Contribution to the Special Section

Self-Efficacy, Interest, and Task Performance

Within-Task Changes, Mutual Relationships, and Predictive Effects

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Abstract. The aim of this study was to examine how possible changes in self-efficacy and interest during a task relate to each other and whether such changes independently predict overall task performance. To achieve this, the participants, one hundred ninth-grade students, were repetitively asked to rate their efficacy judgments and interest while they were working on a complex problem-solving task. The results from a series of latent growth curve models showed a significant overall increase in students' self-efficacy during the task. Changes in interest and self-efficacy were positively correlated, and, after controlling for the effects of prior mathematics achievement, both the initial level of self-efficacy and the rate of change in interest independently predicted final task performance.

Keywords: change, self-efficacy, interest, performance, complex problem solving

Selbstwirksamkeit, Interesse und Leistung: Änderungen während der Aufgabenbearbeitung, gegenseitige Zusammenhänge und Vorhersagen

Zusammenfassung. Ziel der Studie war es zu untersuchen, wie mögliche Veränderungen der Selbstwirksamkeit und des Interesses während der Bearbeitung einer Aufgabe zusammenhängen und ob solche Veränderungen die Leistung in der Aufgabe vorhersagen. Dazu wurden 100 Schüler (9. Klasse) gebeten, ihre Selbstwirksamkeit und ihr Interesse einzuschätzen, während sie eine komplexe Problemlöseaufgabe bearbeiteten. Die Ergebnisse von mehreren *latent-growth-curve*-Modellen zeigten einen signifikanten Zuwachs der Selbstwirksamkeit der Schüler während der Aufgabenbearbeitung. Die Veränderungen von Interesse und Selbstwirksamkeit waren miteinander positiv korreliert, und, nachdem die Leistung in Mathematik kontrolliert wurde, sagten sowohl die Selbstwirksamkeit vor der Aufgabe als auch die Änderungsrate von Interesse die Leistung am Ende der Aufgabe vorher.

Schlüsselwörter: Interesse, komplexes Problemlösen, Leistung, Selbstwirksamkeit, Veränderung

1 Introduction

Self-efficacy and interest have frequently been identified as important motivational factors that influence learning and performance (Eccles & Wigfield, 2002). Self-efficacy beliefs refer to judgments about one's ability to organize and execute the courses of action required to produce given outcomes (Bandura, 1977). They mainly originate in the inferential process concerning one's prior performance, and influence performance by boosting persistence, resiliency, and sustained effort, especially under challenging and changing circumstances (Multon, Brown, & Lent, 1991; Pajares, 1996, 1997). Self-efficacy also has a bearing on both the level and type of goals people decide to strive for (Latham & Locke, 1991) as well as the accompanying goal-striving processes (for reviews, see Bandura, 1986; Bandura, 1989, 1997; Schunk & Ertmer, 2000; Zimmerman, 2000). Although "more is better" seems to apply to much of the findings on the effects of self-efficacy, "overconfidence" may sometimes lead to inaccurate appraisals or unrealistically high goals (Niemivirta, 1999; Stone, 1994; Vancouver, Thompson, Tischner, & Putka, 2002).

Interest is a multifaceted phenomenon and can be viewed from different perspectives depending on the level of specificity. Personal interest reflects the person's relatively stable evaluative orientation toward a certain object

DOI 10.1024/1010-0652.21.3.241

(Krapp, Hidi, & Renninger, 1992; Schiefele, 1991), whereas situational interest refers to the transitory emotional state aroused in a specific situation or by features of an activity (Hidi & Anderson, 1992; Schiefele, 1996; Schraw, 1997). As reviewed by Schraw and Lehman (2001), situational interest was found to have a positive effect on text comprehension, the production of written responses, and achievement level, among other things (Alexander, Kulikowich, & Schulze, 1994; Schiefele & Krapp, 1996; Schraw, 1997). Generally, these effects have been attributed to the mediational processes of heightened attention and enhanced persistence (Hidi, 1990; Schraw & Lehman, 2001).

