Self-regulation of the motivation to learn

SELF-REGULATION OF THE MOTIVATION TO LEARN

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DISSERTATION

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CHAPTER 1

General introduction

GENERAL INTRODUCTION

1

When entering higher education, students face a lot of changes: Not only does their new university environment suddenly call for more autonomous behavior, they are also exposed to external dynamics, such as COVID-19. These circumstances require students to effectively self-regulate their learning. For instance, they need to regulate how to participate in class work and how to do their homework. Effective self-regulated learners can set their own learning goals, choose the right learning activities and strategies to reach these goals, and reflect on their learning behavior and change it if needed (Zimmerman, 2000). Such proactive learning behavior is essential to decrease procrastination and to improve academic achievement and well-being (Bäulke et al., 2021; Kim et al., 2020, 2021; Kryshko et al., 2020). However, students can experience various motivational problems, for instance, when they do not feel capable of handling the learning task, prefer to chat with friends rather than study, or are distracted by social media (Engelschalk et al., 2016; Moberly & Dickson, 2018). Consequently, the motivational problems can cause them to experience lower affective well-being (Grund et al., 2015), put in less effort (Capelle et al., 2022; Eckerlein et al., 2019), and spend less time studying (Koudela-Hamila et al., 2019). Motivation as such constitutes an important part of SRL. Yet, there is a paucity of information on how students actually regulate their motivation to learn.

In search of ways for students to self-regulate their motivation to learn, Wolters (1998) presented them with different motivational problems, asking them what they would do if they encountered these in real life. From their answers and literature review, he identified specific motivational regulation strategies (MRSs) that students wielded to create, maintain, and improve their motivation (Wolters, 1998, 1999, 2003). These strategies took the form of different kinds of self-talk by which students, for example, linked their present study behavior and associated actions to their future life, or took the form of action, for example, removing all distractions. To understand how these MRSs work, other studies have sought to analyze their relationship with different aspects of motivation, such as students' degree of self-efficacy (Teng, 2021; Trautner & Schwinger, 2020), their values, and their goal orientations (Wang et al., 2017; Schwinger et al., 2007; Wolters, & Benzon, 2013). In doing so, however, they essentially focused on *one* aspect of motivation only, such as students' motives or their degree of self-efficacy, whereas it is likely that multiple, interacting aspects are at play. Hence, to date, a systematic view on the relationship between the MRSs and various aspects of motivation is lacking, which leads to low ecological validity. One of the purposes of the present Ph.D. dissertation was therefore to help overcome these methodological difficulties by taking a systematic approach to motivation and its self-regulation.

What also complicates the investigation into the relationships between motivation and the said strategies is that motivational problems can be manifold and that the MRSs should therefore be carefully selected to address the specific problem at hand

(Engelschalk et al., 2016; Eckerlein et al., 2019; Bäulke et al., 2021; Kim et al., 2021). For instance, if students *think* they lack the skills to perform the learning task, then using an MRS that adds gamification to increase enjoyability may be ineffective. However, as yet, we do not know when and how MRSs do and do not affect motivation, and, consequently, whether and how they could improve students' motivation to learn. Neither do we know whether the MRSs hitherto identified sufficiently cover the full range of motivational problems.

Although the said studies on MRSs did shed light on different effects and specificities of their use, they did not explain how they relate to motivation because the concept of "motivation" remains nebulous. Moreover, the identification of MRSs as previously explained was not grounded in motivational theory. In this dissertation, we therefore adopted a systematic view on motivation with the aim to investigate the differences between known MRSs and their relation to motivation, as well as their effectiveness in improving students' motivation to learn. In other words, we will hereinafter consider motivation as a system of multiple motivational elements which we will investigate simultaneously to improve the ecological validity of MRS research. Such an approach will help to determine whether the MRSs hitherto identified sufficiently strengthen students' motivation to learn and whether they can adequately resolve a broad set of motivational problems. Furthermore, we will view motivation through the lens of activity theory, by considering it a system that is composed of multiple elements, so as to help us understand whether and how the known MRSs appropriately address the full range of motivational elements. To conclude, we will present the dissertation's research questions, and briefly introduce each of the chapters that address them.

MOTIVATION THROUGH THE LENS OF ACTIVITY THEORY

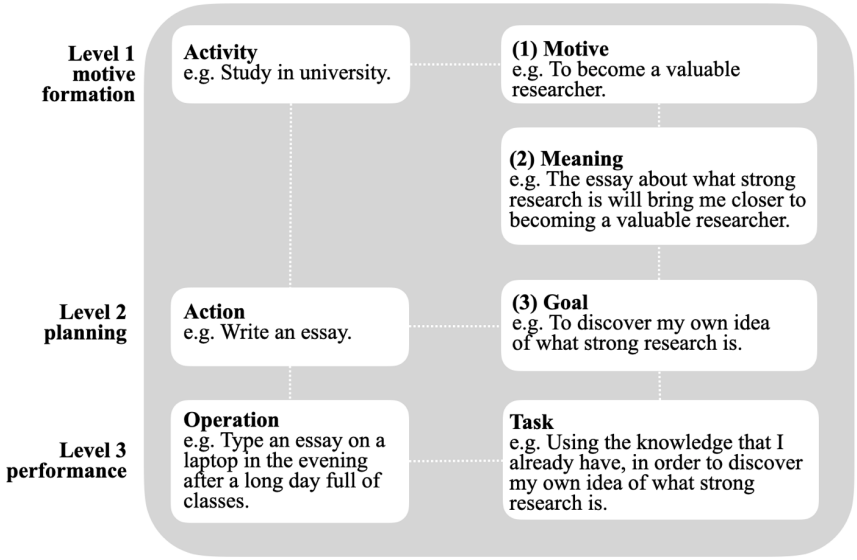
Our foray into the relationship between known MRSs and students' motivation to learn is complicated by the fact that many different theoretical views exist on what exactly constitutes motivation. Nevertheless, each of these theories offer a meaningful contribution to our understanding of motivation. Self-determination theory, for instance, suggests that several reasons can underlie students' actions and that these are mediated by the extent to which their basic needs for autonomy, relatedness, and competence have been satisfied. Similarly, the regulatory style subsequently adopted reflects students' relative autonomy (Ryan & Deci, 2020). From expectancy-value theory (Eccles & Wigfield, 2020) and social cognitive theory (Bandura, 1977), moreover, we learned that students' self-perceptions can interfere with their actions. Yet, as Hattie et al. pointed out in their review of motivational studies (2020), rather than being a single reason to act or a desire to achieve a particular result, motivation encompasses a variety of motivational elements that have been described by different theories.

Hence, to prevent the so-called "atomization" of motivation, we chose to look at motivation from the perspective of activity theory which considers it a system. First developed by Leont'ev, (1971/1978) and subsequently elaborated by Ivannikov (1985a, 2015), activity theory expressly defines motivation as a *process* that is made up of different elements, describes how these elements interact, and suggests the mechanism by which MRSs could work (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978). Put that way, motivation is an unmistakable part of the activity - the learning activity in our case - and together they are two sides of the same coin. In this system of activity, a process of social relations convert an object into its subjective form, a mental image, which, in turn, may translate back into an objective result (Leont'ev, 1971/1978). As such, activity is a unit of life. Learning, for instance, is one such activity that together with work and social activities make up a student's life. In the process of learning, students interact with the world, form an image of this world (What is learning? What kind of student am I? What is this task and how will I cope with it?), and deliver products (essays, projects, competencies).

In addition, comparable to a matryoshka doll, activity can be described as a nested system spanning three layers or levels that are each accompanied by a level of motivation. First, the top level, which is the "activity" itself, accommodates all the others and is accompanied by "motive formation" (What object can satisfy my need? What do I want and how can studying in university help me achieve that?). Second, on a medium level, "action" is accompanied by "goal planning" (What sub-steps do I need to take to obtain the desired object? What should I do to improve my graduate portfolio / pass the exam / land an internship in that particular company?). And finally, the bottom level of "operation" is accompanied by "task performance" (the planned action is actually performed in the real context through a multitude of operations, depending on the situation).

To explain how this theoretical framework works out in practice, take the example of a student who sits in a chair in the evening, opens a book, and starts reading it line by line. In this case, the student is performing an operation (reading) on the third level in a specific context at a set time. Before this operation, however, the student must first have had a general motive to engage in the learning activity, such as the desire to become a researcher (Level 1). Subsequently, the student must have formulated the goal to read a textbook and planned to take corresponding action (Level 2). The said example demonstrates that having a desire alone does not suffice: The student must progress through the entire system in an integrated fashion, passing all three levels of activity and motivation. Figure 1 illustrates how, according to activity theory, motivation and activity are two sides of the same coin, starting from a student's motive to become a researcher. As depicted, the three levels of activity (on the left) are "intertwined" with specific elements of motivation (on the right).

Figure 1.1.
The structure of activity and motivation.



*(4) Means (e.g. laptop, knowledge, energy), (5) Beliefs (e.g. belief that I can do it), and (6) Emotional states (boring, good mood, excited) are not in the Figure as they permeate the entire system.

The elements involved are six: (1) motives, (2) meaning, (3) goal, (4) means, (5) beliefs, and (6) emotional states. Together, they help transform the student's desire to learn (I want) into a real operation (I do). The first motivational element presented in Figure 1 is motive – an object that can satisfy the student's needs (becoming a valuable researcher can satisfy different needs). The motive determines the direction of the activity. We can distinguish two types of motives, that is, stimulus-constructing and personal meaning-making motives, which are similar to "controlled extrinsic motivation" and "autonomous intrinsic motivation" proposed in self-determination theory (Leontiev, 2016; Ryan & Deci, 2020). Although other motivational elements are still needed, the whole activity essentially starts from a motive.

The motive then serves as an impulse to create a goal (Element 2 in Figure 1), which is the primary motivational element at the planning level. By planning a chain of intermediate goals and actions, the student can ultimately reach their desired motive, even though these goals and actions usually do not, by themselves, lead to the motive directly. For instance, developing own ideas of what strong research is (goal) does not automatically make the student a valuable researcher (motive). However, the student's goal will only translate into an activity if it has personal meaning (Element 3). As such, personal meaning helps to connect the student's current goal to what they are hoping to achieve in the future (motive). In the example above, the student may choose to write

an essay about what constitutes strong research because they understand that this is the first step toward becoming a valuable researcher in the future.

Yet, even when meaning connects motive and goals, the student may still struggle to perform operation if the next two elements are lacking: means and beliefs (Elements 4 and 5). The student could simply lack a pencil to write or be frustrated by previous negative experiences of essay writing. The last motivational element, emotional states (Element 6), permeates all three levels. Emotional states signal that the particular object could satisfy the need and inform the student about whether or not the previously planned operations are going as planned and are helping them to reach the motive.

At each level, however, students may find that the quality or quantity of one or more of the said motivational elements is insufficient. Whether or not and the extent to which this is the case differs across students. For instance, whereas one student may understand why attending a particular lecture is necessary (has meaning), another might lack this understanding (misses meaning). Similarly, a student may have a lot of time (means) to study, whereas another might not because of work or family commitments. Because of these differences, each student has an individual set of motivational elements, that is, a motivational profile. To uphold the whole process of motivation and activity, students must therefore sometimes individually self-regulate their motivation (Ivannikov, 1985a, 2015).

In the present dissertation, we have used the three levels of activity and motivation and the motivational elements previously outlined as a theoretical starting point. In the chapters to come, we will first scrutinize the top level of activity and motivation (motive formation) and move on to study the more specific and contextual levels of goal planning and performance. More specifically, we will first study the static relationship between the motivational elements at the first level and students' concomitant MRS uptake, before exploring the long-term dynamic relationships between the different configurations of these elements and MRSs. We conclude by observing the motivational elements and MRSs during the planning and performance levels, when students are experiencing motivational problems in real time.

RESEARCH QUESTIONS AND DISSERTATION OUTLINE

The primary goal of the research presented in this dissertation was to investigate how adequately the known MRSs cover the full range of motivational elements and improve students' motivation to learn. To this end, we explored how the MRSs and the specific motivational elements were interrelated, whether and how the MRSs effected changes in motivational elements across time, and to what extent the existing MRSs sufficiently addressed the full range of motivational problems. We performed four studies with students from Moscow-based universities in Russia as our participants. In these universities, the key learning activities consisted of teacher-centered plenary lectures,

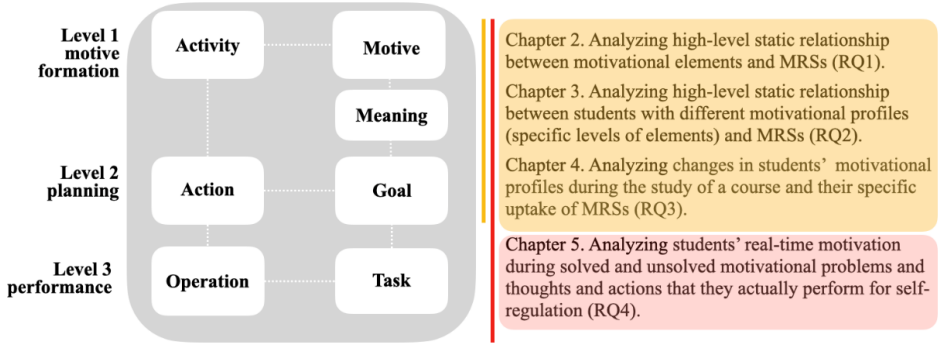
teacher-facilitated seminars where students discuss different cases and questions in smaller groups, and homework such as reading a textbook, writing an essay, or creating a project. The study sample was very diverse, with participants coming from different countries of the former Commonwealth of Independent States (CIS) and attending different study programs.

To reach the aforementioned goals, we addressed the following research questions (RQs):

1) How are students' motives, emotional states, meaning, goal, means, and beliefs interrelated and how do they relate to students' MRS uptake? (Chapter 2, which addresses Levels one and two of activity theory, as shown in Figure 2).
2) How do students with different motivational profiles differ in their uptake of known MRSs? (Chapter 3, which addresses Levels one and two of activity theory).
3) How are long-term changes in students' motivational profiles during the study of a course associated with their uptake of known MRSs? (Chapter 4, which addresses Levels one and two of activity theory).
4) How does students' real-time experience of motivational problems relate to the known MRSs, and what MRSs do they actually use? (Chapter 5, which addresses all three levels of activity theory).

By answering the research questions listed above, we aimed to unearth the differences and effectiveness of known MRSs from the perspective of the three-level activity and motivation system proposed by activity theory. We hope that the insights thus obtained can help students to better regulate their motivation to learn. Figure 2 provides an outline of the dissertation and is followed by a concise overview of the studies reported in the subsequent chapters.

Figure 1.2.
Dissertation outline



* Means, Beliefs, and Emotional states are not in the Figure as they permeate the entire system.

In the first study reported in Chapter 2, we investigated the static relationship between the motivational elements at the first activity and motivation level and the set of MRSs identified by Wolters (2003) and Schwinger, Steinmayr, and Spinath (2009). We used five existing and validated paper-based questionnaires to measure students' motivational elements – i.e., their motives, emotional states, goals combined with meaning, and means combined with beliefs – as well as their specific MRS uptake. Participants were 716 students from two Russian universities. They filled out the five questionnaires just before the start of the semester. To examine the said relationships between students' motivational elements and their MRS uptake, we performed correlational and confirmatory factor analyses.

The focus of the second study reported in Chapter 3 was to investigate how students with distinct motivational profiles differed in their uptake of known MRSs. We measured students' motivational elements and MRS uptake using the same five questionnaires as in the previous study. Participants were 1039 students from two Russian universities from different CIS countries, faculties, and study years. They completed the five questionnaires three times: Just before the start (Occasion 1), halfway (Occasion 2), and at the end (Occasion 3) of the semester. We first performed a latent profile analysis (LPA) based on students' motivational elements on the three occasions simultaneously to identify their motivational profiles. We then used the Wilcoxon test to determine how students with distinct motivational profiles differed in their MRS uptake across all three occasions.

The third study, which is reported in Chapter 4, had for its aim to investigate how students' specific MRS uptake during a 3-month course predicted changes in their motivational profiles. The participants and questionnaires were the same as in the previous study. In this longitudinal study, we first performed an LPA based on four motivational elements (motives, mood, perceptions of instrumentality, and general self-efficacy) for the three occasions simultaneously to capture students' motivational profiles. We then performed a transition analysis to examine how students' profiles changed across these occasions. Finally, we performed a multinomial analysis of any changes in motivational profiles between Occasion 1 and Occasion 3 to investigate which MRSs helped students to become more motivated.

Chapter 5 reports the results of our last study that explored students' thoughts, motivation, and the motivational problems they experienced during real-time study. Participants were 153 students from two Russian universities from different CIS countries, faculties (Psychology, Linguistics, Journalism, and Pedagogy), and study years. In this mixed-methods study, we combined the questionnaires previously used with an SRL microanalysis survey that students completed several times a day during the course of one week. The respective questionnaires measured students' motives, emotional states, means, and beliefs during the first stage of the motivation process (motive formation) and their concomitant MRS uptake. The SRL microanalysis survey, on the other

hand, measured students' motivational elements during the planning and performance levels of the motivation process (i.e., goal, meaning, emotional states, means, and beliefs) when they were about to decide on whether or not to study. The survey also measured the experienced by students motivational problems, and the thoughts that accompanied these problems. Together, these measures gave us a more comprehensive picture of the students' motivation and the used MRSs that students contemplated when confronted with problems of motivation. First, we performed several analyses to determine the relationships between students' motivational elements and motivational problems at all three levels, as well as the relationship between motivational problems and MRS uptake. As a next step, we performed a thematic analysis to investigate how students' thoughts during their real-time experience of motivational problems relate to the specific motivational elements and their concomitant MRS uptake.

Finally, Chapter 6 synthesizes and discusses the findings of the studies previously described. This is followed by a reflection on the theoretical and practical implications of the entire Ph.D. project, as well as on its strengths and limitations. The dissertation ends with an Impact chapter that addresses the scientific and societal impact of the research undertaken in this dissertation.

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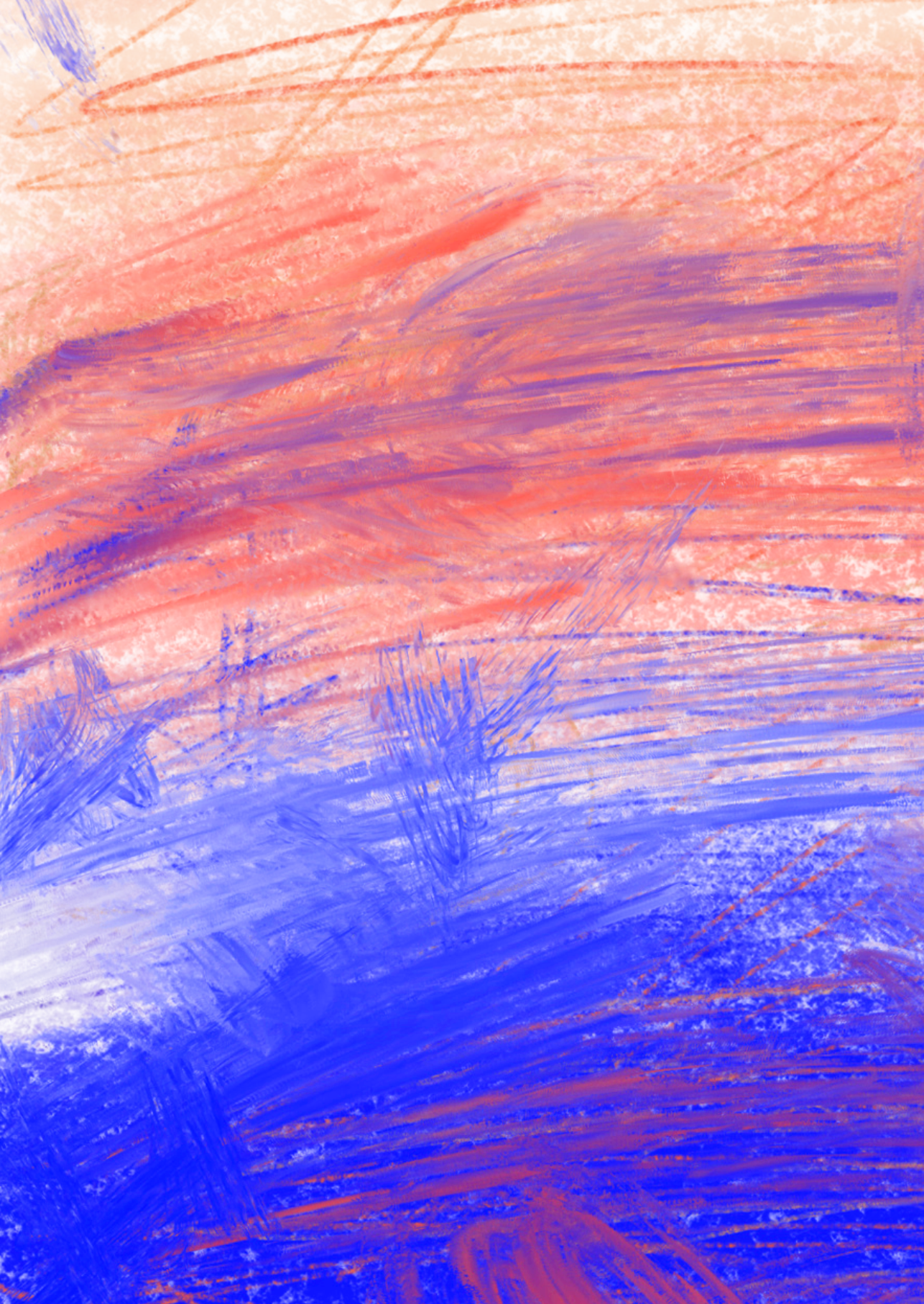


CHAPTER 2

Understanding self-regulated learning through the lens of motivation: Motivational regulation strategies vary with students' motives.

This chapter has been published as Ilishkina, D., De Bruin, A., Podolskiy, A., Volk, M., & Van Merriënboer, J., (2022). Understanding self-regulated learning through the lens of motivation: Motivational regulation strategies vary with students' motives. *International Journal of Educational Research*, *113*, 101956, https://doi,org/10,1016/j,ijer,2022,101956

ABSTRACT

Successful learners should self-regulate their motivation to learn. Although 8 motivational regulation strategies (MRSs) have been described, their relations with student motivation remain underexplored. To analyze this relationship, we conducted a correlational study grounded in Wolters' theory of MRSs and Ivannikov's adaptation of Leont'ev's activity theory. We considered four different motivational elements: motives-to-learn, mood, perceptions-of-instrumentality, and general self-efficacy. We found that two groups of MRSs could be distinguished by their relation to extrinsic and intrinsic motives. Five intrinsic-MRSs target interest, personal significance, mastery orientation, self-consequating, and environmental control; three extrinsic-MRSs target performance-approach/performance-avoidance orientation, and goal-setting. By making students aware of their own motives to learn (intrinsic vs extrinsic), we might help them choose more appropriate MRSs.

Highlights:

- Intrinsic & extrinsic motives differ relative to other motivational elements
- Mood, self-efficacy, instrumentality have higher relations with intrinsic motives
- Groups of MRSs correlate with either intrinsic or extrinsic motives to learn
- Intrinsic-MRSs target interest, personal significance, and mastery orientation
- Extrinsic-MRSs target performance, goal-setting, self-consequating, environment

Keywords
motivational regulation strategies, intrinsic motives, extrinsic motives, instrumentality, self-efficacy

INTRODUCTION

Self-regulated learning (SRL) has been defined as 'the self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals' (Zimmerman, 2000, p. 14). Many things in students' life, such as reading Facebook notifications, going out with friends or undertaking sports activities, compete with learning activities for attention, time and effort (Engelschalk, Steuer, & Dresel, 2016; Moberly & Dickson, 2018). Panadero's review (2017) of SRL models showed that in leading models, regulating the motivation to learn is inseparable from SRL. For example, Zimmerman's Cyclical Phases Model (2000) includes self-motivation beliefs; Boekaerts' Dual Processing Model (2011) includes motivational self-regulation with different strategies; Winne and Hadwin's SRL model (1998) includes motivational factors and orientations, and Pintrich's SRL Model (2000) considers motivation as one of the areas of self-regulation. Therefore, if we want to help students better regulate their motivation, it is important to investigate different ways of how they can do this effectively.

Different SRL models include three phases —preparatory, performance, and appraisal — which are targeting the three spheres of metacognition, emotion, and motivation (Panadero, 2017). Within the SRL sphere of motivation, Wolters (2003) identified motivational regulation strategies (MRSs) that students wield to create, maintain and improve their motivation to learn, thereby helping them initiate and support their learning activities. Based on previous studies, Wolters (2003) and Schwinger, Steinmayr and Spinath (2009) have identified eight MRSs: (1) enhancement of situational interest - adding game elements to a tedious task or modifying it so as to increase pleasure; (2) enhancement of personal significance - connecting an unpleasant activity with individual interests and searching for links with real life; (3) performance-approach self-talk - emphasising the need to complete a task in order to achieve a good result; (4) performance-avoidance self-talk - emphasising that one needs to learn in order not to be disgraced or worse than others; (5) mastery self-talk - challenging and orienting oneself to master the skill; (6) self-consequating - promising oneself some kind of reinforcement or reward after completion of the task; (7) proximal goal-setting - dividing a large task into smaller subtasks; and (8) environmental control - eliminating factors that can distract from learning. The above categorisation, rather than being associated with the different aspects of student motivation that the strategies target, is based on the specific behaviours that constitute the MRSs (Miele & Scholer, 2018).

Although several studies have investigated the relationship between MRSs and different aspects of motivation (Schwinger, von der Laden, & Spinath, 2007; Trautner & Schwinger, 2020; Wolters & Benzon, 2013; Wolters & Rosenthal, 2000), the concept of 'motivation' remains nebulous. Motivation is frequently defined as a willingness or desire to be engaged in a particular activity, or as something that produces this desire, goal-directed behaviours or effort and persistence (Schwinger & Otterpohl, 2017;

Trautner & Schwinger, 2020; Wolters, 1998, 2003; Wolters & Rosenthal, 2000). A desire to do something, however, does not always lead to real actions, which may be the case when students have low self-efficacy (Bandura, 1977). In the literature, moreover, there is a tendency among researchers to integrate different motivation theories and, consequently, to use different motivational elements (e.g. indicators, beliefs, attitudes), reducing motivation to only one or to the sum of these elements without clearly explaining the relationships between them (Wolters et al., 2014). In the most recent overview of different definitions, models and theories of motivation, Hattie, Hodis and Kang (2020) concluded that there is a need for a more reduced higher-order model.

This lack of a common definition of motivation complicates the study of MRSs, because it remains unclear what exactly the MRSs regulate. The main aim of the present study was therefore to introduce the definition of motivation grounded in Activity Theory (i.e., motivation as a mental *process*; Ivannikov, 1985a, 2015; Leont'ev, 1971/1978) and use it as a meta-framework to investigate the relations between the eight MRSs previously described and students' motivation. Such research could lead to a new classification of MRSs based on their relations with different motivational elements. Eventually, this could help students to better regulate their motivation by choosing more appropriate MRSs to solve specific motivational problems. For example, if a student does not find the topic of a lecture interesting, using a goal-oriented MRS (asking the question: why do I need this material?) is probably more effective than using a self-efficacy oriented MRS (saying: I am capable to listen to the lecture, I can do it!).

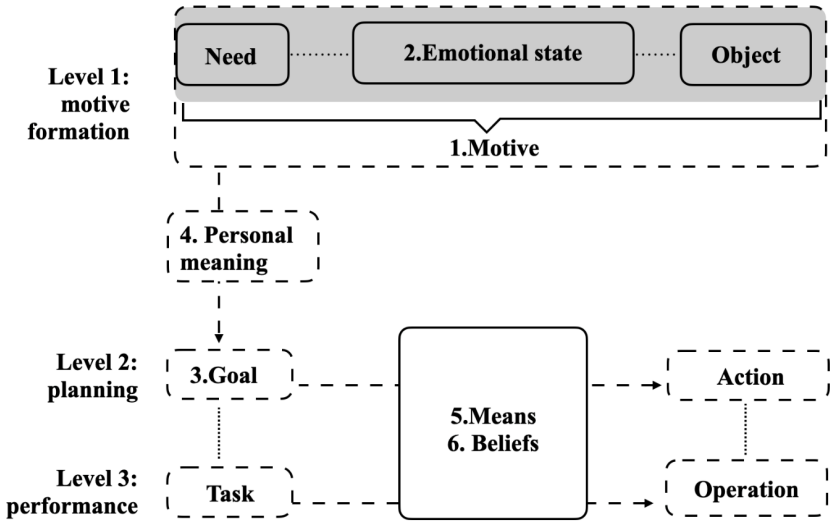
In the following paragraphs, we will first describe Leont'ev's activity theory (1971/1978) as a meta-framework and Ivannikov's (1985a, 2015) view on motivation as a subjective component in the structure of activity (special mental action), which provides the initiation of activity and includes a number of intermediate stages. We will present the activity theory which gave rise to the key elements involved in the process of motivation, while also explaining the work of Ivannikov (1985a, 2015) who added additional motivational elements. Then, we will explain how the process of motivation can be self-regulated through the prism of Ivannikov's theory of willpower (Ivannikov, 1985a, 2016; Ivannikov, Gusev, Barabanov, & Aidman, 2020). Finally, we will briefly describe the operational model and the research questions that this study addressed.

Motivation from the perspective of activity theory

The key feature of activity theory is that it defines motivation not as a *state* of mind, such as a reason to act or desire to achieve a particular result (Hattie et al., 2020), but as a mental *process* that consists of specific elements and the principles of their formation (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978). As many of the elements specified in activity theory can also be found in other motivation theories as separate entities, we believe it makes a good candidate for the reduced higher-order model that Hattie and colleagues (2020) called for. According to Leont'ev (1971/1978), human life is a changing

stream of activities, a macrostructure of human activity consists of three levels: motive formation, planning and performance (see Figure 2.1). Ivannikov (1985a, 2015) further elaborated on this macrostructure by describing additional elements (i.e. means and beliefs) and defining motivation as the mental process whereby an impulse for action and corresponding operation are created.

Figure 2.1
Macrostructure of activity and the motivational elements involved in the process of impulse construction.



Note. Dashed arrow and dashed box: impulse; dotted line: corresponds with; solid box: elements that do not contain an impulse.

Level 1: motive formation

As can be seen in Figure 2.1, motivation begins with a motive (Element 1) that is formed in response to a person's need in order to find an object that satisfies this need. Once that object is found, the motive crystallises into an 'impulse' (i.e. the dashed box around Element 1: motive). The motive is not created in the person, nor by society, but at the junction of both (Leont'ev, 1971/1978).

Emotional states (Element 2) play an important role in the formation and regulation of motivation. Not only do they encapsulate emotions, they also include subjective experiences, desires, wishes, aspirations, moods and affects. By attracting a person to an object that can satisfy a need, emotional states connect a need with an object (see Figure 2.1, Level 1). Moreover, they indicate whether the ongoing activity brings a person closer to the fulfilment of this need (motive). For example, when students receive a high grade for an exam they may experience either a positive emotional state if they consider

this an expert confirmation of their deep understanding of the materials or a negative one because they feel they achieved this grade through rote learning, without having gained a deep understanding of the materials (Leont'ev, 1971/1978).

Level 2: planning

A motive triggers further stages of impulse building. However, it does not provide a direct impulse to perform specific operations as other motivational elements are needed to reach that stage – hence why the dashed arrow does not move directly from motive to goal in Figure 2.1. The motive starts a process of goal formation whereby a person formulates a goal (Element 3) from a set of potentially adequate goals. The goal is a form of a mental representation of the intermediate outcome that can be achieved by means of a specific action. In other words, the goal directs the process of action.

In order for a person to actually start planning actions, the goal must receive an impulse from the motive (dashed arrow from motive to goal through personal meaning). The key mechanism of transferring an impulse from a motive to a goal is the construction of a goal's personal meaning (Element 4). Personal meaning serves as a bridge between motive formation (Level 1) and planning (Level 2; Leont'ev, 1971/1978). For example, two students may decide to read the first chapter of a statistics textbook for the same reason (goal): they want to know the basic statistical notions. However, when asked why they need to develop this knowledge, they might reply differently. While one student might feel that it would help to develop the statistical analysis skills needed to become a good researcher (a goal with meaning), the other might wonder, in turn, how knowing the basic statistical notions would help to become a good psychotherapist (a goal without meaning).

Level 3: performance

Finally, at the last level, students enact the goals and actions planned in the previous stage by performing specific tasks and operations in the real environment with its specific conditions (Leont'ev, 1971/1978) (see the dotted lines between goal and task and between action and operation in Figure 2.1). Ivannikov (1985a, 2015) suggested that the impulse from task to operation must overcome a subjective threshold before the operation is actually performed (the dashed arrow from task to operation).

