Motivation and Self-Regulated Learning

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3 authors:

Falko Rheinberg
Universität Potsdam

Regina Vollmeyer
Goethe-Universität Frankfurt am Main

Bruce Burns
The University of Sydney

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Falko Rheinberg, Regina Vollmeyer, and Bruce D. Burns

Introduction

It is obvious that the acquisition and development of competence are strongly dependent on motivational factors. For this reason, questions regarding motivation have always been of great interest to psychologists and educationalists (e.g., Dewey, 1913; Fischer, 1912; Herbart, 1965; Lunk, 1926). At first, philosophical and speculative concepts dominated the approach to these questions (e.g., Herbart, 1965; Lunk, 1926). However, in the 1960s research on learning motivation took a more empirical orientation[1](e.g., Atkinson & Litwin, 1960; Gjesme, 1971; Isaacson, 1964; Mahone, 1960; for an overview, see Rand, 1987). In particular, the concept of achievement motivation—as described by McClelland, Atkinson, Clark, and Lowell (1953), Atkinson (1957), and Heckhausen (1963, 1969)—gained influence in educational psychology.

The earlier speculative theories did not anticipate a surprising problem discovered by empirical research in the 1960s: The influence of achievement motivation on learning outcomes was more difficult to demonstrate empirically than would be expected based on our naive everyday-life experience (for an overview, see Heckhausen, Schmalt, & Schneider, 1985; Rheinberg, 1996). Naive expectations were similarly confounded when other motivational concepts were examined, for example, individual interest (U. Schiefele, 1996). Even if we could reliably show a clear effect of motivation on the outcome of learning, it remains unclear as to how exactly motivation could influence the

[1] In Germany there existed much earlier an experimentally oriented research program into the impact of volitional processes on learning (i.e., Ach, 1905) and on level of aspiration (Hoppe, 1930). However, the program's impact on educational psychology remained small, although it did have some effect on other areas of psychology.

cognitive processes that lead to learning and the acquisition of competence (Rheinberg, Vollmeyer, & Rollett, 2000; U. Schiefele & Rheinberg, 1997).

Before we can know what to look for when searching for an empirical relationship between motivation and learning, it is necessary to construct a plausible theoretical model of the path by which motivation impacts learning. Only then will we know what variables to measure and what processes to examine. Without a model, we are in effect arbitrarily choosing what experiments to run without a firm basis for knowing what to expect. Therefore, it is not surprising that the proposed relationships have proved difficult to find. Such a model will be proposed for self-regulated learning in this chapter. First, we will describe the framework, and in doing so we will define learning motivation. Then, we will show how other motivational concepts could be explained in terms of the framework. Finally, the results of some initial empirical investigations based on this framework will be discussed.

The Conceptual Framework

Self-regulated learning (SRL) is central to the development of our theoretical framework for learning motivation. SRL is learning that is goal oriented, conscious, and not under a tutor's immediate control (Rheinberg et al., 2000). Examples of SRL are, trying to gain familiarity with a mathematical formula, practicing the correct pronunciation of a foreign language, studying for a pilot license, learning how to work with a computer, or practicing a piece for the piano. During SRL a tutor's immediate control and guidance is missing, so learning motivation should play a particularly important role. Figure 1 presents a framework that organizes the variables and processes that must be considered if we want to try to understand how motivation has an impact on learning.

Figure 1 consists of four sections. It begins with the fixed *antecedents* of a learning situation for a given person: the person (Box 1) and situation (Box 2) characteristics. The second section encompasses *aspects of current learning motivation* (Boxes 3 and 4). Such current motivation results from the interaction between the situation (Box 2) and person characteristics (Box 1). It has a certain strength and quality and—if strong enough—leads to learning behavior. The third section (Box 5) refers to the *mediating variables during learning* that affect the learning process. The final section is the learning outcome achieved from engaging in a specific learning behavior in a specific learning episode.

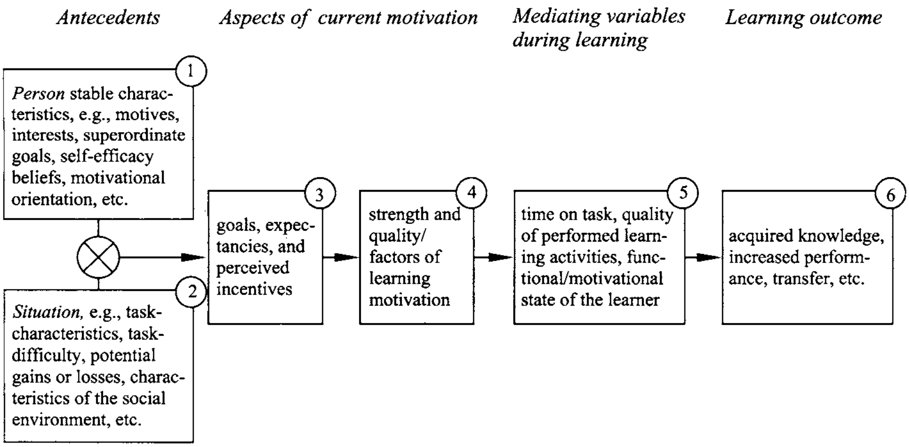

Figure 1. A framework for learning motivation and its effects on self-regulated learning.

We assume that motivated behavior is always a function of person *and* situation, similar to Lewin (1951). With regard to *person* characteristics we place into Box 1 motivational traits, such as competence-related motives (e.g., Atkinson, 1957; White, 1959), individual interests (Krapp, 1992), superordinate goals (Heckhausen, 1977), and similar variables that describe stable motivational characteristics of the person. With regard to *situation,* Box 2 encompasses task characteristics, such as the subject matter or the task's structure and difficulty. Box 2 also contains more general features of the learning situation, including the social setting (learning alone vs. learning within a group) and the potential gains and losses the learner could anticipate in the presented situation. Possible gains could be new information about one's own ability, good marks, learning about something one finds interesting, praise from relevant agents, and so on. Possible losses could be a feeling of not understanding a topic, bad grades, or blame from important people. Which aspects of Box 2 are most salient will depend on the situation.