Although numerous studies have independently examined the influence of self-efficacy and interest on task performance, there still are few issues that seem somewhat unaddressed. First, how are self-efficacy and interest related to each other? Despite the intuitively obvious association between self-efficacy and interest – "people are likely to be interested in what they expect to do well" – our understanding of such a relationship is surprisingly limited. Second, although self-efficacy and situational interest are considered as dynamic motivational constructs that fluctuate over time as a function of the changing conditions or features of the situation or task, rather little is known about how efficacy judgments and experiences of interest change during a task, how those changes relate to each other, and how they predict the actual task performance. The main objective of this study was thus to contribute to the issues above by examining the following research questions: Do students' efficacy beliefs and interest change while they work on a mathematical problem-solving task? Are mean levels and possible changes in task-specific self-efficacy and interest related to each other? Does prior achievement in a related domain (i.e., mathematics) predict either the level or rate of change in task-specific self-efficacy and interest? Does the level or rate of change in task-specific self-efficacy and interest uniquely contribute to final task performance?

The view of interest as an emotion provides a perspective to considering how interest influences task engagement and how it might relate to self-efficacy. In her broaden-and-build theory of positive emotions, Fredrickson (Fredrickson, 1998, 2001) argues that interest broadens the momentary thought-action tendency of exploration by arousing feelings of involvement that aim at increasing knowledge of and experience with the target of interest. Similarly grounding on the works by Tomkins (1962), Izard (1977) and Berlyne (1960), Silvia (2003, 2005) further claims that the experience of interest itself is aroused by certain collative variables, such as novelty, complexity, uncertainty, and conflict (see also, Chen, Darst, & Pangrazi, 2001), and that these are the factors that link interest to self-efficacy. For example, the level of subjective uncertainty that arouses situational interest is moderated by self-efficacy; if the outcome of a task is certain, that is, when self-efficacy is either extremely low (certain failure) or extremely high (certain success), the task is unlikely to arouse any interest. This is in line with Bandura's (1986) claim that supreme self-assurance, just as extreme self-doubt, may render activities unchallenging and, thus, uninteresting.

The changes in efficacy beliefs and interest within a task follow similar logic. As the main sources of change in self-efficacy include performance accomplishments and emotional arousal (Bandura, 1986), we can expect that progress in the task (i.e., increases in accomplishments) induces positive affective states and, subsequently, results in stronger sense of efficacy. This again, given that the task itself has not lost its appeal due to, say, insufficient complexity or novelty, is likely to enhance interest. Consequently, as both self-efficacy and interest seem to improve the quality of engagement by broadening one's thought-action tendencies, strengthening commitment, and enhancing attention and persistence, it is also likely that positive changes in self-efficacy and interest during a task contribute to further performance.

The empirical evidence for the above assumptions is, however, fairly limited. In educational psychology, hardly any research has been published that explicitly investigates the links between self-efficacy and interest. The studies that bear some relevance to this context have focused on more general constructs such as competence beliefs and task value (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002), competence beliefs and learning motivation (Spinath & Spinath, 2005), self-concept of ability and academic interests (Marsh, Trautwein, Ludtke, Koller, & Baumert, 2005), and self-concept of ability and task motivation (Nurmi & Aunola, 2005). Moreover, these studies have examined mutual dependencies in a longitudinal setting rather than in relation to a specific task. Regarding findings, all studies show that the different pairs of beliefs mentioned above are indeed correlated, but the results pertaining to causal dependencies are less clear. The studies by Spinath and Spinath (2005) and Nurmi and Aunola (2005) demonstrate no specific causal links between competence beliefs and task or learning motivation, whereas the findings of Marsh et al. (2005) and Jacobs et al. (2002) studies suggest that ability perceptions are stronger predictors of interest and value than vice versa.