As mentioned, the four motivational elements hitherto described are vital to the process of building an impulse for action and corresponding operations. The following two motivational elements, however, are *optional* in this process: their absence or presence may vary depending on the situation.

Additional elements: means and beliefs

When planning specific actions to achieve their goals, and in the process of actually performing operations to complete a task, students may come to realise they lack the 'means' to achieve their goal (Element 5). This means could be a tool (e.g. they have no

pen, no Internet), knowledge and skills (e.g. they do not know how to use a particular tool), or physical functionality (e.g. they are ill). Similarly, the means they do have at their disposal while performing operations could be insufficient or simply break down.

The next additional element is the set of beliefs students have about themselves, about the activity that is undertaken and about the situation (Element 6). With respect to the 'means' (Element 5), for instance, students could have beliefs about the extent to which they consider themselves capable of using their own means, the probability of success or the functionality of the means (Ivannikov, 1985b, 2016). Means and beliefs are just two of the possible additional motivational elements involved in the process of motivation.

By defining motivation as a *process,* activity theory differs from most other motivation theories that, however, did consider roughly the same motivational elements, although not as part of a united process of motivation. 'Motive' (Element 1), for example, resembles Vallerand et al.'s (1992) taxonomy of motivation which captures the different reasons for engaging in activities (the 'why' behaviour); their *motives to learn* are based on self-determination theory (Ryan & Deci, 2000). In this taxonomy, however, the authors used 'motive' and 'motivation' interchangeably which could be confusing, whereas activity theory distinguished between 'motives' as a single *element* and the *process* of motivation that involved both motives and other elements. Similarly, Barkanova's *mood* (positive or negative, 2009), which the author considered as directing a person's emotional state over the long term, bears a resemblance to the theory's 'emotional state' (Element 2). Although, as stated before, Element 2 encapsulates not only emotions itself, but also different subjective experiences, moods and affects, it could be reminiscent of *mood* when considered as students' overall emotional state during their long period of study (activity in general). Likewise, Element 2 shares commonalities with Miele & Scholer's *emotions* (2018) if we consider the particular type of emotional state students experience when planning specific actions or performing particular operations, such as being interested, curious or annoyed. By the same token, Russell, Weiss and Mendelsohn's *affect* (1989) corresponds with emotional state if we consider students' just-in-time reactions to a specific operation. Also, 'goal' (Element 3), when combined with 'personal meaning' (Element 4), compares with Husman et al.'s *perceptions of instrumentality* (2004), denoting an individual's understanding of an activity's instrumental value, that is, whether a student considers this action as meaningful for reaching the goal. Finally, the concepts of 'means' (Element 5) and 'beliefs' (Element 6) together, particularly students' belief in their ability to use own means, in the probability of success and in the functionality of the means, correspond with Bandura's concept of *self-efficacy* (1977), because it represents the belief in one's ability and potential to perform the activity.

To summarise, activity theory describes motivation as a *process* by which motivational elements interact with each other? As the described theoretical ideas were not tested empirically in the educational domain, this led us to the first research question: How are the four aspects of motivation described in activity theory – motives to learn, mood,

perceptions of instrumentality and general self-efficacy – related to each other?

Willpower: using MRSs to strengthen motivational elements

If one or more motivational elements are missing or frustrated, the motivational process becomes disrupted. According to the Ivannikov's theory of 'willpower' developed on the basis of activity theory, willpower is a form of self-regulation responsible for strengthening weakened motivational elements and restoring an impulse for action and corresponding operations (Ivannikov, 1985b, 2016). Ivannikov and colleagues' empirical works focused on studying the relation of willpower measured as general level of self-control with meaningfulness (Ivannikov, Gusev, Barabanov, & Aidman, 2020), with sense-making processes (Ivannikov, Barabanov, & Aidman, 2018), with the type of performed activity (Ivannikov & Monroz, 2016), and with the type of ethnic and cultural group (Ivannikov & Shlyapnikov, 2019). However, the concept of willpower has not been studied in relation to students' motivation in the educational domain.

In the literature, strategies to *initiate* an activity are sometimes called motivational, whereas those wielded to *continue* the activity are called volitional. The theory of willpower combines motivational and volitional perspectives because they are both concerned with the act of self-regulating one's own motivation. We argue that Ivannikov's concept of willpower can be equated with Wolter's MRSs, because they both relate to strategies students use to build up and maintain motivation for learning activities (Wolters, 1998). Like Wolters, Ivannikov refused to divide the volitional and motivational perspectives into two categories and suggested to combine them instead. As a result, the MRSs represent a broad array of different strategies that students use to improve their motivation, including motivational and volitional strategies as different manifestations of willpower. Throughout this article, we have used the term MRSs to refer to the same classification used by Wolters specified on page 3 (2003).

As motivation is an active process in which several elements are involved, theoretically, it may be assumed that each motivational element needs one or more specific MRSs to restore it. However, it is unknown how the use of the eight MRSs described in the literature (Schwinger, Steinmayr, & Spinath, 2009; Wolters, 2003) relates to the different motivational elements. This led us to the second research question: How do motives to learn, mood, perceptions of instrumentality and general self-efficacy relate to the eight MRSs described in the literature? The answer to this question will reveal whether particular MRSs help to restore particular motivational elements.

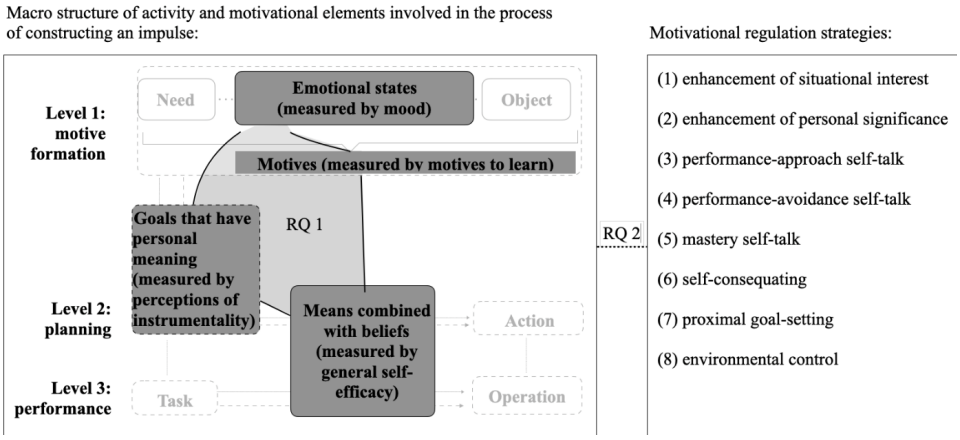
The present study

The primary goal of this study was to test Ivannikov's theory of motivation and willpower, which is an adapted version of Leont'ev's Activity theory, and to shed light on the relationships between MRSs and the different elements or aspects of student motivation. We did so by using five questionnaires that aimed to measure both the MRSs, which

represent the overarching concept of 'willpower', and the six motivational elements previously listed. More specifically, we administered a questionnaire on: 1) *motives to learn* to measure motives (Element 1); 2) *mood* to measure emotional state (Element 2; Barkanova, 2009); 3) *perceptions of instrumentality* to measure goal (Element 3) and personal meaning (Element 4; Husman et al., 2004); 4) *general self-efficacy* to measure means (Element 5) and beliefs (Element 6; Bandura, 1977); and 5) motivational regulation strategies to measure the MRSs. Consequently, we addressed the following research questions:

1. How are the four aspects of motivation – motives to learn, mood, perceptions of instrumentality, and self-efficacy – related to each other? (See the four grey boxes in the left part of Figure 2.2)
2. How do motives to learn, mood, perceptions of instrumentality, and general self-efficacy relate to the eight MRSs described in the literature? (See the dotted link between the left and right parts of Figure 2.2)

Figure 2.2
The research questions



METHOD

Participants

Participants were students from two Russian universities (N = 716; 555 female; age: M = 22.00, SD = 0.42). Most of the students (N = 665) were from former countries of the Commonwealth of Independent States, and the remainder (N = 51) came from other countries. Table 2.1 presents the numbers of students according to year of study and study programme, including their mean age.

Table 2.1
Number of students according to year of study and study programme

	***N* students (female)**	**Mean age (*SD*)**
Total N students	716 (655)	22.00 (0.42)
Year of study		
First-year students	458 (348)	18.73 (1.71)
Second-year students	191 (147)	19.78 (1.61)
Third-year students	67 (60)	20.64 (1.05)
Study programme		
Medicine	291 (213)	19.26 (2.07)
Psychology	87 (67)	20.17 (1.58)
Linguistics	153 (131)	18.82 (1.24)
Journalism	185 (144)	18.92 (1.48)

Measures

We used existing and validated questionnaires to measure the variables from our theoretical model – students' motivational elements and MRSs. Table 2.2 gives an overview of the five measurement instruments used and their linkages to the theoretical and operational models.

Table 2.2
Operationalisation of the motivational elements and MRSs

Theoretical model	**Operational model**	**Measures**
Motive (Element 1)	Motives to learn	Academic Motivation Scales questionnaire (Gordeeva, Sychev, & Osin, 2014)
Emotional state (Element 2)	Mood	The Mood subscale from the Health, Activity and Mood questionnaire (Doskin et al., 1973)
Goal (Element 3) and Personal meaning (Element 4)	Perceptions of instrumentality	Perceptions of Instrumentality Scale (Husman et al., 2004)
Means (Element 5) and Beliefs (Element 6)	General self-efficacy	General Self-Efficacy scale (Shvartser, Jerusalem, & Romek, 1996)
Motivational regulation strategies	Motivational regulation strategies	Motivated Strategies questionnaire (Schwinger et al., 2009)

Motives to learn

To measure and analyse students' motives (Element 1), we used an adapted Russian language version of Vallerand et al.'s taxonomy of reasons for engaging in learning (1992). As we explained in the Introduction, this taxonomy used the term 'motivation' to refer to motives. Gordeeva, Sychev, and Osin (2014) adapted this original taxonomy to include a scale that measures the motivation to develop oneself. Moreover, they changed the items of the taxonomy's two scales that measured 'introjected motivation' and 'external motivation'. The resulting Academic Motivation Scales questionnaire, drafted in Russian,

comprises seven scales and 28 items (4 per scale) that measure intrinsic motives (three scales), extrinsic motivation (three scales) and amotivation (one scale). The first three scales aim to measure students' intrinsic motives to: (1) know (4 items; e.g. 'I like to study'), (2) achieve (4 items; e.g. 'I like to solve difficult problems and invest intellectual effort'), and (3) self-develop (4 items; e.g. 'I like to know how to increase my competence and knowledge'). The next three scales measure students' extrinsic motivation: (4) to self-respect (4 items; e.g. 'To prove to myself that I am a smart person'), as well as their (5) introjected (4 items; e.g. 'Because it is embarrassing to do poorly in studying'), and (6) external motives (4 items; e.g. 'I have no other choice, as they will check my attendance'). The final scale measures (7) amotivation (4 items; e.g. 'Before, I knew why I was studying, but now I am not sure whether to continue'). As in the modified version, all items were rated on a 5-point Likert scale (1 = does not apply at all; 5 = applies completely). The validity of the questionnaire was studied by Gordeeva, Sychev, & Osin (2014). The resulting model demonstrated acceptable indicators of compliance with the initial data: S-B **x2** = 747.142; df = 329; $p < .001$; RMSEA = 0.053; CFI = 0.927; NNFI = 0.916; Cronbach's alphas varied from .71 to .91.

Mood

To measure students' emotional state (Element 2), we used the Mood subscale from Doskin and colleagues' Health, Activity and Mood questionnaire (1973). Spanning 10 items, this scale describes 10 different feelings the intensity of which is to be scored on a 7-point scale ranging from minus 3 to 3, with 0 being the neutral score (e.g. 'cheerful 3 / 2 / 1 / 0 / 1 / 2 / 3 sad'). Positive indicators of mood are always on the left side, while negative indicators can be found on the right. The questionnaire was developed in the Russian language by Doskin and colleagues (1973). Afterwards, it was used in different studies, for example, in studying students' well-being and experiences during social isolation because of the COVID-19 pandemic (Baranova et al., 2021; Potapova et al., 2021).

Perceptions of instrumentality

To measure personal meaning (Element 4) and goal (Element 3), we used the Russian 8-item version of the Perceptions of Instrumentality Scale (Husman et al., 2004). As the original items were in English, we had to translate them into Russian. To ensure validity of the translated instrument, we followed a standard translation and back-translation procedure. This scale consists of two subscales: (1) endogenous instrumentality (4 items; e.g. 'I will use the information I learn in the class selected above in other future classes'), and (2) exogenous instrumentality (4 items; e.g. 'What grade I get in the course selected above will not be important to my future academic success'). All items were rated on a 5-point Likert scale (1 = fully disagree; 5 = fully agree). Cronbach's alphas for the endogenous instrumentality scale varied from .73 to .90 (Heddy et al., 2021; Hilpert et al., 2012; Husman et al., 2004; Lee & Turner, 2018). Cronbach's alphas for the exogenous scale varied from .61 to .64 (Hilpert et al., 2012; Lee & Turner, 2018).

General self-efficacy

To measure means (Element 5) and beliefs (Element 6), we used the Russian version of the General Self-Efficacy (GSE) scale (Shvartser, Jerusalem, & Romek, 1996). This scale helps to identify whether a person has a means and feels that he or she can use it. It comprises 10 items (e.g. 'I can always manage to solve difficult problems if I try hard enough') that were rated on a 4-point Likert scale (1 = fully incorrect; 4 = fully correct). The Cronbach's alphas varied from .82 to .84 (Shvartser, Jerusalem, & Romek, 1996).

Motivational regulation strategies

To measure how often students used each of the eight MRSs mentioned in the Introduction, we used the Russian version of Schwinger et al.'s Motivated Strategies questionnaire (2009). As the original items were in German, we had them translated into Russian. To ensure validity of the translated instrument, we followed a standard translation and back-translation procedure. The 30-item questionnaire comprises eight scales that measure the eight MRSs: (1) enhancement of situational interest (5 items; e.g. 'I make learning more pleasant for myself by trying to arrange it playfully'), (2) enhancement of personal significance (3 items; e.g. 'I look for connections between the tasks and my life as such'), (3) mastery self-talk (4 items; e.g. 'I persuade myself to work intensely for the sake of learning'), (4) performance-approach self-talk (5 items; e.g. 'I attempt to call myself to intense work by focusing on obtaining good grades'), (5) performance-avoidance self-talk (3 items; e.g. 'I tell myself that I have to push myself more if I do not want to make a fool of myself'), (6) proximal goal-setting (3 items; e.g. 'I break down the workload into small segments so I get the feeling that I can handle it more easily'), (7) self-consequating (4 items; e.g. 'I tell myself that after work I can do something nice, if I first keep on learning now'), and (8) environmental control (3 items; e.g. 'I consciously choose such learning times when I can concentrate especially well'). All items were rated on a 5-point Likert scale (1 = rarely used; 5 = very often used). The Cronbach's alphas of the Motivated Strategies questionnaire scales varied from .68 to .96 (Schwinger et al., 2009).

Procedure

Students filled in a set of questionnaires at the beginning of the semester before the start of the course they were taking during the survey. The researchers distributed and collected the questionnaires, instructing students to carefully read the information on the form and to complete all questionnaires. In these questionnaires, students were asked to describe their feelings about studying in university, including their study behaviour. The perceptions of instrumentality scale asked students about their attitudes towards the course they were attending at the time of the survey. To control for order effects, we ordered the five questionnaires according to a Latin square in five different ways. The first set of questionnaires started with the Academic Motivation Scales questionnaire,

followed by the Mood subscale from the Health, Activity and Mood questionnaire, the Generalised Self-Efficacy scale, the Perceptions of Instrumentality Scale and the Motivated Strategies questionnaire, respectively. The second set of questionnaires started with the Mood subscale from the Health, Activity and Mood questionnaire, followed by the other questionnaires in the order mentioned above, and ending with the Academic Motivation Scales questionnaire. The other three sets were organised according to the same logic. Students needed about 20 minutes to complete the entire survey**.**

Before participating in the research project students gave informed consent orally after being informed about the study; information about the study and anonymity of data was also written on the first page of the questionnaires and students gave consent again by filling out and handing in the questionnaires. They were also informed they could end their participation whenever they wanted, without giving a reason for that.

To motivate students for participation and to overcome the possible social-desirability biases students were informed that they would receive the additional course credits as a reward for their participation, but not for the type of answers they would give.

Additionally, participants were guaranteed anonymity. They were informed that all their responses would be anonymized and the questionnaire data will only be accessible by the primary researcher. The researcher informed the education office about the students who had earned additional credits, but their data were not available to their teachers or to the education office.

The research team was unfamiliar to the participants, the researcher who gathered the questionnaires was introduced to the participants by their teachers.

All procedures were performed in compliance with relevant laws and institutional guidelines, the teachers and the Dean granted approval for carrying out the study. The study was performed in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans (World Medical Association., n.d.)".

Data analysis

We performed statistical analyses using SPSS, version 24, and Mplus 8. To check the psychometric structure of the questionnaires, we performed confirmatory factor analyses and computed Cronbach's alpha and McDonald's omega for each factor. Correlational and confirmatory factor analyses served to answer the two research questions.

RESULTS

Reliability and validity of the questionnaires

As can be seen in Table 2.3, some items showed relatively low standardised coefficients (e.g. item 7 of the Health, Activity and Mood questionnaire; item 3 of the Generalised Self-

Efficacy scale; and item 15 of the Motivated Strategies questionnaire). For standardised coefficients the benchmark was chosen <. 50. However, goodness-of-fit indices did not improve after excluding these items from the factor models. We therefore decided to test the model without items 3, 5, 8 (exogenous subscale) as well as item 4 (endogenous subscale) of the Perceptions of Instrumentality Scale which also had low standardised coefficients (see Table 2.3).

Table 2.3
Standardized coefficients for items from confirmatory factor analysis

Scales	Items	Standardized coefficients
Academic Motivation Scales questionnaire (AMSQ)		
To know	1	.85
	8	.85
	15	.76
	22	.82
To achieve	2	.84
	9	.79
	16	.80
	23	.84
To self-develop	3	.71
	10	.78
	17	.80
	24	.81
To self-respect	4	.80
	11	.81
	18	.77
	25	.87
Introjected	5	.70
	12	.68
	19	.75
	26	.72
External	6	.66
	13	.71
	20	.73
	27	.56
Amotivation	7	.86
	14	.81
	21	.85
	28	.79
Health, Activity, Mood questionnaire		
Mood	1	.78
	2	.81
	3	.80
	4	.84
	5	.73
	6	.84
	7	.32

Table 2.3 *Continued.*

Scales	Items	Standardized coefficients
	8	.72
	9	.67
	10	.76
Perceptions of instrumentality scale		
Perceptions of instrumentality	1	.63
	2	.76
	3	.10
	4	.33
	5	.17
	6	.78
	7	.55
	8	.44
General Self-Efficacy (GSE) scale		
General self-efficacy	1	.65
	2	.67
	3	.49
	4	.59
	5	.71
	6	.68
	7	.73
	8	.61
	9	.65
	10	.68
Motivated Strategies questionnaire		
Enhancement of situational interest	7	.79
	12	.84
	14	.78
	22	.74
	28	.83
Enhancement of personal significance	6	.62
	15	.48
	23	.77
Mastery self-talk	10	.67
	17	.70
	21	.71
	30	.65
Performance-approach self-talk	1	.68
	8	.81
	16	.83
	26	.85
	29	.77
Performance-avoidance self-talk	4	.57
	5	.78
	25	.92
Proximal goal-setting	13	.78
	20	.88
	27	.87
Self-consequating	2	.82

Table 2.3 *Continued.*

Scales	Items	Standardized coefficients
	9	.84
	19	.82
	24	.77
Environmental control	3	.67
	11	.68
	18	.77

After this test, the goodness-of-fit results appeared acceptable (see Table 2.4). We therefore excluded these items from further analysis and united two subscales into one. Table 2.4 presents the goodness-of-fit results showing acceptable final factor models of all questionnaires.

Table 2.4
Goodness-of-fit statistics for the estimated models of all questionnaires

x2(df)	AIC	BIC	CFI	TLI	RMSEA	90% CI RMSEA
Academic Motivation Scales questionnaire (AMSQ) - All items						
1194.6 (105)	52059.53	52539.76	. 91	.90	.06	.06 - .06
Health, Activity and Mood (HAM) questionnaire - All items						
298.86 (35)	19777.89	19912.20	.92	.90	.11	.10 - .12
Perceptions of Instrumentality (PI) scale - Without items 3,4,5,8						
3.84 (2)	6682.44	6737.32	.99	.99	.04	.00 - .09
General Self-Efficacy (GSE) scale - All items						
169.69 (35)	14567.48	14704.74	.93	.91	.07	.06 - .08
Motivated Strategies questionnaire (MSQ) - All items						
1355.26 (377)	62247.41	62787.27	.89	.88	.06	.06 - .06

Comparative Fit Indices (CFIs; Bentler, 1990) and Tucker-Lewis Indices (TLIs; Tucker & Lewis, 1973) were around .90, and the Root Mean Square Errors of Approximation (RMSEAs; Steiger, 2016) were around .07, except for the Perceptions of Instrumentality Scale (RMSEA = .04). The following benchmarks were chosen for analysis: CFI – values close to 1.0 being indicative of a well-fitting model. The values >.90 represent a well-fitting model (Bentler, 1992); TLI – values close to 1.0 being indicative of a well-fitting model (Tucker & Lewis, 1973); RMSEA – values less then .05 indicate good fit; values higher than .08 represent reasonable errors of approximation in the population; values ranging from .08 to .10 indicate mediocre fit, and values greater than .10 indicate poor fit (Browne & Cudeck, 1993).

As shown in Table 2.5, Cronbach's alphas and McDonald's omegas were adequate for all questionnaires. The benchmark was chosen as >.50, the higher the better.

Table 2.5
Cronbach's alpha and McDonald's omega values for all questionnaires

		Cronbach's alpha	McDonald's omega
AMSQ			
	Motive to know	.84	.84
	Motive to achieve	.85	.85
	Motive to self-develop	.82	.82
	Motive to self-respect	.85	.85
	Introjected motive	.76	.76
	External motive	.70	.70
	Amotivation	.83	.83
HAM questionnaire			
	Mood	.91	.92
PI scale			
	Perceptions of instrumentality (only items 1, 2, 6, 7)	.76	.78
GSE scale			
	General self-efficacy	.84	.84
MSQ			
	Enhancement of situational interest	.84	.84
	Enhancement of personal significance	.59	.61
	Mastery self-talk	.72	.72
	Performance-approach self-talk	.86	.86
	Performance-avoidance self-talk	.74	.75
	Proximal goal-setting	.85	.85
	Self-consequating	.84	.85
	Environmental control	.69	.70

Finally, we analyzed the difference between males and females. A significant difference was found in 4 from the 19 scales used in the study; females had higher scores than males on 2 scales but this was the other way round for the other two scales (see Table 2.6).

Table 2.6
The difference in answers to the motivation and MRSs questionnaire between males and females: results of Kruskal-Wallis test

Scales	Chi-squared	p-value	Females M (SD)	Males M (SD)
Academic Motivation Scales questionnaire (AMSQ)				
To know	.10	.75	16.71 (2.82)	16.38 (2.51)
To achieve	.03	.87	14.65 (3.28)	15.18 (3.01)
To self-develop	3.05	.08	15.88 (3.07)	15.83 (2.68)
To self-respect	**12.58**	**.00**	**15.93 (3.50)**	**15.13 (4.12)**
Introjected	3.23	.07	13.36 (3.67)	12.95 (4.06)
External	1.14	.29	10.93 (3.93)	9.90 (4.13)
Amotivation	.08	.78	7.96 (2.72)	7.13 (2.60)

Table 2.6 *Continued.*

Scales	Chi-squared	p-value	Females M (SD)	Males M (SD)
Health, Activity, Mood questionnaire				
Mood	.14	.71	52.43 (9.56)	51.53 (10.12)
Perceptions of instrumentality scale				
Perceptions of instrumentality	.05	.83	30.21 (4.79)	30.23 (4.07)
General Self-Efficacy (GSE) scale				
General self-efficacy	**14.95**	**.00**	**29.31 (5.05)**	**31.73 (4.03)**
Motivated Strategies questionnaire				
Enhancement of personal significance	1.43	.23	11.58 (2.42)	12.13 (1.74)
Enhancement of situational interest	**6.07**	**.02**	**15.71 (4.64)**	**17.40 (5.03)**
Mastery self-talk	1.643	.20	15.49 (3.14)	15.38 (3.46)
Performance-approach self-talk	**7.65**	**.01**	**19.21 (4.47)**	**18.78 (4.17)**
Performance-avoidance self-talk	3.41	.07	8.78 (3.31)	8.90 (3.33)
Proximal goal-setting	.68	.41	9.82 (3.25)	10.55 (3.48)
Self-consequating	3.29	.07	15.19 (4.07)	14.73 (4.26)
Environmental control	.64	.42	10.07 (2.69)	10.60 (2.71)

df = 1; significant differences are marked in bold

The four scales that revealed the significant difference were:

(1) Motive to self-respect from the Academic Motivation Scales questionnaire. Chi-squared = 12.58, df = 1, p-value = .00, M(female) = 15.93, M(male) = 15.13
(2) General self-efficacy scale from the questionnaire of the same name. Chi-squared = 14.95, df = 1, p-value = .00, M(female) = 21.31, M(male) = 31.73
(3) Enhancement of situational interest scale from the Motivated Strategies questionnaire. Chi-squared = 6.07, df = 1, p-value = .07, M(female) = 15.71, M(male) = 17.40
(4) Performance-approach self-talk scale from the Motivated Strategies questionnaire. Chi-squared = 7.65, df = 1, p-value = .01, M(female) = 19.21, M(male) = 18.78.

In further analyses we did not use the amotivation scale, because the focus of this study is on the relationships between motives and MRSs, alongside other motivational elements, and the state of amotivation cannot be seen as a motive.

Motivational regulation strategies and motivational elements

Relations between motives, mood, self-efficacy and perceptions of instrumentality

To answer the first research question about the specific relationships between the four motivational elements, in the following we will describe the results of our correlational analysis of these elements (motives to learn, mood, general self-efficacy and perceptions of instrumentality). The motives to learn were again categorized as intrinsic and extrinsic motives. As shown in Table 2.7, most motivational elements were significantly correlated with each other.

Table 2.7
Correlations between the motivational elements (motives, mood, perceptions of instrumentality and self-efficacy).

	2	3	4	5	6	7	8	9
Intrinsic motives:								
1. To know	**.69****	**.70****	**.42****	**.16****	**-.25****	**.44****	**.49****	**.23****
2. To achieve		**.71****	**.36****	**.13****	**-.16****	**.37****	**.41****	**.37****
3. To self-develop			**.63****	**.32****	-.05	**.36****	**.45****	**.26****
Extrinsic motives:								
4. To self-respect				**.61****	**.23****	**.29****	**.39****	.10
5. Introjected					**.59****	**.11****	**.26****	.01
6. External						**-.12****	-.04	**-.15****
7. Mood							**.28****	**.26****
8. Perceptions of instrumentality								.17**
9. General self-efficacy								**-**

**p<.01

Although the correlations between mood, perceptions of instrumentality and general self-efficacy were relatively weak (between .17 and .28), those between motives to learn and the other three motivational elements were statistically significant in some instances. However, there was a difference between the group of intrinsic motives and the group of extrinsic motives. The group of *intrinsic motives* revealed a moderate correlation with mood (between .36 and .44), perceptions of instrumentality (between .41 and .49) and general self-efficacy (between .23 and .37). The relations between intrinsic motives and these motivational elements were all significant ($p < .01$). The group of *extrinsic motives* showed weaker but often still significant correlations with mood (between - .12 and .29) and perceptions of instrumentality (between .26 and .39; excluding the non-significant correlation of -.04 with the extrinsic external motive). External motives was the only motivational element to correlate significantly with general self-efficacy (-.15).

Hence, the analysis of motivational elements pointed to a difference between two groups of motives (extrinsic and intrinsic) in how they related to other motivational elements. As described below, further correlational analysis also revealed differences in MRSs that corresponded to the differences between extrinsic and intrinsic motives previously mentioned.

Relations between the motivational elements and MRSs

To answer the second research question about how the four motivational elements and MRSs are interrelated, in the next paragraphs we will describe the results of our correlational analysis and corresponding confirmatory factor analysis. As can be seen from Table 2.8, the analysis of correlations revealed that all MRSs had weak to moderate correlations with the motivational elements.

Almost all MRSs had weak but significant correlations with mood, perceptions of instrumentality and general self-efficacy (between -.03 and .32), except for the mastery self-talk and performance-approach self-talk MRSs which did not correlate significantly with perceptions of instrumentality (.43 and .36, respectively). The correlations between the MRSs and motives varied depending on the type of motive (intrinsic or extrinsic).

In most cases, the first three MRSs in Table 2.8 (enhancement of situational interest, enhancement of personal significance and mastery self-talk) had higher correlations with the group of intrinsic motives (between .25 and .54) than with the group of extrinsic motives (between -.02 and .34). Only for the relation between mastery self-talk and the extrinsic motive to self-respect the reverse was true (.50). We therefore coined this group 'intrinsic-motives MRSs.'

The next three MRSs in Table 2.8 (performance-approach self-talk, performance-avoidance self-task and self-consequating) had higher correlations with the group of extrinsic motives (between .19 and .61) than with the group of intrinsic motives (between .12 and .47). We therefore coined this group 'extrinsic-motives MRSs.'

The last two MRSs in Table 2.8 (proximal goal-setting and environmental control) correlated with both groups of motives in much the same way (between .00 and .36).

We also checked the differences between MRSs by calculating two models using structural equation modelling. The two model fits are presented in Table 2.9. In Model 1, we grouped the MRSs into three factors based on the previous results of our correlational analysis, the intrinsic and extrinsic motives each constituting one factor, and mood, perceptions of instrumentality and general self-efficacy combined representing the third factor. The first group of intrinsic-motives MRSs consisted of enhancement of situational interest, enhancement of personal significance, and mastery self-talk; the second group of extrinsic-motives MRSs consisted of performance-approach self-talk, performance-avoidance self-talk and self-consequating. And finally, the third group included the proximal goal-setting and environmental control MRSs.

Although Model 1 presented a moderate fit (see Table 2.9), it was hard to interpret because the latent variable covariance matrix (psi) was not positive definite, which could indicate a negative variance (Kline, 2011). The error could occur because two latent variables were very strongly correlated (almost 1.0).

More specifically, our analysis pointed to two latent variables, that is, the group of intrinsic-motives MRSs and the group of other MRSs which correlated .97, and to another two latent variables, the group of intrinsic motives and the group of mood, perceptions of instrumentality and general self-efficacy, which correlated .93 (see the first model of Figure 2.3). We therefore decided to calculate another model that grouped intrinsic-motives MRSs and other MRSs together to form one factor. As can be seen from Table 2.9 that presents the model fits and Figure 2.3, this new model (Model 2) had fit indices similar to those of Model 1, albeit with weaker between-factor correlations (between .12 and .43).

