisted of 70 classes and 1,275 eighth graders (51.2% female; mean age at first measurement point: $M = 13.84$, $SD = 0.57$). For the majority of teachers, only one of their classes participated, but student responses from two classes were available for eight teachers. Of the participating students, 93.8% were born in Switzerland. Moreover, 88.9% of the students' mothers and 88.7% of fathers were born in Switzerland, and 92.5% of the students

reported speaking German with their parents most or all the time. Finally, 28.7% of the fathers and 15.2% of the mothers had obtained a college degree—figures typical for this generation in Switzerland.

Procedure

The study was conducted during regular lesson time in intact classes in the 2003/2004 school year. Participation was voluntary. All participating students and teachers were informed about the study's objectives and assured that their data would be used for scientific purposes only. The first set of instruments (student questionnaire and standardized French test) was administered in September and October 2003 (Time 1); the second student questionnaire and French test in June 2004 (Time 2). All participating students were attending compulsory lessons in French as a second language. Materials, including detailed written instructions on data collection, were mailed to the French teachers, who administered the instruments. Immediately after testing, teachers collected the materials, put them in a sealed envelope, and mailed them back to the researchers. In the year after data collection, teachers and students received written feedback on the study, its main outcomes, and some information on their own class, but no individual feedback.

Instruments

French achievement test. Students' French skills were assessed at two points of measurement (beginning and end of eighth grade) using a standardized achievement measure. Test scores were scaled according to item response theory (IRT) using the ConQuest package (Wu, Adams, & Wilson, 1998). The French test was designed to provide a broad overview of students' command of the language by assessing a range of skills (reading comprehension, listening comprehension, and writing proficiency) and levels of language. Different response formats were used: multiple choice tasks were combined with tasks requiring sentences to be completed, generated from words provided, put in the right order, or translated from French into German. Achievement scores were calculated on the basis of 62 items at T1 and 48 items at T2, with 13 items serving as anchor items. The reliability of the tests was high at both

points of measurement. The internal consistency (Kuder-Richardson formula 20) was 0.89 at T1 and 0.91 at T2. Test scores at T1 were standardized ($M = 0$, $SD = 1$). Test scores at T2 were standardized to have the mean and standard deviation of T1, meaning that test scores at both times of measurement could be interpreted on a common metric.

Homework variables. Students were first asked to report the *frequency* of homework assignments. "You probably have about 10 French lessons every 2 or 3 weeks. On average, how often does your French teacher set you homework?" Students checked one of 11 boxes, ranging from "never" (coded as 0) to "always" (10). The *homework time* question was open-ended: "On average, how many minutes do you need to complete the French homework you are set (not including learning vocabulary)?" Responses were then summarized to four categories (up to 10 minutes, 11 to 20 minutes, 21 to 30 minutes, more than 30 minutes). The *homework effort* scale consisted of four items (sample item: "I always try to finish my French homework"). Students high on homework effort do their homework assignments carefully and do not copy from others. Internal consistency (Cronbach's alpha) of the scale scores was adequate ($\alpha = .72$). Students' *negative homework emotions* were assessed by means of five items describing negative emotional states that may accompany the completion of homework assignments (sample item: "Doing French homework often annoys me"). Students high on this scale feel angry, uneasy, and tense when working on their assignments. Internal consistency was adequate ($\alpha = .81$). All homework variables were taken from the student questionnaire administered at the end of the school year.

Track level and region. Although the Swiss school system varies from canton to canton, it is generally characterized by explicit tracking of students. Students are placed in one of the two or three secondary tracks available, based primarily on their achievement at the end of grade 6. Two of the three cantons included in our study have a two-track system; the third offers three tracks. We dummy coded *track level* (0 = lower track, 1 = upper tracks) for all analyses. We also dummy coded the *region*, using Valais as the reference category.

Statistical Analyses

Multilevel regression analyses were conducted to predict French achievement. In most studies conducted in school settings, individual student characteristics are confounded with classroom or school characteristics because individuals are not randomly assigned to groups. This clustering effect introduces problems related to appropriate levels of analysis, aggregation bias, and heterogeneity of regression. For the present research, it is important to note that the meaning of a variable at the student level may not bear any straightforward relation to its meaning at the classroom level. This holds particularly for the "time on homework" measure, which provides different information at the individual than at the class level. The average time typically spent on homework at the class level is a proxy measure of the typical assignment *length* in the class, whereas the time typically spent on a homework assignment at the student level may either signify a student's working speed or the effort he or she makes to complete homework assignments. In Switzerland, homework is typically given to all students in a class. Therefore, the frequency of homework assignments within a class is constant, and does not need to be considered at the individual level.

Whenever major variables represent different levels of analysis, it is important to use appropriate multilevel statistical procedures for data analysis. Multilevel modeling, a special form of regression analysis, provides a powerful methodology for handling hierarchical data, and was used in this study. A detailed presentation of multilevel modeling (also referred to as hierarchical linear modeling, HLM) is beyond the scope of the present investigation and is available elsewhere (e.g., Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). In the present study, students were used as level-1 variables, and classes as level-2 units. The HLM 6 software (Raudenbush, Bryk, Cheong, & Congdon, 2004) was used to conduct the statistical analyses. Because HLM does not report standardized regression coefficients, the original metric of all variables was conserved in the analyses to be reported. All models were random-intercept models estimated by restricted maximum likelihood (REML) procedures.

Missing data are inevitably a major challenge in large-scale studies, particularly if the

proportion of data missing exceeds 5% (Graham, Cumsille, & Elek-Fisk, 2003). We used the multiple imputation procedure (Schafer, 1997) to deal with missing data, the proportion of which did not exceed 7% on any of the variables considered here. Using the NORM software (version 2.03, see Schafer & Graham, 2002) and several auxiliary variables (see Collins, Schafer, & Kam, 2001), we generated five data sets in which missing data were replaced with estimated values. The HLM 6 software (Raudenbush et al., 2004) was then used to simultaneously analyze all five imputed data sets. Descriptive reports are based on the first imputed data set.

