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Bruno Leutwyler & Katharina Maag Merki

## School Effects on Students' Self-regulated Learning

### A Multivariate Analysis of the Relationship Between Individual Perceptions of School Processes and Cognitive, Metacognitive, and Motivational Dimensions of Self-regulated Learning

#### Abstract

*The main objective of this study is to identify the scope of influence for enhancing students' self-regulated learning. Whereas the existing evidence generally shows the impact of schooling on motivational, cognitive, and metacognitive dimensions of self-regulated learning separately for each dimension, the present study compares the impact of schooling on the different aspects of self-regulated learning in an ecologically valid setting without specific training programs. To this end, the study analyses the individual development patterns of 1 432 students in a longitudinal sample drawn from Grade 10 to Grade 12. The results of multiple regression analyses show that school and instructional processes can explain a remarkable part of students' development in self-regulated learning. Furthermore, the current data suggest that different configurations of social and didactical factors promote motivational, cognitive, and metacognitive self-regulation and that the scope of influence varies to a substantial degree within the construct "self-regulated learning." The present study thus allows for a differentiated estimate regarding the extent to which the schools can promote the pivotal aim – that of self-regulated learning.*

#### Keywords

*self-regulated learning, school quality, longitudinal study*

## Schuleffekte auf das selbstregulierte Lernen

Eine multivariate Analyse der Zusammenhänge zwischen individuellen Wahrnehmungen schulischer Prozessmerkmale und kognitiven, meta-kognitiven und motivationalen Dimensionen des selbstregulierten Lernens

#### Zusammenfassung

*Zentrales Ziel der vorliegenden Studie ist es, die schulisch-instrukionalen Gestaltungsmöglichkeiten für die Förderung selbstregulierten Lernens darzustellen. Während bestehende Befunde insbesondere die schulischen Fördermöglichkeiten für motivationale, kognitive oder metakognitive Dimensionen selbstregulierten Lernens je einzeln darstellen, vergleicht diese Studie die Bedeutung des schulisch-instrukionalen Kontextes für die Förderung der unterschiedlichen Aspekte selbstregulierten Lernens.*

*Dazu analysiert sie die individuellen Entwicklungsverläufe von 1432 Schülerinnen und Schülern in einem Längsschnitt vom 10. bis zum 12. Schuljahr.*

*Die Resultate zeigen, dass schulische Prozessfaktoren in einem bedeutenden Ausmaß die Entwicklung selbstregulierten Lernens erklären können. Die Ergebnisse weisen darüber hinaus aber auch darauf hin, dass je unterschiedliche Konfigurationen von sozialen und didaktischen Faktoren die motivationale, die kognitive oder die metakognitive Selbstregulation fördern und dass die Fördermöglichkeiten innerhalb des Konstruktes „selbstreguliertes Lernen“ deutlich variieren. Damit erlauben die Ergebnisse auch eine differenzierte Einschätzung, wie gut Schulen die unterschiedlichen Aspekte der zentralen Zieldimension „selbstreguliertes Lernen“ zu fördern vermögen.*

## **Schlagworte**

*selbstreguliertes Lernen, Schulqualität, Längsschnittstudie*

## **Introduction**

Self-regulated learning has received increasing attention in the educational sciences over the last three decades. This growing interest can be explained from several different perspectives. First, modern qualification theory examines the technical, scientific, and social developments that require individuals to constantly readapt and optimize their learning behavior within continuously changing situations. This perspective has elevated the capacity for self-regulated learning to a “key qualification” (European Centre for the Development of Vocational Training, 2003). Second, from the perspective of cognitive theory, the importance of self-regulated learning emerges from the predominant current understanding of productive learning as a broadly intentional, conscious, actively constructing, goal-oriented, and controllable process (Reusser, 1998). Because this is an idealized perspective, in that it aspires towards complete self-direction of learning, it makes the capacity for self-regulated learning one of the central objectives of pedagogical activities in the classroom. Third, the importance of self-regulated learning can be justified from a traditional educational theory perspective. Here, developing the capacity for self-regulated learning is viewed as one component of the comprehensive educational ideal of achieving maturity or self-determination (Grob & Maag Merki, 2001) so that “self-organization and self-determination will take the place of domination, and a modern concept of freedom will replace pedagogical paternalism” (Forneck, 2002, p. 243, translation ours).

Yet self-regulated learning is not just an objective, it is not just the desired *product* of classroom instruction; it is also, to a substantial degree, the *precondition* for successful and productive classroom learning. Although the compiled empirical findings from the relevant literature do not produce a consistent picture of the importance of self-regulated learning for learning outcomes, they nevertheless yield considerable support for the view that self-regulated learning constitutes a crucial precondition for the success of learning processes (Leutwyler, 2007): the

use of more complex learning tasks in the empirical measurement of learning outcomes (Artelt, 2000) and the evaluation of different aspects of self-regulated learning in practical and domain-specific contexts (Artelt & Schellhas, 1996; Artelt, Baumert, Julius-McElvany, & Peschar, 2003) brings forth evidence that clearly indicates strong connections between the degree of self-regulated learning and the success of learning outcomes.

Despite its fundamental importance, self-regulated learning has been the focus of only a few comprehensive studies aimed at identifying how it can best be fostered. Empirical studies traditionally focus more on individual factors such as sex and socio-economic background or motivational factors and their influence on cognitive or metacognitive self-regulation (Mandl & Friedrich, 2006). This predominant orientation toward attributional or dispositional approaches underestimates the role of context. Learning activities do not, after all, take place in a vacuum; they are always integrated into specific learning arrangements that shape and define learning activities (Garner, 1990).

It is against this background that the importance of the instructional setting for specific aspects of self-regulated learning has been investigated increasingly over the last decade. However, these studies usually retain a limited focus on individual dimensions of self-regulated learning and do not look at self-regulated learning as a totality. (For motivational factors, see, for example, Deci, Ryan, & Williams, 1996; Schwarzer & Satow, 2003; Trautwein, 2003. For cognitive and metacognitive self-regulation, see, for example, De Jager, 2002; Perry, VandeKamp, Mercer, & Nordby, 2002; Pape, Bell, & Yetkin, 2003). This is particularly true of large-scale longitudinal studies, such as TOSCA (Köller, Watermann, Trautwein, & Lüdtke, 2004), the Michigan Study of Adolescent and Adult Life Transitions (Wigfield & Eccles, 1994), the LAU study (Lehmann, Vieluf, Nikolova, & Ivanov, 2006) and DESI (Klieme et al., 2006). Conversely, those studies that do address self-regulated learning as a totality often fail to account for the influence of the instructional context on all the different dimensions of self-regulated learning. The latter is true, for example, of the BIJU study (Baumert, 1993), the OECD's PISA surveys (Baumert et al., 2000), and the TIMSS survey (Martin, Mullis, & Chrostowski, 2004). Even if some longitudinal studies exist that do address the development of self-regulated learning in its totality and that do consider the context, these studies deal with specifically designed programs for enhancing students' self-regulated learning and ask for evidence of effects of different program characteristics (see, for example, Dignath, Büttner & Langfeldt, 2008; Landmann & Schmitz, 2007).