Conceptually most coherent work on the relationships between self-efficacy and interest comes from the applied field of vocational psychology. The claim that at least moderate perceived efficacy is required to generate and sustain interest in an activity (Bandura, 1986; Bandura & Schunk, 1981) is an explicit part of the social-cognitive theory of career choice and academic interest developed by Lent and his colleagues (Lent, Brown, & Hackett, 1994). The findings from studies testing this model suggest that self-efficacy and interest are indeed connected (for a review, see Rottinghaus, Larson, & Borgen, 2003), but the evidence supporting the given causal claim is rather scant. Efficacy-based manipulations have been shown to modify interests (e.g., Betz & Schifano, 2000; Hackett & Campbell, 1987), but the few longitudinal studies available (Lent et al., 2006; Nauta, Kahn, Angell, & Cantarelli, 2002; Tracey, 2002) provide support for a bidirectional view, suggesting that the relationship between self-efficacy and interest is in fact reciprocal. However, it is important to note that most of these studies have been conducted on a subject- or domain-specific level, not on a task-specific level, which clearly contributes to the findings. Thus, it is not surprising that Lent et al. (2006) recently called for research that examines self-efficacy-interest relations "during periods of active skill development or immersion in novel or challenging tasks" (p. 189). This exactly is what the present study sought to do.

If the work on the relationships between task-specific self-efficacy and interest is scarce, so is research focusing on within-task changes in these constructs. A series of studies by Hackett and her colleagues (Campbell & Hackett, 1986; Hackett, Betz, O'Halloran, & Romac, 1990; Hackett & Campbell, 1987) showed how the level of success in a task influences subsequent self-efficacy and interest, thus providing support for the assumption that efficacy judgments and experiences of interest fluctuate as a function of the perceived progress in the task. Although these findings also demonstrated a moderate relationship between ratings of self-efficacy and interest, none of the studies examined whether *change* in one construct was associated with *change* in the other, or whether the *extent of change* in either construct influenced later performance above and beyond the effects of the mean level. The design used by Ainley and her colleagues in a promising series of studies (Ainley, Corrigan, & Richardson, 2005; Ainley, Hidi, & Berndorff, 2002; Ainley, Hillman, & Hidi, 2002) does include repetitive interest ratings, but the actual change has not been a focus of analysis yet. The indirect evidence, however, suggests that, in terms of predicting task-related outcomes, the level of interest may be more influential than the change in it, meaning that an increase in interest during a task may not be sufficient to enhance students' task commitment if the overall level is relatively low (see Ainley et al., 2005).

The Present Study

The aim of this study was to examine how possible changes in self-efficacy and interest during a task relate to each other and whether such changes independently predict overall task performance. To achieve this, we had students work on a problem-solving task, during which we asked them to repetitively rate their efficacy judgments and interest. Naturally, to expect systematic changes in self-efficacy or interest to take place during a task, the task itself must hold certain characteristics. In our view, the task needs to be novel, complex, and challenging enough to arouse sufficient challenge and interest, and in order to provide the students with information about progress on which they can base their ratings, the task must also be structured in a way that permits both exploration and feedback. For this purpose, we used a dynamic problem-solving task, which included several learning trials with systematic feedback.

2 Method

2.1 Participants

The participants in this study were 100 ninth-graders (53 girls and 47 boys) from four different schools in southern Finland. The mean age of the students was 15.4 ($SD = .50$). The test session was carried out in small-group sessions during ordinary mathematics and information and communication technology classes with the number of students ranging from 9 to 14. Participation was voluntary, but none of the students declined.

2.2 The task

A dynamic computer simulation task, "The MED-LAB," was used as the actual experimental task (for a description of the general framework, see Funke, 1993). The task is intended to induce complex problem solving, which is defined as the activity that occurs to overcome barriers between a given state and a desired goal state by means of behavioral or cognitive multi-step activities (Frensch & Funke, 1995). In the present context, the participants were first required to explore a dynamic system of structural equations, then to construct knowledge based on their exploration (for similar applications, see Vollmeyer & Rheinberg, 1999; Vollmeyer & Rheinberg, 2000).

In a cover story, the participants were told that they were in a medical laboratory and that they were supposed to take part in a study that investigated the impact of drugs on certain chemicals in human body. Accordingly, the students were supposed to explore how the variation in drug intake (with drugs A, B, and C) influenced the quantity of three chemicals (thyroxin, histamine, and serotonin) in human body. The underlying (fictional) structural model is presented in Figure 1.

