


Assessment and Relationships of Conditional Motivational Regulation Strategy Knowledge as an Aspect of Undergraduates' Self-regulated Learning Competencies

Gabriele Steuer^{1,2} , Tobias Engelschalk², Nicole Eckerlein², and Markus Dresel²

¹University of Bielefeld

²University of Augsburg

Abstract: For learners, motivational regulation represents a daily challenge in terms of initiating, increasing and maintaining motivation. Crucial here is conditional knowledge about which motivational regulation strategies are appropriate for which specific motivational problems. This paper addresses the relationships between this type of strategy knowledge and regulatory effectiveness and characteristics of learning behavior. In a sample of 188 undergraduates, this strategy knowledge – assessed with a newly developed Situational Judgement Test – showed moderately positive correlations with motivational regulation on the behavioral level. Moreover, it was positively related to the effectiveness of motivational regulation and effort. Hence, conditional motivational regulation strategy knowledge is relevant and contributes to an extended understanding of motivational regulation in the higher education context.

Erfassung und Zusammenhänge konditionalen Strategiewissens zur Motivationsregulation als Aspekt der Kompetenzen zum Selbst-regulierten Lernen von Studierenden

Zusammenfassung: Für Lernende ist Motivationsregulation, im Sinne der Initiierung, Steigerung und Aufrechterhaltung der Motivation eine alltägliche Herausforderung. Fundamental dafür ist das konditionale Wissen darüber, welche Motivationsregulationsstrategien bei welchen konkreten Regulationsanlässen funktional sind. Die vorliegende Arbeit untersucht Zusammenhänge dieser Art des Strategiewissens mit Regulationserfolg und Merkmalen des Lernverhaltens. Anhand einer Stichprobe von 188 Studierenden konnte gezeigt werden, dass dieses Strategiewissen – erfasst mittels eines neu konstruierten Situational Judgement Tests – moderat positiv mit Motivationsregulation auf Verhaltenzebene, mit Regulationserfolg und mit Anstrengung korreliert. Somit ist konditionales Strategiewissen zur Motivationsregulation von Relevanz und leistet einen Beitrag zum erweiterten Verständnis von Motivationsregulation im Hochschulkontext.

For learners who have to master complex learning tasks, the processes of initiating, increasing and maintaining motivation are frequently challenging. Accordingly, the significance of motivational regulation, in the sense of consciously influencing one's own learning motivation (e.g., Wolters, 1999), is reflected in many models of self-regulated learning (e.g., Boekaerts, 1999). Regulation of motivation is manifested on a behavioral level in terms of the application of strategies such as proximal goal-setting. However, it is not conceivable without the underlying strategy knowledge – as part of broader self-regulated learning

competencies. The present paper focuses on conditional motivational regulation strategy knowledge – that is, knowledge regarding which motivational regulation strategies function appropriately for which specific motivational problem (Paris, Lipson, & Wixson, 1983). Since requirements can vary greatly depending on the situation (see Dresel et al., 2015), we can assume that adaptive motivational regulation must be specific to the situation and the motivational problem. Despite general agreement that the role played by strategy knowledge for motivational regulation is highly significant (e.g., Boekaerts, 1999; Wolters,

1998), currently no measuring instrument has attempted to assess aspects of motivational regulation strategy knowledge, and thus gone beyond self-reported assessments on the behavioral level (with one exception, see Thillmann & Wirth, 2011). In this work, a Situational Judgment Test (SJT) for the assessment of conditional strategy knowledge regarding motivational regulation is developed and examined with an eye to its relations with motivational regulation on a behavioral level, regulatory effectiveness and effort (convergent validity) as well as with general motivational tendencies (discriminant validity).

Motivational regulation

With regard to the object of regulation, motivational regulation can be understood as the regulation of one's self and the management of resources. Within Boekaerts' (1999) three-layered model of self-regulated learning, this is represented by the external layer of the model – aside from the core layer (regulation of processing modes, cognitive learning strategies) and the middle layer (regulation of learning process, metacognitive strategies). Furthermore, motivational regulation also represents a significant element in all phases of the learning process (cf. to process models, e.g., proposed by Schmitz & Wiese, 2006). Here, it is assumed that learning processes typically do not run smoothly, and that it is rather necessary to maintain and/or increase motivation throughout the course of a learning activity.

Various studies have demonstrated, in the context of both secondary education (e.g., Prudie & Hattie, 1996; Zimmerman & Martinez-Pons, 1990) as well as tertiary education (Leutner, Barthel, & Schreiber, 2001; Sansone, Weir, Harpster, & Morgan, 1992), that learners consciously monitor their motivation, potentially recognize inadequate motivation, and try to influence it at will. The role of motivational regulation is particularly noteworthy with regard to university studies because the demands for effective self-regulation of learning are particularly strong here. These demands stem from complex learning tasks and high levels of autonomy (see Händel, Artelt, & Weinert, 2013; Schlagmüller & Schneider, 2007).