Results

Means and intercorrelations for the variables used in this study are shown in Table 1. Overall, students reported a relatively high frequency of homework assignments (M = 7.28). 37.7% students reported typically spending up to 10 minutes on their assignments, 42.7% between 11 and 20 minutes, and 13.6% between 21 and 30 minutes. Only 5.9% reported typically spending more than 30 minutes on their assignments. On average, students' reported homework effort (M = 2.99) was above the scale midpoint, and reported negative homework emotions (M = 2.05) were below the scale midpoint.

At the between-student level, correlations among the homework variables were low to moderate, with the exception of a substantial negative association between homework effort and negative homework emotions (r = -.48). Homework time was only loosely related to the other homework variables; the association with homework effort amounted to r = .20, thus supporting our call for these two constructs to be separated. The association of homework variables with French achievement was complex. Whereas higher homework effort was associated with higher achievement, higher homework time and higher levels of negative homework emotions were negatively related to achievement. The pattern of correlations at the class level was similar to that found for the student level, but the correlations were, in general, somewhat larger.

We next turn to the multilevel analyses. French achievement at the end of the school

year was the criterion variable in all models. Furthermore, we included region, homework frequency, and homework time as class-level variables, and gender and homework time as student-level variables in all models. Additional variables were entered in Model 2 (prior knowledge) and Model 3 (track level). Preliminary analyses indicated that simultaneous consideration of homework effort and negative homework emotions (which correlated substantially at both levels of analysis) impacted the size of the respective regression coefficients. For this reason, homework effort was included at both the class and the student level in half of the models (Models 1a, 2a, and 3a), and negative homework emotion was used as an additional predictor variable in the remaining models (Models 1b, 2b, and 3b). Of the student variables, prior knowledge and gender were entered as uncentered variables. When this centering option is used, the class-level effects are controlled for the effects of the predictor variable at the student level (see Hofmann & Gavin, 1998). Group-mean centering was used for the homework variables because we were interested in the independent effects of these variables at the student and class levels. The results of the analyses are reported in Table 2.

In Models 1a and 1b, the majority of predictor variables were statistically significantly associated with French achievement. At the class level, we found a statistically significant effect of homework frequency. Classes in which homework was assigned frequently had comparatively high average French achievement. The regression coefficient of .16/.17 indicates that an increase of two units in homework frequency (e.g., assignments for 8 out of 10 rather than 6 out of 10 lessons) was, on average, associated with an increase in French achievement of about one third of a standard deviation. Homework length was statistically negatively associated with achievement. On average, an increase of one unit in homework length was associated with a decrease of about three quarters of a standard deviation in achievement. In interpreting this regression coefficient, however, one needs to bear in mind that an increase of one unit in homework time is about three standard deviations above the mean of all classes. Class-average homework effort was positively associated with

achievement; however, given the large standard error, the association was not statistically significant. Class-average negative homework emotions, on the other hand, were statistically significantly negatively associated with French achievement: achievement was higher in classes in which students reported comparatively low levels of negative homework emotions. In total, 32% (Model 1a) and 40% (Model 1b) of the class-level variance was explained.

At the between-student level, female gender was associated with higher French achievement. Homework time had a statistically significant negative predictive effect on achievement. Similarly, high levels of negative emotions when doing homework predicted low French achievement. Conversely, homework effort was positively associated with achievement. At the student level, 8% (Model 1a) and 13% (Model 1b) of the variance was explained.

In Models 2a and 2b, French achievement as measured at the beginning of the school year was included as an additional (uncentered) predictor variable. These models test our hypothesis that the association between homework and achievement would be substantially reduced by including an indicator of prior knowledge. As can be seen in Table 2, prior knowledge was substantially associated with French achievement at the end of the school year. As expected, when controlling for prior knowledge, the regression coefficients of the homework variables were substantially reduced in size, but all student-level predictors and a number of class-level homework variables were still statistically significantly related to French achievement. At the class level, homework frequency and negative homework emotions statistically significantly predicted French achievement. The negative effect of homework length was no longer statistically significant, however. The inclusion of prior knowledge lead to a substantial increase in explained variance (Level 1: R^2 = .88; Level 2: R^2 = .49/.50) at both levels of analysis.

Finally, in Models 3a and 3b, we included track level as a further predictor variable to test our assumption that homework effects may be confounded with track level. As Table 2 shows, when controlling for prior knowledge, placement in the upper tracks predicted higher

achievement at the end of the school year. The size of the class-level homework effects were further reduced. Homework frequency was not statistically significantly associated with achievement once track level was controlled, but the negative association between negative homework emotions and achievement remained statistically significant.

Summary of Part 1

Part 1 confirmed most of our assumptions. Three findings are of particular importance. First, depending on the variables chosen, the homework-achievement association was either positive, negative, or not statistically significantly different from zero. Second, the homework-achievement association differed across the levels of analysis. In the present study, the most consistent association was found for negative homework emotions: at both analytical levels, a high value for negative homework emotions was associated with unfavorable achievement. Homework effort had a positive regression weight at both levels, but the class-level effect was not statistically significant. Third, the size of the homework-achievement association was considerably affected by the inclusion of prior knowledge and track level in the models. For instance, when controlling for several additional variables, the predictive effect of homework time was comparably small and, at the student level, negative.

Part 2

Whereas Part 1 examined both class-level and between-student level effects, Part 2 focused exclusively on between-student effects. Furthermore, Part 2 extended on Part 1 in two important respects. First, we examined the dynamics between homework and achievement across three measurement points spanning about 7 months. Second, a homework diary was used to collect students' homework data at two of these measurement points. The reliability and validity of questionnaire reports on homework has proved somewhat controversial (e.g., Cooper et al., 1998; De Jong et al., 2000). Diaries seem to complement questionnaire data (e.g., Schmitz & Wiese, 2006). Based on earlier research and the results reported above, we expected homework effort to positively predict achievement, but homework time and negative homework emotions to negatively predict achievement.