Thus, there is a lack of empirical analyses that present the potential means for schools to foster various aspects of self-regulated learning from a comparative perspective. Furthermore, there is a lack of longitudinal studies at secondary level that treat the dimensions of self-regulated learning as dependent variables within the instructional context of teaching in an ecologically valid setting beyond specific training programs. The present study attempts to fill this gap. It evaluates the importance of the instructional context for the development of students' self-regulated learning, thus allowing for comparative evaluation of how different instructional

designs affect different dimensions of self-regulated learning in a longitudinal perspective. Only through this kind of unified methodological approach does the variance between different models of instructional design within the construct of “self-regulated learning” become apparent. The present study thus offers a broad overview of the various possible starting points for fostering different dimensions of self-regulated learning. Furthermore, it serves the purposes of comprehensive educational monitoring by providing the basis for evaluation of how well schools are achieving the central goals of fostering “self-regulated learning.” Specifically, this study sought answers to the following questions:

- To what extent does the instructional setting influence motivational, cognitive, and metacognitive dimensions of students’ self-regulated learning? To what extent are differences between individual dimensions of self-regulated learning seen in the effects of school contexts?
- Which of the factors that may be influenced by schools foster the motivational, cognitive, and metacognitive dimensions of students’ self-regulated learning? To what extent can different factors be identified that foster the development of motivational, cognitive, and metacognitive dimensions of self-regulated learning?

In order to answer these questions, we start by describing the conceptual background of the study. We outline the model of self-regulated learning upon which this study is based and propose an impact model explaining the effects of different instructional contexts on various dimensions of students’ self-regulated learning. We then explain the research design, the sample, the survey instruments and strategies of analyses, as well as the results of the study. The last section provides a discussion of the findings and summarizes our conclusions.

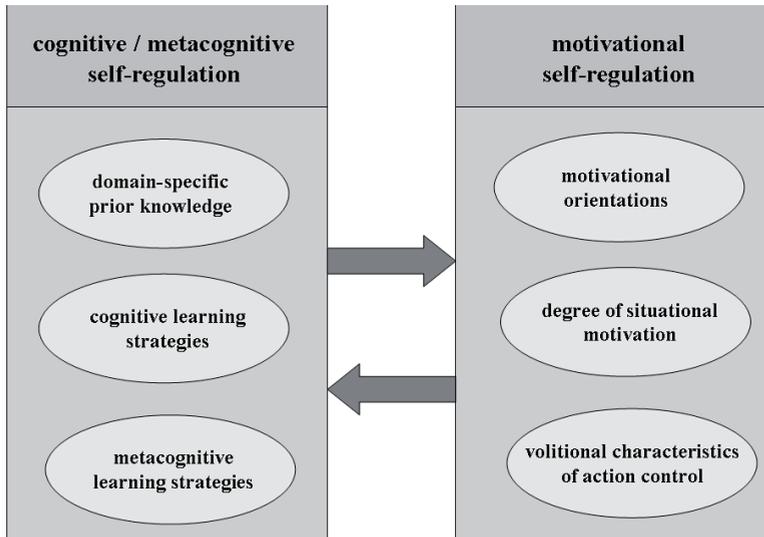
## **Theoretical Background**

If we are to comprehensively analyze school influences on self-regulated learning, we need to account for some components that take effect only through their mutual interaction. To identify these components in an overall model of self-regulated learning, several different approaches are conceivable. The literature also contains different approaches to the conceptualization of self-regulated learning (for example, Simons, 1992; Pintrich, 2004; Pressly, Borkowski, & Schneider, 1989; Schmitz, Landmann, & Perels, 2007; Zimmermann & Schunk, 2001, 2007).

A comparison of these different approaches clearly reveals that comprehensive self-regulated learning only becomes possible when the learner possesses a repertoire that can be employed adaptively and used intentionally and that contains cognitive, metacognitive, motivational, and behavioral strategies. Thus, self-regulated learning is a proactive, intentional, reflexive form of learning that entails a sense of personal responsibility for learning: it is “a dynamic interaction of ‘skill and will’” (Baumert, 1993, p. 328, translation ours).

An overall model of self-regulated learning that is capable of uniting these various approaches was therefore chosen as the basis for the present study. The model is founded on the model developed by Baumert and colleagues (2000), in turn based on Boekaerts' (1999) three-layered model. In it, motivational, cognitive, and metacognitive self-regulation form a complementary whole (see Figure 1).

**Figure 1:** Model of self-regulated learning based on Baumert et al. (2000)



In this model, cognitive and metacognitive self-regulation includes the activation of domain-specific prior knowledge, cognitive learning strategies, and metacognitive learning strategies. The *activation of domain-specific prior knowledge* is the basis for all cognitive learning, which is understood in the sense of knowledge acquisition processes as content-related structural learning (see Aebli, 1987; Piaget, 1973). *Cognitive learning strategies* also play an important role in the self-regulation of learning. These are mainly strategies for the regulation of information-processing modes, for example, strategies for memorization, transformation, and/or elaboration (Artelt, Baumert, Julius-McElvany & Peschar, 2003). With the help of *metacognitive learning strategies*, the process of cognitive processing is planned, monitored, reflected upon, and/or evaluated.

Along with cognitive and metacognitive self-regulation, motivational self-regulation is central to the overall model of self-regulated learning developed by Baumert et al. (2000). Motivational self-regulation is conceptualized as including all those attitudes, abilities, and motivations that have the objective of facilitating learning, sustaining effort and attention, and enabling completion of activities. The model distinguishes among three different components of motivational self-regulation: motivational orientations, degree of situational motivation, and volitional characteristics of action control.

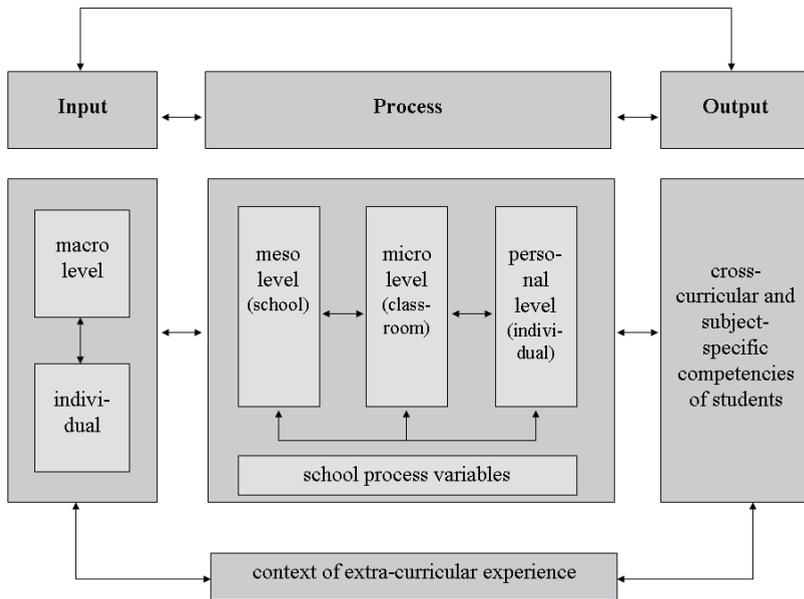
The component *motivational orientations* encompasses self-referent cognitions and motivational preferences. Self-referent cognitions that are particularly relevant for motivational orientations include self-esteem and self-efficacy beliefs (Garcia & Pintrich, 1994; Bandura, 1997). Motivational orientations also include motivational preferences, such as a person's particular motives for learning (Deci & Ryan, 1985) and for tackling certain tasks (Dweck & Elliott, 1983).