Table 2.8

Correlations between the motivational elements and motivational regulation strategies

	Motivational regulation strategies							
	Enhancement of situational interest	**Enhancement of personal significance**	**Mastery self-talk**	**Performance-approach self-talk**	**Performance-avoidance self-talk**	**Self-consequating**	**Proximal goal-setting**	**Environmental control**
Intrinsic motives								
To know	.25**	.27**	.52**	.35**	.16**	.19**	.27**	.36**
To achieve	.28**	.32**	.50**	.30**	.12**	.17**	.26**	.33**
To self-develop	.31**	.34**	.54**	.47**	.29**	.33**	.33**	.36**
Extrinsic motives								
To self-respect	.21**	.17**	.50**	.61**	.47**	.38**	.34**	.35**
Introjected	.12**	.09	.34**	.55**	.52**	.31**	.26**	.26**
External	.02	-.02	.04	.21**	.31**	.19**	.11**	.00
Mood	.24**	.15**	.28**	.23**	.05	.16**	.22**	.26**
Perceptions of instrumentality	.24**	.27**	.43**	.36**	.23**	.22**	.32**	.32**
General self-efficacy	.21**	.27**	.25**	.08	-.03	.04	.20**	.18**

**p<.01

Table 2.9

Results of structural equation modelling for motivational elements and motivational regulation strategies - model fit indices and information criteria

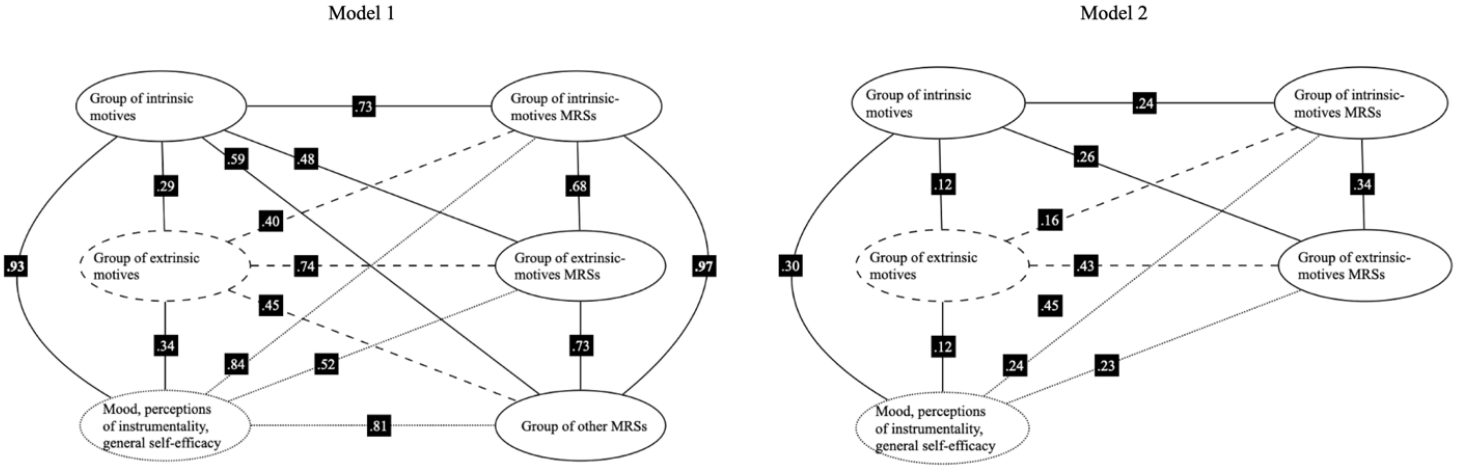
Model		x2(df)	AIC	BIC	CFI	TLI	RMSEA	90% CI RMSEA
Model 1*	1	1044.757 (104)	27169.117	27471.347	.820	.820	.112	.106 - .118
Model 2	1	1064.673 (109)	27179.033	27458.367	.817	.772	.110	.104 - .116

* error - the latent variable covariance matrix (psi) was not positive definite.

Model 1: f1= group of intrinsic-motives MRSs; f2 = group of extrinsic-motives MRSs; f3 = other MRSs; f4 = intrinsic motives; f5 = mood, perceptions of instrumentality, general self-efficacy; f6 = extrinsic motives.

Model 2: f1= group of intrinsic-motives MRSs and other MRSs; f2= group of extrinsic-motives MRSs; f3= intrinsic motives; f4 = extrinsic motives; f5= mood, perceptions of instrumentality, general self-efficacy.

Figure 2.3
Confirmatory factor analysis for Model 1 and 2: Factor correlations



Hence, the answer to our second research question of how the four motivational elements of motives, mood, perceptions of instrumentality and general self-efficacy and the MRSs are interrelated is that all MRSs can be divided into two groups: (1) intrinsic-motives MRSs, which had stronger relations with the group of intrinsic motives than with the group of extrinsic motives; and (2) extrinsic-motives MRSs, which showed the opposite relations, that is, weaker relations with the group of intrinsic motives than with the group of extrinsic motives. The intrinsic-motives MRSs focused on trying to master the skill, on changing self-talk to make it more interesting and to connect it with one's own sphere of interests, on setting proximal goals and on eliminating factors that can distract from learning. The extrinsic-motives MRSs focused on achieving good results and avoiding failures, as well as on rewarding oneself after completing the task.

DISCUSSION

The main goals of the present study were to investigate whether the motivational elements described in activity theory (Leont'ev, 1971/1978; Ivannikov, 1985a, 2015) are interrelated, and, as such, constitute a meta-framework, and whether the previously reported MRSs could be grouped according to their relations with particular motivational elements. Although all motivational elements and MRSs were found to correlate with each other, correlational patterns showed clear differences. We identified two groups of MRSs, specifically the MRSs that learners mostly used when they had intrinsic motives and those that they mostly used when they had extrinsic motives.

Concerning the first research question, we found that all motivational elements, specifically motives (measured by motives to learn), emotional states (measured by mood), goals that have personal meaning (measured by perceptions of instrumentality) and means combined with beliefs (measured by general self-efficacy), had positive and significant correlations with each other ranging from weak to strong. Indeed, previous studies have shown the importance of motives to learn (Guay & Bureau, 2018; Karlen et al., 2019), emotional states (Kahlke et al., 2020; Zhen, Liu, Ding, Wang, & Liu, 2017), perceptions of instrumentality (Mburayi & Wall, 2018) and self-efficacy (Herndon & Bembenutty, 2017; Uçar & Sungur, 2017) to students' motivation to learn and their academic performance. Our study, however, introduces the likelihood of a change in one element being accompanied by changes in other elements. It is therefore important to consider and treat the motivational elements as one unitary system, as was postulated by activity theory (Leont'ev, 1971/1978; Ivannikov, 1985a, 2015). We might obtain a more accurate picture of motivation if we include these elements in motivational profiles. Also, we assume that a focus on working with students' motives – the reasons why they are learning and the role of education in their life - could have a cumulative effect on their motivation.

The results also showed that extrinsic motives had much weaker correlations with

the other three motivational elements (emotional state, personal meaning/goals, and means/beliefs) than intrinsic motives had. Partly in line with our results, findings of Cheng and colleagues (2020) revealed that the size and type of someone's smile can serve as a strong nonverbal signal of intrinsic motivation. Furthermore, Vandercammen and colleagues (2014) found a positive relation between emotions and intrinsic motivation. In line with our study, Wu and colleagues (2020) found that self-efficacy had higher correlations with intrinsic motives than with extrinsic motives. Lee and Turner (2018) found that intrinsic motivation had a higher relation with endogenous instrumentality than extrinsic motivation had.

This might suggest that intrinsically motivated students have more control over motivational elements: if they self-regulate one of the elements, other elements will change along with it. Extrinsically motivated students, on the other hand, might have more difficulties self-regulating the motivational elements together as the relations between them are weaker. We also propose the hypothesis that intrinsic motives are more powerful than extrinsic motives in effecting changes in the other three motivational elements.

The above findings were also relevant to our second research question, which connected the motivational elements to the MRSs that students used to regulate the motivational elements. We found that the eight MRSs reported in the literature showed strong correlations with motives, but much weaker correlations (two to three times as weak) with the other three motivational elements (i.e. emotional state, personal meaning/goals, means/beliefs). The finding that the MRSs had stronger correlations with motives than with the other three motivational elements is partly inconsistent with other studies demonstrating that goal orientation (coined 'motives' in activity theory - the reason why one chooses to study) had weak to strong correlations with several MRSs (Wolters & Rosenthal, 2000; Wolters & Benzon, 2013).

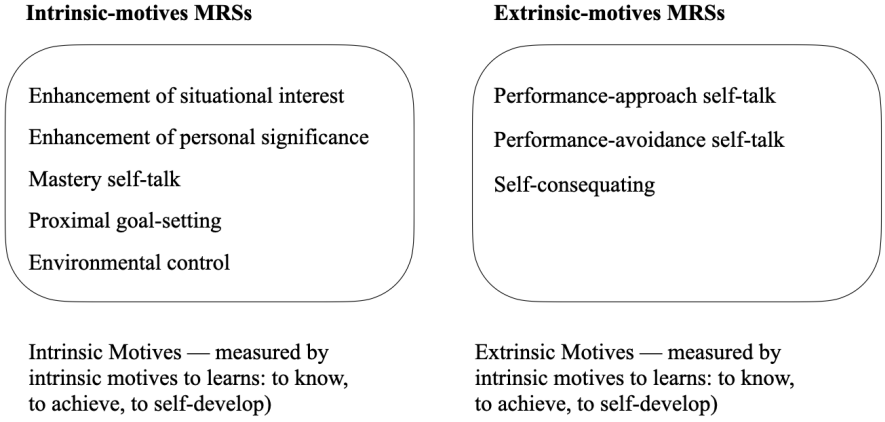
This finding suggests that the MRSs studied could be more effective when students' motivation is disrupted by their motives, which is the case when learning no longer satisfies their perceived needs. When motivation is disrupted by one or more of the other three motivational elements, however, known MRSs are probably less effective in restoring motivation. For example, when a student feels that s/he does not have the resources to perform an educational task, experiences anxiety or does not have a clear goal, known MRSs might not work. An important line for future research and the further development of SRL models would therefore be to identify new MRSs that specifically aim to restore motivational elements other than motives, such as emotions, personal meaning, goals, means and beliefs.

Our main findings concerning the relations between MRSs and motives also showed that MRSs can be divided into two groups (see Figure 2.4).

The first group, which we coined 'intrinsic-motives MRSs', included MRSs that specifically targeted intrinsic motives. These MRSs aim to enhance situational and personal interest, enlarge one's own competence and master challenging tasks, set proximal goals to achieve the end goal, and control the environment for more attentive

and productive study. The second group, referred to as 'extrinsic-motives MRSs', included MRSs that mainly targeted extrinsic motives. These MRSs emphasise the importance of achieving good results or avoiding poor results, and of thinking about pleasant rewards the learner receives once the study task is completed. These results tie in nicely with a study by Wolters (1998), who also classified intrinsic and extrinsic MRSs based on an analysis of students' open-ended responses. In a similar vein, our results overlap with those of earlier studies into the relations between MRSs and goal orientations, which investigated students' reasons for starting or continuing/discontinuing a task (cf. motives in activity theory). The mastery goal orientations in these studies could be considered similar to our intrinsic motives as they both mean that students want to improve their abilities, increase their understanding or master the materials they study. Likewise, the performance goal orientations in these studies show similarities with our extrinsic motives as they both mean that students' aim is to obtain high grades, extrinsic rewards or approval from others. As in our study, their results revealed that extrinsic-group MRSs had stronger relations with performance goal orientations than with mastery goal orientations, whereas the reverse was true for intrinsic-group MRSs (Schwinger et al., 2007; Wolters & Rosenthal, 2000; Wolters & Benzon, 2013).

Figure 2.4
The two groups of MRSs and corresponding motives



The distinction between intrinsic-motives and extrinsic-motives MRSs is potentially an important key to understanding how to help students change their motives orientation, thereby improving their motivation. We therefore invite future experimental researchers to identify causal relationships between the use of particular MRSs and changes in motivational elements. It may be the case that interventions to affect the use of particular MRSs contribute to a shift in motives from extrinsic to intrinsic, or vice versa. If this is

true, teaching students intrinsic-group MRSs could help them become more intrinsically motivated. For example, the students who emerged as 'extrinsically motivated' from our study could visit several workshops about intrinsic-group MRSs where they can practise the use of these MRSs with a gradual decline in scaffolding from the trainer. By comparing the experimental group with the control group in terms of their motivational elements and the MRSs used before and after such intervention, we might learn more about whether the intrinsic-group MRSs could change students' motives. Similarly, students' motives may affect what type of MRSs they use. If so, the type of MRSs that students use may inform teachers about their motivational orientation.

The found weaker relations between MRSs and the other three motivational elements different from motives (i.e. emotional state, personal meaning/goals, means/beliefs) are partly inconsistent with other studies. With respect to means/beliefs or self-efficacy our results do tie in with other studies which showed the same weak relations with MRSs (Wolters & Rosenthal, 2000; Wolters & Benzon, 2013). Close to our results are the findings reported by Fritea and Fritea (2013), who also revealed low correlations with emotional state measured by boredom and MRSs (Fritea & Fritea, 2013). Studies reporting relations of MRSs with instrumentality were not found.

The reported study has several limitations. First, our operationalisation of the activity-theory-inspired theoretical model in terms of motives, mood, perceptions of instrumentality and general self-efficacy using existing questionnaires may not have done full justice to the original theory. Additionally, we only measured a subset of all theoretically postulated beliefs (Element 6) in our study. Adjusted operationalisations of the motivational elements could lead to more accurate measurements of motivation. Secondly, our analysis only focused on the first two levels of the macrostructure of activity, that is, motive formation and planning, excluding the level of performance. We therefore welcome future studies that measure students' actual performance alongside their motivational elements to test the whole macrostructure of activity theory. Thirdly, since four items from the original Perceptions of Instrumentality Scale showed low reliability, low standardised coefficients and a poor model fit, we had to omit several items and unite two scales into one. Future studies should use a better instrument to measure perceptions of instrumentality. Finally, the specificity of the sample imposes restrictions to the generalizability of our findings, as it included only science and arts students from two universities across four different programs in Moscow, Russia, and most of the participants were females. The gender affect is not considerable: the Kruskal-Wallis test revealed a significant difference for only 4 from the 19 scales and the direction of this difference was not consistent.

A critical feature of our work is that we conceptualised motivation as a mental *process* that consists of several interrelated elements students can at least partially control. This suggests that there could be many roads to restoring one's own motivation. For instance, students could find a new personal meaning in learning activities, formulate

new, personally significant goals, find and master alternative means (material, physical, intellectual, etc.) to achieve these goals, and form the belief that they are able to accomplish the task. Hence, by developing the heuristics or rules of thumb necessary to analyse their motivational elements, allowing them to select suitable MRSs that strengthen weakened elements, students could be able to regulate their motivation. Not only students, but also teachers, student advisers and training programme developers could use these rules of thumb to help students regulate their motivation. The said heuristics should include checking on motivational elements - motives, emotional state, personal meaning, goals, means and beliefs - and should suggest concrete things to do when one or more of these elements are absent or weakened. Relevant questions for students to ask include: Where should you start when an impulse to action declines? How can you determine the cause of this decline? How can you select a strategy to counteract the decline? Miele and Scholer (2018) described a meta-model of motivational regulation that is fully in line with our suggested approach because it postulates that 'motivational monitoring' is a crucial aspect of motivational regulation.

The rules of thumb used to analyse motivation and choose appropriate MRSs should differ in accordance with students' motives orientation (intrinsic vs extrinsic). This is because in students who were intrinsically motivated a change in one of the motivational elements could more easily lead to corresponding changes in other elements. This was not the case for extrinsically motivated students, as the relations between their motivational elements were weaker. As stated, students should consider different MRSs depending on their respective motives' orientations, with extrinsically motivated students potentially needing several other MRSs to work on different motivational elements. Teachers should be aware that they possibly can help intrinsically motivated students by focusing on only *one* of the motivational elements (as other elements will be enhanced correspondingly). In order to help extrinsically motivated students, working with *different* motivational elements at the same time is probably needed.

To conclude, our findings show that motivational elements (motives, emotional state, personal meaning and goals, means and beliefs) are interrelated and can be targeted by MRSs. Based on their relation to motives, known MRSs can be grouped into intrinsic-motives strategies and extrinsic-motives strategies. In particular, three MRSs which target interest, personal significance, mastery orientation, goal-setting, and environmental control had stronger relations with intrinsic motives to know, to achieve, and to self-develop. The other three MRSs target performance-approach/performance-avoidance orientation, and self-consequating, and they have stronger relations with extrinsic motives to self-respect, introjected motives, and external motives. If we seek to expand the list of MRSs, identify new strategies for each of the motivational elements, and create self-regulation recommendations and rules of thumb for students with different motives orientations, we will be better able to scaffold students' self-regulation of their motivation to learn.

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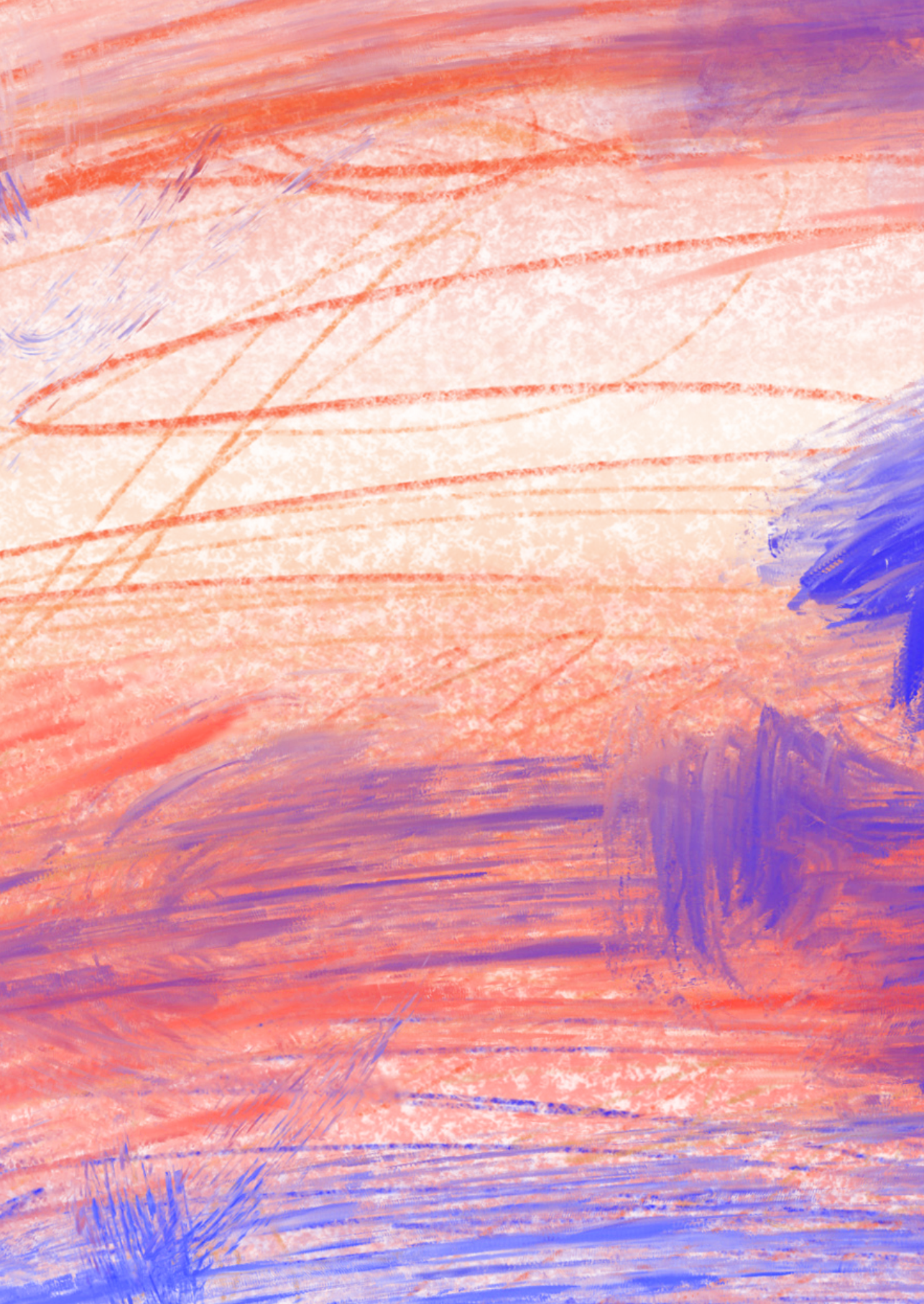


CHAPTER 3

The role of heterogeneous motives in motivational self-regulation

This chapter has been submitted as Ilishkina, D., De Bruin, A., Donkers, J., Podolskiy, A. Volk, M., & Van Merriënboer, J. (submitted). The role of heterogeneous motives in motivational self-regulation.

ABSTRACT

Motivational regulation strategies (MRSs) help students improve their motivation. Yet, it is unknown whether students' choice of MRSs relate to their motive orientation. Drawing from activity theory, we performed latent profile analyses of higher education students' (*N* = 1039) motivational elements, revealing four motivational profiles: a controlled-homogeneous, controlled-heterogeneous, autonomous-heterogeneous and autonomous-homogeneous profile. Profiles differed according to their level of motives'autonomy as well as the dominance of one type (homogeneous) or different types (heterogeneous) of motives. As students' motives became more heterogeneous, all MRSs were used more frequently and more MRSs were included in the set of strategies most frequently used. Students with heterogeneous profiles preferred to use 3 to 4 MRSs most frequently, while students with homogeneous profiles preferred to use only 1 or 2. The best profiles with autonomous- heterogeneous motives focused on creating meaning for learning by connecting it with own future, emphasizing importance of mastery and achievement. We propose that heterogeneous motives and considering personal meaning for learning from different perspectives are beneficial for self-regulating motivation.

Keywords
Motivational regulation strategies, autonomous-controlled motivation, personal meaning, self-efficacy, mood

INTRODUCTION

Students live in a world of numerous events and activities that compete for their attention, effort and time. Studying is one of these activities. While some students experience learning mostly as a harmonious flow, others are fighting distractors such as checking social media or lack confidence in their abilities. In other words, students are constantly facing motivational problems that they must solve along with their academic tasks (Engelschalk et al., 2016; Miele & Scholer, 2018). For this reason, self-regulation of motivation has become an important topic of study and an integral part of self-regulated learning models (Panadero, 2017).

Previous studies that aimed to help students self-regulate their motivation have identified specific strategies, coined 'motivational regulation strategies' (MRSs), that students wield to improve their motivation to learn (Schwinger & Otterpohl, 2017; Schwinger et al., 2009; Wolters, 1998, 2003; Wolters & Benzon, 2013). Examples of such MRSs are to ask oneself why the assignment is important to one's life or career or to organise the environment in such a way that it is more suitable for studying. In this original presentation, however, the MRSs described specific behaviours rather than targeted aspects of student motivation (Miele & Scholer, 2018). Research on the relation between MRSs and motivation is further complicated by the fact that the concept of motivation remains nebulous. As could be seen in Hattie et al. review of motivational studies (2020), motivation is not a single reason to act or desire to achieve a particular result, but it refers to a variety of motivational elements as described in different theories. Nevertheless, empirical research often focuses on only *one* of the motivational elements, ignoring the others, which could lead to a misrepresentation of motivational processes.

We have sought to address this gap in our previous study, by exploring the relationship between students' sets of motivational elements and their uptake of MRSs as suggested by Leont'ev's Activity theory (1971/1978) — the framework that allows to unite different perspectives on motivation (Ilishkina et al., 2022). We found that the MRSs have the strongest relation with the motivational element "motive" and could be categorised into two groups: (1) strategies that learners mostly use when they have intrinsic motives, and (2) strategies they mostly use when they have extrinsic motives. These findings suggested that the types of MRSs that students choose to wield differ in accordance with their motive orientation.

New questions have arisen, however, as recent studies have suggested that students can have *motivational profiles* that contain both intrinsic *and* extrinsic motives in varying proportions (Gillet et al., 2017; Litalien et al., 2019; Zhang & Lin, 2019). By these 'motivational profiles' we mean groups of students that have similar levels of variables. More specifically, in one such group or profile a certain type of motive, either extrinsic or intrinsic, could dominate, making it a homogeneous profile. In another group of students, both intrinsic and extrinsic motives could dominate, so that they

have a heterogeneous motivational profile. To complicate matters even more, other motivational elements beyond students' motives, such as their mood, self-efficacy and perceptions of instrumentality, (Ilishkina et al., 2022; Wolters & Benzon, 2013) might also play a role in shaping students' motivational profiles, as we will describe below.

Such a differentiated take on motivation begs the question of how we can help *all* students, regardless of their diverse motivational profiles, make their learning process harmonious. As previously stated, the diversity in types and weights of motivational elements could point to considering motivation as a system that could be presented in different motivational profiles. This means that students with a certain motivational profile might use different MRSs than those with another type of motivational profile. Our research aimed to understand how students with different motivational profiles, consisting of either homogeneous or heterogeneous motives and other motivational elements, differ in their uptake of MRSs. To understand what motivation is and how MRSs are related to it, we will first describe motivation from the perspective of activity theory (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978).

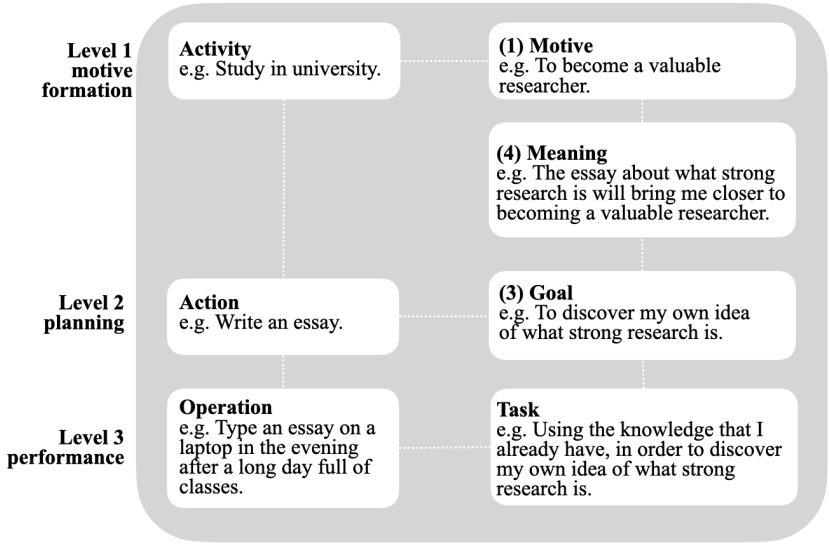
Motivation as a process

Activity theory provides the possibility to unite different kinds of motivational elements and the theories behind them. It presents motivation as a *process* whereby motivational elements interact in order to transfer an impulse from motives to operations, to be performed under given conditions (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978). As depicted in Figure 3.1, this process spans three levels, namely motive formation, planning and performance.

The first step (Level 1) in process of motivation is to form a motive (Element 1) which happens when the learner finds an object that can satisfy an existing need. Since needs are inert without objects, the study of learners' needs is only possible by studying their motives. In this process of motive formation, emotional states (Element 2) signal that the objects could satisfy a need, they attract one's attention to these objects. Moreover, emotional states are wider than only emotions; they also include subjective experiences, moods and affects.

At this point, it is important to realise that learners can have different motives — meaning-making motives or stimulus-constructing motives (Leont'ev, 1971/1978). Although the titles are different, this classification is similar to "autonomous intrinsic motivation" and "controlled extrinsic motivation" proposed in self-determination theory (Leontiev, 2016; Ryan & Deci, 2020). The meaning-making motives indicate that students value the activity for personal reasons and feel a natural connection with it, they choose activity autonomously. In contrast, the stimulus-constructing motives indicate that student choice is under external control — rewards, absence of punishment, shame, guilt, and others. Even though the motives are essential for the motivation, from the Activity theory perspective, there are other motivational elements.

Figure 3.1
Macrostructure of activity and motivational elements involved in the process of impulse construction



* (2) Emotional states (boring, good mood, excited), (5) Means (e.g. laptop, knowledge, energy), and (6) Beliefs (e.g. belief that I can do it) are not in the Figure as they permeate the entire system.

Note. Dotted lines mean: corresponds with; solid boxes mean: elements that do not contain an impulse.

As soon as a motive has been formed, the creation of impulse moves to the second level: planning (Level 2). On this level, the learner starts to plan goals (Element 3) and actions to achieve these goals. In order to get the impulse from the motive, the goals must be personally meaningful (Element 4). This is the case, for instance, when a student attentively reads a statistics textbook as he/she understands that acquiring basic statistical notions is one of the steps in the long road to becoming a researcher. Conversely, a goal does *not* have meaning if the student prefers not to read the textbook or reads it only superficially because he/she does not understand how this will help him/her to become a good researcher.

Once the learner has set meaningful goals and has planned actions, it is time to perform operations and actually start doing something (Level 3). That is to say, the learner executes the goals and actions in the real environment with its specific conditions. Motive, emotional state, meaning and goal are vital to the process of building an impulse for action and its corresponding operations. In order to move from the planning level to the performance level and actually start performing operations, the learner must overcome a subjective threshold (the dashed arrow from task to operation; Ivannikov, 1985a, 2015).

Depending on the situation, however, additional elements – means (Element 5) and beliefs (Element 6) – could interfere with the process of impulse construction (Ivannikov, 1985b, 2016). When planning actions and performing operations, learners need a means

to achieve their goal, such as tools, knowledge, skills and physical functionality. Absence of such means could decrease or even disrupt the impulse. Likewise, students' beliefs about oneself, the activity that is undertaken and the situation could negatively affect the process of impulse formation. For example, they may lack confidence in their ability to use the means, in the probability of success or in the functionality of the means. Means and beliefs are just two of the possible additional motivational elements involved in the process of motivation.

Willpower: using MRSs to strengthen motivational elements

In situations where one or more motivational elements are missing or frustrated, the learner can restore the process of constructing an impulse for action and its corresponding operations by willpower (Ivannikov, 1985b, 2016; Ivannikov & Monroz, 2014). Willpower is the name for a variety of methods students wield to help themselves perform operations. Some scholars have made a distinction between motivational and volitional strategies that students use to build up and maintain their motivation. Other authors, however, have argued that such a division is unnecessary and have proposed to use the general term 'MRSs' instead as these strategies combine both meanings and are aimed to help students to learn (Wolters, 1998). That is, MRSs should help students to start learning, for instance when they are tempted to watch TV instead, or to return to their study activities after quitting them because they were bored or distracted by other notifications. We argue that Ivannikov's concept of willpower can be equated with Wolter's concept of MRSs, because they both relate to strategies students wield to start performing learning operations and finish them. We will hereinafter use the term MRSs as in Wolters' classification (2003) to denote a broad array of different strategies that students use to improve their motivation, including motivational and volitional strategies as different manifestations of willpower.

Overall, the goal of this study was to explore whether and how students with different motivational profiles, that is, with different constellations of motives and other motivational elements, differ in their use of MRSs. As motivation is a process that involves several elements, including students' motives, emotional states, attributed meanings, goals, means and beliefs, students could use MRSs to restore any of these motivational elements that have become frustrated. Activity theory suggests that a variety of motives can drive students to undertake learning activities, and the empirical studies previously referred to have demonstrated that these drivers can be a single type or various types of motives (homogeneous vs. heterogeneous motives). Consequently, we might assume that these different constellations of motives and other motivational elements equally yield a variety of motivational profiles. In sum, students with different motivational profiles could differ in their MRS preferences.

The present study

We performed a longitudinal study with the aim to explore whether and how students with either homogeneous or heterogeneous motives differ in their uptake of MRSs. We hypothesised that students with heterogeneous motives would use a greater variety of MRSs than students with more homogeneous motives. The main research question was: How do students with either homogeneous or heterogeneous motives differ in their uptake of MRSs? In addition, we explored how the other motivational elements (emotional state, meaning, and means combined with beliefs) affected the use of MRSs. To measure the MRSs students used, and thereby the overarching concept of 'willpower', as well as their motives and other motivational elements that together would make up a variety of motivational profiles, we used the following five questionnaires:

1) a questionnaire on *motives to learn* to measure motives (Element 1);
2) a questionnaire on *mood* to measure students' overall emotional state (Element 2) when performing different learning operations during a course (Barkanova, 2009);
3) a questionnaire on *perceptions of instrumentality* to measure 'goal' (Element 3) and 'personal meaning' (Element 4), because perceptions of instrumentality are an individual's understanding of the instrumental value an activity has (Is this a meaningful action to reach my goal?; Husman et al., 2004); and
4) a questionnaire on *general self-efficacy* to measure 'means' (Element 5) and 'beliefs' (Element 6), because general self-efficacy has been defined as the belief in one's ability to perform the activity (Bandura, 1977). We used it because it closely corresponds to means (Element 5) and four of Ivannikov's (1985a, 2015) types of beliefs (Element 6) in: (1) the ability to use own means, (2) the probability of success, (3) the functionality of the means, and (4) one's own state of health and functionality; and
5) a questionnaire on students' use of MRSs.

Consequently, in order to answer the main research question, we addressed the following two sub questions:

1. What motivational profiles can be identified based on the different constellations of students' motives and the other three motivational elements, that is, mood, perceptions of instrumentality and general self-efficacy?
2. How do students with different motivational profiles differ with respect to the MRSs they prefer?

METHOD

Participants

Participants were students from two Russian universities (N = 1039; 799 female, age: M = 19.25, SD = 1.67). Most of the students (N = 953) were from former countries of the Commonwealth of Independent States; the remainder (N = 86) came from other countries. Table 3.1 presents the numbers of students according to their year of study and study programme, including their mean age.

Table 3.1
Numbers of students according to year of study and study programme

	***N* students (female)**	**Mean age (*SD*)**
	Year of study	
First-year students	691 (527)	18.90 (1.68)
Second-year students	281 (213)	19.77 (1.46)
Third-year students	67 (60)	20.64 (1.05)
	Study program	
Medicine	440 (317)	19.25 (1.90)
Psychology	146 (108)	20.19 (1.45)
Linguistics	228 (197)	18.88 (1.28)
Journalism	225 (177)	19.00 (1.44)
Total *N* students	1039 (799)	19.25 (1.67)

Students completed the set of five questionnaires three times: at the beginning, halfway and at the end of the semester (yielding 716, 522 and 559 responses, respectively). A total of 229 students participated in all three occasions, 342 students participated in the first two occasions, 229 students participated in Occasions 2 and 3, and 347 students participated in Occasions 1 and 3.