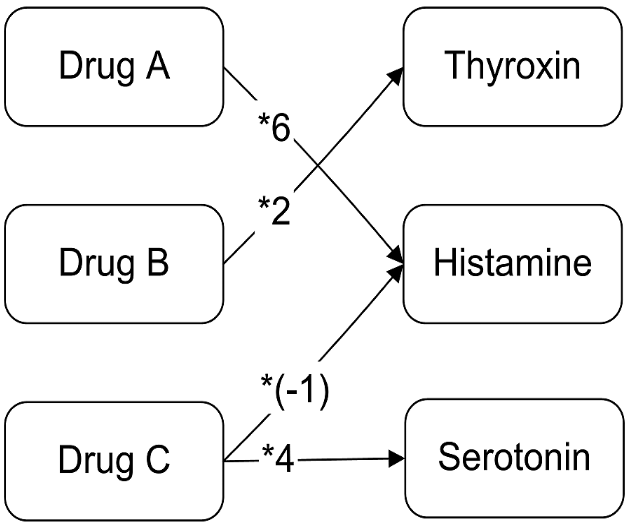

Figure 1. Structural model of the "MED-LAB."

The exploration phase consisted of three rounds with six trials in each. For each trial, the students were asked to enter quantities for each drug (input) after which they were supposed to observe the changes in all chemicals (output). The changes in the outputs were to be used to figure out which input affected which output and how strong the impact was. After going through the six trials, the participants were asked to specify what they had learned about the relationships between inputs and outputs. This was done by drawing arrows and entering weights into a structured diagram. After each round, the participants were also asked to rate their current level of self-efficacy and interest (see below).

2.3 Measures

Self-Efficacy and Interest

As noted above, the students were asked to rate their self-efficacy and interest three times during the task, once after each exploration round. Self-efficacy was assessed with two 7-point Likert-scaled (1 = Not true at all – 7 = Very true) items (e.g., "I will most certainly do well in this task") with reliabilities (α) of .86, .93, and .91 for measurement points 1, 2, and 3, respectively. Interest was assessed with three similarly scaled items (e.g., "This task appears to be very interesting") with reliabilities of .89, .87, and .84 for measurement points 1, 2 and 3, respectively. Considerable normative stability across the measurement points was found with correlations ranging from .74 to .86 for self-efficacy and from .78 to .89 for interest.

Task Performance

As to the task outcome, a structure score was calculated based on the students' drawings (see above). The total score composed of the number of correct links between inputs and outputs, correct directions (positive or negative effect), correct weights, and correct markings. Only the total score, theoretically ranging from 0 to 16, was used for the present purposes. Two independent reviewers scored the drawings with an interrater agreement of 93%. The score mean was 11.77 (SD = 4.60).

Covariates

As it is reasonable to assume that mathematics grades reflect domain-specific (i.e., mathematical problem-solving) ability and, to some extent, personal interest in the domain, which both have found to influence corresponding task-specific appraisals (e.g., Alexander & Jetton, 1996), we expected students with higher mathematics achievement to view the target task more favorably and to feel more confident about working on it. Therefore, in order to control for such effects, we used prior (8th grade) mathematics grades (M = 7.90, SD = 1.22, range = 4–10) as a covariate in the analyses of change.

2.4 Analyses

Latent growth curve models (LGCMs) within the structural equation modeling framework were used for the analyses of change over time (for overviews and applications, see Duncan, Duncan, Strycker, Li, & Alpert, 1999; Niemivirta, 2002). The analyses were carried out in four steps (see Figure 2): First, univariate LGCMs were estimated for self-efficacy and interest (A). Next, a bivariate LGCM was estimated to examine how the parameters of change for both constructs were related to each other (B). Then, the bivariate model was extended by including a covariate (C), and, finally, a full model with a predictor and a distal outcome was estimated (D). All analyses were performed using the M*plus* statistical software (Muthen & Muthen, 1998–2006). Maximum likelihood parameter estimates with robust standard errors and mean-adjusted χ^2 test statistics (Satorra & Bentler, 2001) were used for analyzing mean and covariance structures. Following Hu and Bentler's (1998; 1999) recommendation for a two-index presentation strategy with small samples, the overall model fit was evaluated using the fit indices CFI and SRMR along with the χ^2-statistic. Cutoff values of = .95 and = .09 were used for CFI and SRMR, respectively (Hu & Bentler, 1999).