The components *degree of situational motivation* and *volitional characteristics of action control* are vital components of motivational self-regulation. They involve, on the one hand, the aspect of volition, such as dealing with competing desires and intentions in the initiation of action (Heckhausen, 1989). On the other hand, they involve the aspect of persistence, that is, continuing a learning task when difficulties arise (Kuhl, 1996).

This conceptual description of self-regulated learning may convey the impression that individuals can use the capacity for self-regulation in a general sense, that is, independent of specific subject matter and contexts. The relevant literature clearly shows, however, that the use of learning and working strategies – indeed, the essential characteristic of self-regulated learning – should be conceived of as fundamentally domain-specific (Mandl & Friedrich, 2006; Reusser, 1998). Nevertheless, some interesting empirical findings suggest that not all dimensions of self-regulated learning are equally domain-specific. Studies by Lompscher (1996), Schraw & Nietfeld (1998), and Wolters and Pintrich (1998), as well as by the research group around Veenman (Veenman, Elshout, & Meijer, 1997; Veenman, Wilhelm, & Beishuizen, 2004) provide clear evidence that the capacity for metacognitive self-regulation has an overarching character. In relation to the cognitive and motivational dimensions, it must also be kept in mind that when engaging in self-regulated learning, people usually employ a combination of general and specific strategies that make different contributions to and bear different potentials for solving the concrete learning problems associated with specific subject matter (Baumert, 1993). Thus, in view of the central questions of the present study, it appears justifiable to assess the domain-transcending aspects of self-regulated learning.

## The Impact Model

To evaluate the influence of school factors on these different aspects of self-regulated learning, we need to take into account the different levels at which learning processes are influenced in the school and the classroom. This consideration means that the impact model chosen should be one that does justice to the multi-level process structure of school and classroom realities (Ditton, 2000; Eder, 1996; Fend, 1998a). An impact model of this kind, which was the basis for the present study, is depicted in Figure 2.

**Figure 2:** School impact model

This school impact model conceives of students' subject-specific and cross-curricular competencies as the result of school processes that take place on three interacting levels. At the *personal* level, the teacher's competencies play – to differing degrees from one dimension to the next – a central role in fostering self-regulated learning. Here, the teacher's ability to motivate students must be considered particularly important (Ames & Archer, 1988; Baumert, 1993; Suárez Riveiro, Cabanach, & Valle Arias, 2001; Trautwein, 2003). Reference to the students, however, shows that school achievement plays a role in self-regulated learning at the personal level (Schiefele, 2005).

At the *micro level* of classroom instruction, empirical findings highlight the major importance of a process orientation, evidenced on the one hand by teachers' explicit reflection on the learning processes that take place in class, and on the other by their provision of individual support in response to students' individual learning processes (see, for example, Borkowski & Muthukrishna, 1995; Collins, Brown, & Newman, 1989; Lehtinen, 1992; Schoenfeld, 1985). Empirical results also indicate the considerable importance of self-reliance in learners, which calls on the need to offer students opportunities to engage in autonomous activities and self-assessment (see, for example, Baird & White, 1996; Perry, 1998; Perry & VandeKamp, 2000; Sanz de Acedo Lizarraga, Ugarte, Cardelle-Elawar, Iriarte, & Sanz de Acedo Baquedano, 2003). Self-reliance also highlights the relevance of a transfer orientation, which is seen in tasks that aim to stimulate in-depth information processing and require the student to establish connections with other subjects or life contexts (see, for example, De Jager, 2002; Pape et al., 2003; Ross, Salisbury-Glennon,

Guarino, Reed, & Marshall, 2003). Furthermore, at the classroom instruction level, we must also take into account the climatic dimensions that can be expected to produce general effects on both subject competencies and cross-curricular competencies (Fend, 1977, 1998a).

Finally, at the *meso level of the school*, we can expect climatic aspects or collective achievement expectations to affect motivational and/or cognitive and metacognitive aspects of self-regulated learning (Fend, 1977; Horstkemper, 1995). Not least of all, we also have to consider the opportunities available to students to participate at the meso level.

School process factors such as these interact with one another at the different levels, and they also interact with other factors that – from the point of view of each school – cannot be influenced. These include students' individual starting conditions, as well as their context of extra-curricular experience.

The impact model described above forms the conceptual basis for the present study and has been applied here using an extensive longitudinal design. We used this design to test the hypothesis that, after controlling for individual starting conditions and the context of extra-curricular experience, the variance in students' motivational, cognitive, and metacognitive self-regulation at the end of high school (Gymnasium, ISCED 3A) can be explained to a significant degree through school process characteristics, which do, however, vary between dimensions. We also assume that both social and didactic process characteristics explain a significant part of the variance in the individual dimensions of self-regulated learning. Based on the empirical evidence discussed above, we proceed on the assumption that didactic process characteristics (for example, a process and transfer orientation in the classroom) contribute more than social factors to explaining the variance in cognitive and metacognitive self-regulation, but that social process characteristics contribute more than didactic factors to explaining the variance in motivational self-regulation.

## Method

The analyses presented here are part of an extensive longitudinally designed research project in Switzerland in 20 public and two private high schools (Gymnasium, ISCED 3A) in the canton of Zurich. With this project, all of the students in a cohort (total population survey) were surveyed to investigate the development of their cross-curricular competencies at two different points in time. The survey was first administered at the beginning of Grade 10. At that time, the students had successfully completed the probationary period and had been accepted into the high school. The second point in time of the survey was at the end of Grade 12 – the conclusion of high school. At this point, students were about to take their final examinations (Abitur).

### Research instrument

To measure the students' capacity for self-regulated learning, we used a standardized questionnaire (Grob & Maag Merki, 2001; Maag Merki, 2002). We operationalized the individual dimensions by using different scales (see Table 1). Students were offered answer options on a four-point Likert scale (1 = disagree completely, 4 = agree completely). High values indicate high development of the respective dimension; low values indicate low development. The internal consistencies of the scales can be described as good.

**Table 1:** The scales measuring the capacity for self-regulated learning, statistics and sample items

Construct	Sample item <i>Answer options:</i> 1 = disagree completely, ... 4 = agree completely; (Cronbach's Alpha 1 <sup>st</sup> survey; Cronbach's Alpha 2 <sup>nd</sup> survey)	10 <sup>th</sup> grade 2001			12 <sup>th</sup> grade 2004			Effect size* change 2001-2004 <i>d</i>
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	
<i>Motivational self-regulation</i>								
Self-esteem	I am satisfied with myself overall. (Number of items: 6; .83; .86)	1421	3.26	0.57	1421	3.36	0.58	0.18
Self-efficacy	If I really want something and give my best effort, I can achieve it. (Number of items: 5; .69; .74)	1420	3.32	0.46	1420	3.41	0.46	0.18
Achievement motivation	I enjoy tasks that challenge me. (Number of items: 8; .78; .81)	1422	2.77	0.51	1422	2.90	0.51	0.26
Intrinsic motivation to learn	In high school, I learn ... – because I enjoy working with the different school subjects. (Number of items: 4; .82; .85)	1422	2.89	0.57	1422	2.80	0.62	-0.17
Volition	When I have a difficult task to do ... – I often procrastinate for a long time. (-) (Number of items: 5; .88; .91)	1404	2.51	0.71	1404	2.30	0.78	-0.28
Persistence	Even when I encounter difficulties in a test, I stay determined and keep going. (Number of items: 6; .80; .83)	1425	2.91	0.51	1425	2.99	0.54	0.15
<i>Cognitive regulation</i>								
Transformation strategies	When I have a difficult task to do ... – I write down the most important things. (Number of items: 4; .67; .70)	1408	2.85	0.65	1408	2.86	0.66	0.02
Elaboration strategies	When I have a difficult task to do ... – I remind myself how I solved similar tasks in the past. (Number of items: 5; .70; .76)	1408	2.90	0.54	1408	2.94	0.57	0.07
<i>Metacognitive regulation</i>								
Planning strategies	When I have a difficult task to do ... – I plan out exactly how I can solve it best. (Number of items: 5; .80; .84)	1407	2.55	0.62	1407	2.54	0.65	-0.01
Monitoring	While doing a difficult task ... – I sometimes consciously interrupt my work to check it. (Number of items: 5; .73; .79)	1402	2.93	0.51	1402	2.93	0.55	0.01
Evaluation strategies	After completing a difficult task ... – I try to find out what I did particularly well and what I did not do so well. (Number of items: 5; .72; .76)	1401	2.68	0.59	1401	2.64	0.61	0.06