Motivational regulation has to be distinguished from motivation itself. Motivational regulation takes place within a situation and refers to a more or less conscious control of state motivation. Thus, motivational regulation is the regulation process, while motivation itself is a product of regulation. In particular, more stable motivational tendencies, like goal orientations or academic self-concepts, should be conceptually differentiated from motivational regulation (although a positive interdependence may exist in the long run).

Motivational regulation is manifested through the application of strategies. Different taxonomies of important strategies have been proposed (e.g., Engelschalk, Steuer, & Dresel, 2015; Schwinger, von der Laden, & Spinath, 2007; Schwinger, Steinmayr, & Spinath, 2009; Wolters, 1998, 1999). On this basis, the following strategies were included in the development of the SJT: *enhancement of personal significance* (increase awareness of the connection between the learning material and one's own life), *enhancement of situational interest* (increase appeal of the learning material), *mastery self-talk* (increase awareness of the importance of learning), *performance-approach self-talk* (increase awareness of positive reactions following a good performance, i.e., external incentives, e.g., good grades), *self-consequating* (independently set positive incentives), *environmental control* (reduction of distracting factors), *performance-avoidance self-talk* (increase awareness of negative reactions following a poor performance, e.g., bad grades), *proximal goal setting* (break a task down into smaller pieces with the aim of making it more manageable) and *ability-focus self-talk* (increase awareness of one's own skills, or remind oneself of successful mastery of similar situations in the past).

Situational specificity of motivational regulation

Against the background of the diversity of motivational issues calling for regulation, it can be assumed that motivational regulation strategies function, at least to some degree, differently in different situations. Wolters (1998) showed that many students prefer using different motivational regulation strategies depending on the motivational problem being addressed. A common distinction is the one between motivational problems that stem from low expectations and those that stem from low subjective value (see Wolters, 1998, 1999). In situations where the expectation of success is low, students see themselves as facing very demanding and subjectively difficult circumstances. On the other hand, situations with low subjective value are perceived as meaningless or boring, possibly due to a perceived lack of relevance. It seems obvious that different strategies are suitable for these different motivational problems. For value problems, it may be assumed that motivational regulation strategies that aim to increase situational interest or personal significance are particularly adaptive. In turn, it seems reasonable that this would be less helpful in cases of expectation problems. Here, it may be assumed that strategies grounded in ability-focused self-talk are productive. A third group of strategies remains that cannot be clearly classified as specifically addressing expectations or value (e.g., strate-

gies based on self-rewards) – they can be assumed to be functional for both types of problems.

Further, different motivational problems may occur in different phases of the learning process, which may call for different motivational regulation strategies. In process models of self-regulated learning (e.g., Schmitz & Wiese, 2006), three phases are commonly assumed: the preactional phase, the actional phase and the postactional phase. Each of the three phases places different demands on motivational regulation. In the preactional phase, goals and motivation have to be established. In the actional phase, the learning activities must be shielded from alternatives, and motivation needs to be monitored and maintained. In the postactional phase, a functional assessment of the completed learning task is needed, thus safeguarding motivation for subsequent learning. However, it has to be noted that the regulation process in the third phase is theoretically less clear than in the other two phases (see Engelschalk et al., 2016).

Engelschalk et al. (2015) showed that students distinguish between expectancy and value problems and different phases of the learning process in their perceptions of motivational problems and that this is reflected in their application of different strategies. Subsequently, Engelschalk et al. (2016) found that students report clear differences between these types of motivational problems regarding their actual effectiveness of regulation endeavors. Conceptually, this effectiveness of motivational regulation (regulation performance) has to be clearly distinguished from knowledge about the suitability of different motivational regulation strategies (aspect of regulation competence) and the use of these strategies (regulation behavior).

Conditional motivational regulation strategy knowledge

The differentiations between value and expectancy problems as well as alongside different learning phases represent dimensions along which the requirements for motivational regulation can differ in all possible combinations. Facing this variety in situational demands, it is important for learners to know how to deal with specific motivational problems. This refers to conditional strategy knowledge, that is knowledge about what works in which situation and what does not work – or in other words, when certain strategies should or should not be used (Pintrich, Wolters, & Baxter, 2000). Literature on self-regulated learning in general has emphasised that conditional strategy knowledge is an important factor for effective learning (e.g., Händel, Artelt, & Weinert, 2013; Maag Merki, Ramseier, & Karlen, 2013; Paris et al., 1983). With respect to motivational regulation, conditional knowledge describes the knowledge of

which motivational regulation strategy functions well for which motivational problem.

In contrast to actual strategy use, conditional motivational regulation strategy knowledge does not comprise concrete regulation behavior. Instead, it delineates a personal disposition that is assumed to operate as a situation specific fundament of regulatory behavior that is functional to cope with motivational problem situations while studying. As such, conditional motivational regulation strategy knowledge can be understood as an aspect of broader self-regulated learning competencies. Referring to Klieme and Leutner's (2006) definition of the competence concept as context-specific cognitive dispositions that are needed to successfully cope with certain situations or tasks in specific domains implies that the use of the competence term is justified here (cf. Wirth & Leutner, 2008).