Measures

We used existing and validated paper-based questionnaires to measure the variables from our theoretical model - students' motivational elements and their use of MRSs. Table 3.2 gives an overview of the five measurement instruments used and their linkages to the theoretical and operational models.

Table 3.2
Operationalisation of students' motivational elements and their use of MRSs (willpower)

Operational model	Measures
Six motives to learn and amotivation as the absence of motives	Academic Motivation Scale questionnaire (Gordeeva et al., 2014)
Mood	The Mood subscale from the Health, Activity and Mood questionnaire (Barkanova, 2009)
Perceptions of instrumentality	Perceptions of Instrumentality Scale (Husman et al., 2004)
General self-efficacy	General Self-Efficacy scale (Shvartser et al., 1996)
Motivational regulation strategies	Motivated Strategies questionnaire (Schwinger et al., 2009)

Motives to learn

To measure and analyse students' motives to learn, we used Gordeeva, Sychev, and Osin's (2014) Academic Motivation Scale questionnaire (an improved version of Vallerand et al.'s classification of motives to learn, 1992). The questionnaire contains 28 items that are divided over seven scales (4 items per scale). Three of these scales measure students' intrinsic motives to: (1) know (e.g. 'I like to study'), (2) achieve (e.g. 'I like to solve difficult problems and invest intellectual effort'), and (3) self-develop (e.g. 'I like to know how to increase my competence and knowledge'). Three other scales measure students' extrinsic motives: to (4) self-respect (e.g. 'To prove to myself that I am a smart person'), as well as (5) introjected (e.g. 'Because it is embarrassing to do poorly in studying') and (6) external motives (e.g. 'I have no other choice, as they will check my attendance'). The final scale measures students' (7) amotivation (e.g. 'Before, I knew why I was studying, but now I am not sure whether to continue'). As in the modified version, all items were rated on a 5-point Likert scale (1 = does not apply at all; 5 = applies completely).

Mood

To measure students' mood, we used the Mood subscale from the Health, Activity and Mood questionnaire (Barkanova, 2009). Spanning 10 items, this subscale describes ten different feelings the intensity of which is to be scored on a 7-point scale ranging from minus 3 to plus 3, with 0 being the neutral score (e.g. 'cheerful 3 / 2 / 1 / 0 / 1 / 2 / 3 sad'). Positive feelings are always on the left side, while negative feelings are presented on the right.

Perceptions of instrumentality

To measure students' perceptions of instrumentality**,** we used the Russian 8-item version of the Perceptions of Instrumentality Scale (Husman et al., 2004). This scale consists of two subscales: (1) endogenous instrumentality (4 items; e.g. 'What I learn in the course selected above will be important for my future occupational success'), and (2) exogenous instrumentality (4 items; e.g. 'I must pass the course selected above in order to reach my academic goals.'). All items were rated on a 5-point Likert scale (1 = fully disagree; 5 =

fully agree).

General self-efficacy

To measure students' general self-efficacy, we used the Russian version of the General Self-Efficacy (GSE) scale (Shvartser et al., 1996). This scale comprises 10 items (e.g. 'I can always manage to solve difficult problems if I try hard enough') that were rated on a 4-point Likert scale (1 = fully incorrect; 4 = fully correct).

Motivational regulation strategies

To measure students' uptake of MRSs, we used the Russian version of Schwinger et al.'s Motivated Strategies questionnaire (2009). This 30-item questionnaire comprises the following eight scales: (1) enhancement of situational interest (5 items; e.g. 'I make learning more pleasant for myself by trying to arrange it playfully'), (2) enhancement of personal significance (3 items; e.g. 'I look for connections between the tasks and my life as such'), (3) mastery self-talk (4 items; e.g. 'I persuade myself to work intensely for the sake of learning'), (4) performance-approach self-talk (5 items; e.g. 'I attempt to call myself to intense work by focusing on obtaining good grades'), (5) performance-avoidance self-talk (3 items; e.g. 'I tell myself that I have to push myself more if I do not want to make a fool of myself'), (6) proximal goal-setting (3 items; e.g. 'I break down the workload into small segments so I get the feeling that I can handle it more easily'), (7) self-consequating (4 items; e.g. 'I tell myself that after work I can do something nice, if I first keep on learning now'), and (8) environmental control (3 items; e.g. 'I consciously choose such learning times when I can concentrate especially well'). All items were rated on a 5-point Likert scale (1 = used rarely; 5 = used very often).

Procedure

As stated before, participants filled in the five questionnaires three times: just before the start (Occasion 1), halfway (Occasion 2) and at the end (Occasion 3) of the semester. On Occasion 1, we asked students about their motivation to learn, including their use of MRSs, and the extent to which they believed the course they were attending at the moment of the survey was related to their future. On Occasions 2 and 3, we again asked students about their motivation to learn, including their use of MRSs during the course they had enrolled in following Occasion 1. The researchers distributed and collected the questionnaires before the start of the lectures and instructed the students to carefully read the information written on the form and to complete all questionnaires individually. To control for order effects, we ordered the existing set of questionnaires in five different ways, using a Latin square approach. Students needed about 20 minutes to complete the entire survey. All students participated voluntarily and received additional credits for the course they were attending as a reward for their participation. Their teachers and their faculty's deans granted approval for their participation.

Data analysis

We performed Latent Profile Analysis (LPA) of the motivational elements (motives, mood, perceptions of instrumentality, general self-efficacy) (Venables et al., 2020), using R package MCLUST (Scrucca et al., 2016). To strengthen the credibility of our results, we constructed the profiles based on the three occasions simultaneously (triangulation of sources). Missing items were imputed by taking the mean value for the non-missing items of that variable for the respective student. To determine the optimal number of profiles in the data, we considered the Integrated Complete-data Likelihood (ICL) and the Bayesian Information Criterion (BIC) (Bertoletti et al., 2015; Nylund et al., 2007). Finally, we performed the Wilcoxon test to scrutinise differences across profiles.

RESULTS

Table 3.3 presents the goodness-of-fit results, showing that the factor models of all questionnaires, except for the Perceptions of Instrumentality scale, were acceptable on all three occasions - the Comparative Fit Indices (CFIs; Bentler, 1990) and the Tucker-Lewis Indices (TLIs; Tucker & Lewis, 1973) were around .90. The Root Mean Square Errors of Approximation (RMSEAs; Steiger & Lind, 1980) were around .07, except for the Perceptions of Instrumentality Scale (RMSEA = .04). Table 3.4 shows that Cronbach's alphas and McDonald's Omegas were adequate for all questionnaires on all three occasions. Moreover, Table 3.5 tells us that items 3-5 and 8 of the Perceptions of Instrumentality scale had small standardised coefficients. After we tested the model without these items, the fit resulted acceptable across all three occasions (see Table 3.3) We therefore excluded these items from further analysis.In order to answer the main research question (How do students with different motivational profiles, representing the various constellations of their motives [homogeneous and heterogeneous] and other motivational elements, differ in their uptake of MRSs?), we first checked if different motivational profiles indeed existed across all three occasions and then analysed the differences in MRS uptake across these profiles.

Table 3.3
Goodness-of-fit statistics for the estimated models of all questionnaires

Model	Occasion	x2(df)	AIC	BIC	CFI	TLI	RMSEA	90% CI RMSEA
Academic Motivation Scales questionnaire (AMSQ)								
All items	1	1194.598 (105)	52059.526	52539.762	. 913	.900	.061	.057 - .064
All items	2	975.945 (329)	36473.913	36920.766	.924	.912	.061	.057 - .066
All items	3	1122.624 (329)	39356.667	39810.912	.911	.898	.066	.061 - .070
Health, Activity, and Mood (HAM) questionnaire								
All items	1	298.864 (35)	19777.893	19912.202	.920	.897	.108	.097 - .119
All items	2	178.013 (35)	13843.628	13968.400	.950	.936	.093	.080 - .107
All items	3	249.701 (35)	14851.191	14978.574	.943	.927	.109	.097 - .122
Perceptions of Instrumentality (PI) Scale								
Without items 3,4,5,8	1	3.841 (2)	6682.435	6737.319	.998	.993	.036	.000 - .090
Without items 3,4,5,8	2	5.888 (2)	4829.846	4880.891	.995	.984	.061	.000 - .121
Without items 3,4,5,8	3	12.908 (2)	5194.819	5246.733	.986	.957	.099	.052 - .153
General Self-Efficacy (GSE) scale								
All items	1	169.686 (35)	14567.484	14704.736	.926	.905	.073	.062 - .084
All items	2	225.937 (35)	10337.540	10465.097	.899	.871	.103	.090 - .115
All items	3	189.477 (35)	10897.080	11026.811	.921	.899	.089	.077 - .102
Motivated Strategies questionnaire (MSQ)								
All items	1	1355.263 (377)	62247.409	62787.268	.894	.878	.060	.057 - .064
All items	2	1124.906 (377)	42082.735	42585.140	.890	.873	.062	.058 - .066
All items	3	1447.369 (377)	44780.596	45291.082	.870	.850	.071	.067 - .075

Table 3.4
Cronbach's alpha and McDonald's omega values for all questionnaires

Scales	Items	Occasion 1		Occasion 2		Occasion 3	
		Cronbach's alpha	McDonald's omega	Cronbach's alpha	McDonald's omega	Cronbach's alpha	McDonald's omega
Academic Motivation Scales questionnaire (AMSQ)							
To know	1, 8, 15, 22	.837	.839	855	.858	.858	.858
To achieve	2, 9, 16, 23	.854	.855	.883	.883	.847	.848
To self-develop	3, 10, 17, 24	.820	.822	.850	.850	.846	.847
To self-respect	4, 11, 18, 25	.851	.854	.852	.855	.866	.869
Introjected	5, 12, 19, 26	.759	.763	.727	.733	.721	.729
External	6, 13, 20, 27	.696	.701	.729	.737	.783	.786
Amotivation	7, 14, 21, 28	.829	.831	.891	.892	.877	.878
Health, Activity, and Mood (HAM) questionnaire							
Mood	1, 2, 3, 4, 5, 6, 8, 9 10	.913	.916	.928	.931	.945	.947
Perceptions of Instrumentality (PI) Scale							
Perceptions of instrumentality	1, 2, 6, 7	.763	.782	.821	.826	.810	.816
General Self-Efficacy (GSE) scale							
General self-efficacy	1, 2, 3, 4, 5, 6, 8, 9 10	.836	.838	.876	.877	.879	.881
Motivated Strategies questionnaire (MSQ)							
Enhancement of situational interest	7, 12, 14, 22, 28	.839	.841	.843	.843	.841	.843
Enhancement of personal significance	6, 15, 23	.586	.610	.645	.665	.656	.672
Mastery self-talk	10, 17, 21, 30	.719	.724	.705	.710	.719	.723
Performance-approach self-talk	1, 8, 16, 26, 29	.861	.863	.858	.859	.856	.859
Performance-avoidance self-talk	4, 5, 25	.736	.746	.750	.758	.750	.770
Proximal goal-setting	13, 20, 27	.853	.854	.802	.804	.838	.838
Self-consequating	2, 9, 19, 24	.844	.848	.851	.855	.872	.875
Environmental control	3, 11, 18	.689	.700	.770	.778	.746	.749

Table 3.5
Standardized coefficients for items from confirmatory factor analysis

Scales	Items	Standardized coefficients		
		Occasion 1	Occasion 2	Occasion 3
Academic Motivation Scales questionnaire (AMSQ)				
Motive to know	1	.846	.839	.857
	8	.845	.838	.850
	15	.752	.773	.821
	22	.817	.870	.801
Motive to achieve	2	.835	.871	.839
	9	.785	.831	.738
	16	.804	.789	.819
	23	.835	.911	.821
Motive to self-develop	3	.708	.763	.773
	10	.782	.828	.799
	17	.802	.828	.836
	24	.805	.823	.818
Motive to self-respect	4	.798	.822	.843
	11	.805	.808	.763
	18	.770	.755	.824
	25	.870	.875	.866
Introjected motive	5	.701	.705	.678
	12	.675	.645	.565
	19	.753	.684	.772
	26	.718	.682	.672
External motive	6	.656	.780	.791
	13	.713	.751	.768
	20	.733	.681	.757
	27	.559	.558	.605
Amotivation	7	.862	.900	.854
	14	.812	.910	.873
	21	.850	.883	.898
	28	.788	.808	.848
Health, Activity, and Mood (HAM) questionnaire				
Mood	1	.784	.832	.863
	2	.808	.876	.894
	3	.797	.841	.863
	4	.837	.856	.887
	5	.734	.755	.826
	6	.843	.879	.901
	7	.315	.357	.436
	8	.716	.786	.795
	9	.672	.697	.745
	10	.760	.780	.831

Table 3.5 *Continued.*

Scales	Items	Standardized coefficients		
		Occasion 1	Occasion 2	Occasion 3
Perceptions of Instrumentality (PI) Scale				
Perceptions of instrumentality	1	.630	.788	.720
	2	.763	.838	.812
	3	.102	.083	.007
	4	.333	.364	.383
	5	.166	.238	.173
	6	.784	.848	.783
	7	.548	.687	.603
	8	.437	.448	.414
General Self-Efficacy (GSE) scale				
General self-efficacy	2	.669	.737	.736
	3	.491	.606	.521
	4	.589	.705	.645
	5	.707	.776	.653
	6	.683	.750	.631
	7	.727	.724	.658
	8	.606	.714	.649
	9	.649	.748	.656
	10	.677	.711	.670
Motivated Strategies questionnaire (MSQ)				
Enhancement of situational interest	7	.790	.777	.731
	12	.835	.781	.727
	14	.776	.765	.825
	22	.737	.786	.785
	28	.828	.831	.849
Enhancement of personal significance	6	.623	.676	.737
	15	.478	.586	.549
	23	.770	.774	.780
Mastery self-talk	10	.667	.729	.728
	17	.697	.702	.695
	21	.711	.651	.683
	30	.646	.610	.637
Performance-approach self-talk	1	.677	.734	.709
	8	.812	.816	.833
	16	.831	.777	.849
	26	.849	.812	.771
	29	.773	.777	.738
Performance-avoidance self-talk	4	.570	.603	.619
	5	.775	.808	.859
	25	.915	.882	.835
Proximal goal-setting	13	.779	.710	.771
	20	.880	.842	.843
	27	.871	.823	.869
Self-consequating	2	.819	.784	.841
	9	.840	.867	.886
	19	.816	.833	.814
	24	.768	.754	.805

Table 3.5 *Continued.*

Scales	Items	Standardized coefficients		
		Occasion 1	Occasion 2	Occasion 3
Environmental control	3	.667	.773	.760
	11	.683	.670	.773
	18	.770	.875	.723

Motivational profiles

In order to answer the first sub question (What motivational profiles can be identified based on the different constellations of students' motives and the other three motivational elements, that is, mood, perceptions of instrumentality and general self-efficacy?), we used LPA as a person-centred statistical technique on all three occasions simultaneously. Table 3.6 provides BIC and ICL values for different class solutions.

Table 3.6
Latent profile analysis fit statistics

N Classes	BIC	BIC diff	ICL	ICL diff
VEV 3	-	-	-42244.24	-130.36
VEV 4	**-41461.65**	**-1.17**	**-42113.88**	**0.0**
VEV 5	- 41460.47	0.0	-42135.43	-21.55
VEE 8	-41507.39	-46.92	-	-

Note. BIC=Bayesian Information Criterion; ICL = Integrated Complete Likelihood. Values in bold type represent the final model selected. Distribution, volume, shape and orientation of each model: ellipsoidal, variable, equal, variable (VEV); ellipsoidal, variable, equal, equal (VEE); ellipsoidal, variable, variable, variable (VVV); ellipsoidal, variable, variable, equal (VVE).

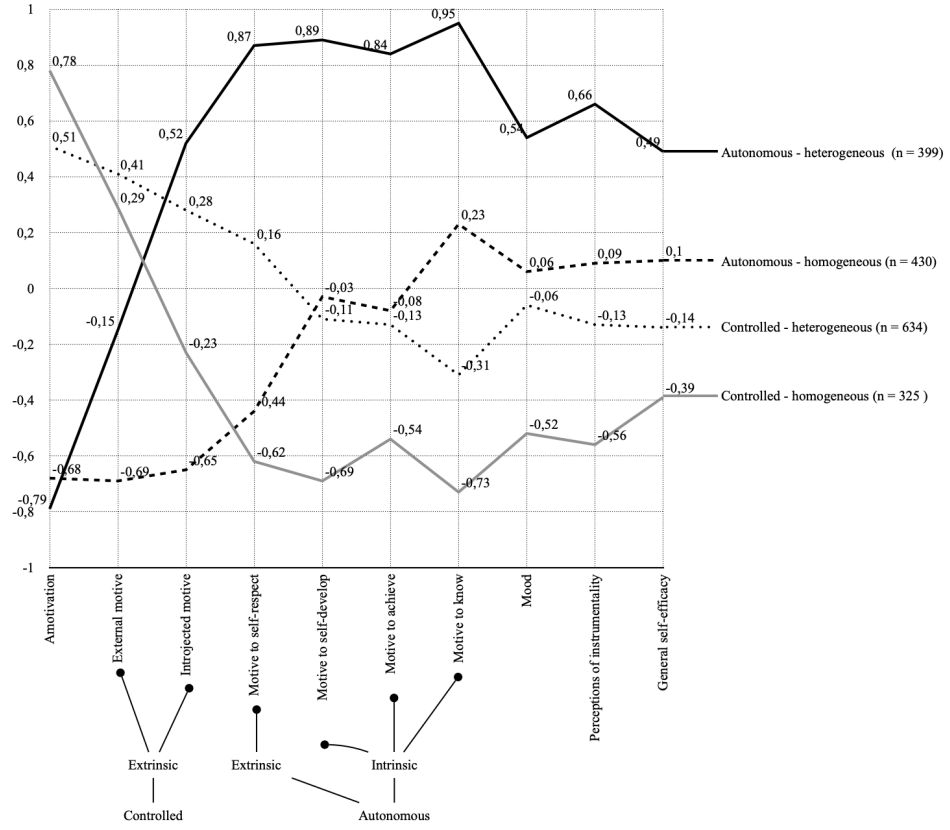
For choosing the best model, we adhered to the following thresholds: BIC values — the lower values, the better fit; ICL — the higher values, the better fit (Bertoletti et al., 2015; Nylund et al., 2007). As can be seen from this Table 3.6, in terms of their BIC values VEV5, VEV4 and VEE8 offered the best cluster solutions in ascending order. Based on ICL values, however, the best cluster solutions would be VEV4, VEV5 and VEV3. Since VEV5 and VEV4 both showed the best BIC and ICL values, the choice was between one of them. In the end, we chose the VEV4 cluster (ellipsoidal, equal shape) that had four profiles (model's fit: log-likelihood = -19847.14, n = 1788, df = 236, BIC = -41461.65, ICL = -42113,88). Additionally, the model with four profiles is more aligned with other studies on motivational profiles that, on average, observed four solutions (Baars & Wijnia, 2018; Chon & Shin, 2019; Gillet et al., 2017; Litalien et. al., 2019; Zhang & Lin, 2019). Moreover, the four-profile solution gives us more variability in observing different types of students' motivation, which is critical to consider as we want to understand how different students use MRSs. Table 3.7 gives an overview of each profile (means and standardised mean scores).

Table 3.7
Means, standard deviations, and standardised scores of the motivational profiles

	Controlled – homogeneous profile (n = 325)		Controlled - heterogeneous profile (n = 634)		Autonomous - homogeneous profile (n = 430)		Autonomous - heterogeneous profile (n =399)	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	Standardised scores	M (SD)	Standardised scores
Academic Motivation Scales questionnaire (AMSQ)								
Amotivation	2.62 (.99)	.78	2.30 (.88)	.51	1.16 (.25)	-.68	1.06 (.13)	-.79
External motive	3.04 (.99)	.29	3.17 (.83)	.41	2.00 (.83)	-.69	2.60 (1.00)	-.15
Introjected motive	2.95 (1.02)	-.23	3.51 (.66)	.28	2.54 (.96)	-.65	3.75 (.82)	.52
Motive to self-respect	2.97 (1.7)	-.62	3.84 (.64)	.16	3.21 (1.00)	-.44	4.55 (.41)	.87
Motive to self-develop	3.17 (.94)	-.69	3.72 (.62)	-.11	3.77 (.76)	-.03	4.55 (.44)	.89
Motive to achieve	3.12 (1.00)	-.54	3.47 (.67)	-.13	3.55 (.84)	-.08	4.33 (.52)	.84
Motive to know	3.36 (.95)	-.73	3.73 (.60)	-.31	4.21 (.58)	.23	4.77 (.27)	.95
Health. Activity. and Mood (HAM) questionnaire								
Mood	4.64 (1.32)	-.52	5.17 (.91)	-.06	5.29 (.85)	.06	5.80 (.77)	.54
Perceptions of Instrumentality (PI) Scale								
Perceptions of instrumentality	3.24 (.60)	-.56	3.53 (.48)	-.13	3.66 (.58)	.09	4.10 (.51)	.66
General Self-Efficacy (GSE) scale								
General self-efficacy	2.84 (.70)	-.39	2.95 (.41)	-.14	3.10 (.46)	.10	3.29 (.40)	.49

Figure 3.2 presents the mean values of motives, mood, perceptions of instrumentality and general self-efficacy per profile.

Figure 3.2
Standardised mean scores for the motivational elements of each motivational profile



As can be seen from Figure 3.2, each motive had two characteristics that defined the difference between the profiles. The first characteristic was the source of the motive, that is, was the motive born out of intrinsic interest or was it extrinsically imposed, for example under pressure from people important to the student? It should be noted that even extrinsic motives could eventually be internalised by students: they could accept the motive as a personal one. Hence, the second characteristic refers to the extent to which such motives were internalised: (1) were students' behaviours extrinsically controlled or (2) were they autonomously enacted? The resulting profiles differed in terms of the dominance of autonomy motives over controlled motives, the dominance of extrinsic motives over intrinsic motives, and in terms of the values for other motivational

elements, that is, mood, perceptions of instrumentality and general self-efficacy. Based on an analysis of the dominant motives, we were able to identify the following four motivational profiles: autonomous-heterogeneous, autonomous-homogeneous, controlled-heterogeneous and controlled-homogeneous. We then set out to describe the quantitative differences across the profiles in terms of mood, perceptions of instrumentality and general self-efficacy.

The autonomous-heterogeneous (*N* = 399) and autonomous-homogeneous (*N* = 430) profiles were characterised by higher scores for intrinsic, autonomous motives (i.e. the motive to know, to self-develop and to achieve) than for two of the extrinsic, controlled motives (i.e. external and introjected motives). The main difference between these two profiles was that the group of motives that dominated in the autonomous-heterogeneous profile also included the autonomous extrinsic motive to self-respect.

The controlled-heterogeneous (*N* = 634) and controlled-homogeneous (*N* = 325) profiles were characterised by higher values for two of the extrinsic, controlled motives (i.e. external and introjected) than for all three intrinsic, autonomous motives. The difference between the said profiles was that the group of motives that dominated in the controlled-heterogeneous profile also included the autonomous extrinsic motive to self-respect.

The autonomous-heterogeneous profile had the highest values for mood, perceptions of instrumentality and general self-efficacy, followed by the autonomous-homogeneous profile, controlled-heterogeneous profile and controlled-homogeneous profile, respectively. The levels of amotivation increased in the same order, with the lowest values for the autonomous-heterogeneous profile and the highest values for the controlled-homogeneous profile.

To recap, we discerned four profiles: the autonomous-heterogeneous, autonomous-homogeneous, controlled-heterogeneous and controlled-homogeneous profiles. Profiles differed according to the heterogeneity of motives, showing either the dominance of one type of motives (controlled-homogeneous and autonomous-homogeneous profiles) or a combination of different types of motives (controlled-heterogeneous and autonomous-heterogeneous profiles). Moreover, profiles varied in terms of their position on the self-determination continuum, with the controlled-homogeneous profile ranking lowest and the autonomous-homogeneous profile ranking highest.

Differences across motivational profiles in preferred MRSs.

In order to answer the main research question (How do students with different motivational profiles differ in their uptake of MRSs?), we first checked for each profile whether the frequency of MRS uptake stayed the same throughout all three occasions, and then analysed the differences across profiles for each separate occasion. Both analyses were done by means of the Wilcoxon test.

In our analysis of the differences in MRS uptake across occasions per profile, we used 'motivational profile' as the independent variable and the eight MRSs as the dependent

variables with three levels (Occasions 1-3). There were no significant differences in MRS uptake across occasions ($p > .05$), except for the Enhancement of Situational Interest MRS which did differ significantly between the first 2 occasions in the autonomous-homogeneous profile ($p = .02$) (See Table 3.8).

Next, for our analysis of the differences in MRS uptake across profiles per occasion, we used 'type of motivational profile' as the independent variable with four levels and the eight MRSs as the dependent variables. The motivational profiles differed significantly in their MRS uptake on all three occasions (See 3.9), with one exception: the self-consequating MRS revealed a non-significant *p*-value on occasion 2 (p = .37). Figure 3.3 visualises the frequency of MRS uptake (as mean values) for each motivational profile and per occasion.

In the next paragraphs, we will first describe the differences in MRS uptake across motivational profiles as could be inferred from our analysis of mean values. Subsequently, we will describe the differences across profiles in the MRSs that were used most and least frequently (referred to as 'least-preferred MRSs' and 'most-preferred MRSs').

First, we found clear differences across three motivational profiles in terms of their overall MRS uptake, which could be categorised as low, medium and high. More specifically, students with a controlled-homogeneous profile showed the lowest uptake (*M* between 2.35 and 3.66), those with a controlled-heterogeneous profile showed a medium uptake (*M* between 2.99 and 3.80), and students with an autonomous-heterogeneous profile showed the highest uptake of MRSs (*M* between 3.12 and 4.34). The fourth, autonomous-homogeneous profile, however, did not fit into this categorisation: students with this profile used the 'performance-avoidance self-talk' and 'enhancement of situational interest' MRSs the least (comparable to the controlled-homogeneous profile, with *M* between 2.17 and 3.19), whereas they used the other MRSs on a medium level (comparable to the controlled-heterogeneous profile, with *M* between 2.98 and 3.79).

Second, we found that on average students of all four profiles scored lowest had the same least-preferred MRS but they differed with respect to their most-preferred MRSs. The MRS they preferred the least was 'performance-avoidance self-talk' (*M* between 2.17 and 3.18). Although 'enhancement of personal significance' was among the most-preferred MRSs (M between 2.89 and 4.24) in all groups, students differed in the other most-preferred MRS, which could be mastery self-talk (MST), performance-approach self-talk (Pap-ST) or self-consequating (SC).

Table 3.8.
Difference between motivation regulation strategies from the same motivational profile within three occasions: Wilcoxon test statistics

Motivational profile	Enhancement of Situational Interest	Enhancement of Personal Significance	Mastery Self-Talk	Performance-Approach Self-Talk	Performance-Avoidance Self-Talk	Proximal goal-setting	Self-Consequating	Environmental Control
	Wilcoxon / Sig.	Wilcoxon / Sig.	Wilcoxon / Sig.	Wilcoxon / Sig.	Wilcoxon / Sig.	Wilcoxon / Sig.	Wilcoxon / Sig.	Wilcoxon / Sig.
Autonomous-heterogeneous								
Waves 1-2	9310.5 / .51	9861/ .88	9818 / .93	19157.5 / .38	9060 / .30	9397 / .59	9452 / .65	9140.5 / .36
Waves 2-3	5774.5 / .03	6305 / .25	6510.5 / .45	6674 / .66	6344 / .28	6205.5 / .18	7004.5 / .84	6667 / .65
Autonomous-homogeneous								
Waves 1-2	**8043.5 / .02**	9775. / .91	9354.5 / .61	9508 / .78	8233.5 / .03	8512.5 / .08	8830 / .20	8825 / .20
Waves 2-3	7984 / .74	7739 / .92	8505.5 / .21	8074.5 / .62	8536 / .19	8275 / .40	8587.5 / .17	8663 / .13
Controlled-heterogeneous								
Waves 1-2	22230 / .51	25547 / .05	24652 / .22	25894 / .03	22201/ .50	23872 / .53	25778 / .04	22892 / .89
Waves 2-3	20567 / .26	20150 / .45	18917 / .73	18132 / .30	19346 / .97	19174 / .91	18790 / .65	19604 / .79
Controlled-homogenous								
Waves 1-2	5314.5 / .07	6713 / .27	6130.5 / .91	6266.5 / .87	6037 / .76	5645 / .26	5745 / .36	5691 / .31
Waves 2-3	4744.5 / .71	4965.5 / .35	5074 / .22	4513.5 / .82	4210.5 / .31	4323 / .47	4200 / .29	4626.5 / .95

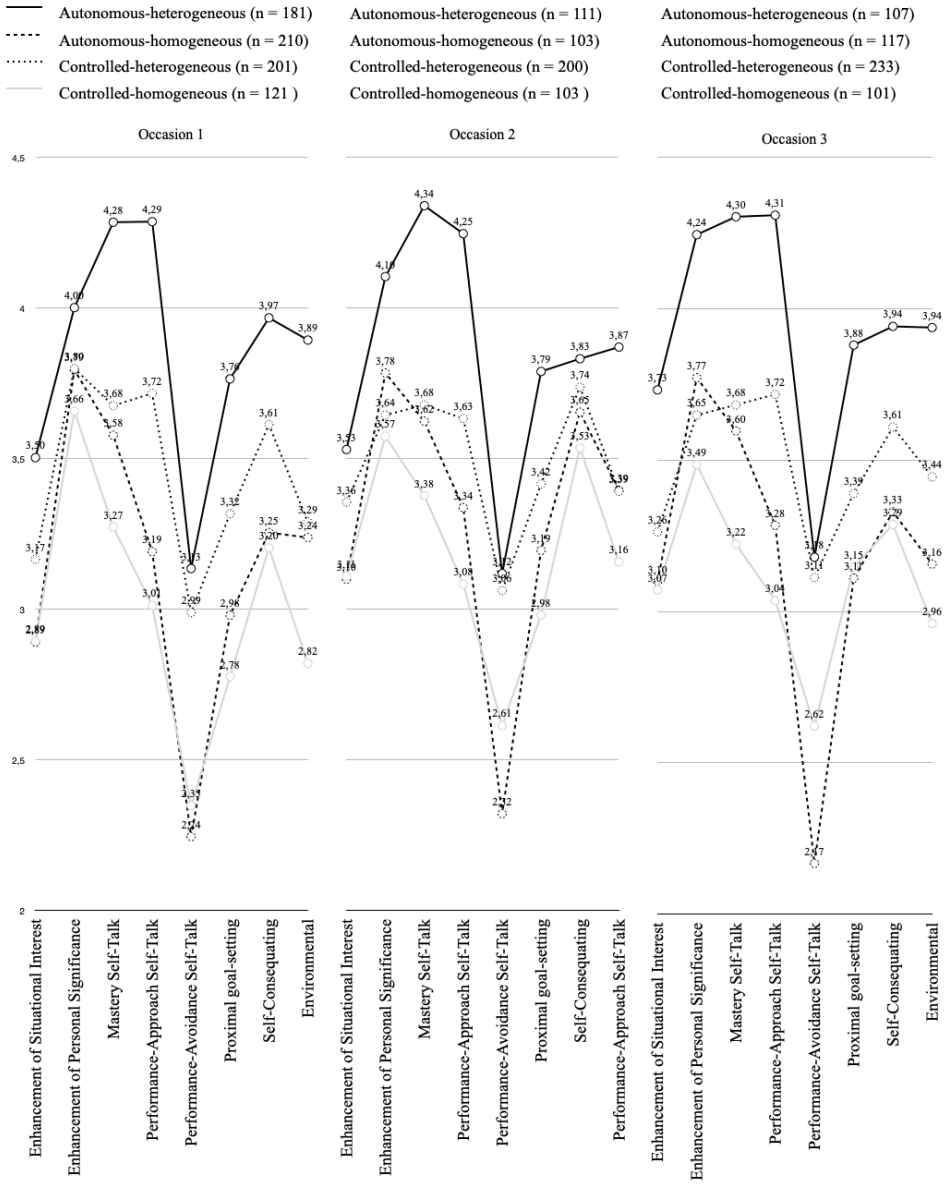
Table 3.9

Difference between motivational profiles and used motivation regulation strategies per occasion: Kruskal–Wallis test statistics

	Enhancement of Situational Interest	Enhancement of Personal Significance	Mastery Self-Talk	Performance-Approach Self-Talk	Performance-Avoidance Self-Talk	Proximal goal-setting	Self-Consequating	Environmental Control
Occasion 1								
Chi-Square	43.06	11.09	122.97	153.93	94.70	71.01	49.52	90.39
df	3	3	3	3	3	3	3	3
Asymp. Sig.	.00	.01	.00	.00	.00	.00	.00	.00
Occasion 2								
Chi-Square	12.14	30.11	97.09	92.24	43.04	33.22	3.13	31.53
df	3	3	3	3	3	3	3	3
Asymp. Sig.	.01	.00	.00	.00	.00	.00	**.37**	.00
Occasion 3								
Chi-Square	36.67	58.39	102.35	117.73	74.97	41.14	26.90	60.94
df	3	3	3	3	3	3	3	3
Asymp. Sig.	.00	.00	.00	.00	.00	.00	.00	.00

Figure 3.3

The differences across motivational profiles in terms of MRS uptake



'Mastery self-talk' was among the most-preferred MRSs of students with an autonomous-heterogeneous profile (*M* between 4.28 and 4.34 throughout occasions), autonomous-homogeneous profile (*M* between 3.58 and 3.62) and controlled-heterogeneous profile (*M* = 3.68 on all occasions). In addition, students with an autonomous-heterogeneous and controlled-heterogeneous profile were similar in that they both had 'performance-approach self-talk' among the MRSs they used the most (*M* between 4.25 and 4.31, and between 3.63 and 3.72, respectively). 'Self-consequating' was among the most-preferred MRSs of students with an autonomous-homogeneous profile on occasion 2 (*M* = 3.65), controlled-heterogeneous profile on all occasions (*M* between 3.61 and 3.74), and controlled-homogeneous profile on occasion 2 (*M* = 3.53).