\* Effect size (Cohen, 1988) is calculated by taking the difference between the mean values of the two groups of interest divided by the pooled standard deviation (standard deviation of the two groups dependent on the number of persons in the two groups = root of  $(n1-1)*s1^2 + (n2-1)*s2^2/n1 + n2 - 2$ )

With these scales, different dimensions of self-regulated learning are covered via self-report data, even though the criticism of the prevailing self-report approaches seems to act as a red thread in research on self-regulated learning. Since Nisbett and Wilson's influential "Telling more than we can know" (1977), self-report data have suffered a loss in credibility. However, today it is widely undisputed that pro- or retrospective self-report data cover different facets of self-regulated learning than do online methods. A number of studies provide evidenced that decontextualized self-report data about strategy use do not coincide with actual activities in concrete situations (see, for example, Artelt, 2000; Veenman, 2005). However, re-

**Table 2:** The scales for measuring school-specific context factors, statistics and sample items

Scales	<i>N</i>	<i>M</i>	<i>SD</i>
<i>Personal level – students</i>			
“Grade point average” (Individual item: What overall grade point average did you have on your last report card?) <sup>a)</sup> – Source: Maag Merki (2002)	1426	2.89	.78
“Subjective achievement level” (Individual item: How well are you generally able to keep up in high school? In general, I keep up ... in high school.) <sup>b)</sup> – Source: Maag Merki (2002)	1429	3.22	.52
<i>Personal level – teachers</i>			
“Teachers’ ability to motivate students” (Scale, 8 Items, Cronbach’s Alpha=.86) Sample item: Our teachers are sometimes able to really awaken students’ enthusiasm. <sup>c)</sup> Source: Prenzel, Kirsten, Dengler, Ettle & Beer (1996), Baumert et al. (1997), adapted	1401	2.14	.48
<i>Classroom level – process orientation</i>			
“Support by teacher in class” (Scale, 5 Items, Cronbach’s Alpha=.75); Sample item: Our teachers do a lot to help us. <sup>c)</sup> – Source: PISA Consortium Germany (2000), adapted	1403	2.26	.50
“Reflection on work” (Scale, 5 Items, Cronbach’s Alpha=.75); Sample item: In class, we reflect on our learning methods and learning activities from time to time. <sup>c)</sup> – Source: Pauli & Reusser (2002), adapted	1402	1.24	.36
<i>Classroom level – self-reliance</i>			
“Autonomous activities” (Scale, 5 Items, Cronbach’s Alpha=.71); Sample item: In class, we students have regular opportunities to realize our own ideas. <sup>c)</sup> – Source: Pauli & Reusser (2002), adapted	1402	2.22	.48
“Self-monitoring” (Scale, 4 Items, Cronbach’s Alpha=.68); Sample item: We students regularly grade each other’s tests. <sup>c)</sup> – Source: author	1402	1.70	.48
<i>Classroom level – transfer orientation</i>			
“Elaboration” (Scale, 7 Items, Cronbach’s Alpha=.73); Sample item: In class, we often have opportunities to connect what we learn in one subject with what we have learned in other subjects. <sup>c)</sup> – Source: Clausen (2002) adapted	1402	2.30	.46
“Genetic-Socratic approach” (Scale, 4 Items, Cronbach’s Alpha=.68); Sample item: In class, our teachers sometimes let us go astray with our own speculations until we figure it out for ourselves. <sup>c)</sup> – Source: Clausen (2002), adapted	1399	2.10	.52
<i>Classroom level – climatic aspects</i>			
“Student – teacher relationship” (Scale, 12 Items, Cronbach’s Alpha=.85); Sample item: Our teachers respect our opinions. <sup>d)</sup> – Source: Maag Merki (2002), Steinert, Gerecht, Klieme & Döbrich (2003), adapted	1428	2.47	.54
“Relationships among students” (Scale, 6 Items, Cronbach’s Alpha=.78); Sample item: With us, friendships between students are only superficial; ultimately everyone is working against everyone else. (-) <sup>d)</sup> – Source: Maag Merki (2002), Eder (1996), adapted	1428	3.70	.67
“Perceived social integration” (Scale, 5 Items, Cronbach’s Alpha=.77); Sample item: In class, I have the feeling of belonging. <sup>d)</sup> – Source: Prenzel, Kirsten, Dengler, Ettle & Beer (1996), adapted	1428	3.88	.59
“Perceived competency support by teacher” (Scale, 6 Items, Cronbach’s Alpha=.72) Sample item: In class I am often praised for doing well. <sup>c)</sup> – Source: Prenzel, Kirsten, Dengler, Ettle & Beer (1996), adapted	1428	2.14	.47
“Perceived autonomy support by teacher” (Scale, 4 Items, Cronbach’s Alpha=.66) Sample item: In class, I have the opportunity to explore new themes independently. <sup>c)</sup> Source: Prenzel, Kirsten, Dengler, Ettle & Beer (1996), adapted	1401	2.19	.48
<i>School level – climatic aspects</i>			
“Having a voice” (Scale, 4 Items, Cronbach’s Alpha=.79); Sample item: At our school, we students or our student council representatives have a lot of influence. <sup>e)</sup> – Source: Maag Merki (2002)	1417	2.39	.65
“Collective performance expectations” (Scale, 6 Items, Cronbach’s Alpha=.78) Sample item: We have to make an effort to meet the demands of the teachers at this school. <sup>e)</sup> – Source: Fend (1977), Maag Merki (2002)	1428	2.75	.52
<sup>a)</sup> Answer options: 1 = under 4 ... 5 = at least 5.5 (grade point averages range from 1 to 6 whereas 4 indicates the least sufficient grade)			
<sup>b)</sup> Answer options: 1 = not well at all ... 4 = very well			
<sup>c)</sup> Answer options: This is true of ... 1 = none or very few of my teachers ... 4 = most or all of my teachers			
<sup>d)</sup> Answer options: 1 = never ... 5 = very often			
<sup>e)</sup> Answer options: 1 = disagree completely ... 4 = agree completely			

cent evidence suggests that there is, nonetheless, a relationship between what people say they would do and what they can do (see, for example, Schiefele, 2005). Therefore, decontextualized self-report data reflect students' awareness of self-regulated learning, whereas online approaches focus on the process and the quality of self-regulated learning (Pintrich, 2004). Given these considerations, it is evident that the one-sided criticism of self-report data is not justifiable. With regard to the objectives of the present study, we consider an approach that considers students' awareness of self-regulated learning appropriate.