However, Box 1 and Box 2 interact. Each salient aspect of the situation does not have equal power to influence learning motivation but instead depends on the learner's motivational traits (Box 1). Thus the impact of situation characteristics on the stimulation of a learner's motivation for SRL will vary. In particular, the interaction between person and situation characteristics influences goal setting, the learner's expectancies, and the incentives the person perceives as possible in this situation (Box 3). These variables in turn determine both the strength and quality/type of learning motivation (Box 4). For example, students may study a text because they are very interested in the topic described in the text, they may enjoy the challenge of a very difficult task, or they may anticipate praise from others. These different qualities/types of learning motivation correspond to different motives (Box 1). Each type has a characteristic constellation of incentives and/or expectancies. For instance, motivation related specifically to achievement, that is, *challenge,* contains the incentive of positive self-evaluation and the expectancy of reaching a challenging goal by one's own action; interest-related motivation contains the incentive to be in close contact with an appreciated object or topic (see exposition in this Chapter).

The next step in developing the model is to ask how, in detail, do motivational variables influence learning and how can we understand the impact they can have on the learning outcome? As learning motivation per se cannot produce any learning outcome, we propose that there must be variables that mediate the influence learning motivation may have on learning (Box 5). In the case of SRL, in which the learner has numerous degrees of freedom for how to learn, we assume that *time on task* and the *mode of learning activity* are clearly relevant mediating variables. A further mediating variable may be the learner's *functional state* during learning. This variable refers to the learner's physiological and psychological activation and concentration during learning. Last but not least, we think that the learner's *motivational state* during learning mediates the effects that the initial learning motivation (i.e., the motivation that led the person to start learning) has on the learning outcome. As the initial learning motivation may change considerably during a long learning period, it is not tautological to regard motivational state during learning as a mediating variable for the impact of initial motivation on learning outcome. Learning outcome (Box 6) marks the end of the chain of processes presented in Figure 1.

Taking into account the number of intervening processes between the person's motivational characteristics (Box 1) and the learning outcome (Box 6), it is not surprising that the contents of these two boxes turn out to be only weakly correlated. Therefore, when attempting to understand the effect of motivation on learning, correlational analyses between such distantly related variables will not reveal much. Instead it is necessary to study functionally closely related variables in a research program that examines every single step of the framework specified in Figure 1.

An Expanded Cognitive Model of Motivation to Learn

As already discussed, learning motivation results from the interaction between person (Box 1) and situation (Box 2). Trait-like person characteristics, such as motives, affect the perception of the situation as well as the development of the expectancies and incentives from consequences that can result from a person's action in a specific situation (Box 3). Expectancies and incentives are variables that were studied by "classical" motivation psychology (see Heckhausen, 1991; Rheinberg, 2000). However, the key question is how, in detail, the variables in Box 3 interact in order to affect the strength and the quality of the resulting learning motivation (Box 4). To deal with this question successfully we need a specific model of the processes within Box 3 that specifies the relations between the perceived situation expectancies and incentives.

To explain learning motivation, traditionally *expectancy × value* models have been used (Feather, 1982). These models usually consider only a single type of expectancy and a single type of incentive, that is, value. However, especially when studying learning motivation in everyday life, these simple models need to be expanded, because more than one type of expectancy and incentive is important in all but the simplest learning situations. As an example, let us consider a person who is aiming to pass the written exam to obtain a pilot's license. This person may be almost certain of passing the exam. This represents a form of expectancy. In addition, successfully passing the exam may have a certain incentive value. This incentive value develops from the anticipated consequences of passing the exam. In our example of the pilot's license, one such consequence may be being allowed to start taking flying lessons. Other consequences may be the satisfaction of having managed a difficult task, or gaining prestige in the eyes of peers, and so on. People may differ in how positively they evaluate such consequences, and in how likely they think the consequences will flow from passing such exams. Expectancy regarding the likelihood of the consequences is separate from the expectancy related to being able to manage the task successfully: The latter expectancy relates to how likely the outcome is and depends on one's own action. The former relates to how likely desirable consequences are to flow from obtaining the outcome and depends on relation structures that are established in a given situation. We have to consider such consequence- versus outcome-related expectancies when we try to understand the incentive value of an action-outcome or when we try to influence an outcome value by manipulating the situation. However, the simpler models would either lump both expectancies

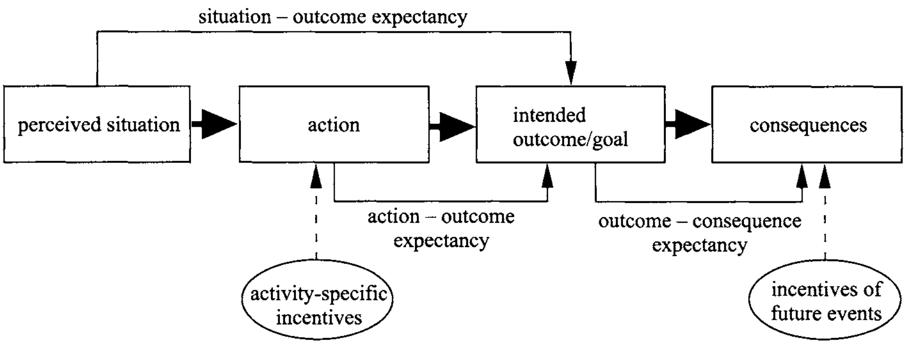

Figure 2. A modified version of the Expanded Motivation Model (Heckhausen & Rheinberg, 1980; Rheinberg, 1989).

into one variable or only consider one of them. To analyze learning motivation in complex everyday life situations, as in our example, Heckhausen and Rheinberg (1980) proposed the *Expanded Motivation Model* (EMM). Figure 2 shows the model's structure in Rheinberg's (1989) final version of it.