3 Results

3.1 Univariate and Bivariate Growth Models

The first step in the present analyses was to describe the characteristics of individual differences in the growth trajectories of students' task-specific self-efficacy and interest. This objective was approached by estimating an unconditional growth model for each construct. Thus, in both models, two latent factors were defined to represent the intercept (initial level) and the slope of the growth trajectory (see A in Figure 2). The factor loadings relating the three observed measures to the intercept factor were fixed to 1 in order to define the starting point of the growth trajectory. The factor loadings relating the observed measures to the slope factor were fixed to 0, 1, and 2, respectively, to capture a linear trend over the three measurement points. The means of the two latent factors (initial level and slope) were freely estimated, the intercepts of the observed measures were fixed to 0, and equality constraints were imposed on residual variances. Thus, the mean structure among the repeated measures was reproduced through the latent factor means. The mean estimate of the intercept factor *(Mi)* represents the mean initial level (starting point) of the growth trajectory, and the estimate of the intercept variance *(Di)* represents the degree of individual variability in

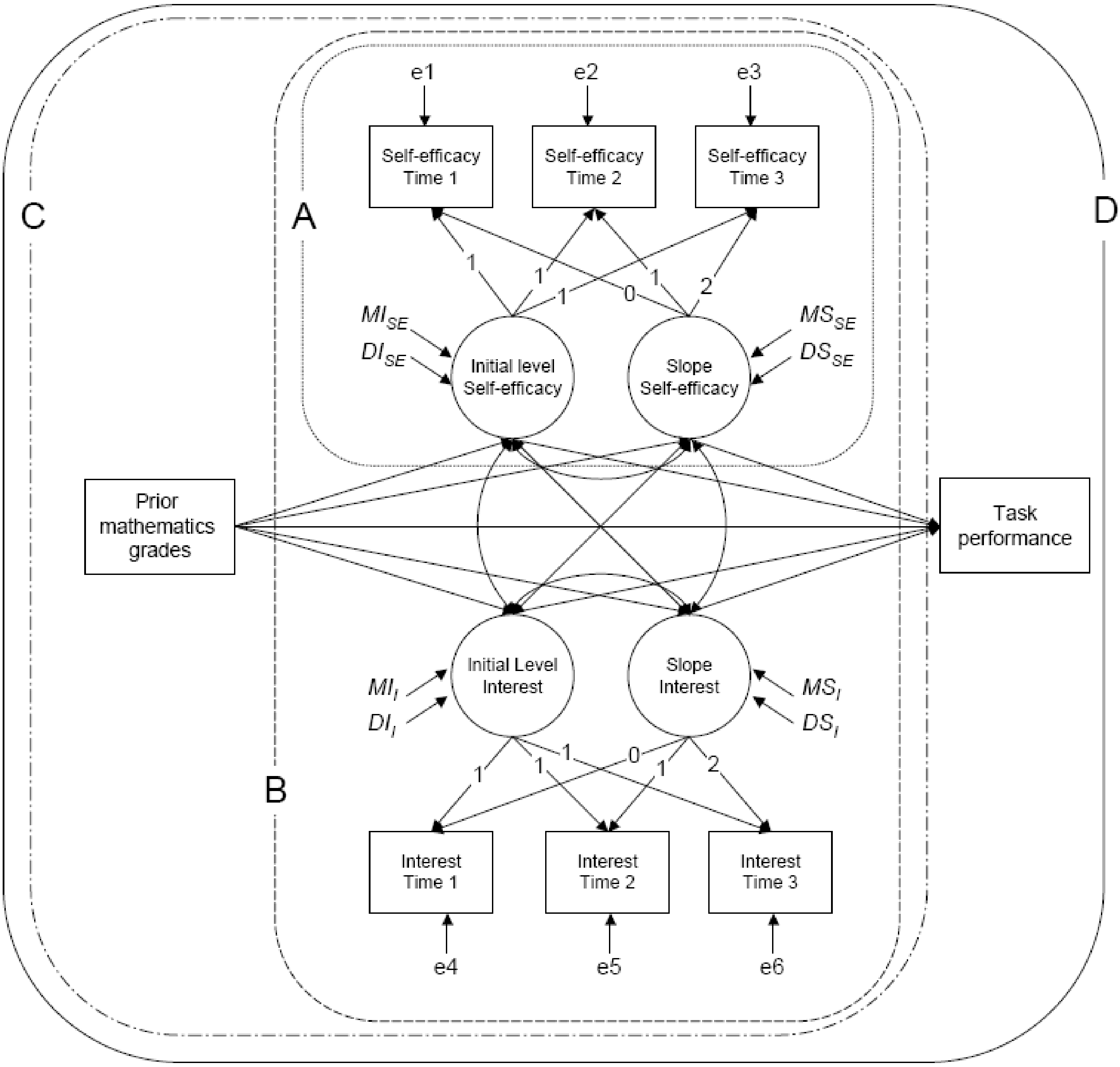

Figure 2. A graphical representation of the different steps of analyses and corresponding latent growth curve models (A = Univariate growth model, B = Bivariate growth model, C = Bivariate growth model with a predictor, D = Full bivariate growth model with a predictor and a distal outcome).

the initial level. Similarly, the mean estimate of the slope factor *(Ms)* represents the mean slope of growth trajectory, and the slope variance *(Ds)* represents individual variability in the rates of change over time.

The estimated unconditional growth model for self-efficacy fitted the data well, $\chi^2(3) = .20$, $p = .98$; CFI = 1.00; SRMR = .01. The mean and variance of the initial level were significant ($Mi_{\text{self-efficacy}} = 3.27$, $t = 17.30$; $Di_{\text{self-efficacy}} = 3.26$, $t = 9.74$), just as were the mean and variance of the slope ($Ms_{\text{self-efficacy}} = .26$, $t = 3.54$; $Ds_{\text{self-efficacy}} = .35$, $t = 4.06$). The correlation between initial level and slope was not significant ($r_{is} = -.12$, $t = -.91$). These results indicated a significant overall positive change in participants' self-efficacy during the task, and significant individual differences in both the initial level and