In sum, two important results stood out. First, students' different motivational profiles corresponded to differences in the uptake of *all* MRSs, which could be categorised into low, medium and high. The uptake of *all* MRSs increased from the controlled-homogeneous profile, through the controlled-heterogeneous profile, to the autonomous-homogeneous profile. Second, for all profiles, the 'performance-avoidance self-talk' MRS was used the least, whereas 'enhancement of personal significance' was among the MRSs that were used the most. Finally, profiles differed in their other most-preferred MRS, which could include 'mastery self-talk', 'performance-approach self-talk' or 'self-consequating'.

DISCUSSION

The primary goal of the present study was to identify whether and how students with different motivational profiles, representing the various constellations of their motives (homogeneous or heterogeneous) and other motivational elements, differ in their uptake of MRSs. We discerned four motivational profiles that differed with respect to the heterogeneity of their motives as well as to their levels of mood, perceptions of instrumentality and general self-efficacy. We found that the four profiles differed in terms of their uptake of all eight MRSs combined *and* in terms of the size of the set of MRSs most frequently used.

With respect to the first research question (What motivational profiles can be identified based on the different constellations of students' motives and the other three motivational elements, that is, mood, perceptions of instrumentality and general self-efficacy?), the motivational profiles we identified reiterate findings from previous empirical research. At the same time, however, these findings are, at least in part, not in agreement with Activity theory (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978). The four motivational profiles identified – the controlled-homogeneous, controlled-heterogeneous, autonomous-heterogeneous and autonomous-homogeneous profile– have been reported separately in previous studies (Baars & Wijnia, 2018; Chon & Shin,

2019; Litalien et. al., 2019; Zhang & Lin, 2019).

As in the theory, our motivational profiles differed according to the various constellations of motives and the other motivational elements, that is, mood (cf. emotional state), perceptions of instrumentality (cf. goals that have personal meaning) and general self-efficacy (cf. means combined with beliefs). However, *unlike* the theory, we did not find students with the same leading motive, for example, the intrinsic motive to know, and different values for other motivational elements, for example with low, medium and high levels of means combined with beliefs (measured by general self-efficacy). However, Vandevelde and colleagues (2017) *did* find such profiles that had similarly high levels of self-efficacy but different constellations of students' motives. Therefore, to be able to develop the higher-order model of motivation that Hattie, Hodis and Kang (2020) called for, we need further studies into the role of the motivational elements other than students' motives in the process of motivation, which could enhance the accuracy of existing motivational profiles.

Additionally, our results showed that when motives are studied in combination with other motivational elements, the sequence in the taxonomy of self-determination theory (Ryan & Deci 2020) is disrupted. We found that students with the highest general self-efficacy, perceptions of instrumentality, and mood had autonomous-*heterogeneous* motives, which contradicts the postulate of self-determination theory that these students would have autonomous-*homogeneous* motives. A few other studies have also demonstrated that autonomous-heterogeneous motives, that is, highly autonomous motives combined with highly controlled motives, are associated with positive outcomes (Gillet et al., 2017; Litalien et al., 2019; Zhang & Lin, 2019). We welcome future studies that further compare autonomous-homogeneous versus autonomous-heterogeneous student groups, to understand when and why the combination of autonomous and controlled motives yields better outcomes, for example in terms of higher interest and effort, better achievement and less disorganisation.

With respect to the second research question (How do students with different motivational profiles differ with respect to the MRSs they prefer?), two interesting findings stood out: 1) the four student motivational profiles clearly differed in terms of their overall uptake of *all* MRSs combined; and 2) students with homogeneous motives differed from students with heterogeneous motives in terms of the set of MRSs they preferred to use the most. And these findings were stable across three occasions. More specifically, as students' uptake of all MRSs combined increased, the values for all motivational elements increased accordingly. Thus, students' motives increased in quantity (low, medium, high) and changed in quality: the proportion of controlled extrinsic motives, autonomous extrinsic motives and autonomous intrinsic motives changed favourably with an enhanced uptake of all MRSs combined.

As Ivannikov (1985a, 2015) was already keen to point out, MRSs are aimed to restore weakened motivational elements. Although it is not entirely clear what such weakening

or restoring of a 'motive' means, especially when students can have various motives, from our findings we may tentatively conclude that it refers to students finding an alternative autonomous extrinsic and/or autonomous intrinsic motive. In other words, they move from being driven by controlled-homogeneous motives to being driven by autonomous-heterogenous motives. Future research on the changes in students' motivational profiles and the corresponding uptake of all MRSs over time could shed light on whether specific MRSs could help students to replace motives that have become frustrated with a different type of motive. However, the correlational nature of our data compels us to also consider the reverse situation: the type of motive might set the frequency of MRS uptake as well.

Drawing further on our second finding that students differed in terms of the set of MRSs they used most frequently, we concluded the following: students with homogeneous motives had one or two MRSs they preferred the most, while students with heterogenous motives preferred using two other MRSs in addition to these two MRSs. More specifically, students with the worst overall motivation and controlled-homogeneous motives chose only enhancement of personal significance as their most-preferred MRS. This MRSs emphasize the relation between studying and students' life and experience. Students with autonomous-homogeneous motives, in addition to above-mentioned MRS, also chose mastery self-talk as their most-preferred MRS which focuses on mastering the competences. Students with the best overall motivation and heterogenous motives also chose performance-approach self-talk in addition to above mentioned MRSs, this strategy emphasize importance of achievement. Finally, students with controlled-heterogeneous motives had a fourth most-preferred MRS – self-consqequating, which targets not learning motives (awarding oneself with something pleasant).

According to activity theory, motives are organised in hierarchy. In particular, there could be simultaneously a lot of reasons of why one is learning. For example, because s/he wants to achieve important life goals, to master the competence, to obtain high scores, or to receive something pleasant as a reward. It could be that students with heterogenous motives, that is who have different reasons to learn, have more ways of how to improve their overall motivation. In other words, the more reasons to study students have, the more types of MRSs can help them. That could be the reason why students with autonomous-heterogenous motives have better overall motivation then students with autonomous-homogenous motives, and the same logic is for students with controlled motives. Thus, heterogeneous motives could give a road to considering personal meaning for learning from different perspectives.

The reported study has several limitations. First, our operationalisation of the activity-theory-inspired theoretical model in terms of motives, mood, perceptions of instrumentality and general self-efficacy using existing questionnaires may not have done full justice to the original theory, as we did not measure all theoretically postulated

types of the group of motivational elements "means and beliefs". Second, we analysed only the first two levels of the activity system's macrostructure – i.e. motive formation and planning – without covering the third level of performance. Third, the questions we asked students differed across the three occasions in that we first asked students about their feelings and related behaviour regarding learning in the *university in general* (Occasion 1), while on the remaining occasions we asked them similar questions, but this time about learning in the *present* course. Fourth, since four items of the original Perceptions of Instrumentality Scale showed low reliability, very small standardised coefficients and poor model fit, we had to omit these items and unite two scales into one. Future research could address these limitations by finding a more appropriate instrument to measure personal meaning, and by observing students' actual performance of a particular task in addition to measuring their motivational elements.

In self-regulating their motivation, students could benefit from identifying, first, their reasons for studying in order to understand whether their study behaviours are driven by homogeneous or heterogeneous motives. Second, depending on what their motives are, they could focus on connecting learning to their life alongside with emphasizing mastery and achievement. Students with homogeneous motives could be encouraged to think primarily about additional reasons for studying, that is, what studying brings them (enhancement of personal meaning MRS). Students who have already found autonomous intrinsic or extrinsic reasons for studying could additionally pay attention to mastery self-talk and performance-approach MRSs.

To conclude, students with different motivational profiles differ both in how often they use the whole range of available MRSs and in which MRSs they use most frequently. The heterogeneity of students' motives is a key distinction. Compared to students with homogeneous motives, students with heterogeneous motives use *all* the available MRSs combined more frequently and have a larger set of MRSs that they use most frequently. In order to improve motivation, we should help students to make their own motives more heterogeneous and to focus not only on personal meaning, but also on mastery and achievement.

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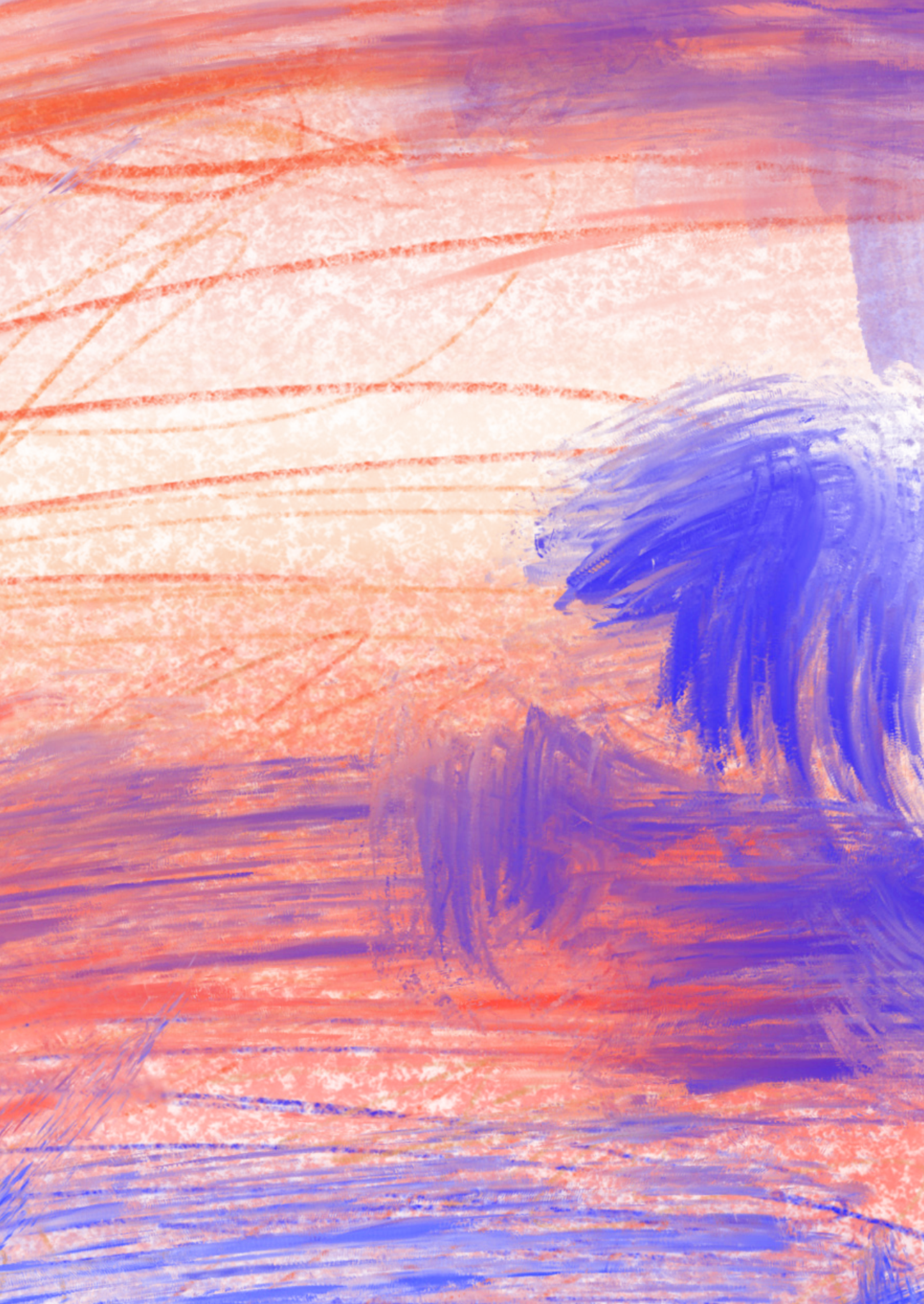


CHAPTER 4

Remaining or becoming autonomously motivated: The role of motivational regulation strategies

This chapter has been submitted as Ilishkina, D., De Bruin, A., Donkers, J., Podolskiy, A., Volk, M., & Van Merriënboer, J. (submitted). Remaining or becoming autonomously motivated: The role of motivational regulation strategies.

ABSTRACT

Motivational regulation strategies (MRSs) are believed to help students stay motivated, however, they hitherto remained underexplored in research. We analyzed the relationships between higher education students' MRSs uptake and how these were associated with changes in their motivational profiles. At three points during a course, we measured students' MRSs and motivation using questionnaires. MRSs were variously related to changes in students' motivation, depending on their leading motives — controlled to autonomous. In students with leading controlled motives, only enhancement of personal significance MRS was associated with *changes to* motivation with leading autonomous motives; Students with leading autonomous motives, in contrast, *remained* autonomously motivated by using performance and mastery-oriented MRSs. We conclude that MRSs could have different functions — changing motivation or maintaining the same motivation — and that taking into account the dynamic nature of motivation and the motive hierarchy could benefit the use of MRSs.

Keywords

Motivational regulation strategies, autonomous motives, controlled motives, instrumentality, self-efficacy

INTRODUCTION

Self-regulated learning (SRL) helps students to achieve better educational outcomes and gives them the freedom to pursue personal goals. Self-regulated learners can set, monitor, and regulate their own thoughts, behavior, and feelings to achieve learning goals (Zimmerman, 2000). Zimmerman (2000), Pintrich (2000), and Boekaerts (2011) suggested that an essential part of SRL is to regulate one's motivation. More specifically, motivational elements such as beliefs, values, goal orientations, and a sense of self-efficacy can all play a role in SRL, sometimes demanding students' attention and conscious regulation (Miele & Scholer, 2017). Complex terms in a textbook, for instance, may negatively affect students' sense of self-efficacy, causing them to avoid reading. Although it is obvious that students may lose their motivation during learning, we do not yet fully understand how they can regulate their motivation to continue learning in a positive way.

Research on the self-regulation of motivation is concerned with investigating what motivation is and how it can be regulated. Previous studies have emphasized that motivation is a complex construct, as it consists of different motivational elements that may change over time. In reviewing recent models of motivation, Hattie, Hopes, and King (2020) identified no less than five motivational dimensions (i.e., task attributes, person, goals, costs, and benefits) that each have their own motivational elements. Other studies have revealed that groups of students may have similar sets of different motivational elements in similar quantities, i.e., they may share the same *motivational profile*. Conversely, they may belong to different motivational profiles when they have a similar mixture of motivational elements, for example, intrinsic and extrinsic motives, but in different proportions (Gillet et al., 2017; Litalien et al., 2019; Zhang & Lin, 2019). As already stated, still other studies, particularly of schoolchildren and students in different subject domains, have shown that students' specific motivational profiles may change over time (Dietrich & Lazarides, 2019; Dietrich et. al., 2019; Gillet et al., 2017, 2020; Lazarides et al., 2019; Tuominen et. al., 2020). Hence, the above findings demonstrate that motivation, rather than being just an overall willingness or drive, is a complex and dynamic system of motivational elements.

With respect to the self-regulation of motivation, Wolters (2003) and Schwinger, Steinmayr, and Spinath (2009) described how students use motivational regulation strategies (MRSs) to manage their motivation to learn. Recent studies have also shed light on the relation between MRSs and motivational elements. For instance, they found that MRSs are related to several motivational elements such as values, goal orientations, and self-efficacy (Ilishkina et al., 2022a; Schwinger et al., 2007; Trautner & Schwinger, 2020; Wolters & Benzon, 2013; Wolters & Rosenthal, 2000). Additionally, the use of specific MRSs is related to coherent sets of motivational elements and hence to motivational profiles (Ilishkina et al., 2022b). More specifically, students with homogeneous motives differed from students with heterogeneous motives, both in terms of how often they

used *all* the available MRSs and in terms of the specific MRSs they preferred and used the most. Overall, students' uptake of different MRSs is related to the respective levels of motivational elements which together constitute their motivation to learn.

Hence, from the above we gather that motivation is a highly complex and dynamic system that relates to the uptake of MRSs. What we still do not know, however, is what role MRSs play in ongoing changes in students' motivation over time. The present study therefore aimed to investigate whether students' actual uptake of specific MRSs can predict how their motivational profile changes over time. To this end, we adopted a person-oriented profile approach by studying the individual differences and changes in relationships between motivational profiles and preferred MRSs. In doing so, we adopted activity theory as our theoretical framework because it expressly defines motivation as a *process* (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978), which reflects the idea that motivation consists of different elements and may change over time.

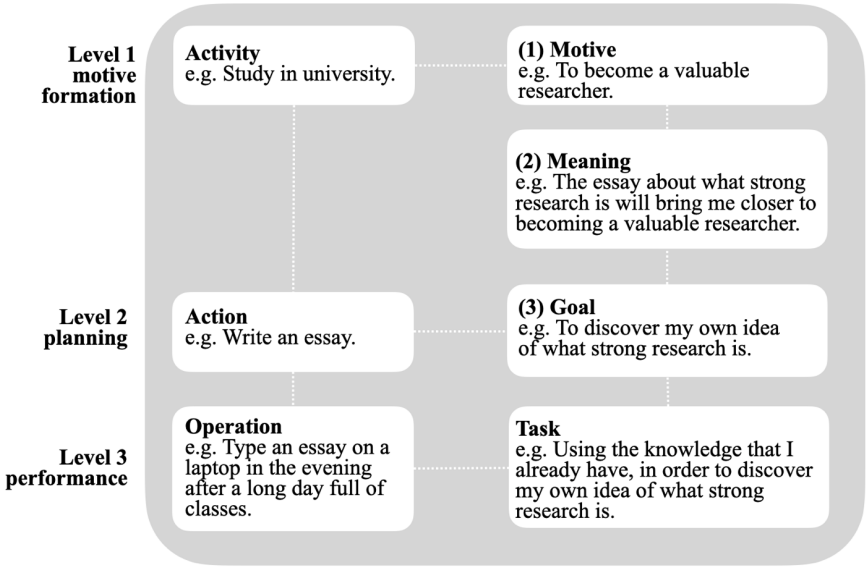
Consistent with the said finding that motivation is a complex and dynamic system, activity theory defines motivation as a process of impulse construction that spans the following three levels: (1) *motive formation* (I want), (2) the *planning* of actions (I plan), and (3) *performance* in which a plan is put into operation (I do). Figure 4.1 shows that these levels, in turn, comprises its own motivational elements that together interact so that the willingness becomes real operations under given conditions (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978). At each level, however, the motivational elements may be weakened and therefore require students' self-regulation so that the overall process of motivation is maintained or restored.

On the first two levels of this motivation process we find four motivational elements that are most essential and require self-regulation, specifically *motive*, *emotional state*, *goal*, and *meaning*. Whereas the first two elements concern the first level of motivation (motive formation), the latter two are needed for the second level (planning). First, a *motive* is an object that can satisfy a person's need; It is the main reason for acting. Of course, one could have many motives, that altogether compose personal motive hierarchy with leading and secondary motives (Leont'ev, 1971/1978). For example, one could desire to become a valuable researcher and also to be an inspiring supervisor.

Emotional states, on the other hand, are an important part of motive as they attract a person's attention to such objects. The motive then creates an "impulse" that is transferred to a *goal*, which is the main motivational element at the planning level. Goals direct one toward a desired motive by planning a chain of intermediate actions, even though these actions and goals usually do not lead to the motive directly. For example, understanding a textbook (goal) does not cause someone to become an expert immediately (motive). By highlighting the relationship between goals and motives, *meaning* therefore helps to connect the current goal to the future motive. In the example above, the student may read the textbook because he/she understands this is a first step on the road to becoming an expert in the future. Hence, motive and meaning are crucial motivational

elements that create an impulse and transfer it to the planning level, whence it is transferred to the performance level. Nevertheless, when one motives carry *personal* meaning, the others may also have a somewhat *artificial* meaning (Leontiev, 1971/1978).

Figure 1.1.
The structure of activity and motivation.



*(4) Means (e.g. laptop, knowledge, energy), (5) Beliefs (e.g. belief that I can do it), and (6) Emotional states (boring, good mood, excited) are not in the Figure as they permeate the entire system.

Leontiev (2016) has drawn parallels between the classification of motives in activity theory and the continuum of motivation postulated in self-determination theory (Ryan & Deci, 2020). Although the two theories use different terms to describe reasons to act ("motives" in activity theory vs. "motivation" in self-determination theory), we will hereinafter use the term "motive" because motivation, as a complex process, entails more than a reason to act. As mentioned, the two theories share several similarities when it comes to the way they classify motives. First, activity theory distinguishes between "stimulus-constructing motives" and "personal meaning-making motives", which can be considered the equivalent of "controlled motivation" and "autonomous motivation" in self-determination theory, respectively. Stimulus-constructing or controlled motives trigger activities because they relate to reasons other than person's inherent satisfactions, such as rewards, absence of punishment, shame, and guilt. The resulting behaviors are experienced as controlled or externally regulated. Students, for instance, may attend a specific course, not so much because they value it, but because

they *need* it to obtain their diploma. According to self-determination theory, moreover, all controlled motives are essentially extrinsic in nature, meaning that actions are not born out of a natural desire to do something (Ryan & Deci, 2020).

Personal meaning-making or autonomous motives, on the other hand, trigger activities because they are naturally connected with the activity itself, which arouses value, interest, and other positive emotions. As such, the resulting behaviors are experienced as autonomous or internally regulated. This may mean, for instance, that students attend a course because they take a genuine interest and pleasure in learning. Additionally, the self-determination theory makes a further distinction between autonomous motives that are intrinsic or extrinsic. Whereas autonomous-intrinsic motives are inspired by students' natural desire to perform an activity because they enjoy it, autonomous-extrinsic motives mean that students undertake the activity for the sake of, say, earning their parents' respect, although they do value the activity. In such cases, their extrinsic motives have become internalized so that they now experience them as somewhat internal (Ryan & Deci, 2020). To recap, students' activities can be triggered by stimulus-constructing or controlled-extrinsic motives, by personal meaning-making or autonomous-intrinsic and autonomous-extrinsic motives, or by a mixture of them (Leontiev, 2016).

In addition to the four essential motivational elements specified in the penultimate paragraph, two other elements may potentially interfere with the process of motivation as well, depending on the situation: *Means* and *beliefs*. *Means* are tools, knowledge, skills, and physical functionalities that are needed to perform the planned actions. For instance, a student may plan to read a textbook in the evening but experience an unexpected power failure. Without light, the student cannot continue reading, even though he/she wants to, which makes light a *means* to perform the reading operation. In a similar fashion, students' *beliefs* about themselves, about the activities undertaken, and the situations in which they are performed may also negatively affect the process of impulse formation. For instance, when a student wanting to read a textbook does not believe in his or her own ability to understand its contents (low self-efficacy), their *belief* can block the process of impulse formation. Hence, *means* and *beliefs* are additional motivational elements that may or may not play a role in motivation, depending on the specific situation and the person. As such, they, too, may require self-regulation. Overall, motivation as a process could consist of at least six motivational elements, leading us to the following research question: Do students differ in the presence of different kinds of motives, emotions, meaning, goal, means, and beliefs, representing different motivational profiles, and if so, how?

When one or more of these six motivational elements are disrupted, students can use their "willpower" to restore them (Ivannikov, 1985b, 2016; Ivannikov & Monroz, 2014). If motivational elements are disrupted, it means that motivation is not stable, leading us to the second research question: Do students' motivational profiles change during their study of a particular course, and if so, how?

In SRL parlance, willpower may be considered as MRSs that students can use to enhance or restore their motivation to learn (Ilishkina et al., 2022a). They can do so in two different ways (Wolters, 1998), affecting either the quantity or quality of motivational elements. First, they may use MRSs to increase the value of elements, such as their *beliefs* about their own self-efficacy which is positive for learning. Second, they may use MRSs to change the content of motivational elements, such as changing controlled motives into autonomous motives. In summary, motivation as a process is not stable but dynamic, and MRSs can make quantitative and qualitative contributions to desired motivational changes. It leads us to the final research question: Are quantitative (low or high) and qualitative (autonomous - controlled) changes in students' motivational profiles during the study of a course related to their specific uptake of MRSs?

The Present Study

The primary aim of the present study was to understand whether students' specific MRS uptake may predict whether their motivational profiles will change from controlled to autonomous, or vice versa. By helping students to choose more appropriate MRSs, the results of this study might eventually help them to self-regulate their motivation better. We operationalized students' motivational profiles in terms of the constellation of motivational elements, and the concept of "willpower" in terms of the MRSs used. The motivational elements and students' MRS uptake were measured using five separate questionnaires. We addressed the following three questions:

1. Do students differ in the presence of different kinds of motives, emotions, meaning, goal, means, and beliefs, representing different motivational profiles, and if so, how?
2. Do students' motivational profiles change during their study of a particular course, and if so, how?
3. Are quantitative (low or high) and qualitative (autonomous - controlled) changes in students' motivational profiles during the study of a course related to their specific uptake of MRSs?

METHODS

Participants

Participants were students from two Russian universities (N = 1039; 799 females, age: M = 19.25, SD = 1.67). Most of the students (N = 953) were from former countries of the Commonwealth of Independent States, and the remainder (N = 86) came from other countries. Table 4.1 presents the number of students according to year of study and study program, including their mean age.

Table 4.1
Number of students according to year of study and study program

	***N* students (female)**	**Mean age (*SD*)**
Year of study		
First-year students	691 (527)	18.90 (1.68)
Second-year students	281 (213)	19.77 (1.46)
Third-year students	67 (60)	20.64 (1.05)
Study program		
Medicine	440 (317)	19.25 (1.90)
Psychology	146 (108)	20.19 (1.45)
Linguistics	228 (197)	18.88 (1.28)
Journalism	225 (177)	19.00 (1.44)
Total N students	1039 (799)	19.25 (1.67)

Students completed the set of five questionnaires three times: At the beginning, halfway, and at the end of the semester (yielding 716, 522, and 559 responses, respectively). A total of 229 students participated in all three occasions, 342 students participated in the first two occasions, 229 students participated in Occasions 2 and 3, and 347 students participated in Occasions 1 and 3.

Measures

We used existing and validated paper-based questionnaires to measure the variables from our theoretical model: Four questionnaires measured students' motivational elements and one questionnaire measured their MRS uptake. Table 4.2 gives an overview of these measurement instruments and their linkages to the operational model.

Table 4.2
Operationalization of students' motivational elements and their MRS uptake (willpower)

Operational model	Measure
Six motives to learn and amotivation as an operationalization of autonomous-intrinsic, autonomous-extrinsic, controlled-extrinsic, and the absence of motives	Academic Motivation Scales questionnaire (Gordeeva et al., 2014)
Mood as an operationalization of "emotions"	The Mood subscale from the Health, Activity, and Mood questionnaire (Doskin et al., 1973)
Perceptions of Instrumentality as an operationalization of "goals" and "personal meaning"	Perceptions of Instrumentality Scale (Husman et al., 2004)
General Self-efficacy as an operationalization of "means" and "beliefs"	General Self-Efficacy scale (Shvartser et al., 1996)
Motivational regulation strategies as an operationalization of "willpower"	Motivated Strategies questionnaire (Schwinger et al., 2009)

Motives to Learn

To measure and analyze students' motives to learn, we used Gordeeva, Sychev, and Osin's (2014) Academic Motivation Scale questionnaire — an adapted Russian language version of Vallerand et al.'s taxonomy of reasons for engaging in learning (1992)._ The questionnaire contains 28 items that are divided over seven scales (4 items per scale). Three of these scales measure students' autonomous-intrinsic motives to know (e.g., "I like to study"), to achieve (e.g., "I like to solve difficult problems and invest intellectual effort"), and to self-develop (e.g., "I like to know how to increase my competence and knowledge"). A fourth scale measures students' autonomous-extrinsic motive to self-respect (e.g., "To prove to myself that I am a smart person"). Another two scales measure two types of controlled-extrinsic motives: Introjected motives (e.g., "Because it is embarrassing to do poorly in studying") and external motives (e.g., "I have no other choice, as they will check my attendance"). Finally, the amotivation scale measures the absence of motives (e.g., "Before, I knew why I was studying, but now I am not sure whether to continue"). All items were rated on a 5-point Likert scale (1 = does not apply at all; 5 = applies completely).

Mood

To measure students' emotions, we used the Mood subscale from the Health, Activity, and Mood questionnaire (Doskin et al., 1973). Spanning 10 items, this subscale describes 10 different feelings the intensity of which was scored on a 7-point scale ranging from minus 3 to plus 3, with 0 being the neutral score (e.g., "cheerful 3 / 2 / 1 / 0 / 1 / 2 / 3 sad"). Positive feelings were reported on the left side, while negative feelings were listed on the right.

Perceptions of Instrumentality

To measure goals and personal meaning**,** we used the Russian 8-item version of the Perceptions of Instrumentality Scale (Husman et al., 2004). As the original items were in English, we had to translate them into Russian. To ensure the validity of the translated instrument, we followed a standard translation and back-translation procedure. This scale consists of two subscales: (1) endogenous instrumentality (4 items; e.g., "What I learn in the course selected above will be important for my future occupational success"), and (2) exogenous instrumentality (4 items; e.g., "I must pass the course selected above in order to reach my academic goals."). All items were rated on a 5-point Likert scale (1 = fully disagree; 5 = fully agree).

General Self-Efficacy

To measure beliefs and means, we used the Russian version of the General Self-Efficacy (GSE) scale (Shvartser et al., 1996). This scale comprises 10 items (e.g., "I can always manage to solve difficult problems if I try hard enough") that were rated on a 4-point

Likert scale (1 = fully incorrect; 4 = fully correct).

Motivational Regulation Strategies

To measure willpower, we used the Russian version of Schwinger et al.'s Motivated Strategies questionnaire (2009). As the original items were in German, we had them translated into Russian. To ensure the validity of the translated instrument, we followed a standard translation and back-translation procedure. This 30-item questionnaire comprises the following eight scales: (1) Enhancement of situational interest (5 items; e.g., "I make learning more pleasant for myself by trying to arrange it playfully"), (2) enhancement of personal significance (3 items; e.g., "I look for connections between the tasks and my life as such"), (3) mastery self-talk (4 items; e.g., "I persuade myself to work intensely for the sake of learning"), (4) performance-approach self-talk (5 items; e.g., "I attempt to call myself to intense work by focusing on obtaining good grades"), (5) performance-avoidance self-talk (3 items; e.g., "I tell myself that I have to push myself more if I do not want to make a fool of myself"), (6) proximal goal-setting (3 items; e.g., "I break down the workload into small segments so I get the feeling that I can handle it more easily"), (7) self-consequating (4 items; e.g., "I tell myself that after work I can do something nice, if I first keep on learning now"), and (8) environmental control (3 items; e.g., "I consciously choose such learning times when I can concentrate especially well"). All items were rated on a 5-point Likert scale (1 = used rarely; 5 = used very often).

Procedure

As stated before, students completed the five questionnaires three times: Just before the start (Occasion 1), halfway (Occasion 2), and at the end (Occasion 3) of the semester. On Occasion 1, we asked students about their motivation to learn in university, including their current MRS uptake before starting the course, and about their perceptions of the course they planned to attend. On Occasions 2 and 3, we asked students about their motivation to learn on the course, including the MRSs they were using during the course they had enrolled in following Occasion 1. Before the start of the class, the experimenter distributed and collected the questionnaires and instructed the students to carefully read the information on the form and to complete all questionnaires individually. To control for order effects, we ordered the existing set of questionnaires in five different ways, using a Latin square approach. Students needed about 20 minutes to complete the entire survey. All students participated voluntarily and received additional course credits for their participation. Their teachers and faculty deans had assented to their participation.