The EMM expands Box 3 of Figure 1 in order to explain the derivation of a specific person's learning motivation and its strength and quality (Box 4) in a specific learning episode. This learning motivation subsequently produces behavior, but the derivation processes operate on *anticipated* learning behavior and what the learner believes to be the outcomes and consequences of that behavior. The model subdivides this process into four interacting elements: the perceived situation, the action being considered, the intended outcome/goal of that action, and consequences that may flow from attaining the intended goal. In the pilot's license example used above, let us assume that this person has set a date for the pilot practical test. In the model, this is the current *situation* with all of its perceived options for actions, and positive and negative expectancies. Although the passed test is the *intended outcome/goal,* the model also takes into account the anticipated consequences of failing the test. As already discussed, the intended outcome may have various *consequences,* for example: the chance to fly alone, gain in self-determination, pride in passing a test, gain in mobility, heightened prestige in the eyes of peers, and so on. The most critical element is the *action* because it is the current learning motivation to perform a specific action that we want to study. For each possible action that the person believes could improve his or her skill at the tasks necessary to pass the test, the model can derive a motivational strength (see Heckhausen et al., 1985). For the budding pilot, these actions could be reading several books or memorizing the necessary theoretical knowledge.

To derive the motivational strength for each learning activity, we first have to know the characteristics of the consequences of the activities' outcome: The learner's estimation of the *likelihood* that a hoped-for consequence will result from reaching the intended goal (e.g., from receiving the pilot's license), and the *value* of each of these consequences. Such values represent the *incentives from future events,* an input to the consequences element in Figure 2. These two aspects of consequences are independent: High value does not necessarily imply high likelihood of obtaining that consequence. For example, it may be highly likely that the new pilot will gain the consequence of prestige in the eyes of his or her peers; however, this consequence may have only a moderate incentive-value. On the other hand, gaining the consequence of being allowed to fly an airplane alone will have a high incentive-value but may be less than certain unless one owns a plane, as it is unlikely that other people will lend their planes to a new pilot. The likelihood that an outcome produces a consequence is the *outcome→consequence expectancy,* which is also called *instrumentality* (Heckhausen, 1991; Heckhausen & Rheinberg, 1980).

In parallel to the attractive consequences of a positive outcome, the person may take into account the negative incentives of the consequences of failing to reach the intended goal, for example, feeling oneself to be a failure, loss of prestige, the costs of repeating the exam, and so on. Depending on the person and the situation, either the positive consequences of a success or the negative consequences of a failure can have greater weight in the person's mind (see Heckhausen et al., 1985).

Independent of the consequence-related expectancies people can vary in their certainty that an action will increase the probability of passing the exam. This *action→outcome expectancy* is the same concept as *probability of success,* a concept known from the traditional research on level of aspiration and achievement motivation (Atkinson, 1957). This expectancy can be very high ("If I practice enough, I'm sure to pass the exam"), or it can be very low ("Even if I practice a lot, I won't pass the exam").

As well as these *outcome→consequence* and *action→outcome expectancies* there is a third one: the *situation→outcome expectancy.* It relates to the perceived likelihood that the situation will lead to the desired outcome without the expenditure of effort (e.g., "I already can fly so well that without any further practice I will pass the exam").

The EMM predicts that the motivational strength for a learning activity will be sufficiently high for the action to be performed if the following four criteria are met: (1) consequences have a sufficiently high incentive; (2) such consequences seem highly likely to result from the intended outcome (high *outcome→consequence expectancy*); (3) the outcome is strongly dependent on learning (high *action→outcome expectancy*); and, (4) the outcome does not already flow from the current situation (low *situation→outcome expectancy*). In a series of studies on students preparing for a test or an exam, this model successfully predicted learning motivation when these four conditions were fulfilled (Heckhausen & Rheinberg, 1980; Rheinberg, 1989). However, these studies also showed that the learning activity itself was an important incentive, separate from the incentive derived from the anticipated consequences. For example, learning by heart may be a highly aversive activity for some students, whereas learning by discussing a topic with others may be highly attractive.

In our example of the person studying for a pilot's license, the practical training of flying a flight simulator may be more attractive than learning the facts about motors and rules about how to fly and maintain an airplane. Rheinberg (1989) added these *activity-specific incentives* to the original model, as can be seen in Figure 2. Thus, the model can be described as not only consequence centered (i.e., action focused on consequences) but also as incorporating a hedonistic component (i.e., enjoying a pleasant activity or finishing an aversive activity as quickly as possible). Taking these activity-specific incentives into account helped to improve the predictive goodness of the model (Rheinberg, 1989).

Exposition: The Expanded Motivation Model and Other Concepts of Learning Motivation

Depending on which incentives are uppermost, and therefore, which expectancies become more or less important, different aspects of learning motivation become most salient in Box 4 of the framework in Figure 1. In previous research on learning motivation, other theories of the motivation to learn have focused on various characteristic constellations of specific incentives and expectancies. The generality of the EMM gives it a high potential for incorporating other well-known theories as special cases that can be characterized in terms of the EMM. In the following exposition we will briefly attempt such integration.

Achievement Motivation

The classical *achievement motivation* theory, especially as reformulated by Heckhausen (1972, 1975), defines achievement motivation as "a person's striving to improve his or her competence (or maintain it on the highest possible level) in all those activities where a person has committed himself or herself to a standard of excellence" (Heckhausen, 1965, p. 603). The incentive lies in the self-evaluation of one's own competence (pride or shame after success or failure, respectively). The classical achievement motivation theory defines two dimensions of achievement-related motivation—namely *hope for success* and *fear of failure*—which differ in terms of goal preference (realistic vs. too simple or too difficult goals) and how strongly success or failure is an incentive.