slope. The model for interest fitted the data as well, $\chi^2(3) = 2.54$, $p = .47$; CFI = 1.00; SRMR = .05. The parameters of change demonstrated no overall change in interest, but significant variability in both the initial level ($Mi_{\text{interest}} = 2.73$, $t = 18.13$; $Di_{\text{interest}} = 2.02$, $t = 7.16$) and slope ($Ms_{\text{interest}} = .06$, $t = 1.33$; $Ds_{\text{interest}} = .15$, $t = 4.20$). The correlation between initial level and slope was not significant ($r_{is} = -.11$, $t = -1.53$).

The next step was to examine whether the level and change in self-efficacy and interest were related. This was

Table 1
Correlations between the initial levels and slopes of self-efficacy and interest

	Self-efficacy (level)	Self-efficacy (slope)	Interest (level)	Interest (slope)
Self-efficacy (level)	1			
Self-efficacy (slope)	–.11	1		
Interest (level)	.52**	.08	1	
Interest (slope)	–.24*	.41**	–.20	1

*p < .05, **p < .01.

done by estimating a bivariate latent growth model, which permits the estimation of correlations between initial levels and slopes (see B in Figure 2). Accordingly, a model with free parameters between the slope and intercept factors was estimated. The fit of this model was good, $\chi^2(11) = 16.75$, $p = .12$; CFI = .99; SRMR = .03. As shown in Table 1, correlations between the initial levels and slopes of self-efficacy and interest were positive and significant. That is, the levels of self-efficacy and interest in the beginning of the task were associated, just as were the rates of change during the task. Moreover, the significant negative correlation between initial self-efficacy and the slope of interest indicates that the increase in interest was steeper for those with lower initial self-efficacy.

3.2 Bivariate Growth Model With a Predictor

The third step extended the previous model by introducing an independent predictor, prior math grades. Thus, the observed variability in the initial levels and slopes of self-efficacy and interest was modeled by regressing them on an exogenous variable (see C in Figure 2). The conditional model was estimated and found to fit the data well, $\chi^2(13) = 20.46$, $p = .08$; CFI = .99; SRMR = .03. An examination of the regression coefficients indicated that mathematics grades predicted the initial levels of both self-efficacy ($\gamma = .47$, $t = 5.37$) and interest ($\gamma = .25$, $t = 2.32$), but no effects were found on the slope parameters. Mathematics grades explained 22% and 6% of the variance in the initial levels and 0% and 1% of the variance in the slopes of self-efficacy and interest, respectively.