Data Analysis

To check the psychometric structure of the questionnaires, we performed confirmatory factor analyses and computed Cronbach's alpha and McDonald's omega for each factor. To capture all existing profiles during the course, we performed Latent Profile Analysis

(LPA) of the motivational elements (motives, mood, perceptions of instrumentality, general self-efficacy) for the three occasions simultaneously, using R package MCLUST (R Core Team, 2020; Scrucca et al., 2020). Missing items were imputed by taking the mean value for the non-missing items of that variable for the respective student. To determine the optimal number of profiles in the data (question 1), we considered the Integrated Complete-data Likelihood (ICL) and the Bayesian Information Criterion (BIC) (Bertoletti et al., 2015; Nylund et al., 2007). Additionally, we analyzed changes between profiles to find out whether students changed their motivation during the course (question 2). More specifically, we analyzed the probabilities of students changing their motivational profiles from Occasion 1 to Occasion 2, and from Occasion 2 to Occasion 3. We performed a multinomial analysis (stepwise logistic regression) of changes in motivational profiles between Occasion 1 and Occasion 3 in SPPS, version 23; This analysis allowed us to investigate which MRSs helped students to become more autonomously motivated (question 3).

RESULTS

This study is a continuation of the previous study, from which we took the already identified profiles and used them for a transition analysis to answer the new research questions. Further, we briefly repeat the goodness-of-fit results and the results of the latent profiles analysis that were made in the previous study. Afterwards, we present the new results of the transition analysis. Table 4.3 presents goodness-of-fit results, showing that the factor models of all questionnaires, except for the Perceptions of Instrumentality scale, were acceptable on all three occasions - the Comparative Fit Indices (CFIs; Bentler, 1990) and the Tucker-Lewis indices (TLIs; Tucker & Lewis, 1973) were around .90. The Root Mean Square Errors of Approximation (RMSEAs; Steiger, 2016) were around .07, except for the Perceptions of Instrumentality Scale (RMSEA = .04). Table 4.4 shows that Cronbach's alphas and McDonald's Omegas were adequate for all questionnaires on all three occasions.

Table 4.3

Goodness-of-fit statistics for the estimated models of all questionnaires

Model		x2(df)	AIC	BIC	CFI	TLI	RMSEA	90% CI RMSEA
Academic Motivation Scales questionnaire (AMSQ)								
All items	1	1194.598 (105)	52059.526	52539.762	.913	.900	.061	.057 - .064
All items	2	975.945 (329)	36473.913	36920.766	.924	.912	.061	.057 - .066
All items	3	1122.624 (329)	39356.667	39810.912	.911	.898	.066	.061 - .070
Health, Activity, and Mood (HAM) questionnaire								
All items	1	298.864 (35)	19777.893	19912.202	.920	.897	.108	.097 - .119
All items	2	178.013 (35)	13843.628	13968.400	.950	.936	.093	.080 - .107
All items	3	249.701 (35)	14851.191	14978.574	.943	.927	.109	.097 - .122
Perceptions of Instrumentality (PI) scale								
Without items 3,4,5,8	1	3.841 (2)	6682.435	6737.319	.998	.993	.036	.000 - .090
Without items 3,4,5,8	2	5.888 (2)	4829.846	4880.891	.995	.984	.061	.000 - .121
Without items 3,4,5,8	3	12.908 (2)	5194.819	5246.733	.986	.957	.099	.052 - .153
General Self-Efficacy (GSE) scale								
All items	1	169.686 (35)	14567.484	14704.736	.926	.905	.073	.062 - .084
All items	2	225.937 (35)	10337.540	10465.097	.899	.871	.103	.090 - .115
All items	3	189.477 (35)	10897.080	11026.811	.921	.899	.089	.077 - .102
Motivated Strategies questionnaire (MSQ)								
All items	1	1355.263 (377)	62247.409	62787.268	.894	.878	.060	.057 - .064
All items	2	1124.906 (377)	42082.735	42585.140	.890	.873	.062	.058 - .066
All items	3	1447.369 (377)	44780.596	45291.082	.870	.850	.071	.067 - .075

Table 4.4
Cronbach's alpha and McDonald's omega values for all questionnaires

Scales	Items	Occasion 1		Occasion 2		Occasion 3	
		Cronbach's alpha	McDonald's omega	Cronbach's alpha	McDonald's omega	Cronbach's alpha	McDonald's omega
Academic Motivation Scales questionnaire (AMSQ)							
To know	1, 8, 15, 22	.837	.839	855	.858	.858	.858
To achieve	2, 9, 16, 23	.854	.855	.883	.883	.847	.848
To self-develop	3, 10, 17, 24	.820	.822	.850	.850	.846	.847
To self-respect	4, 11, 18, 25	.851	.854	.852	.855	.866	.869
Introjected	5, 12, 19, 26	.759	.763	.727	.733	.721	.729
External	6, 13, 20, 27	.696	.701	.729	.737	.783	.786
Amotivation	7, 14, 21, 28	.829	.831	.891	.892	.877	.878
Health, Activity, and Mood (HAM) questionnaire							
Mood	1, 2, 3, 4, 5, 6, 8, 9 10	.913	.916	.928	.931	.945	.947
Perceptions of Instrumentality (PI) scale							
Perceptions of instrumentality	1, 2, 6, 7	.763	.782	.821	.826	.810	.816
General Self-Efficacy (GSE) scale							
General self-efficacy	1, 2, 3, 4, 5, 6, 8, 9 10	.836	.838	.876	.877	.879	.881
Motivated Strategies questionnaire (MSQ)							
Enhancement of situational interest	7, 12, 14, 22, 28	.839	.841	.843	.843	.841	.843
Enhancement of personal significance	6, 15, 23	.586	.610	.645	.665	.656	.672
Mastery self-talk	10, 17, 21, 30	.719	.724	.705	.710	.719	.723
Performance-approach self-talk	1, 8, 16, 26, 29	.861	.863	.858	.859	.856	.859
Performance-avoidance self-talk	4, 5, 25	.736	.746	.750	.758	.750	.770
Proximal goal-setting	13, 20, 27	.853	.854	.802	.804	.838	.838
Self-consequating	2, 9, 19, 24	.844	.848	.851	.855	.872	.875
Environmental control	3, 11, 18	.689	.700	.770	.778	.746	.749

Moreover, Table 4.5 tells us that items 3-5 and 8 of the Perceptions of Instrumentality scale had low standardized coefficients. After we tested the model without these items, the fit resulted acceptable across all three occasions (see Table 4.3). We therefore excluded these items from further analysis.

Table 4.5
Standardized coefficients for items from confirmatory factor analysis

		Standardized coefficients		
Scales	**Items**	**Occasion 1**	**Occasion 2**	**Occasion 3**
Academic Motivation Scales questionnaire (AMSQ)				
Motive to know	1	.846	.839	.857
	8	.845	.838	.850
	15	.752	.773	.821
	22	.817	.870	.801
Motive to achieve	2	.835	.871	.839
	9	.785	.831	.738
	16	.804	.789	.819
	23	.835	.911	.821
Motive to self-develop	3	.708	.763	.773
	10	.782	.828	.799
	17	.802	.828	.836
	24	.805	.823	.818
Motive to self-respect	4	.798	.822	.843
	11	.805	.808	.763
	18	.770	.755	.824
	25	.870	.875	.866
Introjected motive	5	.701	.705	.678
	12	.675	.645	.565
	19	.753	.684	.772
	26	.718	.682	.672
External motive	6	.656	.780	.791
	13	.713	.751	.768
	20	.733	.681	.757
	27	.559	.558	.605
Amotivation	7	.862	.900	.854
	14	.812	.910	.873
	21	.850	.883	.898
	28	.788	.808	.848
Health, Activity, and Mood (HAM) questionnaire				

Table 4.5 *Continued.*

Scales	Items	Standardized coefficients		
		Occasion 1	Occasion 2	Occasion 3
Mood	1	.784	.832	.863
	2	.808	.876	.894
	3	.797	.841	.863
	4	.837	.856	.887
	5	.734	.755	.826
	6	.843	.879	.901
	7	.315	.357	.436
	8	.716	.786	.795
	9	.672	.697	.745
	10	.760	.780	.831
Perceptions of Instrumentality (PI) scale				
Perceptions of instrumentality	1	.630	.788	.720
	2	.763	.838	.812
	3	.102	.083	.007
	4	.333	.364	.383
	5	.166	.238	.173
	6	.784	.848	.783
	7	.548	.687	.603
	8	.437	.448	.414
General Self-Efficacy (GSE) scale				
General self-efficacy				
	2	.669	.737	.736
	3	.491	.606	.521
	4	.589	.705	.645
	5	.707	.776	.653
	6	.683	.750	.631
	7	.727	.724	.658
	8	.606	.714	.649
	9	.649	.748	.656
	10	.677	.711	.670
Motivated Strategies questionnaire (MSQ)				
Enhancement of situational interest	7	.790	.777	.731
	12	.835	.781	.727
	14	.776	.765	.825
	22	.737	.786	.785
	28	.828	.831	.849
Enhancement of personal significance	6	.623	.676	.737
	15	.478	.586	.549
	23	.770	.774	.780
Mastery self-talk	10	.667	.729	.728
	17	.697	.702	.695
	21	.711	.651	.683
	30	.646	.610	.637

Table 4.5 *Continued.*

Scales	Items	Standardized coefficients		
		Occasion 1	Occasion 2	Occasion 3
Performance-approach self-talk	1	.677	.734	.709
	8	.812	.816	.833
	16	.831	.777	.849
	26	.849	.812	.771
	29	.773	.777	.738
Performance-avoidance self-talk	4	.570	.603	.619
	5	.775	.808	.859
	25	.915	.882	.835
Proximal goal-setting	13	.779	.710	.771
	20	.880	.842	.843
	27	.871	.823	.869
Self-consequating	2	.819	.784	.841
	9	.840	.867	.886
	19	.816	.833	.814
	24	.768	.754	.805
Environmental control	3	.667	.773	.760
	11	.683	.670	.773
	18	.770	.875	.723

We first checked if student profiles differed in their levels of autonomous and controlled motives across all three occasions (question 1). We then analyzed the probabilities of students transitioning to a different motivational profile, both from Occasion 1 to Occasion 2 and from Occasion 2 to Occasion 3 (question 2). Finally, we performed a multinomial analysis (stepwise logistic regression) of profile transitions from Occasion 1 to Occasion 3 to see whether particular MRSs could predict changes between motivational profiles (question 3).

Motivational Profiles

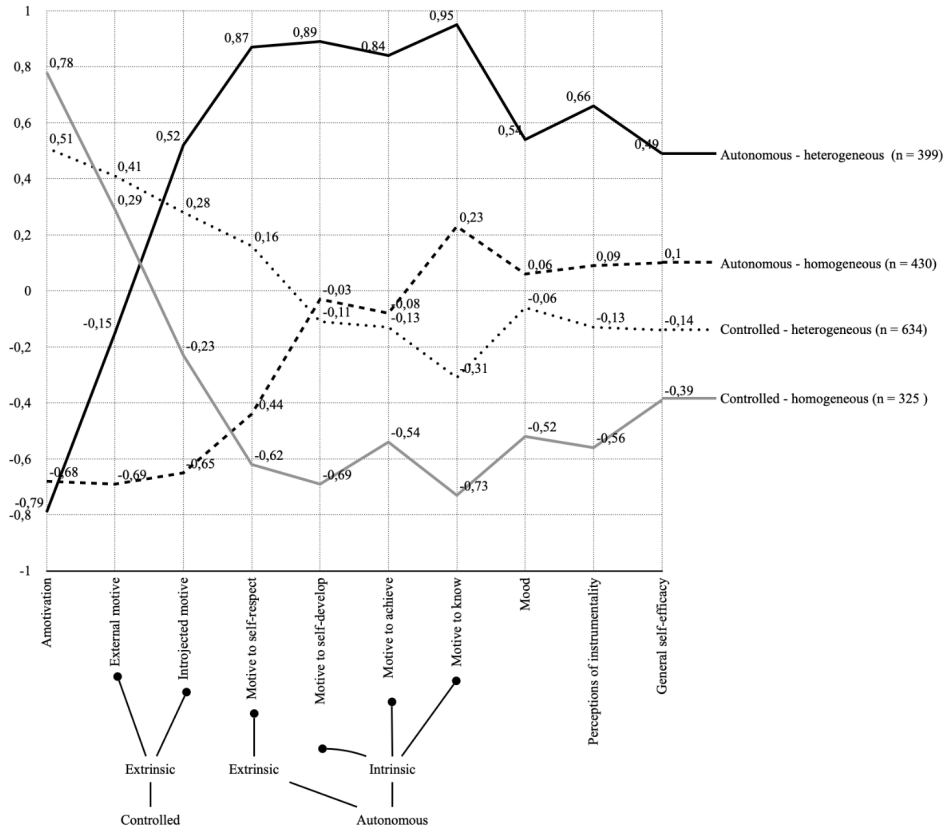
To answer the first question about whether and how students differ in the presence of motivational elements, representing different motivational profiles, we used LPA as a person-centered statistical technique on all three occasions simultaneously. In doing so, we used students' motives and the other three motivational elements (mood, perceptions of instrumentality, and general self-efficacy) as the components of their motivational profiles. In the end, we chose an ellipsoidal, equal shape mixture clustering model with four profiles (VEV4) (model fit: log likelihood = -19847.14, n = 1788, df = 236, BIC = -41461.65, ICL = -42113.88). Table 4.6 gives an overview of each profile (reporting means and standardized mean scores), while Figure 4.2 below presents the mean values of motives, mood, perceptions of instrumentality, and general self-efficacy per profile.

Table 4.6

Means, standard deviations, and standardized scores of the motivational profiles

	Controlled – homogeneous profile (n = 325)		Controlled - heterogeneous profile (n = 634)		Autonomous - homogeneous profile (n = 430)		Autonomous - heterogeneous profile (n =399)	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	Standardized scores	M (SD)	Standardized scores
Academic Motivation Scales questionnaire (AMSQ)								
Amotivation	2.62 (.99)	.78	2.30 (.88)	.51	1.16 (.25)	-.68	1.06 (.13)	-.79
External motive	3.04 (.99)	.29	3.17 (.83)	.41	2.00 (.83)	-.69	2.60 (1.00)	-.15
Introjected motive	2.95 (1.02)	-.23	3.51 (.66)	.28	2.54 (.96)	-.65	3.75 (.82)	.52
Motive to self-respect	2.97 (1.7)	-.62	3.84 (.64)	.16	3.21 (1.00)	-.44	4.55 (.41)	.87
Motive to self-develop	3.17 (.94)	-.69	3.72 (.62)	-.11	3.77 (.76)	-.03	4.55 (.44)	.89
Motive to achieve	3.12 (1.00)	-.54	3.47 (.67)	-.13	3.55 (.84)	-.08	4.33 (.52)	.84
Motive to know	3.36 (.95)	-.73	3.73 (.60)	-.31	4.21 (.58)	.23	4.77 (.27)	.95
Health. Activity. and Mood (HAM) questionnaire								
Mood	4.64 (1.32)	-.52	5.17 (.91)	-.06	5.29 (.85)	.06	5.80 (.77)	.54
Perceptions of Instrumentality (PI) scale								
Perceptions of instrumentality	3.24 (.60)	-.56	3.53 (.48)	-.13	3.66 (.58)	.09	4.10 (.51)	.66
General Self-Efficacy (GSE) scale								
General self-efficacy	2.84 (.70)	-.39	2.95 (.41)	-.14	3.10 (.46)	.10	3.29 (.40)	.49

Figure 4.2
Standardized mean scores for the motivational elements of each motivational profile



As depicted in Figure 4.2, we identified the following four profiles: An autonomous-heterogeneous (*N* = 399), autonomous-homogeneous (*N* = 430), controlled-heterogeneous (*N* = 634), and a controlled-homogeneous (*N* = 325) profile. These profiles differed in two important ways. First, they differed in terms of their dominant set of motives: While only one type of motive dominated in the two homogeneous profiles, multiple types of motives prevailed in the two heterogeneous profiles. More specifically, controlled-extrinsic motives (i.e., external and introjected motives) dominated in the controlled-homogeneous profile, meaning that these motives received higher ratings than did the autonomous motives (extrinsic motive to self-respect and intrinsic motive to self-develop, to achieve, and to know). The three autonomous-intrinsic motives, on the other hand, dominated in the autonomous-homogeneous profile, as these motives received higher ratings than did the three extrinsic motives (one autonomous - to self-respect - and two controlled - external and introjected). In the controlled-heterogeneous

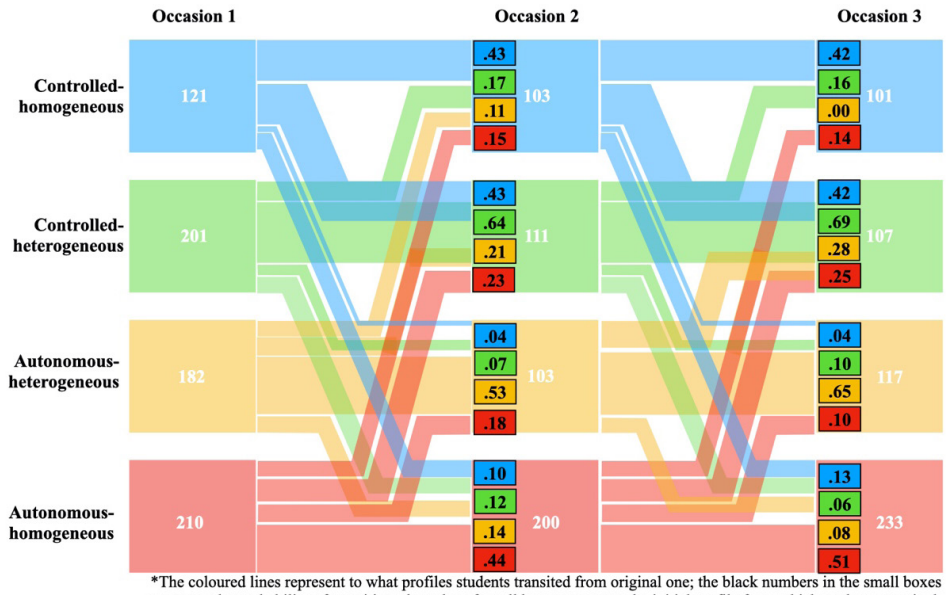
profile, by contrast, a mixture of autonomous-extrinsic motives to self-respect and two controlled-extrinsic motives dominated, with the controlled-extrinsic motives as leading. Finally, in the autonomous-heterogeneous profile, both the autonomous-extrinsic and autonomous-intrinsic motives dominated, with the autonomous-intrinsic motives as leading.

A second distinction between the profiles were the ratings they received for the three remaining motivational elements (general self-efficacy, perceptions of instrumentality, and mood): The controlled-homogeneous profile received the lowest ratings, the controlled-heterogeneous profile and autonomous-homogeneous profile both received medium ratings, and the autonomous-heterogeneous profile received the highest ratings. Hence, to answer our first question, we conclude that the motivational profiles differed in terms of the presence, combined or otherwise, of autonomous-intrinsic, autonomous-extrinsic, and controlled-extrinsic motives, as well as levels of mood, perception of instrumentality, and self-efficacy, revealing four different configurations.

Students' Transitions Between Motivational Profiles

To answer the second question about whether and how students' motivational profiles change over time, in the following we will present the results from our transition probability analysis from Occasion 1 to Occasion 2, and from Occasion 2 to Occasion 3.

Figure 4.3
Students' transitions across profiles



*The coloured lines represent to what profiles students transited from original one; the black numbers in the small boxes represent the probability of transition; the color of small boxes represent the initial profile from which students transited; white numbers represent a number of students in profile;

As depicted in Figure 4.3, students' motivational profiles were not stable across the three occasions. Nevertheless, the probability of students keeping their profile was higher than that they would change to another one: Probability numbers in rectangles on the background of squares with the same color (varying from .42 to .69) were 4-5 times higher than probability numbers in rectangles on the background of squares with another color (varying from .00 to .28). The only exception, however, was that students in the controlled-homogeneous profile were as likely to keep their profile as they were to move to the controlled-heterogeneous profile: Both probabilities in blue rectangles on the background of blue squares (keep their profile) and green squares (move to another profile) were .43 from Occasion 1 to 2, and .42 from Occasion 2 to 3. The probability of students keeping their profile increased in the following order: Controlled-homogeneous (.43 and .42), autonomous-homogeneous (.44 and .51), autonomous-heterogeneous (.53 and .65), and controlled-heterogeneous (.64 and .69) profile.

When students did change their profile, however, they were more likely to move to a more controlled profile. In these cases, most students with a controlled-heterogeneous profile moved to the controlled-homogeneous profile, as the probabilities in green rectangles on the background of blue squares (between.16 and .17) were higher than the probabilities on the backgrounds of other squares (between .06 and .12). Students with an autonomous-heterogeneous and autonomous-homogeneous profile were more inclined to move to a controlled-heterogeneous profile, as the probabilities in the yellow and red rectangles on the background of green squares (between .21 and .28) were higher than the probabilities in the yellow and red rectangles on the backgrounds of other squares (between .00 and .18).

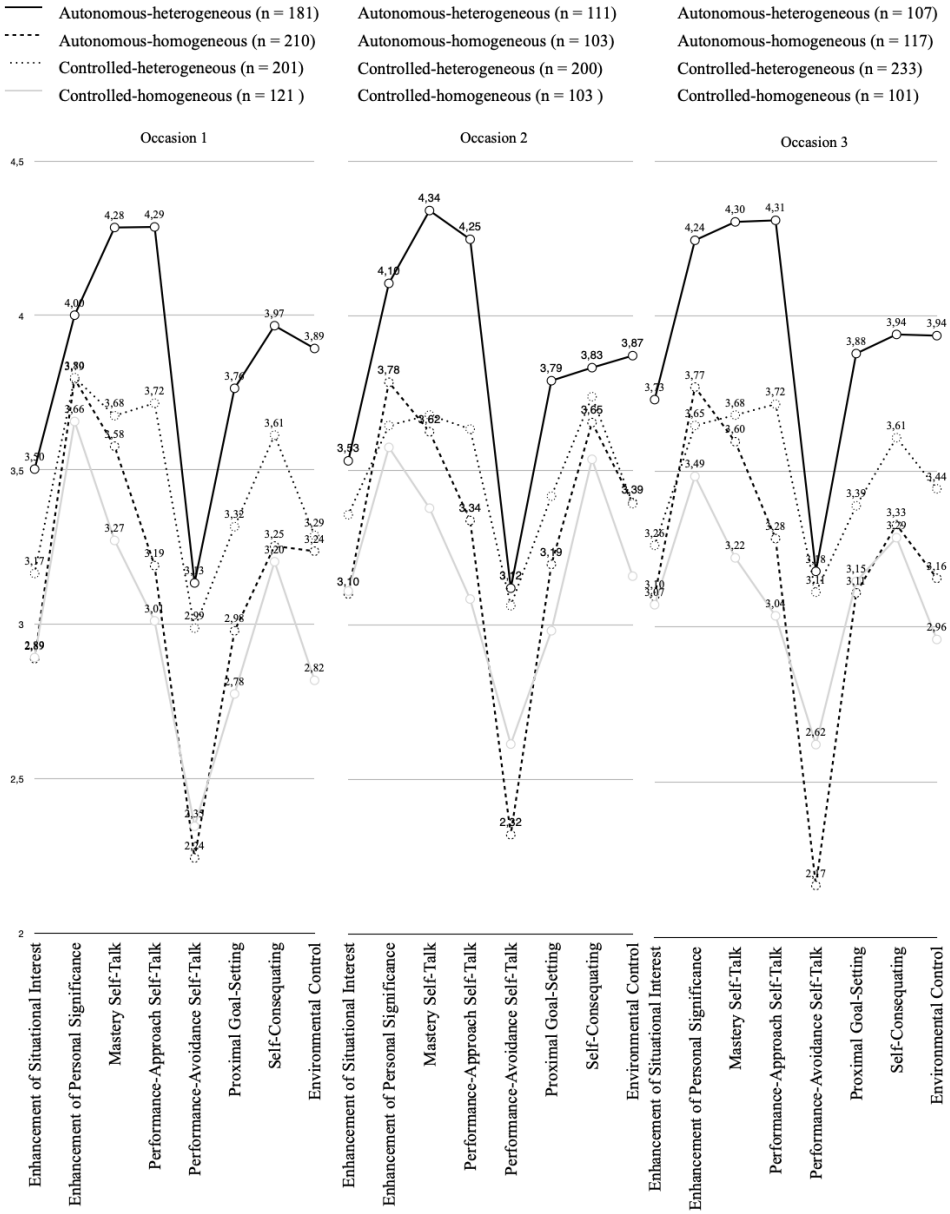
To recapitulate, all students were more likely to keep their profile than to change to another one. Chances of students maintaining their profile increased from the homogeneous to the heterogeneous profiles with the autonomous profiles in the middle of this continuum. When students did change their profile, however, they were more likely to move to a more controlled profile than to change to a more autonomous profile. To this, however, students with a controlled-homogeneous profile formed an exception, for they were just as likely to keep their profile as they were to move to the controlled-heterogeneous profile.

MRSs as Predictors of Changes Between Autonomous and Controlled Motivational Profiles

To answer the third question about whether and how changes in students' motivational profiles related to their specific MRS uptake, we will first describe how the motivational profiles differed in terms of how often the MRSs were used and then report the results of the multinomial analysis (stepwise logistic regression). All students, regardless of their motivational profile, used all the MRSs, albeit with different frequencies (see Figure 4.4).

Figure 4.4

The differences across motivational profiles in terms of MRS uptake.



Students with a controlled-homogeneous profile used all MRSs the least (*M* between 2.35 and 3.66), students with a controlled-heterogeneous profile had a medium uptake of all MRSs (*M* between 2.99 and 3.80), and students with an autonomous-heterogeneous

profile used all MRSs most frequently (*M* between 3.12 and 4.34). Students with an autonomous-homogeneous profile used the "performance-avoidance self-talk" and the "enhancement of situational interest" MRSs the least (*M* between 2.17 and 3.19) and the remaining MRSs on a medium level (with *M* between 2.98 and 3.79).

As the main qualitative difference between profiles was in different combinations of controlled and autonomous motives, the main motivational element according to activity theory, we further focus on them. Specifically, to investigate whether MRSs predicted changes from autonomous to controlled profiles and vice versa, we performed a multinomial analysis, for which we grouped students in two different ways, respectively. First, we created an autonomous profile group, consisting of students who had an autonomous-heterogeneous and autonomous-homogeneous profile on Occasion 1, and a controlled profile group, which encompassed all students with a controlled-heterogeneous and controlled-homogeneous profile on Occasion 1. We did the same for Occasion 3.

Next, we created two transition groups based on students' change between the aforementioned two profile groups from Occasion 1 to Occasion 3, each with two categories:

- Transition group CC&CA, consisting of students who stayed in the controlled profile group (CC) and students who changed from the controlled to the autonomous profile group (CA);
- Transition group AA&AC, consisting of students who stayed in the autonomous profile group (AA) and students who changed from the autonomous to the controlled profile group (AC).

We performed multinomial analyses (stepwise logistic regression) with students' self-assessed frequencies of using the eight MRSs during the course as independent variables. Each transition group served as dependent variable with two categories in two separate analyses. The first analysis investigated which MRSs likely predicted students to keep their controlled profile (CC) rather than to change to an autonomous profile (CA) by the end of the course. The statistical model was significant: AIC = 132.50; BIC = 159.77; -2 Log Likelihood = 114.50; X2 (df) = 17.05 (8); p = .03; Pearson: X2 (df) = 139.08 (143), p = .58; Deviance: X2 (df) = 113.11 (143), p = .97. The second analysis investigated which MRSs predicted students to keep their autonomous profile (AA) rather than to change to a controlled profile (AC) by the end of the course. The statistical model was again significant: AIC = 223.62; BIC = 252.89; -2 Log Likelihood = 205.62; X2 (df) = 53.43 (8); p = .00; Pearson: X2 (df) = 217.14 (180), p = .03; Deviance: X2 (df) = 205.62 (180), p = .09.

Table 4.7

Multinomial analysis (stepwise logistic regression) of MRSs' likelihood to predict students to keep or change their motivational profile (controlled or autonomous)

MRSs	B	Std. Error	Wald x2 (df)	Exp (B)	P
The likelihood of students changing from a controlled profile to an autonomous profile (group CA; N=24) as opposed to keeping their controlled profile (group CC; N=129) for Occasions 1-3					
Enhancement of situational interest	-.10	.49	.04 (1)	.91	.84
Enhancement of personal significance	.95	.46	4.32 (1)	**2.58**	**.04**
Performance-approach self-talk	.25	.42	.35 (1)	1.28	.56
Self-consequating	-.16	.36	.19 (1)	.86	.67
Mastery self-talk	.02	.46	.00 (1)	1.02	.96
Environmental control	.73	.39	3.56 (1)	2.07	.06
Performance-avoidance self-talk	-.36	.30	1.43 (1)	.70	.23
Proximal goal-setting	-.09	.37	.07 (1)	.91	.80
The likelihood of students changing from an autonomous profile to a controlled profile (group AC; N=79) as opposed to keeping their autonomous profile (group AA; N=112) for Occasions 1-3					
Enhancement of situational interest	-.32	.26	1.44 (1)	.73	.23
Enhancement of personal significance	.00	.28	.00 (1)	1.00	.99
Performance-approach self-talk	-1.05	.30	12.20 (1)	**.35**	**.00**
Self-consequating	.23	.23	.96 (1)	1.26	.33
Mastery self-talk	-1.24	.35	12.33 (1)	**.29**	**.00**
Environmental control	.64	.25	6.48 (1)	**1.89**	**.01**
Performance-avoidance self-talk	1.13	.24	22.50 (1)	**3.08**	**.00**
Proximal goal-setting	.01	.26	.00 (1)	1.01	.98

From the upper part of Table 4.7, we may construe that only one MRS significantly explained students' move from the controlled to the autonomous profile group CA: Enhancement of personal significance. That is to say, as students intensified their uptake of this specific MRS, they were more likely to move to the autonomous profile group (b = .95, Wald X2 (1) = 4.32, Exp. (B) = 2.58, p=.04). From the bottom part of Table 3, on the other hand, we may infer that the MRSs that significantly explained students' move from the autonomous to the controlled profile group AC were four: Performance-approach self-talk, mastery self-talk, environmental control, and performance-avoidance self-talk. An enhanced uptake of the performance-approach self-talk (b = -1.05, Wald X2 (1) = 12.20, Exp. (B) = .35, p=.00) and the mastery self-talk MRSs (b = -1.24, Wald X2 (1) = 12.33, Exp. (B) = .29, p=.00) significantly predicted that students would stay in the autonomous profile group. In contrast, an enhanced uptake of the environmental control (b = .64, Wald X2 (1) = 6.48, Exp. (B) = 1.89, p=.01) and the performance-avoidance self-talk MRSs (b = 1.13, Wald X2 (1) = 22.50, Exp. (B) = 3.08, p=.00) significantly predicted that students would move to the controlled profile group rather than stay in the autonomous profile group.

In summary, a greater uptake of the enhancement of personal significance MRS significantly predicted a desirable change from the controlled to the autonomous motivational profiles. An enhanced uptake of the performance-approach self-talk and mastery self-talk MRSs significantly predicted that students would keep their

autonomous profiles, whereas an enhanced uptake of the environmental control and performance-avoidance self-talk MRSs significantly predicted an undesirable move from the autonomous to the controlled motivational profiles.

DISCUSSION

The primary goal of the present study was to investigate whether students' uptake of specific MRSs during a course was related to changes in their motivation. First, we identified four motivational profiles according to their different constellations of autonomous and controlled motives, and other motivational elements. Second, we revealed patterns of transition across these profiles, with a tendency among students to transition toward more controlled and less autonomous motivational profiles during the course. Third, we identified five MRSs that were related to these transitions, some of which predicted a desirable increase or the retention of motivational profiles with leading autonomous motives, while others anticipated undesirable changes toward motivational profiles with leading controlled motives.

To answer our first research question about the possible types of motivational profiles, we revealed four motivational profiles with different constellations of controlled and autonomous motives, which could be either homogeneous (i.e., a clear dominance of either controlled or autonomous motives) or heterogeneous (the mixture of motives). The profiles we identified fit in with the continuum of motivation postulated in self-determination theory (Ryan & Deci 2020) along which they can be placed in the following sequence, according to the presence of autonomous motives: From controlled-homogeneous, via controlled-heterogeneous and autonomous-heterogeneous, to autonomous-homogeneous. The proportion of the other motivational elements (mood, perceptions of instrumentality, and general self-efficacy) rose in a similar order, with one exception: The autonomous-heterogeneous profile had the highest levels of these three elements, whereas the continuum of motivation postulates that the highest psychological growth and wellness should have students with more autonomous motivation, i.e with the autonomous-*homogeneous* profile in our study.