We used a standardized questionnaire at the time of the second survey (end of Grade 12) to cover the school-specific context factors selected according to the theoretical analyses and literature investigations described above. These factors relate to students' retrospectively reported experiences attending high school. Empirical studies suggest that valid assessments are possible with respective retrospective approaches (Fend, 1998a, p. 279 ff.). In a narrow sense, however, this approach does not allow us to identify causal effects. The indicators were developed on the basis of already existing instruments. In some cases, we adapted or revised the scales we used to suit the particular context. Table 2 shows, for the analyses presented here, the scales and items.

Students' context of extra-curricular experience was measured by the variable *familial educational background* with the indicators being "most recently completed educational training of mother/father" (1 = compulsory schooling, 4 = entrance examinations to higher education, teacher training, university) and "number of books at home" (1 = 0 to 10 books, 5 = over 500 books). We used five indicators for the young people's leisure-time activities (for consideration of the relevance of peers, see, for example, Fend, 1998b).<sup>1</sup>

### *Analysis strategies*

To study the effects of school and classroom instruction on individual dimensions of students' self-regulated learning, we used multiple regression analyses (pairwise deletion of missing data) to assess the influence of school factors when controlling for starting conditions and the context of extra-curricular experience. The values in each of the individual dimensions at the time of the second survey at the end of high school served as dependent variables. To take into account the independent variables, we specified three models, in which the variables were entered block-wise:

1. *Starting conditions*: initial level at the first survey at the beginning of Grade 10, sex
2. *Context of extra-curricular experience*: family educational background, leisure activities
3. *School process factors*: (see Table 2)

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<sup>1</sup> *Sample item*: "How often do you engage in the following activities in your free time? In my free time, I am active in a club or organization." (Answer format: 1 = never, 5 = very frequently.)

Despite the multilevel structure of the data (schools, classes, individuals), we did not carry out any multilevel analyses. We found among the independent variables only very modest intra-class correlations of a maximum of one percent. This finding coincides with findings from previous studies indicating that the variance between schools is much narrower for cross-curricular competencies than for subject-specific competencies (Ditton & Krecker, 1995; Gruehn, 2000; Köller, 1998). Furthermore, empirical findings show that individual perceptions are of high importance, despite the different perceptions found within classes and schools (Eder, 1996; Rakoczy, 2008). The focus of the present study is therefore on the individual perception of teaching and school and its effectiveness in promoting the development of the dimensions under investigation. To avoid possible mis-estimations of individual-level effects brought about by ignoring the hierarchical structure, we carried out the analyses on the basis of weighted samples. We determined the weighting factor on the basis of the intra-class correlation among the dependent variables, and took into account the actual sample size and the mean class size (Kish, 1987). We used the statistics program SPSS 14 for all evaluations.

### Sample

Between the first and the second survey, 21.3 % of the students had left high school or had moved to a different grade (cf. Table 3). Just over 11 % of the students either could not be covered a second time or could not be included in the second survey because of temporary absence or missing codes. These dropouts did not, however, cause any systematic distortions in the longitudinal composition of the survey group, such that no corrections had to be made for the analyses presented here (see also in this regard, Maag Merki & Leutwyler, 2004). Three hundred and thirty-two students were covered for the first time in the second survey and therefore could not be included in the longitudinal analyses. Thus, the longitudinal test group included 1 434 students, of whom nearly two-thirds were young women (63.9 %) and just above one-third young men (36.1 %).

**Table 3:** The 2001 and 2004 test groups

	2001 Survey		2004 Survey	
	<i>N</i>	%	<i>N</i>	%
Students in 2001 test group only				
Left school / left grade	453	21.3%		
Absent at the time of the 2004 survey /	238	11.2%		
No codes in 2004 / excluded cases				
Students in 2001 and 2004 test groups	1434	67.5%	1434	81.2%
Students in 2004 test group only			332	18.8%
Total	2125	100%	1766	100%

## Results

The analyses clearly showed that both the motivational aspects and the cognitive and metacognitive aspects of self-regulation differed in their stability and can thus be fostered to differing degrees through different features of the school and the instructional process. The same was true – and to a significant degree – for the different dimensions of *motivational* self-regulation (see Table 4). The variance in motivational self-regulation in the final year of high school explained by the different starting conditions varied between 18.1% (for self-efficacy expectations) and 33.7% (for self-esteem). In all dimensions, we can see that the degree of motivational self-regulation at time  $t_1$  (2001) explained by far the greatest percentage of variance ( $\beta_{\min} = .425$ ;  $p < .001$ ). Sex had different effects on the change in students' motivational self-regulation. It was evident that self-esteem and achievement motivation had developed more strongly in young men, while intrinsic motivation and volition had developed more strongly in young women. Sex played no role, however, in the development of self-efficacy and persistence. This finding indicates differential effects, namely that sex influences the individual dimensions of motivational self-regulation to different degrees.

Students' extra-curricular experience played a relatively minor role compared to their starting conditions. In no case did the variance explained by the extra-curricular experience exceed a value of 2.8% (see Table 4). We found no effect on the development of motivational self-regulation during the senior year of high school, either for the number of books at home or for parents' educational level. Leisure-time activities, however, helped to explain different degrees of variance in different dimensions of motivational self-regulation. Organizing activities among friends increased self-esteem ( $\beta = .139$ ;  $p < .001$ ), self-efficacy expectations ( $\beta = .114$ ;  $p < .001$ ), and achievement motivation ( $\beta = .085$ ;  $p < .01$ ), while taking on responsibilities within the household significantly increased achievement motivation ( $\beta = .082$ ;  $p < .01$ ), intrinsic motivation ( $\beta = .086$ ;  $p < .01$ ), volition ( $\beta = .053$ ;  $p < .05$ ), and persistence ( $\beta = .070$ ;  $p < .05$ ). While participating in a club or organization had a positive impact on self-efficacy expectations ( $\beta = .090$ ;  $p < .05$ ) and persistence ( $\beta = .083$ ;  $p < .05$ ), helping people in need of care helped to explain the variance in change of achievement motivation ( $\beta = .060$ ;  $p < .05$ ). Overall, students' extra-curricular experience explained only a modest percentage of the variance in motivational self-regulation; its explanatory power was greatest for achievement motivation (2.8%) and self-esteem (2.5%).