Assessing conditional motivational regulation strategy knowledge

Assessment of conditional motivational regulation strategy knowledge is challenging, due to the fact that self-reports are not sufficient in this case. This may be the reason as to why the aspect of choosing the strategy that best fits the concrete motivational problem has been widely neglected so far. It is reasonable that an adaptive motivational regulation is characterized more by the application of one or very few strategies that are optimally suited for the motivational problem situation at hand (*qualitative standard* sensu Wirth & Leutner, 2008) than by the application of many strategies regardless of their suitability (*quantitative standard*).

One possible approach, with which the various situational specifics could be represented, is to use SJTs (cf. Weekley & Ployhart, 2006). Here specific problems are presented in the form of vignettes (usually in text or video formats) and the respondent is asked to choose from a selection of possible answers. The instructions can either be to identify the best or worst option (forced choice), or to evaluate all solutions (on Likert-type scales). Scoring is usually done by comparing the responses given by the respondents with empirical keys, typically resulting from expert ratings (e.g., pairwise comparisons between suitable options and non-suitable options as consensually judged by experts). The aim of such tests is to obtain reliable results that are generated by evaluations of distinctive situations by using qualitative standards regarding the suitability of the chosen options.

In the field of motivational regulation, as far as we know, only one competence-oriented procedure has been introduced (Thillmann & Wirth, 2011). It is inspired by the Würzburg Reading Strategy Knowledge Test (WLST 7–12;

Schlagmüller & Schneider, 2007) and includes various motivational problems an individual may encounter while learning (for instance, tasks that are too difficult or uninteresting). In this test, relevant situations are presented, but are not systematically varied with regard to underlying motivational problems and different phases of learning. Furthermore, the procedure is designed for secondary school pupils – there is no corresponding procedure for the tertiary educational sector, which is particularly demanding in terms of self-regulated learning.

Aims of the present research

The central aim of this work was to examine conditional motivational regulation strategy knowledge and to make it empirically tangible through the construction and validation of a SJT. The core assumption was that by considering different situations and the associated strategies, differentiated motivational regulation strategy knowledge can be assessed. The SJT was developed on the basis of existing research and construction procedures (e.g., Weekley & Ployhart, 2006). To generate standards for the evaluation of students' responses, an expert survey was conducted.

Subsequently, the test was submitted to a sample of undergraduate students in order to generate empirical evidence regarding the psychometric properties and validity of the newly developed test. Therefore, the relationships with different potential consequences were addressed (as evidence for the test's convergent validity). Aside from the use of motivational regulation strategies (behavioral level) and the effectiveness of regulation (performance level) we incorporated effort, since it was analyzed as the central consequence in most prior studies on motivational regulation (e.g., Schwinger et al., 2009; Wolters, 1999). To obtain evidence for the test's discriminant validity, we also focused on important motivational tendencies (academic self-concept, goal orientations) as conceptually distinct concepts.

Based on the theoretical assumptions and empirical findings presented above, we expected that conditional motivational regulation strategy knowledge about the suitability of motivation regulation strategies for specific situational requirements has a positive relationship with motivational regulation on the behavioral level (strategy use), the effectiveness of motivational regulation and effort (Hypothesis 1). Furthermore, we presumed that conditional motivational regulation strategy knowledge also predicts

individuals' effectiveness of motivational regulation and effort when controlling for the use of regulation strategies independent of their situational suitability (Hypothesis 2). Finally, we expected, at the most, moderate correlations between motivational tendencies and conditional motivational regulation strategy knowledge (Hypothesis 3).

Method

Design and construction of the SJT

The newly developed SJT consists of a total of eight standardized vignettes resulting from a combination of two motivational issues (*low expectation* and *low subjective value*), two action phases (*preactional phase* and *actional phase*), as well as two typical learning situations in higher education (*exam preparation* and *writing a term paper*). Learning situations were selected on the basis of an expert interview study, which revealed that these are significant for success at university and necessitate a great deal of self-regulation (see Dresel et al., 2015). As the very nature of regulation processes and strategies in the postactional phase is still theoretically rather unclear (see Engelschalk et al., 2016), this phase was not included.

In the first paragraph of the vignettes, the students were asked to imagine that they were in one of the two learning situations. In order to underpin this process, the requirements usually expected for each situation were briefly outlined (e.g., for term paper writing: “To accomplish this task, you must research literature independently, process the information you find, and submit a scientific document by a specified deadline”). In the second paragraph of the vignettes, the different motivational regulatory requirements were presented. Here, the students were asked to imagine that they are *unmotivated* to respond to the situation in the expected way. The presented reason for this lack of motivation was that the content they would have to process was described as being either “difficult (e.g., multi-layered, complicated, challenging to understand)” (*expectation problem*) or “boring (e.g., uninteresting, not very useful, not meaningful)” (*value problem*). Localization to the individual phases of action was expressed at two different places within a vignette: The first sentences of the descriptions of the situations began with one of two phrases, either “You are faced with the task of ...” (*preactional phase*) or “You are in the process of ...” (*actional phase*). Furthermore, an expectation or value problem was combined with the supplementary phrase, “... that's why you are unmo-

¹ Here concrete behavior and therefore the term “would” was chosen (as opposed to the term “should”) in order to foster personal significance and obligation for the situation presented in the vignette (see Weekley & Ployhart, 2006).

tivated to start” (*preactional phase*) or “... therefore, you are unmotivated to continue working” (*actional phase*).