Method

Sample and Procedure

The student sample of 1,275 eighth graders in three Swiss cantons used in Part 2 is identical to the sample used in Part 1. We used data from the student questionnaire administered in September/October 2003 (Time 1) as well as data from two diary components (see below) administered in January 2004 (Time 2) and April 2004 (Time 3).

Instruments

French achievement. School grades reported in the student questionnaires were used as indicators of school achievement. At Time 1, we obtained the French grade awarded on the final grade 7 record card; at Time 2, the mid-year French grade awarded in January of grade 8; at Time 3, the grade on the last French test set between April and May. In most classes, grades were given on a decimal point system, with grade 6.0 indicating the best possible outcome. A few classes used a letter-based grading system similar to that applied in the U.S.; grades from A to D were converted to the decimal point system. Grades rather than achievement on a standardized test were used for two reasons. First, no test scores were available for Time 2. Second, it tends to be grades, and not achievement test scores, that determine a student's school career. It is on the basis of grades that teaching staff decide whether a student is ready to advance to the next grade level (see Keith et al., 1993). Moreover, grades may be more sensitive to increases in effort and motivation than test scores (Keith et al., 1993; Natriello & McDill, 1986). In sum, grades are suitable indicators of achievement for analyses at the between-student level (but not at the class level).

Time 1 homework variables. The homework scales described in Part 1 were used to measure homework effort and negative homework emotions. Internal consistencies of the scale scores at T1 were satisfactory for both homework effort (α = .69) and negative homework emotions (α = .80).

Diary instrument. A 1-week homework diary was implemented at Time 2 and again at

Time 3. Students were asked to fill out the diary immediately after completing each of their homework assignments. Because no class had more than four French lessons per week, the same set of questions was prepared for a total of four days. Students were asked to report the amount of *time* they had spent on each assignment: "I did [blank] minutes' homework." In addition, they indicated their agreement with a total of seven statements addressing specific aspects of the assignment. Two of these items are used in the present analyses. The first describes students' *homework effort*: "I did my best to answer all of the questions." The item captured *negative homework emotions*: "This homework assignment put me in a bad mood." The homework indicators were averaged for each individual student for Time 2 and Time 3 separately. As in Part 1, homework time responses were summarized to four categories (0 to 10 minutes, 11 to 20 minutes, 21 to 30 minutes, more than 30 minutes).

Statistical Analyses

Path analysis was performed using the computer program Mplus 4.0 (Muthén & Muthén, 1998-2006). In Part 2, we focused exclusively on homework completion effects. In other words, we were interested in differences between students in the same classes. In order to remove any between-class differences (e.g., Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005), we standardized ($M = 0$, $SD = 1$) all variables within class before data analysis.

On average, 9.8% of data for the variables used in Part 2 were missing. We used the missing values estimator implemented in Mplus 4.0 to deal with these missing data. The model-based approach to missing data applied in Mplus builds on a full information maximum likelihood estimation (see Allison, 2001).

Results

Table 3 reports means, standard deviations, and intercorrelations of the variables used in Part 2. In interpreting the results, it is important to bear in mind that different instruments were used at T1 and T2/T3. However, the correlations between the same constructs measured at different time points were moderate to high ($.25 \leq r \leq .63$). In addition, there was a substantial negative correlation between homework effort and negative homework emotions at

all measurement points. Furthermore, homework time was negatively related to school grades at all three measurement points, whereas homework effort was statistically significantly positively related to school grades at Time 1 and Time 2. Negative homework emotions were statistically significantly associated with school grades at all three measurement points; students with lower grades expressed more negative homework emotions.

In the next step, we specified path models relating school grades, time on homework, homework effort, and negative homework emotions over the three waves of data collection. Paralleling the procedure used in Part 1, we included either homework effort or negative homework emotions (but not both constructs simultaneously) in these two models. Figure 1 shows the results of the analyses.

School grades remained fairly stable over the three measurement points. Controlling for time on homework, high French grades were associated with less time on homework at the subsequent measurement point. Furthermore, school grades predicted homework effort (high achievement at Time 2 was associated with more effort at Time 3) and negative homework emotions (high achievement was associated with lower levels of negative homework emotions at the subsequent measurement point).

Time on homework was a significant predictor of school grades: the more time students reported spending on their homework at Time 1, the lower their French grades at Time 2. Furthermore, time on homework at Time 2 statistically significantly predicted homework effort (more time on homework was associated with more homework effort) and negative homework emotions (more time on homework predicted lower levels of negative homework emotions) at T3.

Homework effort at Time 1 positively predicted school grades and time on homework at Time 2. No significant regression weights were found for the Time 2/Time 3 interval. Students who reported a comparably high level of negative homework emotions were assigned lower school grades at the subsequent measurement point. Furthermore, Time 1 negative homework emotions were statistically significantly associated with time on

homework at Time 2 (more negative homework emotions predicted less time on homework).

Summary of Part 2

In general, we found support for our hypotheses. Homework effort positively predicted achievement, whereas homework time and negative homework emotions negatively predicted achievement. Furthermore, we found higher achievement to predict less homework time, more homework effort, and lower levels of negative homework emotions. In general, the regressions coefficients were small to moderate, with the largest predictive effects being found for negative homework emotions. However, small beta coefficients for cross-lagged effects are common in real-world, non-experimental longitudinal research on person characteristics, and can be considered meaningful (e.g., Roberts, Caspi, & Moffitt, 2003). When interpreting such cross-lagged effects, it is important to bear in mind that changes in school grades, homework time, homework effort, and negative homework emotions are multiply determined (Ahadi & Diener, 1989), and that cross-lagged effects are potentially cumulative over time: the specific effect of a small beta coefficient may be quite substantial if it persists over an extended period (Neyer & Asendorpf, 2001; Prentice & Miller, 1992).