Moreover, we also conclude that our motivational profiles partly resonate with activity theory. According to this theory, motivation, which is represented by motivational profiles in our study, differ not only in terms of their underlying motives but also according to their emotional state (measured by mood), goals that have personal meaning (measured by perceptions of instrumentality), and means combined with beliefs (measured by general self-efficacy). Yet, we did not find students who, despite sharing the same leading motive (e.g., the autonomous motive to know new things), differed in their proportions of the other motivational elements. From this we conclude that, within the process of motivation, that is, within the process of constructing an impulse

to operate, the relationship between specific types of motives and other motivational elements may be more fixed than postulated in activity theory.

As for the second research question about the changes of motivation, we found that students' motivational profiles changed during the course. Although an average 50% of all students kept their motivational profile, the majority of the other students showed a tendency to shift toward less autonomous and more controlled motivational profiles. The changes in motivation have also been observed by previous studies that dealt with other levels of education, course types, and student samples (Dietrich, & Lazarides, 2019; Dietrich et. al., 2019; Gillet et al.,2017, 2020; Lazarides et al., 2019; Tuominen et. al., 2020). In other words, as motivation has a dynamic nature, or in terms of Activity theory, motivation is a *process*, motivational self-regulation should also be dynamic. We welcome further research to investigate the dynamic nature of motivation and find ways to help students use MRSs dynamically throughout their courses.

As the main qualitative difference between profiles was in different combinations of controlled and autonomous motives, we focus on answering the last research question about the MRSs contribution to motivational changes in students' controlled-autonomous motives changes. Whereas enhancement of personal significance MRS helped to *change* motives to more autonomous, we also found that the mastery- and performance-approach MRSs could help to *maintain* the same autonomous motives. These findings enrich Ivannikov's (1985, 2015) idea that for successful self-regulation, each motivational element needs corresponding MRSs as indicated by the motive hierarchy as originally assumed by Leontiev (1971/1978). The motive hierarchy could explain the change-maintenance difference in MRSs' function. In particular, the above mentioned three MRSs revealed higher relations with motives than with other motivational elements (Ilishkina et al., 2022a). It could be that first a student needs to find his/her meaning-making motives "Why is learning important to me? Why do I want to master these skills? Why do achievements matter to me?" Only after finding the higher-order meaning-making motive, students can benefit by creating a heterogeneous hierarchy of motives, that is, adding mastery and achievements motives.

Presumably for the same reason, only the use of the enhancement of personal significance MRS could predict a desirable move from the controlled toward more autonomous profiles. As students in the controlled profile group were missing their autonomous motive, and, thus, were possibly searching for it. According to activity theory, controlled motives create artificial rather than personal meaning, which is not likely to trigger an impulse transition to subsequent motivational levels, and finally to a concrete operation like reading a textbook (Leontiev, 2016). Therefore, these students profited most from searching for motives and the *personal* meaning in learning by using the enhancement of personal significance MRS. These findings enrich the process of self-regulation by taking the motive hierarchy into account, i.e., it could be essential, first, to find the autonomous motive and only when it is found, additionally the student can

focus on lower-level motives (mastery and performance) to maintain motivation.

Hence, an important takeaway from our study is that the use of specific MRSs might help students to move from controlled to more autonomous motivational profiles, or at least to retain their autonomous motivational profile. On the downside, however, frequent uptake of the performance-avoidance self-talk and environmental control MRSs may occasion undesirable changes from autonomous to controlled motivational profiles. It may well be possible that students' enhanced uptake of the environmental control MRS was triggered by environmental distractions. As such, we might consider the environment as part of the motivational element *means* that has the potential to enhance or dampen students' motivation. Overall, our results echo those of Schwinger and Otterpohl (2017) who revealed that not all MRSs are effective at sustaining students' efforts and persistence.

Our study has several limitations. First, we have a high percentage of missing data because many students missed part of the classes. Second, our operationalization of the theoretical model in terms of motives, mood, perceptions of instrumentality, and general self-efficacy using existing questionnaires may not have done full justice to activity theory, as we measured neither goals and personal meaning nor means and beliefs separately. Third, we only analyzed the first two levels of the activity system's macrostructure (motive formation and planning), without covering the third level (performance). Fourth, the questions we asked students differed across the three occasions in that we first asked students about their feelings regarding learning and their related behavior and about their perceptions of instrumentality pertinent to the *projected* course (Occasion 1), while on the remaining occasions we asked them similar questions, but this time about learning in the *present* course. Fifth, since four items of the original Perceptions of Instrumentality Scale showed low reliability, low standardized coefficients, and poor model fit, we had to omit these items and unite two scales into one. Future research could address these limitations by finding a more appropriate instrument to measure personal meaning, and by observing students' actual performance on learning tasks in addition to measuring their motivational elements.

In terms of practical implications, our results suggest that students should consider their motivation as a dynamic process that requires self-regulation throughout the course. Motivational self-regulation could appear in three ways: improving, maintaining, or harming the same motivation. While choosing between these three ways, students could benefit by taking into account their own motives. If the leading motive is controlled or stimulus-construction, then it could be more efficient to focus on finding links between studying and own interests and experience (enhancement of personal significance MRS). When the student has found this autonomous or personal meaning-making motive, then s/he should be aware that motivation could still be changed. So, motivational self-regulation is still needed, but now for maintaining motivation. In such a case, students could benefit by expanding their motive hierarchy by adding other motives — mastery

and achievement (mastery and performance-approach MRSs). Instructional designers and teachers who wish to create a learning environment that fosters student motivation to learn should realize that students have different motivations that may also vary over time. Consequently, they should embed activities in courses that prompt students to reflect on their motives and other motivational elements, and to consider the use of relevant MRSs to make and keep them autonomously motivated.

To conclude, we found that students' motivation changes during a course, with a general tendency to become less autonomously motivated in favor of controlled motivation. Only five MRSs appeared to be significantly related to observed changes in motivational profiles. These MRSs contributed in two ways: changing or maintaining motivation. However, when leading motives were controlled, these MRSs no longer worked. In such a case only the use of the enhancement of personal significance MRS was related to desirable changes toward more autonomous motivational profiles. Hence, to maintain or become autonomously motivated, it is not just the arbitrary use of MRSs that matters, but the choose of specific MRSs by considering student's motive hierarchy. This important insight might help students to self-regulate their motivation and teachers to support them in selecting the appropriate strategies to do so.

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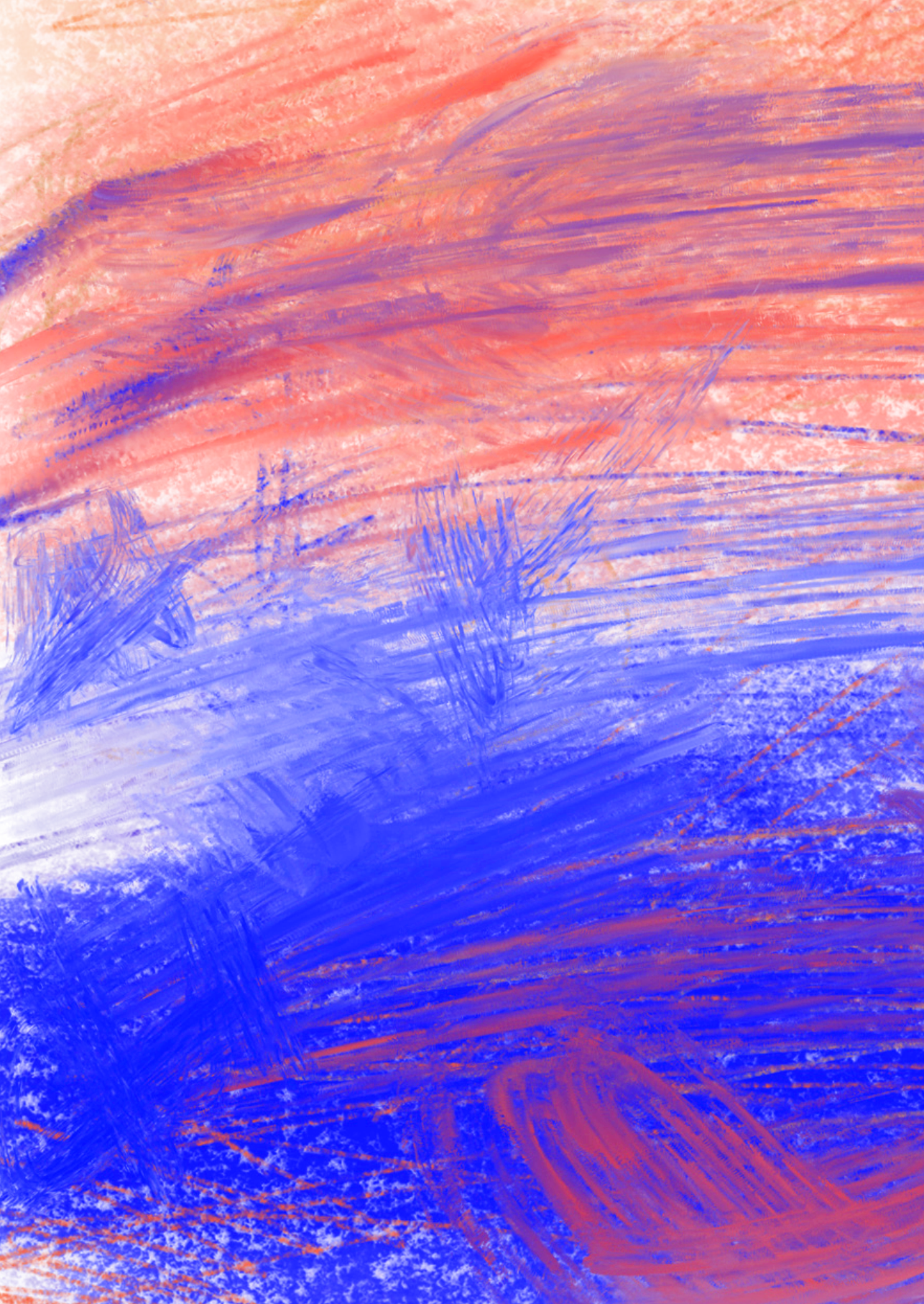

CHAPTER 5

Refining motivational regulation strategies based on students' real-time thoughts and motivation whilst facing motivational problems

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ABSTRACT

Students can use several motivational regulation strategies (MRSs) to stay motivated. What they really do, think and feel, however, when they lack the motivation to study is mostly unknown. We therefore conducted a mixed-methods study to measure how students' motivational problems were related to the 7 motivational elements postulated by activity theory, and to their concomitant MRS uptake and thoughts. To this end, 153 university students completed 4 questionnaires including a one-week self-regulated learning microanalysis survey. Surprisingly, we found that motivational problems were unrelated to students' MRS uptake, although they did coincide with lower quantities of meaning, goal, affect and specific self-efficacy. Students' reflections indicated that they contemplated the motivational elements, but *not* how they could use the MRSs to solve their motivational problem. Yet, our results led us to redefine the MRSs as follows so as to make them more applicable to students' specific situation and potentially render them more useful in solving real-time motivational problems: *lending meaning to (not) learning*, *preparing the means necessary for learning and optimising beliefs,* and *prioritising different motives for (not) learning*. Hence, we argue that the above redefinition of MRSs is needed to improve their link with students' individual motivational elements and, consequently, their usability for students who lack the motivation to study.

Educational impact and implications statement: Our scrutiny of students' reflections yielded cues as to how to refine the existing MRSs in order to render them useful during planning and performing learning actions. As such, the proposed MRSs might help students to better regulate their motivation in real time.

Keywords

Self-regulated learning, motivational regulation strategies, motivational problem, motivational conflict, motivational interference

INTRODUCTION

Throughout their education, students sometimes lack the motivation to study. The reasons can be manifold, such as conflicting activities, learning impairments, interferences or incentives experienced during study. Consequently, such motivational problems can cause students to experience lower affective well-being (Grund et. al., 2015;), to put in less effort (Capelle et. al., 2022; Eckerlein et. al., 2019) and to spend less time studying (Koudela-Hamila et. al., 2019). In order to counter these negative effects, it is essential that we help students to self-regulate their motivation effectively so that they can overcome these problems of motivation.

One such way to boost motivation is to promote the uptake of motivational regulation strategies (MRSs) among students. As previous research has demonstrated, students wield specific MRSs to create, maintain and improve their motivation (Wolters, 2003; Schwinger, Steinmayr and Spinath, 2009). These strategies take the form of different kinds of self-talk, for example, when students try to link their present study behaviour with consequences for future life, and strategies take the form of actions, such as removing all distractions. Recent research has already demonstrated that MRSs are related to motivation (Ilishkina et al., 2022; Schwinger et al., 2007; Trautner & Schwinger, 2020; Wolters & Benzon, 2013; Wolters & Rosenthal, 2000) and to motivational problems (Engelschalk et. al., 2016; Eckerlein et. al., 2019; Bäulke et. al., 2021; Kim et. al., 2021). Engelschalk, Steuer, and Dresel (2016), moreover, found that the effectiveness of MRSs depends on the specific motivational problem a student is having. To our knowledge, however, theirs has been the only attempt to capture students' motivation and MRS uptake in relation to their experienced motivational problems.

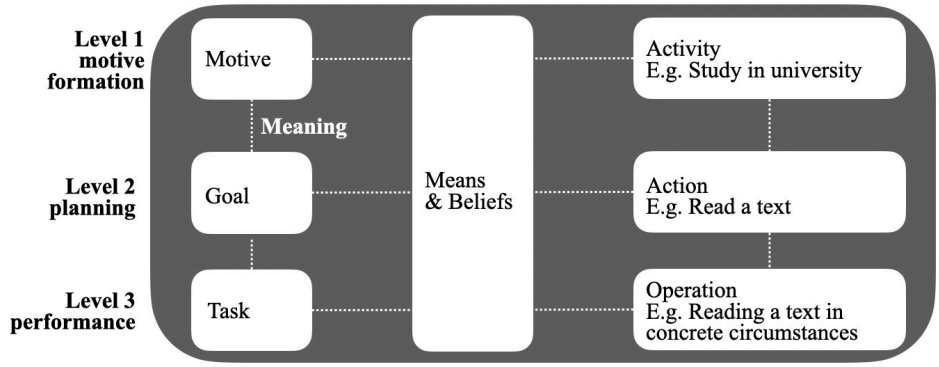
To close this gap, we aimed to investigate how students experience and tackle their motivational problems in relation to their motivation and specific MRS uptake. With this exploration, we hoped to complement the few studies that have analysed students' motivational problems and MRS uptake in real time and in their natural context as opposed to the common approach that asks students to respond to the written scenario of hypothetical motivational problems (Brassler et al., 2021; Fries et al., 2008; Grund, 2013).

Motivation Through the Lens of Activity Theory

To investigate students' motivation and their concomitant MRS uptake when experiencing motivational problems, we drew from Leontiev's activity theory (Leont'ev, 1971/1978) and Ivannikov's additions to this theory (1985a, 2015) which together provide a systematic perspective on motivation and its relation to motivational problems and MRSs. Bearing in mind that there is no single view on motivation (Hattie, Hodis, Kang, 2020), we adopted activity theory as a theoretical framework because it considered activity as a system and motivation as a process proceeding within it, whilst uniting different motivational elements (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978). As such, this holistic view

captures different aspects of motivation and allows us to integrate different perspectives on motivation (Hattie et al., 2020). As shown in Figure 1, activity theory considers activity and motivation as two sides of the same coin or system that spans three interrelated layers: motive formation, goal planning and task realisation for the motivation side (the left side of Figure 5.1), and activity, action and operation for the activity side (the right side of Figure 5.1). According to this theory, students should not only have a general motive to study in university, but also formulate meaningful goals and plan and perform specific learning activities and operations that altogether make up this abstract activity of 'studying in university'. Each of the said layers comprises motivational elements that, when compromised, can become a motivational problem and hence a target for MRSs.

Figure 5.1
Macrostructure of activity and the elements involved in motivation.



*Emotion is not in the picture as it permeates the entire system.

The upper row of Figure 5.1 shows that the motivation process starts with *the formation of a motive* (Level 1), which is important but not yet sufficient to spur the student into action. The main elements that drive motivation at this level *are the student's motive* and *emotions*. Whereas a motive can satisfy their need, students' emotions direct them towards these motives and inform them about whether or not the activity process (i.e. the planned and performed operations) is going as planned and is helping them to satisfy their respective need. We can distinguish two types of motives, that is, stimulus-constructing and personal meaning-making motives, which are similar to 'controlled extrinsic motivation' and 'autonomous intrinsic motivation' proposed in self-determination theory (Leontiev, 2016; Ryan & Deci, 2020). Constituting a hierarchy, moreover, certain motives can take precedence over others, for instance when the student attaches more weight to the relationship with their partner than to successful learning.

Before the student can really start acting, however, they must first move on to

the *planning and performance* level (Levels 2 and 3). The student's motive serves as an impulse to create a *goal,* which, as the main motivational element at *this level,* targets the actions that constitute this activity (see Figure 1, middle row). By planning a chain of intermediate actions to achieve their goals, the student can ultimately reach their desired motive, even though the intermediate actions and goals do not, by themselves, lead to the motive immediately. Despite their importance, not all motives and their ensuing goals participate equally in the student's motivational process. Theoretically speaking, only those that have *meaning* can create an impulse to real actions and operations. As the fourth main motivational element, meaning is what links the student's motives to their goals. At the final stage, the student enters *the level of performance* where they execute the operations that constitute the actions (see bottom row of Figure 1). At this third level, the plans of level 2 are transposed into the real context and environment, where the goal becomes a task and an action becomes an operation. Hence, at this point, the student actually starts putting their plans of the previous level into action. In summary, a student's motive, emotions, goals and the meaning they attach to them are crucial elements that constitute their motivation.

However, as Ivvanikov was keen to point out, two other elements may potentially interfere with the process of motivation as well, depending on the situation. That is to say, the various tools or *means* at the student's disposal as well as their own *beliefs* about what is needed to perform the action can impact upon their motivation (Ivannikov, 1985a, 2015). As also indicated in the middle part of Figure 1, in the following we will employ the term 'means and beliefs' to refer to the final two motivational elements. Overall, motives, emotions, goals, meaning, means and beliefs are the motivational elements that altogether transfer an impulse through three levels of activity, that is, from motive ('I want') to planning ('I plan'), and finally to the real performance ('I do').

Motivation, Motivational Problems and MRSs

In addition to describing the process of motivation and its constituent elements, activity theory also addresses the question of how motivational problems actually arise. Elaborating the theory, Ivannikov (1985a, 2015) suggested that the various motivational elements previously specified could also disrupt the motivation process, thereby acting as the source of motivational problems. In theory, this happens when one of the motivational elements is quantitatively or qualitatively compromised. When a textbook is too difficult for the student to grasp, for instance, because they lack the required knowledge or 'means' (motivational element 5), they could be discouraged to continue reading. The impulse has then diminished to such a degree that the student terminates their operations. With this knowledge in mind, the purpose of the present empirical study was to address the following research question: How does students' real-time experience of motivational problems relate to the above-specified motivational elements?

When any one motivational element is compromised, theoretically speaking

the student could use their 'willpower' as a form of self-regulation to restore that particular element, thereby solving their motivational problem in the process (1985a, 2015). Ivannikov defined willpower in such an extensive way that we see similarities with our definition of MRSs: a broad array of different strategies that students wield to improve their motivation, including motivational and volitional strategies as different manifestations of willpower (Ilishkina et. al., 2022). In the remainder of this article, we will therefore use the term MRSs to refer to the different ways in which students can improve their motivation. We should note, however, that Ivannikov and colleagues did not analyse this assumption in their empirical studies, as they mainly studied the relationship between self-control and various factors, without specifying the different MRSs and investigating their relationship with the elements and associated problems of motivation (Ivannikov et. al., 2020; Ivannikov et. al., 2018; Ivannikov & Monroz, 2016; Ivannikov & Shlyapnikov, 2019).

Other researchers, however, did shed light on the types of MRSs, which we will continue to investigate in the study at hand. More specifically, Wolters (2003) and Schwinger, Steinmayr and Spinath (2009) have identified the following eight MRSs: (1) enhancement of situational interest – adding game elements to a tedious task or modifying it so as to increase pleasure; (2) enhancement of personal significance – connecting an unpleasant activity with individual interests and searching for links with real life; (3) performance-approach self-talk – emphasising the need to complete a task in order to achieve a good result; (4) performance-avoidance self-talk – emphasising that one needs to learn in order not to be disgraced or worse than others; (5) mastery self-talk – challenging and orienting oneself to master the skill; (6) self-consequating – promising oneself some kind of reinforcement or reward after completion of the task; (7) proximal goal-setting – dividing a large task into smaller subtasks; and (8) environmental control – eliminating factors that can distract from learning. Based on the suggestion that MRSs can restore the threatened motivational elements, solving motivational problems in the process, and given the eight MRSs outlined above, we introduce our second research question that reads: How does students' real-time experience of motivational problems relate to their specific MRS uptake?

Finally, assuming that students use the aforementioned MRSs and that motivation does indeed consist of at least five motivational elements as postulated by activity theory, we present our third and final research question: How do students' thoughts during their real-time experience of motivational problems relate to the specific motivational elements and their concomitant MRS uptake?

The Present Study

To recapitulate, this study will address the following three research questions with the ultimate aim to enhance our understanding of students' motivation process and of how they regulate it in real time:

1. How does students' real-time experience of motivational problems relate to the above-listed motivational elements?
2. How does students' real-time experience of motivational problems relate to their specific MRS uptake?
3. How do students' thoughts during their real-time experience of motivational problems relate to the specific motivational elements and their concomitant MRS uptake?

METHOD

Design and Setting

To measure students' motivational problems, motivation process and MRS uptake, we used a mixed-methods design. First, we invited students to complete four paper-based questionnaires that measured their motives to learn, mood and general self-efficacy during the first level of the motivation process (motive formation) and their concomitant MRS uptake. Consequently, the students filled in an online self-regulated learning (SRL) microanalysis survey for one week during their real-time study. This survey measured students' motivational elements during the planning and performance level of the motivation process (affect, meaning, goal and specific self-efficacy), their motivational problems and the thoughts that accompanied these problems in a natural context. As such, the survey tapped into students' real-time decisions to study or not to study. In the next paragraphs, we will describe the participants and each of the five instruments used in more detail.

Participants

Respondents were 153 students (125 female; age: $M = 19.83$, $SD = 2.44$), most of whom ($N = 151$) were from former countries of the Commonwealth of Independent States, whilst two came from other countries. Table 5.1 presents the number of students according to their year of study and study programme, including their mean age.

Table 5.1
Number of students according to year of study and study programme.

	***N* students (female)**	**Mean age (*SD*)**
Year of study		
First-year students	70 (65)	18.42 (1.08)
Second-year students	18 (17)	19.50 (1.10)
Third-year students	40 (31)	21.24 (2.41)
Fourth-year students	4 (4)	22.75 (1.26)
Fifth-year students	9 (8)	22.50 (0.84)

Table 5.1 *Continued.*

	N students (female)	Mean age (*SD*)
Study programme		
Pedagogy	6 (6)	22.50 (0.84)
Psychology	78 (67)	19.99 (2.49)
Linguistics	22 (21)	18.33 (0.58)
Journalism	33 (29)	19.36 (1.16)
Total N students	153 (125)	19.83 (2.44)

Note. Twelve students did not mention their study year, 14 students did not mention their study programme, and 11 students did not mention their gender, nor their age.

Measures

As stated before, we measured students' motivational elements, specific MRS uptake, the motivational problems encountered and their accompanying thoughts, using five different instruments. Table 5.2 gives an overview of these measurement instruments and their linkages to the operational model.

Table 5.2
Operationalization of students' motivational elements and their MRS uptake

Operational model	Measure
Six motives to learn and amotivation as an operationalization of autonomous-intrinsic, autonomous-extrinsic, controlled-extrinsic, and the absence of motives	Academic Motivation Scales questionnaire (Gordeeva et al., 2014)
Mood and affect as an operationalization of "emotions"	The Mood subscale from the Health, Activity, and Mood questionnaire (Doskin et al., 1973) and The Russell et al.' Affect grid (1989),
Students' answers about what goal and meaning do they have (if have) as an operationalization of "goals" and "meaning"	Self-Regulated Learning Microanalysis survey (Cleary, 2012)
General self-efficacy and specific self-efficacy as an operationalization of "means" and "beliefs"	General Self-Efficacy scale (Shvartser et al., 1996) and Self-Regulated Learning Microanalysis survey (Cleary, 2012)
Motivational regulation strategies as an operationalization of "willpower"	Motivated Strategies questionnaire (Schwinger et al., 2009) and Self-Regulated Learning Microanalysis survey (Cleary, 2012)
The situation of student' choice to learn or not to learn as an operationalization of "motivational problem"	Self-Regulated Learning Microanalysis survey (Cleary, 2012)

In the next paragraphs, we will give a more detailed description of each of the instruments used.

Four questionnaires to measure students' motivational elements during motive formation.

The four questionnaires we administered at the beginning of the study measured students':

Motives to learn

To measure students' motives to learn, we used Gordeeva, Sychev, and Osin's Academic Motivation Scale (AMS) questionnaire (2014), which is an improved version of Vallerand et al.'s classification of students' motives to learn (1992). The questionnaire contains 28 items that are divided over seven scales (four items per scale). Three of these scales measure students' intrinsic motives to know (Scale 1; e.g. 'I like to study'), to achieve (Scale 2; e.g. 'I like to solve difficult problems and invest intellectual effort'), and to self-develop (Scale 3; e.g. 'I like to know how to increase my competence and knowledge'). Three other scales measure: students' extrinsic motives to self-respect (Scale 4; e.g. 'To prove to myself that I am a smart person'), their introjected motives (Scale 5; e.g. 'Because it is embarrassing to do poorly in studying'), and their external motives (Scale 6; e.g. 'I have no other choice, as they will check my attendance'). The final scale measures students' amotivation (Scale 7; e.g. 'Before, I knew why I was studying, but now I am unsure whether to continue'). As in the modified version, all items were rated on a 5-point Likert scale (1 = does not apply at all; 5 = applies completely).

Mood

To measure students' mood, we used the Mood subscale from the Health, Activity and Mood (HAM) questionnaire (Barkanova, 2009). Spanning ten items, this subscale describes ten different feelings the intensity of which was scored on a 7-point scale ranging from minus 3 to plus 3, with 0 being the neutral score (e.g., 'cheerful 3 / 2 / 1 / 0 / 1 / 2 / 3 sad'). Positive feelings were reported on the left side, whilst negative feelings were listed on the right.

General self-efficacy

To measure students' general self-efficacy, we used the Russian version of the General Self-Efficacy (GSE) scale (Shvartser et. al., 1996). This scale comprises ten items (e.g. 'I can always manage to solve difficult problems if I try hard enough') that were rated on a 4-point Likert scale (1 = fully incorrect; 4 = fully correct).

MRS uptake

To measure students' MRS uptake, we used the Russian version of Schwinger et al.'s Motivated Strategies (MS) questionnaire (2009). This 30-item questionnaire comprises the following eight scales: (1) enhancement of situational interest (5 items; e.g. 'I make learning more pleasant for myself by trying to arrange it playfully'), (2) enhancement of

personal significance (3 items; e.g. 'I look for connections between the tasks and my life as such'), (3) mastery self-talk (4 items; e.g. 'I persuade myself to work intensely for the sake of learning'), (4) performance-approach self-talk (5 items; e.g. 'I attempt to call myself to intense work by focusing on obtaining good grades'), (5) performance-avoidance self-talk (3 items; e.g. 'I tell myself that I have to push myself more if I do not want to make a fool of myself'), (6) proximal goal-setting (3 items; e.g. 'I break down the workload into small segments so I get the feeling that I can handle it more easily'), (7) self-consequating (4 items; e.g. 'I tell myself that after work I can do something nice, if I first keep on learning now'), and (8) environmental control (3 items; e.g. 'I consciously choose such learning times when I can concentrate especially well'). All items were rated on a 5-point Likert scale (1 = used rarely; 5 = used very often).

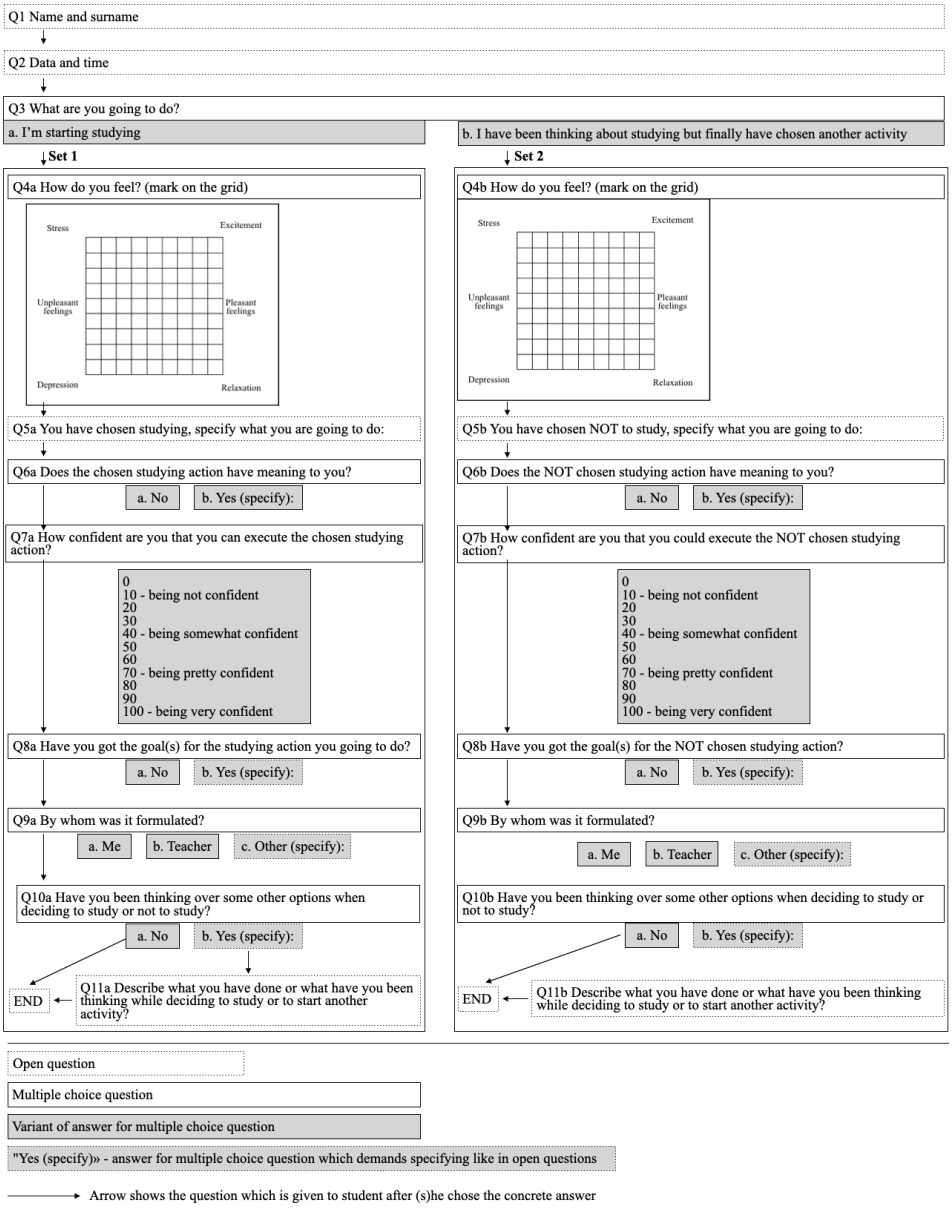
SRL microanalysis survey to measure students' motivational elements and thoughts during planning and performance.

Based on the guidelines set out by Cleary et al. (2012), we designed an SRL microanalysis survey that measured students' motivational elements during the planning and performance levels of the motivation process as well as their real-time thoughts when experiencing motivational problems. In doing so, we first chose the learning activity as the target task, no matter what and how specifically student was learning — the student could outlining a lecture, watching an online course, solving a mathematical task or conducting any other learning activity. Next, we targeted students' motivational elements at the said levels of the motivation process – that is, affect, meaning, goals and specific self-efficacy as postulated by activity theory (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978) -, the motivational problems they experienced (Grund et. al., 2015), and the thoughts that accompanied these problems. Finally, we formulated open-ended questions and/or closed questions with multiple answer options or Likert scales. See Figure 5.2 for a complete overview of the survey.

As shown in Figure 5.2, the first two questions of the survey asked for students' general information such as their names, and the date and time at which they completed the survey. Students filled in their names only once, as the programme automatically recognised their ID on each subsequent occasion. At Question 3 (What are you going to do?), students were automatically directed to a particular set of questions, depending on their answer. If they responded 'a. I will start learning', then their next set of questions would be Q4a-Q11a. In case they replied 'b. I thought about learning, but finally chose to perform another action', then questions 4b-11b would appear next. In the following paragraphs, we will describe how we measured each of the motivational elements during the planning and performance levels, using Questions 4 through to 11 (a's and b's included).