Below each vignette the following question was posed: “What would you do in this situation to increase your motivation to learn?”¹ Afterwards, the nine strategies mentioned above were presented. As they do not include general dysfunctional strategies, delaying the learning task was added as an undisputed option for dysfunctional behavioral. So, the subjects were asked to select from a total of ten possible strategies. The application of specific strategies was assessed with one item per strategy on Likert-type scales with the poles 1 (*I would certainly not do this*) and 6 (*I would certainly do this*). The order in which the items were used was balanced across the eight situations. In order to vary formulations and to broaden the construct, each strategy was represented with four items. The formulation of the strategy items mainly followed Schwinger et al. (2007). The items for *ability-focus self-talk* as well as those for *delaying* were newly designed.

Generating standards using expert ratings

In order to generate standards for judging subjects' responses in the SJT, an expert survey was conducted with the final test material. The expert sample consisted of 12 experts (67% female) in the field of self-regulated learning (criterion: at least five years of research experience and five publications in this field). Experts were provided with all eight vignettes used in the test along with the associated items. The experts were asked to rate the suitability of each strategy for improving students' motivation in the given situation using Likert-type scales ranging from 1 (*absolutely not suitable*) to 6 (*absolutely suitable*). The ratings of the experts

were generally consistent with both theoretical assumptions and previous empirical findings.² Only one case occurred in which the ratings more strongly contradicted the theoretical assumptions (enhancement of personal significance as a suitable strategy to cope with an expectancy problem in the preactional phase of composing a term paper); it was excluded from standard generation.

Scoring

Scoring of the students' responses was based exclusively on strategies that were consensually classified by the experts as suitable or as unsuitable, respectively (corrected r_{WG} -values of .70 and above and average scores above 4 or below 3, respectively). Pair comparisons (difference scores) between student ratings of suitable and student ratings of unsuitable strategies were calculated within all situations (per syntax script to ensure objectivity). Students who could recognize both suitable and unsuitable strategies would consequently achieve high scores in the SJT. Within each situation, students' ratings for all q unsuitable strategies were subtracted from students' ratings for all p suitable strategies, resulting in $p \cdot q$ pair comparisons. If, for example, the experts classified, in a given situation, three strategies as suitable and two strategies as unsuitable, six pair comparisons are calculated by subtracting a student's rating of the first unsuitable strategy from his or her ratings of the three suitable strategies, followed by the same procedure for the second unsuitable strategy.

The final test consists of 29 item pair comparisons that vary in number between situations (between two and six

Table 1. Descriptive statistics and bivariate correlations

Scales	<i>M</i>	<i>SD</i>	α	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)
(1) Conditional motivational regulation strategy knowledge (SJT)	0.63	1.03	.92	–							
(2) Use of motivational regulation strategies	3.52	0.47	.84	.46***	–						
(3) Regulatory effectiveness	4.17	0.59	.85	.51***	.26***	–					
(4) Effort	4.27	0.70	.92	.50***	.33***	.45***	–				
(5) Ability self concept	3.54	0.57	.78	.05	.08	.23**	.19**	–			
(6) Mastery goal orientation	4.14	0.53	.78	.30***	.30***	.28***	.31***	.27***	–		
(7) Performance approach goal orientation	3.22	0.79	.83	.06	.38***	.20*	.16*	.19*	.17*	–	
(8) Performance avoidance goal orientation	2.32	0.84	.87	–.04	.21**	.01	–.02	–.12*	–.13*	.56***	–
(10) Work avoidance goal orientation	2.20	0.76	.86	–.37***	–.13*	–.39***	–.47***	–.25**	–.29***	.02	.33***

Note: $N = 188$ undergraduates
 *** $p < .001$. ** $p < .01$. * $p < .05$.

² Details are available from the first author.

pair comparisons per situation). Asymmetrical pair comparisons resulted between expectation and value problems (more for expectation problems than value problems), the two action phases (more in the actional phase than in the preactional phase), as well as the regulatory situations (more for exam preparation). The average score of the 29 pair comparisons forms the indicator of an individual's conditional motivational regulation strategy knowledge.

Sample and procedure of the validation study

The sample consisted of 188 undergraduate students attending a medium-sized university in Germany. Students were recruited within lectures in mathematics and economics using promotion material. Participation in the study was voluntary and subjects received 10 Euros for their contribution to the investigation. The actual survey was conducted as 45-minute group tests. The average age of the students was 21.8 years ($SD = 2.8$), and 56.9% were female. On average, these students had been enrolled in their selected majors for 4.4 semesters ($SD = 2.6$), and had attended university for a total of 5.1 semesters ($SD = 3.2$); they were majoring in economics (92 students), mathematics (92 students), or a different degree program (4 students).

Additional measuring instruments used in the validation study

In addition to the SJT, a number of other constructs were assessed. Internal consistencies for all constructs are displayed in Table 1.