Part 3

In Part 2, we examined between-student effects, asking whether students who show high homework engagement perform better than their classmates. In Part 3, we move to the within-student level, and conduct intraindividual analyses. Our research questions are now as follows: When students invest more time or effort in their homework relative to their personal baseline, are they more satisfied than usual with their assignments? And how are negative homework emotions related to the outcome variables? We did not implement daily tests to document the achievement gains associated with doing homework, but relied on students' subjective evaluations of the benefits each assignment. We expected homework effort to positively predict these subjective evaluations and negative homework emotions to negatively predict them. Furthermore, we speculated that more homework time would be associated with less positive subjective evaluations of homework benefits.

Method

Sample and Procedure

We used data from the two diary components described in Part 2. Of the original sample of 1,275 eighth graders, we excluded 66 students who did not provide complete data for at least one diary day. The remaining 1,209 students reported a total of 7,103 assignments (on average, 5.88 assignments per student).

Instruments

The *homework time*, *homework effort*, and *negative homework emotions* items were identical to those described in Part 2. In addition, an item tapping the *subjective homework evaluation* was included: "This assignment helped me to improve my French."

Statistical Analyses

In Part 3, we used multilevel modeling to predict the subjective benefits of homework completion as a within-student variable. In other words, we used the separate assignments from the homework diary as the level-1 variable (within-student level) and the 1,209 students as the level-2 variable (between-student level). On the first (within-person) level, regression equations were modeled for the diary variables—that is, homework time, homework effort, and negative homework emotions. All level-1 predictors were centered around the students' own mean scores across days (Hofmann & Gavin, 1998). At the second (between-person) level, regression equations were modeled for school grades as a central indicator of achievement. As in Part 2, we standardized school grades within classes.

In the following, we illustrate our modeling approach in more detail, using the example of how subjective homework evaluation was related to self-reported homework effort. The regression equation for a simple analysis with just one level-1 predictor variable (homework effort) would be:

$$Y_{ij} = \beta_{0j} + \beta_{1j} \times \text{Homework Effort} + e_{ij},$$

where Y_{ij} represents the subjective homework evaluation on the ith day for the jth student, treated as a continuous variable, β_{1j} represents the homework effort coefficient for the jth student, and β_{0j} represents the average subjective homework evaluation score for the jth student. Random error within students is represented by e_{ij}.

We also examined whether prior knowledge in the form of school grades would predict subjective homework evaluation. To this end, a second-level equation with prior knowledge was modeled:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \times \text{School Grade} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

γ_{00} can be interpreted as the average subjective homework evaluation across all students. γ_{01} represents the effect of the French grade on the student's specific intercept. u_{0j} represents random error across students. The regression parameter β_{1j} is predicted by the coefficient γ_{10}, and is treated as a fixed coefficient. All models reported were random-intercept models estimated by restricted maximum likelihood (REML) using HLM 6 (Raudenbush et al., 2004).

Results

Averaged across all assignments, the subjective homework evaluation variable had a mean of $M = 2.87$ and a standard deviation of $SD = 0.80$. Across all 7,103 assignments, subjective homework evaluation statistically significantly correlated with homework time ($r = .16$, $p < .001$), homework effort ($r = .30$, $p < .001$), and negative homework emotions ($r = -.17$, $p < .001$). Homework time was positively associated with homework effort ($r = .16$, $p < .001$) and negatively associated with negative homework emotions ($r = -.03$, $p < .01$). Homework effort and negative homework emotions were also negatively associated ($r = -.28$, $p < .001$).

We next ran a set of multilevel analyses. In an empty model including only the dependent variable, 58% of the total variance was located at the within-student level, indicating that there was substantial day-to-day variation in students' subjective evaluations of

their homework assignments. In line with the strategy used in Part 1 and 2, we then specified separate analyses with either homework effort or negative homework emotions. The results of these analyses are presented in Table 4. In Model 1 (in which homework time and effort were included as within-student variables), we found a statistically significantly positive effect of both level-1 predictor variables. Students' evaluations of their homework were comparatively high when they invested relatively high amounts of time and effort in them. However, these two predictor variables explained only 4% of the variance located a the within-student level. Prior French grade as a between-student variable did not statistically significantly predict students' subjective homework evaluations. In Model 2, we replaced homework effort by the negative homework emotions variable. This variable statistically significantly predicted subjective homework evaluations; the lower the level of negative emotions, the higher the students' evaluation of the assignment. The two predictors explained only 2% of the variance at the within-person level. In addition to the models reported in Table 4, we ran an additional set of models in which we specified interaction terms between French grade and each of the within-student variables, yielding a total of four beta coefficients for interaction effects. These models test whether the relationship between the predictor variables and the criterion varies with the students' prior level of achievement. However, all four beta coefficients proved to be statistically non-significant.

Summary of Part 3

There are three main results to report from Part 3. First, there was substantial day-to-day variation in students' subjective homework evaluations. It would be interesting to examine this day-to-day variation in more detail. Second, as expected, homework effort positively predicted students' subjective evaluations of their homework, whereas negative homework emotions negatively predicted their evaluations. Third, unexpectedly, homework time was positively associated with subjective homework evaluation. In contrast to the findings at the class and between-student levels, more time on homework predicted a positive outcome.

General Discussion

The findings from this large study designed to test homework effects have three main implications. First, researchers studying the homework-achievement relation need to consider the multilevel structure of homework. Second, depending on the construct used, the association between homework and achievement may be negative, positive, or zero. Third, when prior knowledge and potential confounding variables are included in the model, the strength of the association between homework and achievement decreases considerably. Overall, then, homework research is characterized by a high level of complexity. Depending on the variables investigated and the level of analysis chosen, researchers studying the homework-achievement relation may see different phenomena. It is this complexity of the research topic that lends the homework-achievement association its chameleon-like character. Of course, this does not mean that there is no structure to the homework-achievement association. It does mean, however, that any attempts to capture homework effects in bivariate correlations based on a simple time-on-homework measure will oversimplify the complex nature (see Cooper, 1989) of homework assignments and obscure the reality of homework completion.