The school process factors investigated here explain much more variance than does the students' extra-curricular experience. The percentage of variance explained varies widely, however, among the individual dimensions. While school process factors explained only 2.5% of the development in volition, the same factors explained 12.5% of the development in intrinsic motivation (see Table 4). Subjective evaluations of achievement ability had a significant impact on all dimensions of motivational self-regulation ( $\beta_{\min} = .071$ ;  $p < .05$ ), while objective achievement abil-

**Table 4:** Regression analyses for motivational self-regulation

	Dependent variables					
	Self-esteem 2004	Self-efficacy 2004	Achievement motivation 2004	Intrinsic motivation to learn 2004	Volition 2004	Per- sistence 2004
	$\beta^1)$	$\beta^1)$	$\beta^1)$	$\beta^1)$	$\beta^1)$	$\beta^1)$
<b>Block 1: Starting conditions</b>						
Value at time of first measurement $t_1$ (2001)	.548***	.425***	.533***	.446***	.575***	.494***
Sex	.113***	.038	.097***	-.109***	-.055*	.006
<b>R<sub>a</sub><sup>2</sup> block 1</b>	<b>33.7 %</b>	<b>18.1 %</b>	<b>30.9 %</b>	<b>22.5 %</b>	<b>33.4 %</b>	<b>24.2 %</b>
<b>Block 2: Context of extra-curricular experience</b>						
Number of books at home	.002	-.030	.022	.046	-.010	.017
Most recently completed educational training (mother)	.023	.033	.032	-.052	-.013	-.001
Most recently completed educational training (father)	-.038	-.021	.027	.039	.005	.013
Leisure-time activities: cooperation in an organisation/club	.021	.090*	.009	.068	.001	.083*
Leisure-time activities: leadership in an organisation/club	.036	-.023	.046	-.020	.017	.001
Leisure-time activities: activities with friends	.139***	.114***	.085**	.034	.016	.007
Leisure-time activities: serving in the household	.025	.008	.082**	.086**	.053*	.070*
Leisure-time activities: caring for people in need of help	.029	-.005	.060*	.046	.023	.014
<b>Change in R<sub>a</sub><sup>2</sup> compared to block 1</b>	<b>+ 2.5 %</b>	<b>+ 1.6 %</b>	<b>+ 2.8 %</b>	<b>+ 1.7 %</b>	<b>+ 0.0 %</b>	<b>+ 1.0 %</b>
<b>Block 3: School process factors</b>						
Subjective achievement level	.123***	.152***	.187***	.072*	.071*	.143***
Grade point average	-.052	-.006	.001	.066*	.124***	.109***
Teachers' ability to motivate students	.034	.015	.037	.245***	.096**	.070*
Support by teacher in class	-.032	-.086	-.029	-.030	-.025	-.035
Reflection on work	.056	.004	-.037	-.055	-.015	.009
Autonomous activities	-.041	-.011	-.035	-.064	-.056	-.094*
Self-monitoring	-.023	-.024	-.007	-.005	.028	.005
Elaboration	-.017	-.024	.024	.089*	.019	.045
Genetic-Socratic approach	-.052	-.035	-.044	-.068*	-.019	-.001
Student-teacher-relationship	-.031	.016	.028	.018	-.007	-.014
Relationship among students	-.065	-.059	-.036	-.102**	-.013	-.098**
Perceived social integration	.211***	.131**	.115**	.172***	-.011	.133**
Perceived competency support by teacher	.044	.032	.038	-.003	.014	.051
Perceived autonomy support by teacher	.060	.089*	.053	.052	.061	.026
Having a voice	-.012	.002	-.037	.068*	.019	.033
Collective performance expectations	-.015	-.028	-.089***	-.032	.008	-.011
<b>Change in R<sub>a</sub><sup>2</sup> compared to block 2</b>	<b>+ 3.9 %</b>	<b>+ 3.3 %</b>	<b>+ 7.2 %</b>	<b>+ 12.5 %</b>	<b>+ 2.5 %</b>	<b>+ 7.0 %</b>
<b>R<sub>a</sub><sup>2</sup> for all 3 blocks</b>	<b>40.1 %</b>	<b>23.0 %</b>	<b>40.9 %</b>	<b>36.7 %</b>	<b>36.9 %</b>	<b>32.2 %</b>
F-value for over-all model (p-value)	29.276 (p < .000)	14.164 (p < .000)	30.560 (p < .000)	24.974 (p < .000)	26.518 (p < .000)	21.717 (p < .000)

Notes: <sup>1)</sup>  $\beta$  = standardised regression coefficient

- Cells in grey contain significant regression coefficients

- \* = p &lt; .05; \*\* = p &lt; .01; \*\*\* = p &lt; .001

- Method: enter, blockwise

- Minimal tolerance = .340

ity (measured in grade point average) affected only the change in intrinsic motivation ( $\beta = .066$ ;  $p < .05$ ), volition ( $\beta = .124$ ;  $p < .001$ ), and persistence ( $\beta = .109$ ;  $p < .001$ ). The perception of teachers' ability to motivate students played a prominent role in the development of intrinsic motivation ( $\beta = .245$ ;  $p < .001$ ) and also had an important effect on the development of volition ( $\beta = .096$ ;  $p < .01$ ) and persistence ( $\beta = .070$ ;  $p < .05$ ).

In contrast, only some didactic aspects of classroom instruction affected the development of motivational self-regulation. A process orientation showed no effect at all, while high self-reliance of learners showed a demonstrable effect in just a single case: here, the degree of autonomous activity in class stood in a negative relationship to the development of persistence ( $\beta = -.094$ ;  $p < .05$ ). A connection between motivational self-regulation and teachers' use of a transfer orientation was also demonstrable only in isolated cases: while requiring students to elaborate frequently promoted the development of intrinsic motivation ( $\beta = .089$ ;  $p < .05$ ), a genetic-Socratic approach<sup>2</sup> had a negative effect on intrinsic motivation ( $\beta = -.068$ ;  $p < .05$ ).

An only partially coherent picture emerged relative to social aspects of classroom instruction: perceived social inclusion played an important role in the positive development of practically all dimensions of motivational self-regulation ( $\beta_{\min} = .131$ ;  $p < .05$ ), and in fact left only the dimension of volition unaffected. The quality of relationships among students explained differing percentages of variance: a positive perception of relationships stood in a negative relationship to the development of intrinsic motivation ( $\beta = -.102$ ;  $p < .01$ ) and persistence ( $\beta = -.098$ ;  $p < .01$ ). High promotion of autonomy by teachers showed a positive effect on the development of self-efficacy ( $\beta = .089$ ;  $p < .05$ ). Finally, process factors at the meso level played a significant role in some aspects of the development of motivational self-regulation. High opportunities for participation at the school level promoted the development of intrinsic motivation ( $\beta = .068$ ;  $p < .05$ ), while high collective achievement expectations appeared to impede the development of high personal achievement motivation ( $\beta = -.089$ ;  $p < .001$ ).

In summary, we can state that a considerable degree of the variance in motivational self-regulation at the end of the senior year of high school could be explained by the students' starting conditions. However, the significance of these starting conditions differed widely from one dimension of motivational self-regulation to the next. At the same time, school process factors played an important role in the development of motivational self-regulation: their importance was clearly demonstrable in our study and far exceeded the importance of students' extra-curricular experience in all dimensions. The different school process factors had differential effects, however, and promoted the different dimensions of self-regulated learning to differing degrees.

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2 A teaching style that intentionally permits students to go their own way in order to discover specific connections in knowledge.