3.3 Full Model with a Predictor and an Outcome

In the final stage of the analyses, an outcome was incorporated into the model (see D in Figure 2). Task performance, as indicated by the structure score, was regressed on both the covariate (mathematics grades) and the parameters of change (initial levels and slopes of self-efficacy and interest). Thus, by taking into account differences in prior achievement in mathematics, we were able to estimate the independent effects of the level and change in self-efficacy and interest on task performance. In order to obtain more detailed information about the unique and joint effects, we first estimated separate full models for both constructs. The model for self-efficacy fitted the data well, $\chi^2(5) = 1.57$, $p = .39$; CFI = 1.00; SRMR = .01. An examination of regression coefficients showed that task performance was predicted by prior math grades ($\gamma = .33$, $t = 3.92$) and the initial level of self-efficacy ($\gamma = .42$, $t = 5.04$). The similar model for interest fitted the data as well, $\chi^2(5) = 7.02$, $p = .22$; CFI = .99; SRMR = .04, and the regression coefficients demonstrated that in addition to math grades ($\gamma = .45$, $t = 6.01$) also initial interest influenced final task performance ($\gamma = .25$, $t = 2.32$). The final full model with both self-efficacy and interest included also provided a good fit to the data, $\chi^2(15) = 24.94$, $p = .05$; CFI = .98; SRMR = .03, but showed a somewhat different pattern of effects (see Table 2). Now that the effects of self-efficacy and interest were adjusted for each other's effects, task performance was found to be predicted by math grades ($\gamma = .27$, $t = 2.91$), the initial level of self-efficacy ($\gamma = .47$, $t = 4.45$), and the rate of change in interest ($\gamma = .26$, $t = 2.40$). In other words, the effect of initial interest became nonsignificant when evaluated jointly with self-efficacy, and the change in interest emerged as a significant independent predictor instead. In total, 46% of the variance in task performance was accounted for by these factors.

Table 2
Predictive effects from the full bivariate latent growth curve model with a predictor and an outcome

	Dependent variable				
Predictor	Self-efficacy (level)	Self-efficacy (slope)	Interest (level)	Interest (slope)	Task performance
Mathematics grades	.47**	.01	.25*	.09	.27*
Self-efficacy (level)					.47**
Self-efficacy (slope)					–.03
Interest (level)					.07
Interest (slope)					.26*
Explained variance	22 %	0 %	6 %	1 %	46 %

Note. Values are standardized regression coefficients. *p < .05, ** p < .01.

4 Discussion

The purpose of this study was to examine the dynamic relationships between students' self-efficacy and interest while they work on a complex problem-solving task. By means of latent growth curve modeling, we were able to examine (a) whether students' efficacy beliefs and interest change while they progress in the task; (b) whether the level and possible changes in self-efficacy and interest are related to each other; (c) whether prior mathematics achievement predict either the level or rate of change in task-related self-efficacy and interest; and, (d), whether the level or rate of change in self-efficacy and interest uniquely contribute to final task performance.

Regarding the first question (a), we found considerable individual differences in the level of self-efficacy and interest in the beginning of the task. More importantly, a positive overall trend for self-efficacy, but not for interest, was found, suggesting that the students' self-efficacy, in general, became stronger as they progressed in the task. This finding indicates that the structure of the task provided the students with relevant feedback about their progress, and, therefore, while learning gradually more about the system and the underlying structure (Figure 1), they were able to reinforce their task-related confidence. This clearly points out to the important role of perceived accomplishment in the formation of task-specific self-efficacy.