In the EMM, achievement motivation can be conceptualized as the extent to which the learner has a tendency to perform an action that produces a desired consequence via an intended outcome. With regard to achievement motivation, these consequences are the experience of pride in one's own competence or the minimization of shame. Other consequences such as the praise or admiration of other people, prestige, material gain, and so on, may also be important incentives for achievement. However, these kinds of incentives are not relevant to achievement motivation as it is conceptualized by Atkinson (1957) or Heckhausen (1963, 1967). The topic in which the learner is acquiring competence is also irrelevant. Critical are only that people feel committed to a standard of excellence and to improving their competence.

The difference in goal preference discussed above (hope for success vs. fear of failure) leads to differences in the expectancies specified by the EMM. Specifically, people with high hope for success prefer situations (learning or otherwise), in which they experience high *action→outcome* and low *situation→outcome* expectancies that result from realistic goal setting. However, people with high fear of failure do not have this preference and may even show the reversed tendency (Heckhausen et al., 1985). Their preferences lead people with high hope for success, in combination with their preferred attribution strategy (internal attribution of success, unstable attribution of failure), to experience the positive incentive of success (i.e., pride as a consequence of success) as outweighing the negative incentive of failure (i.e., shame as a consequence of failure). Thus, they approach an achievement situation with a positive perspective. Therefore, people with high hope for success are attracted to such situations. In contrast, for people with high scores on fear of failure, the negative consequences of failure outweigh the positive incentives of success. Thus, they tend to avoid achievement situations because for them the net effect of doing nothing outweighs the perceived consequences of trying to learn. Such behavior is ultimately counterproductive as eventually the learner may be faced with situations in which assessment and evaluation cannot be avoided.

Motive Modification Programs

These differences in the goal-setting, expectancies, and incentives people feel in achievement situations have led to the development of *motive modification programs* (Krug & Hanel, 1976; Rheinberg & Fries, 1998; Weßling-Lünnemann, 1985). These programs have tried to influence the students' goal setting so that the *action→outcome expectancy* is experienced as higher than the *situation→outcome expectancy.* Furthermore, these programs attempt to increase causal self-attribution of success to create higher positive self-evaluation after success (i.e., strengthening the *outcome→consequence expectancy* for positive self-evaluation). More generally, these programs aim to improve all expectancy variables identified by the EMM, as well as the positive consequences of self-evaluation (pride following success). These theory-based programs have been successful in practice (for an overview see Heckhausen & Krug, 1982).

Similarly, in his *origin training,* DeCharms (1976) tries to increase the learner's experience of positive personal causation (i.e., making himself or herself a positive *origin* of action and outcome) by supporting the *action→outcome expectancy.* This training strengthens the learner's tendency to attribute outcomes to one's own actions.

Individual Reference-Norm Orientation

Other programs that try to affect learning via variables that are part of the EMM, are those that aim to support an *individual reference-norm orientation* in school classes (Rheinberg, 1974, 1980; Rheinberg & Krug, 1999; for an English summary see Heckhausen et al., 1985). In contrast to the programs just discussed, programs for individual reference-norm orientation change the teachers' approach. Teachers learn to evaluate students' current performance in comparison to their original state (i.e., create individual reference norms). Furthermore, teachers learn to tailor task difficulty to fit each student's own competence level. Both interventions seek to create learning situations in which students can experience high *action→outcome* and low *situation→outcome expectancies,* and in which success leads to positive self-evaluative emotions. Students know that their performance will not be compared *inter*-individually with those of other learners (i.e., social reference norm), but instead compared with their own previous performance *intra*individually (i.e., individual reference norm). So the consequent self-evaluative emotions are not linked with stable differences in ability. Instead these emotions should be linked to the changes in competence for each individual learner. Several intervention programs have successfully used this training concept (for an overview see Rheinberg & Krug, 1999).

Motivational Orientation

The concept of reference-norm orientation focuses on teachers and their particular instructional techniques. These programs were developed in Germany in the 1970s (Rheinberg, 1974, 1980; for an English summary see Rheinberg, 1983). Later on, Dweck and Leggett (1988) and Nicholls (1984) independently developed the concept of *motivational orientation.* These concepts have their roots in studies of learned helplessness (Dweck, 1975) and in developmental psychology (Nicholls, 1978). However, motivational orientation is not regarded as a property of the teachers' approach but is instead a property of learners who are distinguished with respect to the kinds of goals they strive for. If they strive for *learning goals* then they have the goal to acquire competence and to do better than they did before (an individual reference norm). As these students consider ability to be something that can be developed, success gives them feedback that they are on the right track. Even failure does not bother them because they believe that with additional learning they can improve their abilities. In contrast, if students strive for *performance goals* then their aim is to demonstrate to others their own abilities and superiority (a social reference norm), presumably through using their own high ability. However, if they believe themselves to have low ability, they will want to avoid situations in which their learning outcomes are assessed and evaluated. Failures give them a great deal of trouble as they believe that abilities are stable over time and that additional learning will not lead to improvement. Unlike students with a learning goal orientation, failure thus leads to performance impairment (Elliot & Dweck, 1988; Stiensmeier-Pelster & Schlangen, 1996; for further differentiation see Elliot & Church, 1997).

In the EMM, the crucial distinction between performance and learning goal orientations lies in the consequences, as well as in the *outcome→consequence expectancies* (i.e., instrumentality). Social consequences are particularly important for learners with a high performance goal-orientation especially, as the *evaluation of others* has high positive and negative incentives for them. If self-evaluated ability is high, then attractive situations are those that provide opportunities for actions that can be used instrumentally to demonstrate one's own high ability (high *outcome→consequence expectancy* for evaluations by others). If self-evaluated ability is low, then such situations are instead avoided by learners with a high performance goal-orientation because failure is especially threatening.