**Table 5:** Regression analyses for cognitive and metacognitive self-regulation

	Dependent variables				
	Elaboration strategies 2004	Transformation strategies 2004	Planning strategies 2004	Monitoring 2004	Evaluation strategies 2004
	$\beta^1)$	$\beta^1)$	$\beta^1)$	$\beta^1)$	$\beta^1)$
<b>Block 1: Starting conditions</b>					
Value at time of first measurement $t_1$ (2001)	.387***	.415***	.482***	.358***	.371***
Sex	.011	-.196***	-.054*	-.017	.027
<b>R<sub>a</sub><sup>2</sup> block 1</b>	<b>14.8 %</b>	<b>25.3 %</b>	<b>23.8 %</b>	<b>12.8 %</b>	<b>13.6 %</b>
<b>Block 2: Context of extra-curricular experience</b>					
Number of books at home	.005	.004	.006	-.011	.020
Most recently completed educational training (mother)	-.047	-.009	-.023	-.027	-.085**
Most recently completed educational training (father)	.029	-.004	.011	.024	.029
Leisure-time activities: cooperation in an organisation/club	-.041	-.005	-.040	-.027	-.027
Leisure-time activities: leadership in an organisation/club	.043	.067	.088*	.065	.025
Leisure-time activities: activities with friends	.049	.084**	.016	.024	.001
Leisure-time activities: serving in the household	.047	.085**	.091**	.072*	.072*
Leisure-time activities: caring for people in need of help	.026	.033	.000	.032	.079*
<b>Change in R<sub>a</sub><sup>2</sup> compared to block 1</b>	<b>+ 0.4 %</b>	<b>+ 2.0 %</b>	<b>+ 0.9 %</b>	<b>+ 0.7 %</b>	<b>+ 1.4 %</b>
<b>Block 3: School process factors</b>					
Subjective achievement level	.077*	-.001	.062*	.053	.048
Grade point average	.031	.066*	.089**	.037	.029
Teachers' ability to motivate students	.033	.036	.075*	.061	.166***
Support by teacher in class	-.026	.066	.060	-.020	.007
Reflection on work	-.043	-.001	.036	-.038	-.018
Autonomous activities	-.002	-.026	.012	-.021	-.042
Self-monitoring	.019	.029	.009	.037	.026
Elaboration	.125**	.078*	-.010	.087*	.097*
Genetic-Socratic approach	-.007	-.066*	-.064*	-.043	-.068*
Student-teacher-relationship	-.021	.044	-.006	.016	-.001
Relationship among students	-.046	-.009	-.070	-.092*	-.068
Perceived social integration	.053	.044	.036	.082	.042
Perceived competency support by teacher	.072	-.053	-.018	.078	.077
Perceived autonomy support by teacher	-.050	-.001	.034	.001	-.050
Having a voice	.032	-.001	.064*	.104**	.052
Collective performance expectations	.061*	.077**	.102***	.108***	.021
<b>Change in R<sub>a</sub><sup>2</sup> compared to block 2</b>	<b>+ 2.6 %</b>	<b>+ 1.8 %</b>	<b>+ 3.6 %</b>	<b>+ 5.3 %</b>	<b>+ 5.3 %</b>
<b>R<sub>a</sub><sup>2</sup> for all 3 blocks</b>	<b>17.8 %</b>	<b>29.1 %</b>	<b>28.3 %</b>	<b>18.8 %</b>	<b>20.3 %</b>
F-value for over-all model (p-value)	10.492 (p < .000)	17.587 (p < .000)	18.080 (p < .000)	10.784 (p < .000)	12.462 (p < .000)

Notes: <sup>1)</sup>  $\beta$  = standardised regression coefficient  
- Cells in grey contain significant regression coefficients  
- \* =  $p < .05$ ; \*\* =  $p < .01$ ; \*\*\* =  $p < .001$   
- Method: enter, blockwise  
- Minimal tolerance = .341

Differential effects such as these can be seen in the development of cognitive and metacognitive aspects of self-regulation as well. As with motivational self-regulation, students' starting conditions play the key role in regard to cognitive and metacognitive self-regulation, explaining between 12.8% and 25.3% of the variance for monitoring strategies and transformation strategies, respectively (see Table 5). A substantial degree of the cognitive and metacognitive self-regulation measured at the end of the senior year of high school was explained by the degree thereof measured at the beginning of high school ( $\beta_{\min} = .358$ ;  $p < .001$ ). Sex influenced only some aspects of cognitive and metacognitive self-regulation: young women employed transformation and planning strategies to a greater extent than did young men. Thus, we saw differential effects of sex here as well.

Students' extra-curricular experience also played a relatively minor role in cognitive and metacognitive self-regulation, explaining only 0.4% of the variance (in elaboration strategies) and 2.0% (in transformation strategies). As with motivational self-regulation, educational background played almost no role in the cognitive and metacognitive areas. The only exception was the educational level of the mother, which stood in a negative relationship to the development of evaluation strategies ( $\beta = -.085$ ;  $p < .01$ ). In the case of leisure-time activities, working within the household proved its importance: the more frequently the students took on responsibilities within the household, the more intensively they employed transformation strategies ( $\beta = .085$ ;  $p < .01$ ), planning strategies ( $\beta = .091$ ;  $p < .01$ ), monitoring strategies ( $\beta = .072$ ;  $p < .05$ ), and evaluation strategies ( $\beta = .072$ ;  $p < .05$ ).

School process variables influenced the development of most aspects of cognitive and metacognitive self-regulation, and to a greater degree than students' extra-curricular experience. The percentage of variance in cognitive and metacognitive self-regulation explained by these variables ranged between 1.8% for transformation strategies and 5.3% for monitoring strategies and evaluation strategies (see Table 5), and thus lay somewhat below that explained in motivational self-regulation.

In contrast to motivational self-regulation, the subjective evaluation of personal achievement ability affected the degree of cognitive and metacognitive self-regulation only in isolated dimensions. Subjective achievement ability showed an effect on the development of elaboration strategies ( $\beta = .077$ ;  $p < .05$ ) and planning strategies ( $\beta = .062$ ;  $p < .05$ ), while objective achievement ability showed an effect on the development of transformation strategies ( $\beta = .066$ ;  $p < .05$ ) and planning strategies ( $\beta = .089$ ;  $p < .01$ ): the more highly students evaluated their teachers' ability to motivate, the more intensively the students employed planning strategies ( $\beta = .075$ ;  $p < .05$ ) and evaluation strategies ( $\beta = .166$ ;  $p < .001$ ).

Didactic aspects of teaching explained differing percentages of the variance in the development of cognitive and metacognitive self-regulation. While the level of process-orientation in teaching and in learners' self-reliance did not – in contrast to expectations – show any effect, the degree of transfer orientation in teaching (measured using the scale “elaboration”) was positively related to the development of cognitive and metacognitive self-regulation. A strongly genetic-Socratic

approach, in contrast, was negatively related to students' development of transformation strategies ( $\beta = -.066$ ;  $p < .05$ ) and planning strategies ( $\beta = -.064$ ;  $p < .05$ ). Social aspects of the instructional environment played almost no role in the development of cognitive and metacognitive self-regulation. The exception was the perceived quality of relationships among students, which showed a negative effect on the development of monitoring strategies ( $\beta = -.092$ ;  $p < .05$ ). Process factors at the meso level also played a role. On the one hand, the extent of opportunities for participation at the school level explained some of the variance in the development of planning strategies ( $\beta = .064$ ;  $p < .05$ ) and monitoring strategies ( $\beta = .104$ ;  $p < .01$ ). On the other hand, higher collective achievement expectations led to higher use of elaboration strategies ( $\beta = .061$ ;  $p < .05$ ), transformation strategies ( $\beta = .077$ ;  $p < .01$ ), planning strategies ( $\beta = .102$ ;  $p < .001$ ), and monitoring strategies ( $\beta = .108$ ;  $p < .001$ ).