The results also demonstrated significant variability in the rate of change in both constructs, which means that some participants' self-efficacy and interest increased during the task, while other's decreased or remained stable. Yet, the level and, more interestingly, the changes in these constructs were not independent of each other. Self-efficacy and interest in the beginning of the task were moderately associated, just as were the rates of change. Thus, regarding the second question (b), we not only found that stronger self-efficacy was related to higher interest, but also that increase/decrease in self-efficacy during the task was related to increase/decrease in interest (and vice versa). This implies that the relationship between self-efficacy and interest is dynamic in that *change* in one construct results in *parallel change* in the other. Unfortunately, the present data do not permit any definite conclusions about the causal order of these changes. It is possible, as suggested by Bandura (1986), that an increase in self-efficacy enhances interest by reducing perceived uncertainty and/or complexity, but it is also possible that an increase in interest induces a more positive affective state, which again strengthens one's self-efficacy (e.g., Gendolla, Abele, & Krusken, 2001). Both of these can also be a function of a strengthened link between prior knowledge and the task. That is, the process of advancing and becoming more familiar with the learning task may activate relevant prior knowledge, which again may enhance both self-efficacy and interest (e.g., Tobias, 1994, 1995).

Concerning the third question (c), we found that mathematics grades predicted the initial levels of self-efficacy and interest, which shows that prior achievements in a relevant domain not only influence task-specific self-efficacy but also contribute to the appraisals of the task's interestingness. This also echoes earlier findings (Alexander & Murphy, 1998; Schraw, Bruning, & Svoboda, 1995). However, changes in self-efficacy and interest were independent of mathematics grades, which points out to the strong situation-specificity of these constructs. It appears that students' competence in a related domain (mathematics) does shape their entering level of self-efficacy and interest, but the subsequent changes in those constructs are, to a large extent, a function of the students' unfolding task-specific experiences and appraisals (see Boekaerts, 1999; Boekaerts & Niemivirta, 2000). This is noteworthy when evaluating our fourth and final question (d). When estimated jointly, the level of initial self-efficacy and the degree of change in interest both predicted final task performance. Firstly, this confirms the often replicated finding that confidence in one's capacity to produce appropriate responses in a given situation influences performance above and beyond the effects of relevant ability (Bandura, 1997; Pajares, 1996). Secondly, this importantly extends prior findings concerning the influence of interest on performance by showing how the positive change in, instead of the mere level of, task-specific interest has an additional independent effect on performance. This implies that becoming gradually more involved with the task has an added value in terms of the performance level. Although it is not clear through what processes progressively increasing interest boosts performance, we may suggest, following Fredrickson (1998), that, sufficient initial interest broadens the participant's thought-action repertoire, but steadily growing interest keeps it wide. In other words, it may be that catching and holding one's interest is important (Mitchell, 1993), but catching and enhancing it may provide an additional advantage. Future work should clearly pay more attention to the differentiation of the level and change in task-specific interest.

As pointed out earlier, a clear limitation here is the fact that we cannot say much about the causal ordering of self-efficacy, interest, and performance. That is, the current data do not permit unambiguous conclusions about the underlying dynamics or mechanisms that explain the observed relationships and effects. The so-called autoregressive latent trajectory model (Bollen & Curran, 2004; Curran & Bollen, 2001), which includes cross-lagged regressions among the observed variables in addition to the general latent growth parameters, might provide a tool for a more thorough analysis, but the current data lack both power and sufficient repetitive measures for such analyses. In terms of predicting performance, the current version of the dynamic system was somewhat too easy for the students, which likely resulted in limited variation among the better achieving students. Replications, preferably with larger samples and with somewhat more challenging versions of the task, are therefore needed in order to test the stability of the current findings.

In order to better capture the complex relationships between task progress, efficacy beliefs, and interest, the future work could utilize designs and systems – such as the *Between the Lines* software by Ainley and her colleagues (for a description of the system and research using it, see Ainley & Patrick, 2006) – that allow for a more dynamic and sequential assessment of the participants' task-related experiences and appraisals. In terms of antecedents and mediating processes, more attention should also be paid on individual differences that influence task-specific appraisals and self-regulatory processes (Boekaerts, 1993; Boekaerts & Niemivirta, 2000; Sansone & Thoman, 2006), appraisals that precede experiences of interest (Silvia, 2005), task characteristics that contribute to both judgments of efficacy and ratings of interest (Vancouver & Kendall, 2006; Yeo & Neal, 2006), and performance conditions (e.g., task- versus ego-involvement) under which the relationships between self-efficacy and interest might vary.

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