Different Homework Constructs, Different Associations with Achievement

In line with some earlier studies (e.g., Trautwein et al., 2002), we found that frequent homework assignments predicted achievement, even when controlled for prior achievement. Although the present study does not allow this effect to be explained in detail, it is in line with the emphasis placed on regular, step-by-step learning opportunities in several theories of learning and instruction (e.g., Weinert & Helmke, 1995). Once track level was controlled, however, the regression coefficient of homework frequency was no longer statistically significant. What does this finding mean? As the bivariate correlations at the class level showed, track level and homework frequency were positively associated, with homework being assigned more frequently in the upper tracks than in the lower track. Hence, the two effects were somewhat confounded at the class level. It is thus possible that the “homework frequency effect” observed in the present study was, in fact, primarily an effect of track level.

When it comes to homework time, a complex pattern of findings emerged. In typical homework studies, there are at least two problems with the homework time measure. First, homework time and homework frequency are confounded in the "time on homework" measure. Second, the class level and the between-student level are not differentiated. In Parts 1 and 2 of our study, time on homework at the between-student level was predicted by low prior achievement, and did not positively impact achievement when several other variables were controlled. The association between longer homework time and low achievement is quite plausible: it takes weaker students longer to complete their homework tasks. However, the nonsignificant or even negative effect of homework time on achievement after controlling for other variables warrants some explanation. A first possible explanation is that lengthy homework times might signify a rather inefficient, unmotivated homework style. Indeed, homework time was only loosely (and negatively) related to reported homework effort. A second potential explanation is that the reliability of the "time on homework" measure is questionable (see Trautwein & Köller, 2003). De Jong et al. (2000) reported a rather low correlation between an overall "time on homework" measure and time on homework as documented in a logbook. However, even when using a homework diary in Part 2, we did not find more homework time to predict later achievement. A third explanation concerns the difference between homework time and other out-of-school learning activities (e.g., Cooper et al., 1998). The homework measures reported in the present study targeted homework assigned by the teacher. Extra study time was not included. The only statistically significant positive effect of homework time was found in the within-student analysis that used students' subjective evaluations of their homework assignments as the dependent variable. More research is needed to explain this positive effect. Although it is quite possible that students who work relatively long on a specific assignment will have a relatively high gain from this assignment, the effect may also be attributable to dissonance-reducing mental processes ("I have spent lots of time on this, so it's got to be successful") (e.g., Festinger, 1954).

When it comes to homework effort, the present study supports the view that effort on

homework is associated with positive developments in achievement. This finding is in line with several recent studies (Trautwein, 2007; Trautwein, Lüdtke, Schnyder, & Niggli, 2006; Zimmerman & Kitsantas, 2005) that have documented positive associations between homework effort and achievement. However, the positive effect was restricted to the between- and within-student level. At the class level, the (positive) association was not statistically significant. One reason for this finding is that, in our sample, the natural variation of homework effort at the class level was small (see Table 1). It seems likely that, with a higher number of level-2 units and more variation in the sample studied, researchers will be able to document class-level homework effort effects.

We also administered a measure of negative homework emotions. Although there is a strong link between homework and negative emotions (e.g., Burnett & Fanshawe, 1997; Leone & Richards, 1989), prior research has not systematically examined this variable. Our study indicates that negative homework emotions are closely associated with achievement indicators. Importantly, there seems to be a reciprocal relationship, with low achievement predicting higher levels of negative homework emotions, and higher levels of negative homework emotions predicting low achievement. The negative homework emotions effect was also found at the class level: the more negative homework emotions the students of a class reported on average, the lower the average achievement of that class, even when controlling for prior achievement.

Taken together, our study documented statistically significant homework effects at all levels of analysis. In general, the findings support the view that homework is beneficial to students' achievement, but that "time on homework per assignment" is negatively related to achievement at the class and between-student levels. Moreover, our findings point to the need to focus more closely on the emotional states of students doing homework.

Limitations and Future Research

With its large sample and longitudinal design, the present article makes a strong case for the reconceptualization of homework effects and homework research. At the same time, it has

certain limitations. First, it was restricted to eighth graders. It is quite possible (see Muhlenbruck, Cooper, Nye, & Lindsay, 2000) that the size of the homework-achievement association is stronger in the upper than the lower grades.

Moreover, the sample was drawn from three cantons in Switzerland. Our findings contradict the popular claim that homework time is beneficial to student achievement (Cooper, 1989; Cooper et al., 2006). Notably, the zero-order correlations between homework time and achievement were negative at the class and between-student levels, whereas the majority of zero-order correlations summarized by Cooper et al. (2006) were positive. The question thus arises as to whether the results reported are country specific and/or sample specific. Note that our time-on-homework measure, which conceptually and analytically separates homework time and homework frequency, differs from the time on homework per week measure used in most previous studies (which confound homework frequency and homework time). Moreover, several recent studies from other countries have yielded similar results. Controlling for the hierarchical structure of the data sets, studies from the Netherlands (De Jong et al., 2000) and Germany (Schmitz & Skinner, 1993; Trautwein, 2007) have also reported negative effects or no effects of homework time on achievement gains. Taken together, it is unlikely that the results reported in the present research can be fully explained by country-specific or sample-specific characteristics.

It should also be noted that the present study was restricted to homework in French as a second language. There are some, albeit weak, indications (see Cooper, 1989; Cooper et al., 2006) that homework time is differentially related to achievement across subjects.

In the present study, we introduced additional homework variables to complement the homework time indicator. It is, however, clearly necessary to expand homework research by describing the entire homework process in more detail. Homework assignments differ in quality as well as in quantity (frequency, length). Teachers' homework attitudes and homework quality may have an important impact on students' homework effort. Moreover, whether students invest a little or a lot of effort in homework is determined not only by their

prior knowledge, but also by family and motivational factors. Trautwein, Lüdtke, Kastens, and Köller (2006; see also Trautwein & Lüdtke, 2007) recently proposed a comprehensive multilevel homework model that can be used to study these complex processes in more detail (see also Warton, 2001).