To summarize, the extent of cognitive and metacognitive self-regulation at the end of the senior year of high school was determined in large part by the students' starting conditions. However, the importance of these starting conditions differed widely from one dimension to the next. While sex and the context of extra-curricular experience explained almost none of the variance in cognitive and metacognitive self-regulation, school process factors appeared to play a somewhat more important role, although they did show differential effects on the different dimensions of cognitive and metacognitive self-regulation, as was the case with motivational self-regulation. For the development of cognitive and metacognitive self-regulation, comprehension-oriented teaching contexts as well as high collective-achievement expectations tended to show more significant effects, while social aspects were of virtually no importance.

## Conclusion

In this study, we investigated the question of whether and to what extent variance in students' self-regulated learning at high school can be explained substantially by school process factors when controlling for students' starting conditions. We analyzed differential regression models, comparing the effects of different possible factors on the development of individual dimensions of motivational, cognitive, and metacognitive self-regulation.

The results largely corresponded to our expectations. They showed that, subsequent to our controlling for starting conditions, school process factors and the context of extra-curricular experience contributed significantly to explaining the variance in the individual dimensions. We can describe these influential factors as specific configurations of social and didactic factors whose influence varies among the individual dimensions of self-regulated learning. Furthermore, the effect size of school process variables for the development of self-regulated learning varied systematically and was not very large. However, reference to Lanahan, McGrath, McLaughlin, Burian-Fitzgerald, & Salganik (2005) and Patry & Hager (2000)

shows these effect sizes corresponding to the effect sizes in multivariate and longitudinal studies, when controlling for starting conditions.

While subjective achievement ability and social aspects of instruction (for example, teachers' ability to motivate, perceived social integration in class) played a consistently important role in the development of motivational self-regulation, understanding-oriented instructional contexts (for example, elaboration) as well as high collective achievement expectations promoted the development of almost all dimensions of cognitive and metacognitive self-regulation. School process factors had a significantly greater influence on most aspects of motivational self-regulation – particularly the development of achievement motivation, intrinsic motivation, and persistence – than on the development of cognitive and metacognitive self-regulation. The reason why may be that, for students attending high school, we can more clearly see during their last three years of their schooling the effects on the development of their motivational self-regulation than on the development of their cognitive and metacognitive self-regulation (see Table 1). This finding is consistent with findings from previous studies (e.g. Baumert, 1993; Eder, 1996; Satow, 2002; Zimmerman & Martinez-Pons, 1990).

There are also indications (Leutwyler, 2006) that the kind of instructional design necessary to promote the development of cognitive and metacognitive regulation in particular is almost nonexistent, with almost no variance between classes. This could also explain why neither the use of a process orientation in teaching (for example, reflection on work) nor self-reliance of learners (for example, autonomous activities, self-monitoring) made a significant contribution to explaining the variance in the development of cognitive and metacognitive regulation. However, this outcome could be the result of our having measured self-regulated learning in the present study in general terms rather than in relation to specific subjects. In the future, therefore, domain-specific studies should be conducted in a manner that allows examination of the relationship between school process variables and self-regulated learning.

Closer examination of the individual analyses revealed a number of further striking findings. First, in contrast to our expectations, the connection between the use of a genetic-Socratic approach when working through learning material and the development of intrinsic motivation and transformation, planning, and evaluation strategies was negative. The genetic-Socratic approach tended to be relatively unproductive for the development of self-regulated learning, although the effects here were small. This finding could be because a central element of this methodical approach is that of making students doubt their own existing knowledge structures, which can lead to insecurity and feelings of failure. Thus, the success of this approach depends on the extent to which teachers are able to channel the insecurity created in a productive way, and to guide a learning process that fosters student motivation through the successful generation of knowledge. Future studies on the effect size of the genetic-Socratic approach relative to the development of self-regulated learning are therefore necessary to analyze the structure of this relationship not only in detail but also from a differential perspective.

Yet another outcome of this study was contrary to expectations: the finding that the quality of relationships among students had a negative effect on individual dimensions of self-regulated learning (intrinsic motivation, persistence, monitoring strategies). One explanation for this could be that, during adolescence, peers take on an increased importance for young people (Fend, 1998b), while their interest and enjoyment in learning decreases over the course of school attendance (Czerwenka, Nölle, Pause, Schlotthaus, Schmidt, & Tessloff, 1990; Fend, 1998b). As a result, students who feel they have a good relationship with their peers tend to be less interested in school subject matter and show lower persistence and lower use of metacognitive strategies, while students who perceive the relationships among fellow students to be less positive are better able to concentrate on the subject matter and learning process. This connection indicates an ambivalent structure. To test the plausibility of this hypothesis, we must keep in mind (at least with regard to the development of intrinsic motivation and persistence) that the degree of social integration and the teacher's ability to motivate students (the social context) stand in a positive relationship to the dimensions of self-regulated learning. Working from within the framework of a structural model should make it possible to model this multivariate causal structure in greater detail in more in-depth studies.

Analogously, future studies should more closely examine the negative connection between students' perceived opportunities to investigate their own topics in class and the decrease in persistence. A possible interpretation for this result, which tends to contradict expectations, is that situations in which students have to take action in solving a problem themselves demand much higher persistence. A systematic investigation of the teacher's role in this process could thus be of central importance in showing how students can "stay on the ball" when difficulties or competing desires arise.

The importance of instructional context is indicated as well by the negative effect of collective achievement expectations on the development of achievement motivation. Developing an interest in subject matter and an enjoyment in confronting challenging tasks requires a learning environment that is marked by support and security. High expectations and achievement pressures could certainly have an unproductive effect, leaving little room for students to find their own ways of approaching difficult tasks.

Although, within the present study, the effect size of school process variables for the development of self-regulated learning varied systematically and was not very large in some individual dimensions, we can still conclude that the context of extra-curricular experience explained a significantly smaller percentage of the variance in almost all dimensions. While the sex-specific effects identified here conformed to expectations (see, for example, Artelt, 2003; Brühwiler & Biedermann, 2005; Zimmerman & Martinez-Pons, 1990; Zutavern & Brühwiler, 2002), it is interesting that family educational background did not contribute significantly to explaining the variance in the dimensions investigated. This finding appears to contradict identification of an effect in various prior empirical studies (among them Artelt, Schiefele, & Schneider, 2001; Artelt et al., 2003). Most of these studies,

however, were cross-sectional, with the importance of educational background for self-regulated learning analyzed in relation to the differential levels in the individual dimensions at a specific point in time and not over time. Foregoing controlling for starting conditions would have successfully produced the expected connections with the present data. Another consideration is that we carried out our study with reference to a sample that was relatively homogeneous in terms of students' family educational background and came from one schooling track (Gymnasium). As such, the lack of variance in the predictor variable hardly allowed for the expectation of effects on the development of students' self-regulated learning.

Our study found consistently positive connections in the relationship between individual leisure activities and the development of students' self-regulated learning. A particularly strong effect emerged in regard to taking on tasks around the home, which certainly require a substantial amount of cognitive and metacognitive activity in and of themselves. However, it will be necessary to test the direction of effects between the leisure-time factors as predictors and the dependent criteria within the framework of structural equation model analyses: it may be that household activities not only predict students' self-regulated learning but also are influenced by students' self-regulated learning.

Our comparative analysis of potential means by which schools can influence the different dimensions of self-regulated learning has thus proven highly productive overall. On the one hand, our approach has revealed how differently the individual dimensions of self-regulated learning may be influenced. On the other hand, it has revealed the differential effects of the different process characteristics. These considerations indicate the necessity for future research focused more closely on illuminating the impact of specific configurations of school process characteristics.

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