Use of motivation regulation strategies on the behavioral level

The frequency of the application of strategies to regulate motivation was assessed using a questionnaire developed by Schwinger et al. (2007). It encompasses the use of eight strategies with three to five items per strategy (sample item: "I make myself realize how important it is to do well in tests and exams"). The 30 items were answered on Likert-type scales ranging from 1 (*very rare/never*) to 5 (*very often*). A total score was built referring to Schwinger et al. (2009).

Regulatory effectiveness

The actual effectiveness of regulation endeavors – as their proximal outcome – was also measured with respect to specific situations, using identical vignettes to those in the SJT. Below each vignette, two items from a scale, which had previously been proven to measure subjective regulatory effectiveness, were presented (Engelschalk et al., 2016). These two items read: "I manage to motivate mys-

elf in this situation" and "In this situation, I get my motivational problem under control". Individual agreement with these items was assessed using Likert-type scales ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

Effort

Effort was measured with a 15-item-scale by Engelschalk, Steuer, and Dresel (2017) that represents different aspects of effort (e.g., quality of effort, persistence). A sample item reads: "When I study for my classes, I do not give up very easily". Agreement with each item was measured on a Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

Academic self-concept

Academic self-concept was measured with five items of the scale by Schöne, Dickhäuser, Spinath, and Stiensmeier-Pelster (2002), which were adapted for university students. A sample item reads "Learning new things for me is ...". All five items had to be answered on bipolar five-point scales (1 to 5), e.g., from *very hard* to *very easy*.

Goal orientations

Goal orientations were assessed by using the scales by Spinath, Stiensmeier-Pelster, Schöne, and Dickhäuser (2002). Again, we rephrased the items for the higher education context (item stem: "In my studies, I personally strive ..."). We assessed learning goals ("... to learn as much as possible"), performance approach goals ("... to get my work done better than others"), performance avoidance goals ("... to ensure that other students don't consider me stupid"), and work avoidance goals ("... to work not too hard"). The altogether 31 items had to be answered on Likert-type scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Missing data

Data missing due to item non-response (no item with more than 2% missings) were imputed using the expectation-maximization algorithm (see Peugh & Enders, 2004).

Results

Descriptive statistics are displayed in Table 1.

Psychometric properties of the SJT

The mean value of the 29 pair comparisons measuring conditional motivational regulation strategy knowledge in

the present sample was $M = 0.63$ ($SD = 1.0$; $SE = 0.07$). The observed minimum was -2.6 and the observed maximum was 3.0 (theoretically, the scores could range from -5 to $+5$). The distribution of the measure demonstrated negligible values for skewness (-0.21 ; $SE = 0.18$) and kurtosis (-0.08 ; $SE = 0.35$) and did not deviate significantly from a normal distribution ($p > .05$; see West, Finch, & Curan, 1995). The internal consistency of the test was good ($\alpha = .92$). Reliability was also calculated individually for each of the eight situations, since a calculation across all situations – which are based on the equivalent strategy items – may result in an overestimation of internal consistency (see Maag Merki, Ramseier, & Karlen, 2013). Nevertheless, Cronbach's alphas calculated for each of the 8 situations were in a satisfactory range ($\alpha = .71-.89$).

Correlations between the motivational regulation test and other constructs

In order to obtain evidence regarding convergent validity of the conditional motivational regulation strategy knowledge test, the scores were related to a number of potential consequences (Hypothesis 1). As expected, the new measure consistently showed positive correlations with these constructs (see Table 1). The correlation with motivational regulation on the behavioral level in terms of the quantitative use of strategies proved to be moderately to strongly positive at $r = .46$. Particularly noteworthy is the strong correlation with regulatory effectiveness, which came to $r = .51$. Furthermore, there was a similarly strong correlation with effort ($r = .50$).

To gather information regarding the discriminant validity of the newly developed test, we inspected its interrelations with academic self-concept and goal orientations as conceptually more or less distinct motivational tendencies (Hypothesis 3). The resulting correlations were, as expected, moderately high at the most. A moderate positive correlation was observed with mastery goal orientation and a moderate negative correlation was observed with work avoidance goal orientation. Nil correlations were observed with both performance approach and performance avoidance goal orientations, as well as with academic self-concept.

In addition, we controlled for the potential influence of motivational tendencies on the relations between conditional motivational regulation strategy knowledge on the one hand and behavioral strategy use, regulatory effectiveness and effort on the other hand. The calculated partial

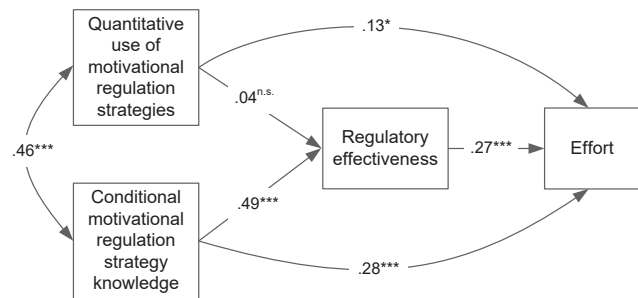


Figure 1. Saturated path model of the relationships between conditional motivational regulation strategy knowledge, quantitative use of regulation strategies, regulatory effectiveness and effort.

correlations were a bit smaller, but still moderate to large (use of motivational regulation strategies: $r = .41$; regulatory effectiveness: $r = .42$; effort: $r = .37$).