References

Ahadi, S., & Diener, E. (1989). Multiple determinants and effect size. *Journal of Personality and Social Psychology, 56,* 398-406.

Allison, P. D. (2001). *Missing data.* Thousand Oaks, CA: Sage.

Beaton, A. E., Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., Kelly, D. L., & Smith, T. A. (1996). *Mathematics achievement in the middle school years: IEA's Third International Mathematics and Science Study*. Chestnut Hill, MA: Boston College.

Burnett, P. C., & Fanshawe, J. P. (1997). Measuring school-related stressors in adolescents. *Journal of Youth and Adolescence, 26,* 415-428.

Carroll, J. B. (1963). A model of school learning. *Teachers' College Record, 64,* 723-733.

Collins, L. M., Schafer, J. L., & Kam, C.-M. (2001). A comparison of inclusive and restrictive strategies in modern missing data procedures. *Psychological Methods, 6,* 330-351.

Cooper, H. (1989). *Homework.* White Plains, NY: Longman.

Cooper, H., Lindsay, J. J., Nye, B., & Greathouse, S. (1998). Relationships among attitudes about homework, amount of homework assigned and completed, and student achievement. *Journal of Educational Psychology, 90,* 70-83.

Cooper, H., Robinson, J. C., & Patall, E. A. (2006). Does homework improve academic achievement? A synthesis of research, 1987-2003. *Review of Educational Research, 76,* 1-62.

Cooper, H., & Valentine, J. C. (2001). Using research to answer practical questions about homework. *Educational Psychologist, 36,* 143-153.

De Jong, R., Westerhof, K. J., & Creemers, B. P. M. (2000). Homework and student math achievement in junior high schools. *Educational Research and Evaluation, 6,* 130-157.

Elawar, M. C., & Corno, L. (1985). A factorial experiment in teachers' written feedback on student homework: Changing teacher behavior a little rather than a lot. *Journal of Educational Psychology, 77,* 162-173.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7,* 117-140.

Graham, J. W., Cumsille, P. E., & Elek-Fisk, E. (2003). Methods for handling missing data. In J. A. Schinka & W. F. Velicer (Eds.), *Handbook of psychology: Vol 2. Research methods in psychology* (pp. 87-114). New York: John Wiley & Sons.

Hattie, J., & Clinton, J. (2001). The assessment of teachers. *Teaching Education, 12*, 279-300.

Hofmann, D. A., & Gavin, M. B. (1998). Centering decisions in hierarchical linear models: Implications for research in organizations. *Journal of Management, 24*, 623-641.

Keith, T. Z. (1986). *Homework*. West Lafayette: Kappa Delta Pi.

Keith, T. Z., & Cool, V. A. (1992). Testing models of school learning: Effects of quality of instruction, motivation, academic coursework, and homework on academic achievement. *School Psychology Quarterly, 3*, 207-226.

Keith, T. Z., Keith, P. B., Troutman, G. C., Bickley, P. G., Trivette, P. S., & Singh, K. (1993). Does parental involvement affect eighth-grade student achievement? Structural analysis of national data. *School Psychology Review, 22*, 474-496.

Kreft, I., & de Leeuw, J. (1998). *Introducing multilevel modeling*. London: Sage Publications.

Leone, C. M,. & Richards, M. H. (1989). Classwork and homework in early adolescence: The ecology of achievement. *Journal of Youth and Adolescence, 18*, 531-548.

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades and standardized test scores: Reciprocal effects models of causal ordering. *Child Development, 76*, 397-416.

Muhlenbruck, L., Cooper, H., Nye, B., & Lindsay, J. J. (2000). Homework and achievement: Explaining the different strengths of relation at the elementary and secondary school levels. *Social Psychology of Education, 3*, 295-317.

Muthén, L. K., & Muthén, B. O. (1998-2006). *Mplus user's guide.* Los Angeles, CA: Muthén & Muthén.

Natriello, G., and McDill, E. L. (1986). Performance standards, student effort on homework, and academic achievement. S*ociology of Education, 59,* 18-31.

Neyer, F. J., & Asendorpf, J. B. (2001). Personality-relationship transaction in young

adulthood. *Journal of Personality and Social Psychology, 81*, 1190-1204.

OECD. (2001). *Knowledge and skills for life: First results from the OECD Programme for International Student Assessment*. Paris, France: Author.

Prentice, D. A., & Miller, D. T. (1992). When small effects are impressive. *Psychological Bulletin, 112*, 160-164.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models* (2nd ed.). Thousand Oaks, CA: Sage.

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., & Congdon, R. T. (2004). *HLM 6: Hierarchical linear and nonlinear modelling*. Lincolnwood, IL: Scientific Software International.

Roberts, B. W., Caspi, A., & Moffitt, T. (2003). Work experiences and personality development in young adulthood. *Journal of Personality and Social Psychology, 84*, 582-593.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. London: Chapman & Hall.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*, 147-177.

Schmitz, B., & Skinner, E. (1993). Perceived control, effort, and academic performance: Interindividual, intraindividual, and multivariate time-series analyses. *Journal of Personality and Social Psychology, 64*, 1010-1028.

Schmitz, B., & Wiese, B. S. (2006). New perspectives for the evaluation of training sessions in self-regulated learning: Time-series analyses of diary data. *Contemporary Educational Psychology, 31*, 64-96.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage.

Trautwein, U. (2007). The homework-achievement relation reconsidered: Differentiating homework time, homework frequency, and homework effort. *Learning and Instruction, 17*, 372-388.

Trautwein, U., & Köller, O. (2003). The relationship between homework and achievement: Still much of a mystery. *Educational Psychology Review*, *15*, 115-145

Trautwein, U., Köller, O., Schmitz, B., & Baumert, J. (2002). Do homework assignments enhance achievement? A multilevel analysis in 7th grade mathematics. *Contemporary Educational Psychology, 27,* 26-50.

Trautwein, U. & Lüdtke, O. (2007). Students' self-reported effort and time on homework in six school subjects: Between-student differences and within-student variation. *Journal of Educational Psychology, 99*, 432-444.