Differences in the belief that abilities can be improved by learning lead to differences in the *action→outcome expectancy,* especially for learners experiencing performance failure. Learners with a learning goal orientation believe they can increase their ability through learning; therefore, they generally have a high *action→outcome expectancy* for their learning activities. However, for learners with a performance goal orientation and a low evaluation of their ability the *action→outcome expectancies* are low following performance failure, because the learners do not believe that they can improve their stable abilities through learning activities.

Interest

Whereas all concepts discussed so far involve variables representing both incentive and expectancy in the EMM, the *pedagogical theory of interest* (Krapp, 1992, 1999; Prenzel, 1988; H. Schiefele, Haußer, & Schneider, 1979) refers mainly to the incentive variables of the EMM. In the pedagogical theory *individual interest* (as a personality trait) is defined as "an individual's relatively enduring predisposition to attend to and engage a class of objects" (Renninger, Hoffmann, & Krapp, 1998, p. 11). (The term *object* was used by Renninger et al. in a very abstract way. It refers to topics and even activities, as well as what would be conventionally called "objects." For a critical discussion of this issue, see Rheinberg, 1998.) As defined this way, interest has two kinds of incentive components: a cognitive and an affective component. The first is called *value-related valence* and refers to the personal significance of an object (similar to task value beliefs, Eccles, 1983; Pintrich & Schunk, 1996). The second is called *feeling-related valence.* It refers to positive affective states while engaging in interest-based activity (Krapp, 1999).

The cognitive component of interest-based learning focuses on the typical attraction and guidance provided by a specific object or topic: A learner wants to acquire knowledge and different perspectives on an object through learning because this object has a high significance for the self (Krapp, 1999). In the EMM this motivation type represents a way of learning in which outcomes are desirable because, as a consequence, a person gains a deeper understanding of a highly valued object. Through learning, the object of interest is integrated step-by-step into the person's knowledge and value structures. Thus interest-motivated learning is a special form of learning based on consequences.

Although there is a cognitive valence component (*value-related valence*) to interest-based learning, this type of learning also has an affective valence component (*feeling-related valence*): Mere consideration or interaction with the object of interest results in positive emotions and feelings during learning. In the EMM this affective valence can be represented by the *activity-specific incentives*[2] (see Figure 2). Thus the activity of interest-based learning itself is attractive—independent of the outcome and consequences. However, this is only true as long as learners are occupied with the specific object of their interest.

Perhaps the existence of positive activity-specific incentives during learning explains why researchers into interest have ignored outcome-related expectancies. It appears to us that expectancies do not play an important role in the pedagogical theory of interest. Instead incentives and valences are all that is considered necessary for motivating learning.

Self-Efficacy

The opposite is true for the concept of *self-efficacy* (Bandura, 1977, 1997): This concept considers only the expectancies and ignores incentives. Originally, Bandura divided what the EMM refers to as *action→outcome expectancy* into two components: (1) the *outcome expectancy* ("a person's estimate that a given behavior will lead to certain outcomes" Bandura, 1977, p. 193) and the *efficacy expectancy,* which he called *self-efficacy* ("... the conviction

[2] We do not consider a possible differentiation between object- and activity-specific incentives in this article, but see Rheinberg (1998, p. 133) and U. Schiefele and Rheinberg (1997, p. 225).

that one can successfully execute the behavior required to produce the outcomes" Bandura, 1977, p. 193). Both expectancies determine what traditionally is called *probability of success:* the actor's subjective probability that he or she is able to produce a certain outcome (Atkinson, 1957; Lewin, Dembo, Festinger, & Sears, 1944).

Thus, self-efficacy expectancy and outcome expectancy were presented as important, and theoretically novel, components of a well-known expectancy concept. However, a close reading of Bandura's research on self-efficacy and learning (e.g., Bandura & Schunk, 1981; Bandura & Wood, 1989) reveals that in learning situations he simply measures the traditional probability of success but calls it self-efficacy expectancy. Therefore, Kirsch (1985) titles his criticism "Old wine with new labels." This gap between Bandura's theory and his operationalization of self-efficacy has attracted some criticism (e.g., Eastman & Marziller, 1984; Meyer, 1984; Rheinberg, 2000), despite the concept's popularity.

In terms of the EMM, self-efficacy—as operationalized by Bandura and Schunk (1981) and Bandura and Wood (1989)—is just the *action→outcome expectancy.* Further, by using the EMM as a theoretical guideline, another critical issue emerges: The self-efficacy concept does not include any incentive component. Therefore, this concept is applicable only to situations in which no participant has any doubt that the potential outcomes are of high incentive value. However, in most realistic situations the learner has a degree of uncertainty as to whether the potential outcome is sufficiently valuable. In such cases, the *action→outcome expectancy* would provide an insufficient basis for determining learning motivation.

Intrinsic Motivation

Finally, the popular distinction between *intrinsic* and *extrinsic motivation* can be reconstructed in the EMM. The problem with this distinction has been that different theorists have given it inconsistent definitions (see Heckhausen & Rheinberg, 1980; Krapp, 1999; Rheinberg, 2000; U. Schiefele & Köller, 1998). All definitions have in common that *intrinsic* denotes a kind of motivation coming from *within* whereas *extrinsic* means a kind of motivation coming from *without* (Heckhausen, 1991). However, there are considerable differences among definitions as to what "within" and "without" refers to (Dyer & Parker, 1975). Sometimes "within" versus "without" refers to the perceived *locus of the determination of behavior* (DeCharms, 1968; Deci &

Ryan, 1987). According to this definition people are intrinsically motivated if they feel *self-determined,* that is, they perceive themselves as causes of their own behavior rather than subject to forces or rewards outside themselves. The latter would be a case of extrinsic motivation. However, DeCharms himself (1976) criticized equating intrinsic motivation with the perception of personal causation. Thus, we do not discuss this conception here.