Model of the postulated effects of conditional motivation regulation strategy knowledge

Hypothesis 3 stated that conditional motivational regulation strategy knowledge also predicts individuals' effectiveness of motivational regulation and effort when controlling for the use of regulation strategies. In order to test this and to obtain insights regarding the interplay of all four aspects, we used path modeling (performed with Mplus, Muthén & Muthén, 2012). In this model, the new indicator for conditional motivational regulation strategy knowledge was examined together with the quantitative use of motivational regulation strategies, regulatory effectiveness and effort, analogous to the theoretically assumed processes, in a single model (Figure 1). The expected interrelations between conditional motivational regulation strategy knowledge and both the effectiveness of motivational regulation and effort that were already found on the bivariate level were also evident in the path model. Accordingly, this knowledge aspect focusing on the suitability of regulation strategies predicted regulatory effectiveness and effort above and beyond the pure quantity of strategy use. Interestingly, the SJT predicted effort both directly as well as indirectly mediated by regulatory effectiveness ($\beta = .15$; $p < .001$). We found a significant direct effect of quantitative strategy use on effort, but no significant path on regulatory effectiveness (although a positive bivariate correlation was evident; see Table 1).³

³ All model estimates were cross-validated by splitting the sample into two random parts ($N_1 = 93$, $N_2 = 95$) and estimating the model separately for both subsamples. The resulting coefficients were quite similar to the original coefficients in both groups (the average absolute deviation to the original coefficients was $.04$) and only one path no longer reached significance in one subsample (effect of quantitative strategy use on effort).

Discussion

Conditional knowledge about which motivational regulation strategies are appropriate for which specific motivational problems while studying can be understood as an important aspect of learners' competence to self-regulate their learning. On the basis of prior research, a SJT was developed which can be used in the higher education context to assess the conditional knowledge of this type that students have. A study was conducted in order to provide first insights in the usability and validity of the newly developed test and to examine the relevance of students' conditional motivational regulation strategy knowledge. The work contributes to, and expands, the state of research in the motivational regulation field by focusing on the conditional knowledge operating behind the actual regulatory behavior, and developing a measurement instrument which can be used for capturing this knowledge.

Validity and reliability of the SJT

The SJT developed here comprises a total of eight (2x2x2) different situations with motivational problems: two typical studying situations (exam preparation, preparing a term paper), two different motivational issues (poor expectancy of success, poor subjective value), as well as two action stages (preactional, actional). Thus, the assessment is not only situation-specific, but also essentially quite broad, encompassing a large proportion of the motivational problems encountered by university students. Qualitative standards (see Wirth & Leutner, 2008) were derived using expert ratings. The results of the conducted study with undergraduate students indicated that the instrument has sound psychometric properties, revealed quite satisfactory reliability and provided first evidence for its convergent and discriminant validity.

The SJT demonstrated sensible positive relations with self-reporting methods used to assess motivational regulation on the behavioral level (Schwinger et al., 2009) as well as students' reports of their effectiveness in regulating motivational problems and their effort while studying (Hypothesis 1). These relationships provide evidence for the convergent validity of the newly developed test. It should be emphasized that, even though only relatively few strategies are taken into account in the SJT, substantial relationships with outcome variables were evident. This can be taken as an indicator that the strategies considered by the experts to be functional are in fact noteworthy strategies that are familiar to, and used by, university students. The collective consideration of all variables within a path modeling approach confirmed the predictive power of the

new indicator. It could be shown that the consideration of conditional strategy knowledge as a competence factor of motivational regulation contributed to the explanation of the effectiveness of motivational regulation and effort besides the predictive value of motivational regulation on the behavioral level (Hypothesis 2). Thus, the analyses attested the incremental validity of the SJT that complements the explanatory value of self-reports previously used in motivational regulation research.

On a conceptual level, this emphasizes the additional theoretical value provided by a focus on (conditional) strategy knowledge that underlies actual motivational regulation endeavors (cf. Paris et al., 1983). The predictive value of conditional motivational regulation strategy knowledge also accentuates the importance of considering qualitative standards for an adequate conceptualization of ideal self-regulated learning (see Wirth & Leutner, 2008).

A somewhat unexpected result of path modeling was the finding of a direct effect of conditional strategy knowledge on effort. This may be taken as a hint that knowledge regarding the suitability of motivational regulation strategies may be a relatively broad concept, while regulatory effectiveness seems to be more narrowly dependent on the specific situation (cf. Engelschalk et al., 2015).

With respect to the discriminant validity of the newly developed test, it could be shown that important motivational tendencies, which should be clearly distinguished from motivational regulation on a conceptual level, were not or, at the most, were moderately correlated with conditional motivational regulation strategy knowledge (Hypothesis 3). This underpins that the concept of conditional motivational regulation knowledge and the newly developed test adds something unique to the literature.