Trautwein, U., Lüdtke, O., Kastens, C., & Köller, O. (2006). Effort on homework in grades 5 through 9: Development, motivational antecedents, and the association with effort on classwork. *Child Development, 77,* 1094-1111.

Trautwein, U., Lüdtke, O., Schnyder, I., & Niggli, A. (2006). Predicting homework effort: Support for a domain-specific, multilevel homework model. *Journal of Educational Psychology, 98*, 438-456.

Walberg, H. J. (1991). Does homework help? *The School Community Journal, 1,* 13-15.

Warton, P. M. (2001). The forgotten voices in homework: Views of students. *Educational Psychologist, 36*, 155-165.

Weinert, F. E., & Helmke, A. (1995). Interclassroom differences in instructional quality and interindividual differences in cognitive development. *Educational Psychologist, 30*, 15-20.

Wu, M. L., Adams, R. J., & Wilson, M. R. (1998). A*CER ConQuest: Generalised item response modelling software manual*. Melbourne: Australian Council for Educational Research.

Zimmerman, B. J., & Kitsantas, A. (2005). Homework practices and academic achievement: The mediating role of self-efficacy and perceived responsibility beliefs. *Contemporary Educational Psychology, 30*, 397-417.

Table 1.

Descriptives and Intercorrelations (Part 1). Correlations Below the Diagonal are Correlations at the Student Level (N = 1,275), Correlations above the Diagonal are Correlations at the Class Level (N = 70)

Variable	M_{ind}	SD_{ind}	1	2	3	4	5	6	7	8	9
1 Gender (0 = female, 1 = male)	0.49	0.50		-0.04	0.04	-0.11	-0.04	0.06	-0.13	0.26	-0.11
2 Canton Fribourg	0.42	0.49	0.00		-0.33	0.12	-0.27	-0.20	-0.22	-0.01	0.26
3 Canton Lucerne	0.13	0.34	0.01	-0.34		0.05	-0.03	-0.02	0.02	0.12	-0.47
4 Track (0 = lower, 1 = upper)	0.71	0.45	-0.02	0.09	0.06		0.25	-0.21	0.06	-0.14	0.66
5 Homework frequency	7.28	2.50	0.01	-0.21	-0.01	0.15		0.17	0.20	0.00	0.19
6 Homework time	1.88	0.86	0.00	-0.10	0.01	-0.09	0.09		0.31	0.00	-0.20
7 Homework effort	2.99	0.62	-0.10	-0.10	0.02	0.01	0.10	0.20		-0.55	0.05
8 Negative homework emotions	2.05	0.69	0.17	0.00	0.05	-0.05	-0.01	0.02	-0.48		-0.34
9 French achievement	0.36	1.28	-0.11	0.18	-0.40	0.50	0.08	-0.16	0.09	-0.28	
M_{class}			0.49	0.40	0.14	0.64	7.28	1.89	2.98	2.06	0.25
SD_{class}			0.11	0.49	0.35	0.48	1.67	0.36	0.27	0.25	1.06

Note. Correlations > .06 (student level) and > .24 (class level) are statistically significant at $p < .05$. M_{ind} and SD_{ind} = means and standard deviations at the between-student level, M_{class} and SD_{class} = means and standard deviations at the class level.

Table 2.

Predicting Time 2 French Achievement: Results from Multilevel Analyses

	Model 1a		Model 2a		Model 3a		Model 1b		Model 2b		Model 3b	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Class level												
Canton Fribourg	0.33	0.21	-0.13	0.10	-0.24*	0.08	0.32	0.20	-0.12	0.10	-0.23**	0.08
Canton Lucerne	-1.20***	0.23	-0.61***	0.12	-0.72***	0.14	-1.11***	0.25	-0.59***	0.12	-0.72***	0.14
Homework frequency	0.16**	0.06	0.06*	0.03	0.01	0.03	0.17**	0.05	0.07*	0.03	0.01	0.03
Homework time	-0.81**	0.28	-0.19	0.12	0.00	0.10	-0.71**	0.25	-0.17	0.11	0.00	0.09
Homework effort	0.47	0.43	0.20	0.14	0.11	0.11						
Negative homework emotions							-1.13**	0.36	-0.40*	0.17	-0.27*	0.13
Track (0 = lower, 1 = upper)					0.52***	0.09					0.53***	0.08
Between-student level												
Gender (0 = female, 1 = male)	-0.23***	0.04	-0.08*	0.03	-0.08*	0.03	-0.18***	0.04	-0.06	0.03	-0.07	0.03
Homework time	-0.18***	0.03	-0.07**	0.02	-0.07**	0.02	-0.14***	0.03	-0.05*	0.02	-0.05*	0.02
Homework effort	0.23***	0.05	0.15***	0.03	0.16***	0.03						
Negative homework emotions							-0.32***	0.04	-0.16***	0.03	-0.17***	0.03
Prior knowledge			0.84***	0.03	0.82***	0.03			0.81***	0.03	0.79***	0.03
Variance explained												
Level 2	0.32		0.88		0.92		0.40		0.88		0.92	
Level 1	0.08		0.49		0.49		0.13		0.50		0.50	

Note. *B* = unstandardized regression coefficient ; *SE* = standard error of *B*.

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

Table 3.

Descriptives and Intercorrelations (Part 2)

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11
1 Time 1 school grade	4.83	0.57											
2 Time 1 homework time	1.92	0.79	-.20										
3 Time 1 homework effort	3.20	0.55	.18	.08									
4 Time 1 negative homework emotions	1.96	0.65	-.35	.14	-.45								
5 Time 2 school grade	4.83	0.63	.63	-.19	.18	-.37							
6 Time 2 homework time	2.30	0.90	-.15	.25	.08	.01	-.14						
7 Time 2 homework effort	3.33	0.61	.09	.07	.38	-.25	.08	.16					
8 Time 2 negative homework emotions	2.03	0.80	-.19	.06	-.29	.39	-.21	-.04	-.32				
9 Time 3 school grade	4.93	0.78	.39	-.12	.11	-.27	.57	-.10	.07	-.14			
10 Time 3 homework time	2.26	0.87	-.09	.29	.08	.04	-.12	.32	.08	.00	-.09		
11 Time 3 homework effort	3.27	0.64	.07	.03	.39	-.25	.10	.12	.47	-.24	.04	.15	
12 Time 3 negative homework emotions	2.12	0.84	-.17	.03	-.29	.37	-.20	-.06	-.18	.49	-.14	.01	-.27

Note. Correlations ≥ .06 are statistically significant at $p < .05$.