There are other quite different conceptions of intrinsic motivation (Heckhausen, 1991). Most of them focus on the distinction between "within" and "without" on the components of an action sequence: *action, outcome,* and *consequences*. However, there are considerable differences in the way this is done. Using the EMM as a framework it becomes possible to differentiate between these conceptions in a theoretically meaningful way. Thus, we can determine which kind of incentives and expectancies the different conceptions of intrinsic motivation implicitly include.

First, we can consider a very restrictive definition of intrinsic motivation that includes only behavior that is performed exclusively for the sake of the activity itself (Deci, 1998; McReynolds, 1971; Pekrun, 1993). All actions in pursuit of the relevant end states or goals are called extrinsic. Thus, "within" refers to the *action,* and "without" are *outcomes* and *consequences.* A good example is a person who eats a delicious meal despite not feeling hungry. In this situation the outcome (i.e., being overfed) and the consequence (i.e., feeling bad for hours) are even disliked. The relevant incentive for such consumption is without doubt anchored in the activity itself.

At first glance, this activity-based conception of intrinsic motivation seems to be identical with the conception of *activity-specific incentives* in the EMM (see Figure 2). However, a deeper analysis reveals that this is not true in all cases because many activities that are done for their own sake require an outcome that is a goal. Their goals are integral to the action as they enable and regulate the activity. This is especially true for productive and artistic activities as well as hill climbing, hiking, or many games. If people enjoy the tension of winning or losing a game then the game needs an outcome, even though this outcome has no incentive itself. As soon as the outcome is reached, people start a new game. Thus, this second conception of intrinsic motivation includes the outcome if the activity-specific incentives cannot be gained without it (Rheinberg, 2000). However, motivation that primarily arises from outcome consequences is defined as extrinsic. In sum, this second conception regards "within" as *action plus outcome* and "without" as *consequences.*

Heckhausen (1991) proposed a third conception. It includes all three components of an action sequence (*action, outcome,* and *consequences*) as parts of intrinsic motivation as long as all three components belong to the same *theme* (in the sense of Murray, 1938). An example of such intrinsically motivated learning would be when a person is engaging in learning (i.e., action) to reach a self-set standard of excellence that indicates an acquisition of a new competence (i.e., outcome), about which one will be proud (i.e., internal consequence). In such learning, action, outcome, and consequence belong to the same theme, that is, the development of competence that is *naturally* linked with a specific affect (pride as a *natural incentive,* Weinberger & McClelland, 1990). In this example, consequence-oriented learning would be called extrinsically motivated if the relevant consequence belonged to a different theme than the activity and its intended outcome, for instance, acquisition of a new competence that allows one to reach a powerful position, or help other people. Increasing power or helping other people are not naturally linked with an increase of competence and pride. Instead, they belong to different systems of motives and affects and thus, could be reached in some way other than by gaining competence (Weinberger & McClelland, 1990). In sum, this conception of intrinsic motivation relates "within" to the *theme* to which action, outcome, and consequence belong.

Projecting these three different conceptions of *intrinsic motivation* onto the structure of the EMM reveals that these concepts differ with respect to the extent they include the model's elements: action, outcome, and consequence. Thus, it is evident that the same term *intrinsic* denotes quite different motivational phenomena: from simple pleasure-seeking activities like eating rich food to quite complex and deliberate actions aimed at achieving anticipated consequences. With the help of the EMM we are able to specify which type of expectancies and incentives we have to assess if we want to predict the different phenomena that are labeled with the same term *intrinsic motivation.* Moreover, we can specify recommendations to someone who plans to foster a type of motivation called *intrinsic.*

Motivation and Learning Activity

Assessing Current Motivation to Learn

As the previous exposition demonstrates, theories of learning motivation differ with regard to the question of which expectancy and incentive variables of the EMM they include and model. Setting different theoretical emphasis seems quite meaningful because—depending on the situation and person—

components of learning motivation that differ in quality can be influential. Therefore, each component needs to be described, theoretically modeled, and specifically measured. Different theories can be seen as carrying out the role of specifying the details of different components. Personality-oriented motivation researchers, for example, McClelland (1951, 1985) or Atkinson (1958, 1983), follow the strategy of studying single types of motivation such as achievement or power motivation. They then measure these motives as personality traits that affect behavior in a broad spectrum of situations. Such a research strategy extends our knowledge about the structure and nature of motivational traits (e.g., motives or individual interests). However, research that is less focused on personality traits as such, but more oriented toward *processes* (especially with regard to how specific motivation components affect learning) tries to measure directly specific motivation components in specific learning situations (Rheinberg, Vollmeyer, & Burns, 2000; Vollmeyer & Rheinberg, 1998). When using this research strategy, all motivation components—expectancies, fears, positive and negative incentives—are measured that may play an essential role in the specific learning situation. To discover the underlying structures, factor or cluster analysis can be used to help find the essential dimensions for these motivation components. If this analysis is successful then it will be possible to conduct research with empirically derived factors representing current *learning motivation* instead of stable motives.

By following this research strategy, learning motivation (in Box 4 in Figure 1) need no longer be a vague concept based on the interaction between person and situation. Instead, it can be conceptualized as a variable that is directly measured by gathering learners' conscious responses to relevant questions.[3]

The advantage of being able to measure learning motivation directly is that it removes the need to speculate as to whether in a specific learning situation a particular personality trait, for example, motive, was activated or not. Instead the already-activated motivation could be measured and directly plugged into Box 4 in Figure 1. Of course, a new problem arises now: Because the indicators of learning motivation can vary between situations, any measure must be specific to the situation. In contrast, stable personality traits can be measured in the same way regardless of the situation.