Limitations

Despite the potential of the concept and the instrument assessing it, it should be noted that the investigation as well as the measurement instrument itself have some limitations. The validation of the SJT presented here is a first step and should be complemented by a broader validation, for example, by using students from other study programs (to enhance the generalizability) or incorporating other criterion variables (see Bülke, Eckerlein, & Dresel, 2018). Here, it would be desirable to assess relations to more distal outcome variables such as achievement measures and also to potential moderator variables such as intelligence (Schwinger et al., 2009). Furthermore, due to the cross-sectional design, the causal order of effects is not proved. Nevertheless, there are strong theoretical reasons to assume that motivational regulation results in solving the motivational problem, which in turn

results in increased effort – rooted in extensive work, for example, by Wolters (e.g., 1999) or Schwinger et al. (2009), who argued for this type of causal ordering. Additionally, the presented SJT does not take into account the postactional phase due to a general lack of knowledge about motivational regulation in this phase. In the light of the significant role the postactional phase plays in models of self-regulated learning, it seems best to study them in more detail separately. One final limitation is that the test has not yet been standardized, which currently restricts its application in individual diagnostics. In research, however, the newly conceptualized SJT can be used without any restrictions.

Perspectives for future research and conclusions

In general, it is important to note that the suitability of a chosen strategy for a given motivational problem is only one of several important aspects of motivational regulation. It has already been shown that motivation regulation on the behavioral level is an important factor (Schwinger et al., 2007, 2009) and also that a concurrent consideration of the quality of strategy application could provide further insights (Engelschalk et al., 2017; Leutner, Barthel, & Schreiber, 2001). It is possible that a broader conceptualized competence for motivational regulation could be accomplished through a combination of conditional knowledge regarding the situational fit of strategies (e.g., assessed by the presented SJT) and the quality of the strategy application. This would mean that the situational suitability of a chosen strategy, the quality of the implementation of the strategy, as well as the extent (quantity) of strategy use would each provide specific aspects to the understanding of motivational regulation and may be considered simultaneously. Consequently, three central aspects would be conflated, each with unique but limited explanatory value. It is conceivable that a few precise but thoroughly and repeatedly executed strategies can level out the effects of a less than ideal strategy fit, and vice versa, a good fit will cushion the less than perfect execution of a strategy.

Another closely related issue could be referred to as “personal fit”. Students may have different preferences or aversions for single strategies. If for one student self-consequating does not work, he or she should probably choose another strategy – even if it would less perfectly fit the situation at hand. Engelschalk et al. (2015) could show that students chose distinct strategies for different situations but that these were not the same for different students. It may be a fruitful approach to address this “personal fit” in future studies – preferably in concert with the above discussed application quality.

Overall, the present work has been able to demonstrate that taking specific motivational problem situations into consideration and adapting motivation regulation strategies to them is a valuable field of investigation that should not be neglected. As for diagnostics, we could provide an approach for a broader and precise assessment of motivational regulation. With regard to student interventions, the results imply that it is not sufficient to engage as many strategies as possible, but rather to concentrate on a situation-specific selection of strategies.

References

- Bäulke, L., Eckerlein, N., & Dresel, M. (2018). Interrelations between motivational regulation, procrastination and college dropout intentions. *Unterrichtswissenschaft, 46*, 461 – 479.
- Boekaerts, M. (1999). Self-regulated learning: Where we are today. *International Journal of Educational Research, 31*, 445 – 457.
- Dresel, M., Schmitz, B., Schober, B., Spiel, S., Ziegler, A., Engelschalk, T., Jöstl, G., Klug, J. Roth, A., Wimmer, B., & Steuer, G. (2015). Competencies for successful self-regulated learning in higher education: Structural model and empirical evidence from expert interviews. *Studies in Higher Education, 40*, 454 – 470.
- Engelschalk, T., Steuer, G., & Dresel, M. (2015). Wie spezifisch regulieren Studierende ihre Motivation bei unterschiedlichen Anlässen? Ergebnisse einer Interviewstudie, [How specifically do students regulate their motivation in different situations? Results from an interview study]. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 47*, 14 – 23. <https://doi.org/10.1026/0049-8637/a000120>.
- Engelschalk, T., Steuer, G., & Dresel, M. (2016). Effectiveness of motivational regulation: Dependence on specific motivational problems. *Learning and Individual Differences, 52*, 72 – 78. <https://doi.org/10.1016/j.lindif.2016.10.011>.
- Engelschalk, T., Steuer, G. & Dresel, M. (2017). Quantity and quality of motivational regulation among university students. *Educational Psychology, 37*, 1154 – 1170. <https://doi.org/10.1080/01443410.2017.1322177>.
- Händel, M., Artelt, C., & Weinert, S. (2013). Assessing metacognitive knowledge: Development and evaluation of a test instrument. *Journal for Educational Research Online, 5*, 162 – 188.
- Klieme, E., & Leutner, D. (2006): Kompetenzmodelle zur Erfassung individueller Lernergebnisse und zur Bilanzierung von Bildungsprozessen. Beschreibung eines neu eingerichteten Schwerpunktprogramms der DFG [Competency models for measuring individual learning and for evaluating education processes: Description of a newly established Priority Program of the DFG]. *Zeitschrift für Pädagogik, 52*, 876 – 903.
- Leutner, D., Barthel, A., & Schreiber, B. (2001). Studierende können lernen, sich selbst zum Lernen zu motivieren: Ein Trainingsexperiment, [Students can learn to motivate themselves to learn: A training experiment]. *Zeitschrift für Pädagogische Psychologie, 15*, 155 – 167.
- Maag Merki, K., Ramseier, E., & Karlen, Y. (2013). Reliability and validity analyses of a newly developed test to assess learning strategy knowledge. *Journal of Cognitive Education and Psychology, 12*, 391 – 408.
- Muthén, L. K., & Muthén, B. O. (2012). *Mplus7* [Computer Software]. Los Angeles, CA: Muthén & Muthén.

- Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, 8, 293–316.
- Peugh, J. L., & Enders, C. K. (2004). Missing data in educational research: A review of reporting practices and suggestions for improvement. *Review of Educational Research*, 74, 525–556.
- Pintrich, P. R., Wolters, C. A., & Baxter, G. P. (2000). Assessing metacognition and self-regulated learning. In G. Schraw & J. C. Impara (Eds.), *Issues in the measurement of metacognition* (pp. 43–97). Lincoln, NE: Buros Center for Testing.
- Prudie, N., & Hattie, J. (1996). Cultural differences in the use of strategies for self-regulated learning. *American Educational Research Journal*, 4, 845–871.
- Sansone, C., Weir, C., Harpster, L., & Morgan, C. (1992). Once a boring task always a boring task? Interest as a self-regulatory mechanism. *Journal of Personality and Social Psychology*, 63, 379–390.
- Schlagmüller, M., & Schneider, W. (2007). *WLST 7–12. Würzburger Lesestrategie-Wissenstest für die Klassen 7 bis 12*, [Würzburg Reading Strategy Knowledge Test for grades 7 to 12]. Göttingen, Germany: Hogrefe.
- Schmitz, B., & Wiese, B. S. (2006). New perspectives for the evaluation of training sessions in self-regulated learning: Time-series analyses of diary data. *Contemporary Educational Psychology*, 31, 64–96.
- Schöne, C., Dickhäuser, O., Spinath, B., & Stiensmeier-Pelster, J. (2002). *Skalen zur Erfassung des schulischen Selbstkonzepts (SESSKO)* [School-Related Self Concept Scales]. Göttingen, Germany: Hogrefe.
- Schwinger, M., Laden, T. von der, & Spinath, B. (2007). Strategien zur Motivationsregulation und ihre Erfassung [Strategies for motivational regulation and assessment]. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, 39, 57–69.
- Schwinger, M., Steinmayr, R., & Spinath, B. (2009). How do motivational regulation strategies affect achievement: Mediated by effort management and moderated by intelligence. *Learning and Individual Differences*, 19, 621–627.
- Spinath, B., Stiensmeier-Pelster, J., Schöne, C., & Dickhäuser, O. (2002). *Skalen zur Erfassung der Lern- und Leistungsmotivation (SELLMO)* [Learning and achievement motivation scales]. Göttingen, Germany: Hogrefe.
- Thillmann, H., & Wirth, J. (2011). *Diagnose und Relevanz des Wissens über Strategien zur Motivationsregulation* [Diagnosis and relevance of knowledge about motivational regulation strategies]. Presentation at the biannual meeting of the section “Educational Psychology” of the German Psychological Society in Erfurt, Germany.
- Weekley, J. A., & Playhart, R. E. (Eds.) (2006). *Situational judgment tests*. London, UK: Lawrence Erlbaum.
- West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with non-normal variables: Problems and remedies. In R. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 56–75). Thousand Oaks, CA: Sage.
- Wirth, J., & Leutner, D. (2008). Self-regulated learning as a competence: Implications of theoretical models for assessment methods. *Zeitschrift für Psychologie / Journal of Psychology*, 216, 102–110.
- Wolters, C. A. (1998). Self-regulated learning and college students' regulation of motivation. *Journal of Educational Psychology*, 90, 224–235.
- Wolters, C. A. (1999). The relation between high school students' motivational regulation and their use of learning strategies, effort, and classroom performance. *Learning and Individual Differences*, 11, 281–299.
- Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology*, 82, 51–59.

Funding/Förderung

This research was supported by grants from the German Federal Ministry of Education and Research (BMBF) for the project “Product- and process oriented modeling and assessment of self-regulation competencies in tertiary education” (Grant number: 01PK11020A) as part of the research program “Modeling and measuring competencies in higher education” (KoKoHs).

ORCID

Dr. Gabriele Steuer

 <https://orcid.org/0000-0001-5525-6757>

Dr. Gabriele Steuer

Department of Psychology

University of Bielefeld

Universitätsstraße 25

33615 Bielefeld

gabriele.steuer@uni-bielefeld.de