Table 4.

Predicting Students' Subjective Homework Evaluations: Results from Multilevel Modeling.

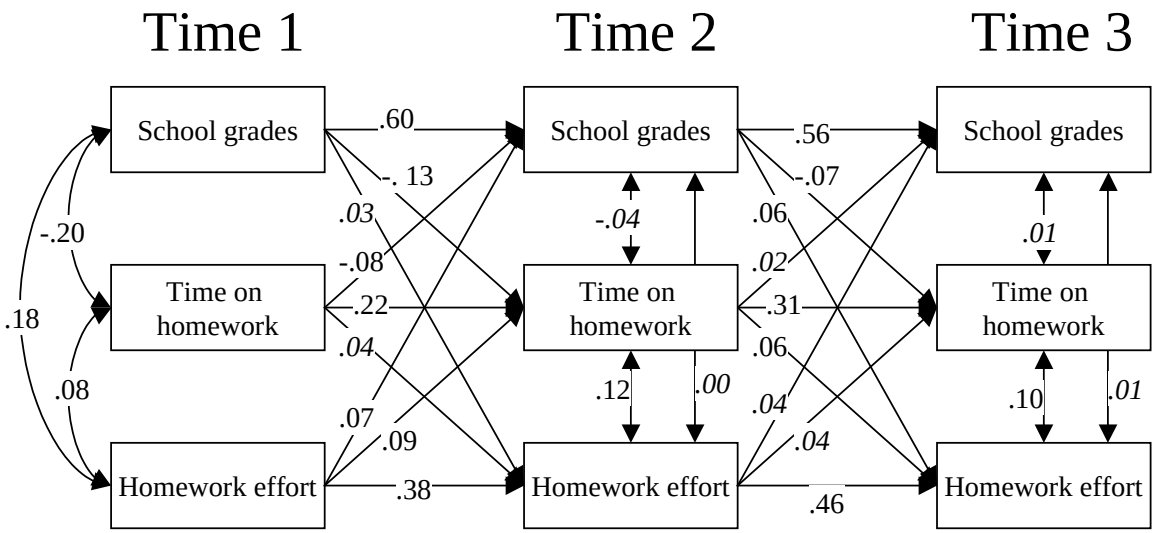
	Model 1		Model 2	
Predictors	*B*	*SE*	*B*	*SE*
Between-student level				
School grade	0.02	0.02	0.02	0.02
Within-student level				
Homework time	0.09***	0.01	0.10***	0.01
Homework effort	0.15***	0.02		
Negative homework emotions			-0.05**	0.02
Variance explained				
Level 2	0.00		0.00	
Level 1	0.04		0.02	

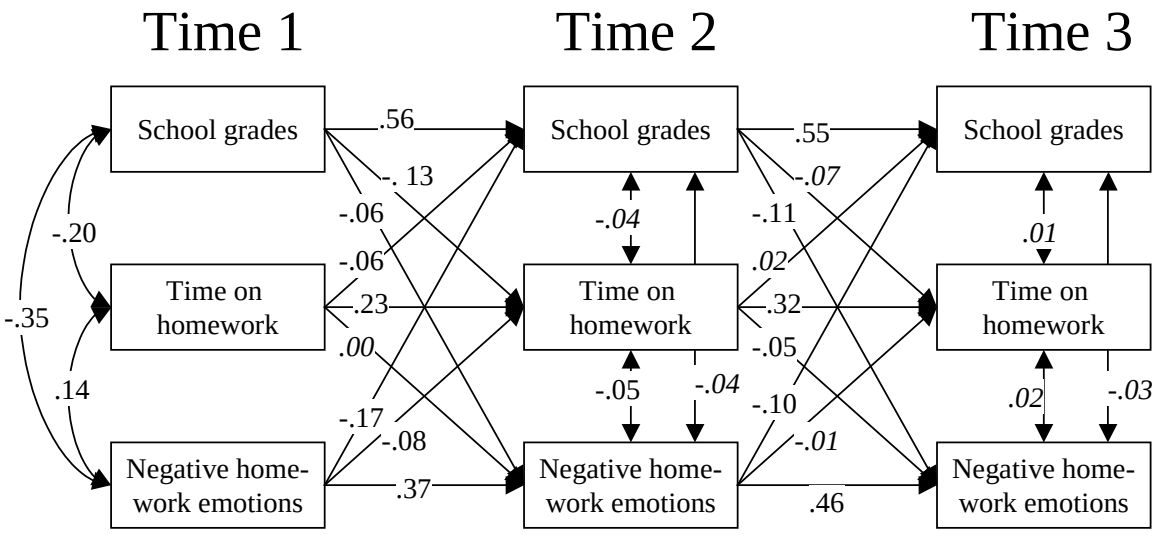
Note. *B* = unstandardized regression coefficient ; *SE* = standard error of *B*.

*** $p < .001$, ** $p < .01$

Figure Captions

Figure 1. Path model (Part 2) relating school grades, time on homework, homework effort, and negative homework emotions at Times 1, 2, and 3





Note. Italicized path coefficients are *not* statistically significant at $p < .05$. Model fit was satisfactory for both models (Model 1, including homework effort: $\chi 2$ (9) = 134.85, CFI = .926, SRMR = .039; Model 2, including negative homework emotions: $\chi 2$ (9) = 105.39, CFI = .944, SRMR = .034).