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[3] The problem of conscious self-attributed versus unconscious implicit motives (McClelland, Koestner, & Weinberger, 1989), cannot be discussed here.

Table 1
Example Items for the Motivational Factors With Factor Loadings

	Factor loading
Probability of success	
I probably will manage to do this task.	.72
I think I am up to the difficulty of this task.	.70
I think I won't do well at that task.	–.68
Challenge	
I am eager to see how I will perform in the task.	.83
This task is a real challenge for me.	.70
If I can do this task, I will feel proud of myself.	.68
Fear	
It would be embarrassing to fail at this task.	.87
I'm afraid I will make a fool out of myself.	.84
I feel under pressure to do the task well.	.71
Interest	
While doing this task I will enjoy playing the role of a scientist.	.80
I would work on this task even in my free time.	.67
I like riddles and puzzles.	.60

The idea of measuring factors of current learning motivation was embraced by Vollmeyer and Rheinberg (1998), who studied self-regulated learning of a computer task. In a learning phase the participants' task was to learn how a complex linear system works. To discover the system's rules, participants could change the inputs to the system in a more or less systematic way (*strategy systematicity*): By observing the resultant changes to the outputs, learners could induce the rules governing the system. To increase the complexity of the system it included a decay; that is, the system changed its state even if the inputs were kept constant. In an application phase participants had to reach goal states for the system (see Vollmeyer, Burns, & Holyoak, 1996; Vollmeyer, Rollett, & Rheinberg, 1997, 1998).

A questionnaire specific to this learning situation (QCM, Questionnaire of Current Motivation) was used to collect responses to a diverse set of items reflecting different motivation components (e.g., expectancies, perceived consequences, incentives). After several studies with these items, four dimensions of current motivation to learn emerged. Table 1 shows these factors with example items (Vollmeyer, 2000).

The four factors were identified through factor analysis, but each was based on a theoretically distinct concept. The probability of success stands for the *action→outcome expectancy* of the EMM. The motivational factor *challenge* measures to what extent learners interpret the situation as a test of their own abilities—in terms of the EMM that means whether the situation is instrumental to evaluating one's own competence (*outcome→consequence expectancy*). In Lazarus and Folkman's (1984) stress model, challenge is assigned only positive emotions like enthusiasm or exhilaration from mastering a new situation. However, our data show that some people develop fear because they believe they will fail in situations that they perceive as a challenge, because the situation is a test of their own competence. Therefore, the QCM treats challenge as neutral but allows the positive or negative connotation to be measured by other factors. Independent of the factor challenge was the affective component *fear.* This factor covers negative incentives coming from self- and other's evaluation. The final factor we identified reflected the value-related valence for the task's topic. This factor fits to the concept of *interest* discussed above.

However, correlational analyses by Rheinberg and Vollmeyer (in press) showed that interest and challenge were not completely independent (they share about 25% common variance). Rheinberg and Vollmeyer replicated this result in several studies with a variety of tasks. This empirical relationship between challenge and interest is theoretically plausible as individual interests tend to develop in areas in which people can satisfy their need to experience competence (Deci, 1998; Krapp, 1992). This experience of competence is only possible if a situation is challenging (Deci, 1998). Therefore, theoretically it would be predicted that the motivation components of challenge and interest will have a medium-sized empirical relationship, despite that they refer to theoretically distinct concepts (achievement motivation vs. preference for a specific object or activity).

From Motivation to Learning Outcome

Although most people are convinced that learning motivation affects learning outcome, little is known about what the mediating processes for this effect are (Rheinberg, 1996; U. Schiefele & Rheinberg, 1997). For example, it is known that for measures of topic interest and the outcomes from studying text, a common variance of nine percent is found on average (U. Schiefele, 1996). However, it was not clear how this effect is mediated. In a series of studies with a variety of mediating variables U. Schiefele (1996) found no replicable effects of possible mediating variables. Highly interested learners read the text differently (e.g., experienced flow) and did different things (e.g., had more elaborative processes) than uninterested readers. However, these and the other mediating variables studied had no effect on the learning outcome. Thus, the proposed mediating variables failed to be validated. Only a single finding of an effect of the mediating variable *activation while reading* was found, but it could not be replicated (U. Schiefele, 1996). Thus, it is unclear whether or not activation mediates motivational effects on learning.

In summary, surprisingly little is known about how the effects of motivation on learning are mediated. This is even more surprising given that self-regulated learning processes have been the subject of much theorizing and empirical study (e.g., Boekarts, Pintrich, & Zeidner, 2000; Pintrich & DeGroot, 1990; Zimmerman & Schunk, 1989).

As discussed above, we have proposed a framework that describes how learning motivation affects learning and learning outcome via three different variables (see Box 5, Figure 1): (a) *time on task,* (b) *quality of the learning activity,* and (c) *functional/motivational state* of the learner during the course of the learning period. Using the framework in Figure 1 we assume that the variables in Box 5 mediate the influence that the motivational factors (Box 4) have on the learning outcome (Box 6). We have already published results applying this framework to the task we discussed above; that is, learning to control a complex computer simulated system (Vollmeyer & Rheinberg, 1998; Vollmeyer, Rheinberg, & Burns, 1998; Vollmeyer, Rollett, & Rheinberg, 1997).

That there is an effect of *time on task* on learning outcomes has long been known in educational psychology (e.g., Bloom, 1968; Carroll, 1963). Nevertheless, when studying time on task with shorter but more constrained tasks (as compared to those used in school settings) difficulties may arise: Learners with high abilities may quickly reach a high level of achievement, at which point they have the necessary competence to control a system or to solve a problem. Once they have attained competence they stop their self-regulated learning, leaving learners who need longer to reach this competence level to increase their time on task. So poor but sufficiently motivated learners may work longer but reach the same knowledge level as learners with high ability. Therefore, when comparing the learners *inter*individually (social reference norm) there is no reason to expect an effect of the mediating variable time on task: Good learners simply do not need much time, and poor learners with sufficient motivation work longer. Both reach the same competence level. However, when comparing the learner's *intra*individual performance (individual reference norm) it was clear that time on task increased each learner's com-

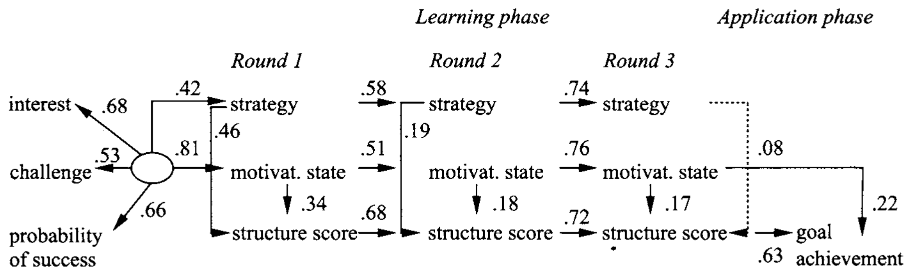

Figure 3. Path analysis for the cognitive-motivational process model.

petence (Vollmeyer & Rheinberg, 2000). An individual learns more by spending more time on a task, but this effect is obscured when we compare across individuals with their different abilities and approaches.

The second mediating variable is *quality of learning activity.* Which learning activities will be considered by the learner depends critically on the task's demands. For our task of controlling a complex system, we already knew that *strategy systematicity* plays a crucial role (Vollmeyer, et al., 1996). Indeed, Vollmeyer, Rollett, and Rheinberg (1998) showed that strategy systematicity mediates the effect of initial learning motivation on learning outcome: With increasing learning motivation, strategy systematicity increases, which then in turn has a positive effect on knowledge acquisition.

The third mediating variable we proposed is the motivational state. As pointed out above, it is not trivial to conceptualize motivational state as a mediating variable for learning motivation, because initial motivation can change during a learning episode (Vollmeyer & Rheinberg, 1998). Figure 3 depicts a path analysis reported in Vollmeyer (2000) that shows how this mediator and strategy systematicity can be integrated into one empirically derived model. This model demonstrates the importance of *motivational state during learning.*

The data for this model was collected in a study in which participants had to learn a system like that described above. Before they started working with the system their initial motivation was measured using the QCM to determine the levels of the motivational factors of interest, challenge, probability of success, and fear. Only fear had no effect on the learning process. A high initial motivation led to a more systematic strategy and a higher motivational state during learning. As we interrupted the learning process three times, we were able to study how variables develop and interact over time. Thus, we found that more systematic strategies helped knowledge acquisition, but also a higher motivational state led to better learning. Finally, when participants had to apply their knowledge, not only did high knowledge help performance, but so did high motivational state.

Currently, we know little about the hypothesized mediator *functional state,* although we would like to measure it directly. A first attempt showed that self-rating for *concentration* during the task mediated motivational effects on performance (Vollmeyer & Rheinberg, 1998). In the future, we will attempt to develop measures that assess concentration and other functional state variables more directly.

Prospects and Constraints

Our theoretical cognitive motivational process model for learning motivation has been empirically supported in several replications (Vollmeyer et al., 1997, 1998). For a specific task it is possible to construct mediating paths for how motivational factors influence learning outcome that are theoretically derived and empirically supported. Although we have initial results, this is only the beginning of a research program.

At this point, the model can only be considered predictive for individual and self-regulated learning activities in a specific computer task, because so far this is the only task we have applied it to. We are now studying different tasks and learning situations. When using different tasks, different mediating variables will probably emerge as most effective. In particular, we expect to require new indicators for both the nature and achievement level of learning activity. Different knowledge will be acquired and different strategies used for different tasks, so appropriate measures must be tailored to the specific characteristics of the task.

In addition, attention has to be paid to the fact that this research program only considers the final three components of the framework described in Figure 1 (Boxes 4–6). If we find solid enough empirical results for these components, then the next task is to test the whole model—starting with Boxes 1 and 2. However, this task creates a practical problem, because given the number of variables and paths between variables, testing the whole model would require a huge number of participants for the statistical tests to have sufficient power. Thus, we prefer to take a smaller step first, which is to investigate the left part of Figure 1 using the computer learning task we have already used. For this purpose we need to design new experiments that can trace the path from the person and situation interaction (Boxes 1 and 2) through to the current learning motivation (Box 4). This will be our next step.

Despite the complexity of our framework, we have not taken into consideration three important aspects of learning. This places constraints on the generality of our framework. First, we have examined motivational variables, but we did not model the effect of *volitional processes* (Heckhausen, 1991; Kuhl, 1998). These volitional processes might have especially strong effects on variables in Box 5 of our framework, because some of the mediators in Box 5 may be controlled voluntarily (e.g., time on task). It would be possible to integrate volitional variables, but for reasons of clarity we have not done this yet. In the long run, doing so would be desirable.

The second constraint is that we have looked at only one type of learning: self-regulated, goal-directed learning. This learning type only applies when people decide they want to improve at something through a learning activity that they regulate themselves. Learning controlled completely by another, such as a tutor who dictates goals and strategies and then gives feedback, is not encompassed by the model. The same is true for learning processes that happen without intention because they are not the focus of one's attention (i.e., incidental and implicit learning).

A third constraint is that long-term changes in the learner's personal characteristics are not included in the model. Such changes could result from the learning outcome and the experience of learning. To take those changes into account in the framework shown in Figure 1, it would be possible to build in feedback loops, in particular connecting the learning outcome (Box 6) to the person (Box 1). Additionally, we could speculate about the person's learning and development in general. This is not our intention. For the moment we consider it most useful to pursue empirical studies that demonstrate the way motivation affects learning.

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