Figure 5.2

SRL microanalysis survey.



Affect

To measure students' affect, we used Russell et al.'s so-called 'Affect grid' (1989), which is a 9x9 grid consisting of two dimensions that measure students' level of arousal-sleepiness and pleasure-displeasure. More specifically, by means of closed Questions 4a/b ('How do you feel now?'), we asked students to place a single mark on the grid as a measure of their feelings (i.e. affect). A mark at the centre of the square denoted a neutral, average, everyday feeling that was neither positive nor negative. Along the grid's vertical dimension, students indicated their degree of arousal, with the top half representing above-average feelings of arousal and the lower half indicating feelings that were below average. Students' degree of pleasure, on the other hand, was marked along the grid's horizontal dimension, the right half representing positive feelings (pleasure) and the left half denoting negative feelings (displeasure). We obtained students' arousal score (A), which ranged from 1 to 9, by counting from the bottom which row the student had checked. Counting from the left, we obtained their pleasure score (P), which also ranged from 1 to 9.

Meaning

We measured students' presence and type of meaning by means of closed Questions 6a/b: 'Does the chosen learning action have meaning to you?, that students could answer with 'yes' or 'no' (see Figure 2). If the student responded with 'yes', then they were asked to explain what meaning they had.

Specific self-efficacy

To measure students' beliefs about their ability to execute the learning activity chosen, we employed a self-efficacy Likert-type scale (Bandura, 2006; Cleary et. al., 2015) as expressed in closed Questions 7a/b: 'How confident are you that you can execute the learning action chosen?'. The 0-100 scale was broken down into 30-point increments, starting from 10 (not confident), on to 40 (somewhat confident) and 70 (pretty confident), to end with 100 (very confident).

Goal

We used closed Questions 8a/b ('Have you got goal[s] for the learning action you are going to do?') to measure the presence and type of goals. The question could be answered with 'yes' or 'no' and in case of a positive answer, students were first asked to specify what these goal(s) were. Students then received an additional question ('By whom was it formulated?') asking them to specify the goal-formulating agent by choosing 'me', 'the teacher', or 'somebody else'. In case of the latter, the student was asked to specify the respective agent.

Motivational problems

We measured whether or not students had experienced motivational problems before deciding to study or not to study by means of Questions 3a/b, combined with Questions 10a/b. Such problems could be absent, which was the case when the student had started to study immediately. They could also have been solved, which happened when the student did experience motivational problem but decided to study anyway. And finally, motivational problems could be unresolved, which was the case when the student experienced motivational problem and consequently decided not to study, without dealing with the problem. Motivational problems were marked as 'absent' or 'solved' when students gave a positive answer to Question 3 (I will start studying) and answered closed Question 10a ('Have you been thinking over some other options when deciding to study or not to study?') with either 'yes' or 'no' (see Figure 2). Motivational problems were flagged as 'unresolved' when students selected option b ('I considered studying, but chose a different activity instead') to answer Question 3 ('What are you going to do?'). As displayed in Figure 2, students received open Questions 11a/b if they had experienced motivational problems, asking them to describe what they had done or what they were thinking about when they decided to study or to perform a different activity instead.

Thoughts accompanying motivational problems

To capture students' thoughts, we used the open question 'Describe what you were doing or thinking when you decided to study or not to study and do something else'.

Procedure

Before starting the main study, we first tested the instruments on 21 students. Based on their feedback, we made a few minor changes to the procedure. We included automatic student ID recognition in the online survey as well as reminder notifications and we incorporated a clear definition of 'learning activity': the process of gaining new knowledge, skills and attitudes.

Upon commencement of the real study, we held a meeting with all participants to explain the procedure and instruct them how to complete the various instruments. In doing so, we provided them with a clear definition of 'learning activity' of which we included examples. Participants then received the four paper-based questionnaires specified under 'Measures' that took them about 20 minutes to complete. After this meeting, students started their one-week SRL microanalysis survey, which they completed online several times per day from Monday to Sunday. They did so on the following three occasions: (1) when they started a new learning activity; (2) when they were thinking about studying, but finally decided not to; (3) and when they had finished learning. In this article, we did not consider the third occasion.

Prior to participation, all students gave their oral, informed consent. On the first page of the questionnaires, we again reported the information about the survey and

anonymity of the data and asked students to also give us their written informed consent by completing the questionnaires and handing them in. All students participated voluntarily, and they were also informed they could end their participation whenever they wanted, without giving any reason. The teachers and the Dean gave their approval for the study. All procedures were performed in compliance with relevant laws and institutional guidelines and with the code of ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans (World Medical Association, n.d.).

To motivate students and to prevent them from giving socially desirable answers, we emphasised the fact that they would receive the additional course credits as a reward for their participation, *regardless of their answers*. However, they would only earn these extra points if they completed the four questionnaires and filled in the SRL survey at least eight times per day (four times for starting and four times for finishing a learning activity), as their university schedule included four learning activities per day.

Data Analysis

As input to the analysis, we computed the mean scores for each scale of the questionnaires. To answer the first research question about the relationship between motivational problems and students' motivational elements, we performed Spearman's correlation analysis, Mann-Whitney U tests and chi-square tests in R of students' questionnaire responses (R Core Team, 2020). More specifically, we first performed Spearman's correlation analysis of students' motives to learn, mood and general self-efficacy (the motivational elements involved in the first level of the motivation process) and the state of their motivational problems (absent, solved, unresolved). For each student, we converted these states into percentages by using the following formula:

$$\frac{\text{No. of absent/solved/unresolved motivational problems}}{\text{Total no. of instances in which student undertook a learning or other activity}} \times 100\%$$

An example of such a calculation is presented in Table 5.3.

Table 5.3
Example calculation to express the state of a random student's motivational problems as a percentage.

State of motivational problem (answers to Questions 3 and 10)	Explanation	No. of occurrences based on SRL survey	Percentage
Absent	The student started to study without considering other options.	2	(2 / 14*)×100 = 14.29%
Solved	The student was tempted to undertake another activity at first, but then decided to study after all.	5	(5 / 14*)×100 = 35.71%
Unresolved	The student considered studying, but decided not to in the end.	7	(7/ 14*)×100 = 50%

*14 — Total number of absent, solved and unresolved motivational problems in the example.

In the next step, we ran Mann-Whitney U tests and chi-square tests of students' responses to the SRL microanalysis survey (*N*=1229). In both tests, the state of students' motivational problems (absent, solved, unresolved) served as the independent variable. The dependent variables for the Mann-Whitney U test were students' survey scores for 'affect' and 'specific self-efficacy'. The other two motivational elements also involved in the planning and performance level of the motivation process – that is, 'meaning' and 'goal' – served as dichotomous dependent variables (present vs. absent) for the chi-square test. To answer the second research question about the relationship between students' motivational problems and their specific MRS uptake, we again performed Spearman's correlation analysis of students' questionnaire responses (N=153).

As a final step, we performed a thematic analysis to address the third research question about how students' thoughts during their real-time experience of motivational problems relate to the specific motivational elements and their concomitant MRS uptake. To this end, we analysed students' responses to question 11a or b of the survey ('Describe what you were doing or what you were thinking when you decided to start learning or do something else'). We did so by following the five steps set out by Nowell and colleagues (2017), as explained below. In total, we analysed 191 solved and 150 unresolved motivational problem cases, excluding those in which the student had neglected to answer the respective question (solved motivational problems: $N = 9$; unresolved motivational problems: $N = 14$).

In the first step of the analysis, the first author read all the answers to familiarise herself with the data. She then considered the students' short descriptions of their thoughts as initial codes. These descriptions were subsequently read one by one to generate initial themes. Central throughout this process was a deductive strategy whereby themes were grounded in the main concepts of activity theory, that is, motive, meaning, goal, means and beliefs. However, in cases where the student's answer did not fit any of these concepts, we inductively generated a new theme based on the relevant answer. When there were not enough similar answers to justify the creation of such a new theme, however, we left them uncategorised. Sometimes, students' thoughts could also fit two or more themes, in which case we assigned them to multiple themes. In the fourth step, we reviewed the results hitherto obtained in the following three steps: (1) the first author reread the answers one by one and reconsidered their theme assignation; (2) she read all the answers that were grouped under one theme and subsequently reconsidered the theme; and (3) another researcher coded students' answers again based on the themes previously identified. The fifth and final step was to revise the theme names, which meant that the two aforementioned researchers discussed any differences in coding and renamed the themes accordingly so as to reflect the meanings as evident from the dataset.

RESULTS

During our one-week research, we analysed a total of 865 absent, 200 solved and 164 unresolved motivational problem cases. The analysis revealed that 87.58% or 134 in 153 respondents experienced motivational problems. For each student, however, the proportion of solved (*N* = 191; *M* = 2.25; *SD* = 1.46) and unresolved motivational problems (*N* = 150; *M* = 1.88; *SD* = 1.55) was relatively small compared to the cases in which they did not experience motivational problem at all (*N* = 865; *M* = 5.88; *SD* = 4.08).

Reliability and Validity of the Questionnaires

The factor models of all questionnaires were found acceptable (see Table 5.4). Some items, however, had relatively low standardised coefficients that crossed our pre-set benchmark of <. 50, such as item 7 of the HAM questionnaire; item 3 of the GSE scale; and items 4 and 6 of the MS questionnaire (see Table 5.5). As the factor models remained almost entirely the same after removing these items, we decided to keep them in the analysis. Overall, the factor models of all questionnaires were acceptable (see Table 5.4).

Table 5.4
Goodness-of-fit statistics for the estimated models of all questionnaires.

x2(df)	AIC	BIC	CFI*	TLI*	RMSEA*	90% CI RMSEA
AMS questionnaire – all items						
706.39 (329)	10188.08	10415.67	. 86	.83	.09	.08 - .10
HAM questionnaire – all items						
98.53 (35)	4325.56	4384.67	.92	.90	.11	.09 - .14
HAM questionnaire – without item 7						
93.77 (27)	3748.31	3801.52	.92	.89	.13	.10 = .16
GSE scale – all items						
67.04 (35)	2594.61	2653.58	.92	.90	.08	.05 - .11
MS questionnaire – all items						
726.82 (377)	12515.83	12775.32	.83	.81	.08	.07 - .09
MS questionnaire – without items 4 and 5						
631.28 (321)	11653.98	11898.73	.85	.82	.08	.07 - .09

*Although the Root Mean Square Errors of Approximation (RMSEAs; Steiger, 2016) showed a moderate fit of around .08, except for the HAM questionnaire (RMSEA = .11), the Comparative Fit Indices (CFIs; Bentler, 1990) and Tucker-Lewis Indices (TLIs; Tucker & Lewis, 1973) pointed to a better fit with values around .90. We chose the following benchmarks for the analysis: CFI values close to 1.0 indicated a good fit (Bentler, 1992); TLI values close to 1.0 indicated a good model fit (Tucker & Lewis, 1973); RMSEA values below .05 indicated a good fit; values above .08 reflected reasonable errors of approximation in the population, with those ranging from .08 to .10 indicating a moderate fit, and those greater than .10 signalling a poor fit (Browne & Cudeck, 1993).

Table 5.5
Standardised coefficients of items from confirmatory factor analysis

Scale	Item no.	Standardised coefficient
AMS questionnaire		
To know	1	.85
	8	.89
	15	.71
	22	.81
To achieve	2	.87
	9	.79
	16	.82
	23	.77
To self-develop	3	.67
	10	.77
	17	.82
	24	.68
To self-respect	4	.75
	11	.74
	18	.79
	25	.85
Introjected	5	.60
	12	.59
	19	.71
	26	.59
External	6	.74
	13	.67
	20	.60
	27	.60
Amotivation	7	.76
	14	.82
	21	.83
	28	.76
HAM questionnaire		
Mood	1	.78
	2	.81
	3	.78
	4	.85
	5	.73
	6	.86
	7	**.24**
	8	.68
	9	.52
	10	.75
GSE scale		
General self-efficacy	1	.66
	2	.62
	3	.61
	4	.59
	5	.64
	6	.59

Table 5.5 *Continued.*

Scale	Item no.	Standardised coefficient
	7	.62
	8	.57
	9	.69
	10	.52
MS questionnaire		
Enhancement of situational interest	7	.79
	12	.76
	14	.72
	22	.72
	28	.79
Enhancement of personal significance	6	.63
	15	.53
	23	.73
Mastery self-talk	10	.75
	17	.58
	21	.55
	30	.57
Performance-approach self-talk	1	.53
	8	.79
	16	.76
	26	.82
	29	.67
Performance-avoidance self-talk	4	**.25**
	5	**.46**
	25	.98
Proximal goal-setting	13	.81
	20	.81
	27	.87
Self-consequating	2	.84
	9	.93
	19	.80
	24	.69
Environmental control	3	.76
	11	.49
	18	.74

Finally, with the benchmark set at >.50 (the higher, the better), Cronbach's alphas and McDonald's omegas were found adequate for all questionnaires (see Table 5.6).

Relationship Between Motivational Elements and Motivational Problems

To answer the first research question about the relationship between motivational elements and motivational problems, we will first report our findings pertinent to the elements involved in the first level of the motivation process. Subsequently, we will elaborate on the elements involved in the planning and performance levels.

Table 5.6
Cronbach's alpha and McDonald's omega values for all questionnaires.

	Cronbach's alpha	McDonald's omega
AMS questionnaire		
Motive to know	.89	.89
Motive to achieve	.89	.88
Motive to self-develop	.82	.83
Motive to self-respect	.86	.86
Introjected motive	.71	.72
External motive	.74	.75
Amotivation	.87	.88
HAM questionnaire		
Mood	.90	.90
GSE scale		
General self-efficacy	.86	.86
MS questionnaire		
Enhancement of situational interest	.87	.87
Enhancement of personal significance	.66	.65
Mastery self-talk	.71	.71
Performance-approach self-talk	.84	.85
Performance-avoidance self-talk	.64	.67
Proximal goal-setting	.87	.87
Self-consequating	.88	.89
Environmental control	.69	.70

Motivational problems during motive formation.

Based on Spearman's correlation analysis, we found one negative and two positive significant relationships between students' motives, mood and general self-efficacy on the one hand and their motivational problem states on the other (see Table 5.7). First, we found a significant positive relationship between the degree of amotivation and the percentage of unresolved motivational problems (r_s = .23, p =.01). We also found general self-efficacy to significantly positively correlate with the absence of motivational problems (r_s = .17, p =.05). Finally, a significant negative correlation was found between the motive to achieve and the percentage of unresolved motivational problems (r_s = -.16, p =.05).

Table 5.7
The correlations between students' motives, mood and general self-efficacy and their motivational problem states.

	Motivational problem state (%)		
Motivational elements during motive formation	**Solved (M = 16.84; SD = 20.32)**	**Unresolved (M = 12.23; SD = 16.72)**	**Absent (M = 69.9; SD = 28.75)**
Motives			
to know (M = 3.96; SD = .85)	-.11	-.16	.07
to achieve (M = 3.57; SD = .95)	-.09	-.16*	.15
to self-develop (M = 3.84; SD = .86)	.02	-.15	.06
to self-respect (M = 3.51; SD = 1.07)	-.03	-.13	.05
introjected (M = 3.12; SD = .90)	.03	-.12	-.14
external (M = 2.71; SD = .97)	.12	.07	-.13
Amotivation (M = 2.03; SD = .96)	.13	. 23**	-.13
Mood (M = 5.29; SD = 1.03)	-.09	.04	.04
General self-efficacy (M = 3.10; SD = .46)	-.09	-.14	.17*

*M = mean; SD = standard deviation; * p ≤.05, ** p ≤ .01. Motives and amotivation were rated on a 5-point scale; mood on a 7-point scale; and general self-efficacy on a 4-point scale. Motivational problems are presented on a 100-point percentage scale. To overcome the missing data, we calculated the mean scores for each scale and used these in the analysis.*

Motivational problems during planning and performance.

Unlike the previous results pertaining to the motive-formation level, all motivational elements at the planning and performance levels (affect, specific self-efficacy, meaning and goal) significantly differed between student's three motivational problem states (see Table 5.8 and Figure 5.3). In the following, we will first present the Mann-Whitney *U* test results for 'affect' (expressed in terms of its two dimensions: 'arousal' and 'pleasure') and 'specific self-efficacy'. Next, we will report the chi-square test results for 'meaning' and 'goal'. As shown in Table 5.8, affect and specific self-efficacy differed only in terms of the presence (solved and unresolved) or absence of motivational problems.

We found that the levels of pleasure (*M* = 5.55), arousal (*M* = 5.59) and specific self-efficacy (*M* = 82.06) were significantly higher when motivational problems were absent than when they were present (both solved and unresolved). At the same time, the mean values of pleasure, arousal and specific self-efficacy were slightly lower when students experienced solved and unresolved motivational problems: pleasure (4.56 and 4.32, respectively), arousal (4.81 and 5.12) and specific self-efficacy (73.10 and 75.24). Solved and unresolved motivational problems did not differ significantly between them.

Table 5.8
Mann-Whitney U test: The difference between students' degree of affect (arousal and pleasure) and specific self-efficacy in the face (or absence) of motivational problems.

	M(SD)	Mann-Whitney	Z	Effect size r	p-value
Absent vs solved motivational problems					
Affect – arousal*	2.95 (49.63)	69072.50	-4.50.	-0.13	.00
Affect – pleasure*	2.77 (49.64)	66400.00	-.5.17	-0.15	.00
Specific self-efficacy*	79.69 (20.59)	67328.50	-.5.01	-0.14	.00
Absent vs unresolved motivational problems					
Affect – arousal	2.95 (49.63)	61308.50	-2.78	-0.08	.01
Affect – pleasure	2.77 (49.64)	50511.00	-.5.89	-0.17	.00
Specific self-efficacy	79.69 (20.59)	60589.50	-.3.04	-0.09	.00
Solved vs unresolved motivational problems					
Affect – arousal	2.95 (49.63)	15669.50	-0.74	-0.02	0.46
Affect – pleasure	2.77 (49.64)	15055.00	-1.36	-0.04	0.18
Specific self-efficacy	79.69 (20.59)	15481.00	-0.93	-0.03	0.35

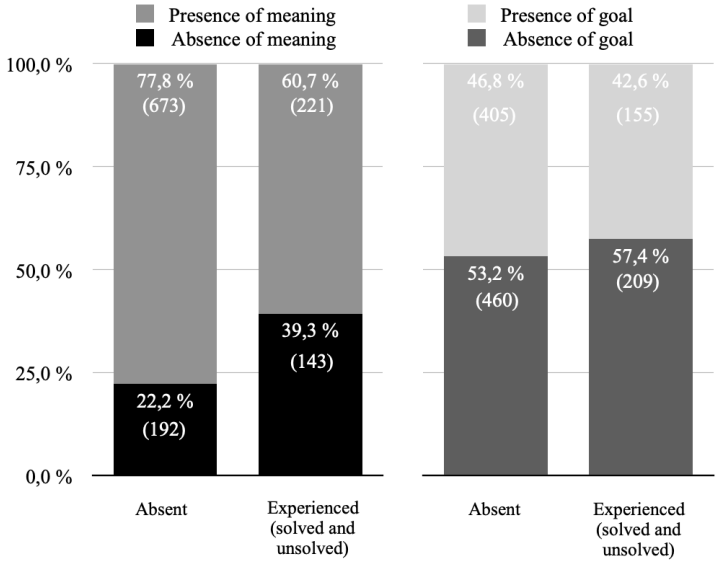
**The two dimensions of affect were rated on a 9-point scale; one item measured specific self-efficacy on a 100-point scale.*

We found similar relationships for the other motivational elements involved in planning and performance: meaning and goal only differed in terms of the presence (solved and unresolved) or absence of motivational problems. More specifically, the chi-square test revealed that the dichotomous variables (the presence or absence of meaning and goal) differed in accordance with the presence or absence of motivational problems: meaning (x^2 (1) = 37.73, p = .00) and goal (x^2 (1) = 1.85, p = .00). All the while, the solved and unresolved motivational problems did not differ in terms of meaning (x^2 (1) = 0.02, p = .90) and goal (x^2 (1) = 2.12, p >.15). Figure 5.3 displays the number of times (and their corresponding percentages) students reported the learning activity to have or not have meaning and a goal when they experienced motivational problem.

We observed that students attributed considerably more meaning to their learning activities when there were no motivational problems (presence of meaning: 77.8%; absence of meaning: 22.2%) than when they were (presence of meaning: 60.7%; absence of meaning: 39.3%). Students' goals, on the other hand, remained roughly constant across the absence or presence of motivational problems, with reported frequencies of 46.8% (vs 53.2%) and 42.6% (vs 57.4%), respectively.

In summary, the elements involved in the first level of the motivation process — motives, mood, and general self-efficacy — did not vary across the three motivational problem states. On the other hand, the elements involved in the second and third levels — affect, specific self-efficacy, meaning, and goal — were significantly higher when students did not experience motivational problems. Except for 'meaning', however, these differences were small. We did not find significant differences between solved and unresolved motivational problems.

Figure 5.3
Chi-square test results: The presence and absence of meaning and goal when students (non-)experienced motivational problems



Relationship Between Students' MRS uptake and Their Motivational Problem States

In the following, we will report the results addressing the second research question about how students' motivational problem states relate to their specific MRS uptake. We found that the use of only four MRSs was significantly related to the percentage of unresolved motivational problems and to the percentage of absence of problems, whereas the relationship with solved motivational problems resulted not significant (see Table 5.9).

Table 5.9
The correlations between students' motivational problem states and their specific MRS uptake.

	Motivational problem state (%)		
Students' specific MRS uptake	**Solved**	**Unresolved**	**Absent**
Enhancement of situational interest	-.01	-.04	.04
Enhancement of personal significance	-.01	-.05	-.05
Performance-approach self-talk	-.13	**-.24*** **	.06
Self-consequating	.04	**-.30*** **	-.09
Mastery self-talk	-.02	**-.18***	.08
Environmental control	-.10	-.14	**.18***
Performance-avoidance self-talk	-.09	-.05	-.07
Proximal goal-setting	-.06	-.13	-.05

** p ≤.05, *** p ≤.001. MRS uptake was rated on a 5-point scale; motivational problem states are presented on a 100-point percentage scale. To overcome the missing data, we calculated the mean scores for each scale and used these in the analysis.*

More specifically, the percentage of unresolved motivational problems decreased as students enhanced their uptake of the following three MRSs: performance-approach self-talk (r_s = -.24, p = .00), self-consequating (r_s = -.30, p = .00) and mastery self-talk (r_s = -.18, p = .04). Similarly, we found that motivational problems were more frequently absent when students enhanced their uptake of environmental control (r_s = .18, p < .03). None of the MRSs revealed significant relationships with solved motivational problems.

Students' Thoughts When Confronted With Motivational Problems

We performed a thematic analysis of students' thoughts during their real-time experience of motivational problems to examine how these thoughts relate to the specific motivational elements and students' concomitant MRS uptake (research question 3). Of the 341 thoughts we collected, we first excluded 108 thoughts from further analysis as they referred to students' actions at the time they completed the questionnaire and were therefore unrelated to the way they regulated their motivation (e.g. 'eating', 'walking'). Another seven thoughts were removed as well, because they were too unique to group them under any one theme. Finally, 226 thoughts remained, from which we distilled five themes and 16 sub-themes (see Table 5.10).

We found that of the 16 sub-themes presented in Table 5.10, 15 directly reflected all the motivational elements postulated by activity theory (motives, goals, meaning, means and beliefs), except for emotions. Unexpectedly, however, we also found that *only* three of the eight MRSs were reflected in students' thoughts, which were: performance-approach self-talk, enhancement of personal significance and self-consequating. More specifically, only 18 of the 226 thoughts we analysed appeared to suggest students' uptake of the three said MRSs and these thoughts were all grouped under theme 3.1: 'Meaning of learning'. Eight of these thoughts reflected the use of the enhancement of personal significance MRS (e.g. 'I thought I would spend my time more usefully'); another eight mirrored the performance-approach self-talk MRS (e.g. 'I thought that if I didn't go, I would be left without points'); and two were indicative of the self-consequating MRS (e.g. 'To go for a walk, you need to do your homework faster first'). Hence, 'Meaning of learning' was the only theme that could be associated, albeit in part, with students' uptake of the three MRSs previously specified. Data availability: The code and datasets generated and analysed during the current study are not publicly available due the fact that they constitute and excerpt of research in progress but are available from the corresponding author on reasonable request.

This study was not preregistered.

Table 5.10
Thematic analysis of students' thoughts when facing motivational problems.

Theme and sub-theme	Description of theme	Example quotes	Frequency*
1. Motive and goal to learn			
1.1 Motive to accomplish the learning task	The student thinks about studying in general or about specific learning tasks such as reports or preparing a presentation.	'about homework'; 'about presentation'	10
1.2 Achievement motives	The student is concerned with achieving academic results, grades and earning points.	'about scores'	6
1.3 Obligation motive	The student acts from a sense of duty, their answers including the words 'necessary', 'must' or 'have to' in relation to studying.	'I must go, because otherwise I will not get points'; 'I thought that it was necessary to master the knowledge of this discipline'	28
1.4 Deadline motive	The student is dedicated to passing the work soon, being intime for the exams, being on schedule.	'I must do everything in advance'; 'About the deadlines for delivery'	18
2. Motive and goal not to learn	The student wishes to undertake study-unrelated things, such as travelling, sleeping, eating and making money.	'I need money'; 'I need to change my life'; 'I was thinking that I want tea'	46
3. Meaning			
3.1 Of learning	The student considers the impact studying has on their future and on their scores.	'In order to go for a walk, I need to do my homework faster first'; 'If I don't do my homework, there will be no scores'	21
3.2 Of not learning	The student considers the consequences of not studying for their future, for their scores and for their relationships with others.	'It's time to start preparing, otherwise I will have to run after the teacher and beg for another chance to pass everything. I was eating when these thoughts came to me'; 'I thought I didn't want the teacher to swear'	13
4. Motive hierarchy	The student contemplates the different actions they can perform, including studying, and their order of priority.	'I was lying in bed thinking, should I get up and study or go to sleep?'; 'about priorities'	35
5. Means and beliefs			
5.1 Schedule	The student conforms to the course schedule.	'I wanted to go to university, but the lesson was cancelled'; 'I would go to university, but we have a day off'	2

Table 5.10 *Continued.*

Theme and sub-theme	Description of theme	Example quotes	Frequency*
5.2 Environment	The student analysis the presence/absence of a comfortable learning environment («quiet place without crowd»; «weather»:	'I thought I could read while I was on the subway, but it became uncomfortable'; 'And why not go to the university for one lesson of physical education, when the weather is so wonderful outside'	4
5.3 Tools	The student is affected by the availability of the tools needed for learning (Internet, university pass).	'I was reading an e-book, and when I decided to start doing my homework, the Internet stopped working in the hostel! And it's hard to do this on the phone'; 'I lost my pass and can't go to the university, so I'm going home'	2
5.4 Prerequisite knowledge	The student is affected by the prerequisite knowledge that is needed for studying (conceptual knowledge, language).	'Nothing. Because it's hard for me to understand the discipline'; 'That I do not know the language spoken by the teacher [Spanish, French]'	3
5.5 Time	The student analysis a suitable time for studying.	'now there is time for this work; if I get tired, I will do something else'; '.. it's easier for me to do it in the morning'	12
5.6 Physical & psychological state	The student analysis his / here physical & psychological state.	'I sleep in transport, I sleep all day. I woke up to drink tea and will go to sleep again. The six-day period is definitely violence'; 'About the fact that I feel bad'	23
5.7 Personal habits & traits	The student's own beliefs, personal traits and habits hinder or help them in their decision to study (the habit to get up earlier, being lazy).	'I was thinking about why I can never get up early to study'; 'I must overcome myself'	5
5.8 Finished priority activities	The student undertakes learning activities only *after* finishing other activities that took precedence.	'I finished my work, decided to prepare for the lesson'; 'I've done all the basic things, so it's time to learn'	3

* Four thoughts could be subsumed under more than one theme.

DISCUSSION

Although several studies have investigated the relationship between motivation and MRSs before (Ilishkina et al., 2022; Schwinger et al., 2007; Trautner & Schwinger, 2020; Wolters & Benzon, 2013; Wolters & Rosenthal, 2000), this study has specifically sought to shed light on how students cope with their motivational problems in relation to their motivational elements, thoughts and concomitant MRS uptake in real time. Our one-week study revealed that 87.6% of the respondents experienced motivational problems, albeit in relatively small numbers per student. Considering students' varying degrees of motivation across situations, we did not expect to find that, a few cases aside, they did not avail themselves of the MRSs to solve their motivational problems. Our scrutiny of students' real-time thoughts, however, did allow us to propose a redefinition of existing MRSs.

Next, we found that students who experienced motivational problems presented lower levels of affect, meaning, goal and specific self-efficacy compared to those who did not experience them. Surprisingly, however, the other motivational elements (i.e. motives, mood and general self-efficacy) and the frequency of use of eight known MRSs described by Wolters (2003) and Schwinger and colleagues (2009) exhibited no association with students' motivational problems. This oddity might be explained by the fact that activity theory (Ivannikov, 1985a, 2015; Leont'ev, 1971/1978), as was described in the Introduction, distinguishes between three different levels of activity and motivation, that is, *motive formation, planning* and *performance*. In our study, we found that only the motivational elements involved in the *second and third* levels were related to students' problems of motivation, meaning that experiencing motivational problems when planning and performing learning actions in real time went hand in hand with lower quantities of affect, meaning, goal and specific self-efficacy. These findings confirm previous studies that also found reduced levels of affect and mood in students who faced motivational problems when performing learning actions in real time (Brassler et al., 202; Fries & Dietz, 2007; Grund et. al., 2015).

As previously noted, we found the motivational elements involved in the *first, motive-formation level* (motives, emotion and general self-efficacy) to be unrelated to the motivational problems experienced during the planning and performance levels of the motivation process as well as to students' uptake of the eight known MRSs. On closer inspection, this makes sense because the respective elements in this first level of the motivation process as well as the MRSs connect students to the learning activity in general (level 1), and *not* (yet) to specific learning actions that they plan and consequently perform (levels 2 and 3). It is likely that such a relationship will only be found if the motivational elements, motivational problems and MRSs alike all represent the same level of motivation process. In other words, motives, emotion, general self-efficacy and frequency of use of known MRSs could be related to the first-level motivational problems: When students are in doubt about their study in general ("Have I chosen the right university? Do I really want to

study to be an IT specialist?"). We invite future researchers to investigate whether specific first-level motivational problems cause students to be disconnected from a learning activity, and whether these problems are related to the motivational elements at this level and to the srequecy of use of eight known MRSs.

Another striking result was that when students experienced motivational problems, they reflected upon all the motivational elements postulated by activity theory, except emotions. At the same time, however, they generally did not consider the uptake of the available MRSs. To name an example, students often wrote down what they wanted to achieve (e.g. good scores), which reflected their motives and goals, but they did so without mentioning *what was needed to achieve this*, as would be the case when invoking the *performance-approach self-talk MRS* ('*I tell myself that I should keep on learning* if I wish to reach a good exam'). Hence, students hardly used the MRSs, despite the fact that they knew about them as far as we could see based on the MS questionnaire answers. This implies that merely informing students about these strategies is not an effective approach. It might be more beneficial to teach them *how* to use the MRSs and to reformulate the MRSs in such a way that they match students' specific motivational problems and their threatened motivational elements. This standpoint was also adopted by recent research that stressed the importance of a match between a particular MRS and the corresponding type of motivational problem (Bäulke et al., 2021; Eckerlein et. al., 2019). Based on our results, we therefore propose a redefinition of Schwinger et al.'s (2009) eight MRSs, which we have presented in Table 5.11.

As can be inferred from Table 5.11, we suggest that the first four known MRSs be combined to form a new one, as well as to reformulate the two subsequent MRSs and to create a new one that was not yet reflected in the MRSs hitherto known. First of all, we found that students often reflected upon the meaning of learning and, more specifically, upon the motive(s) that drove their learning. Theoretically speaking, all first four MRSs address this *link between students' motives and their learning, as they aim to analyse how a learning activity could help them to achieve their aspirations.* Although the mastery self-talk MRS was not reflected in our survey outcomes, according to activity theory it is also about creating a link between studying and mastering a desired competence. Hence, all four MRSs make students think about meaning: about how studying could help them to obtain what they want (motive), such as good grades ('It could occur that the points that I can get for this class will be useful to me') or satisfaction of personal interests and other pleasant things ('In order to go for a walk, I need to do my homework faster first'). I*n our study, however, students' motives were more diverse than those mentioned in the said MRSs,* as they also referred to performing a task, fulfilling an obligation and meeting a deadline. In order to give students more freedom to think about their motives without being constricted by the bounds of the respective MRSs, we suggest they be united to form a new MRS coined '*lending meaning to learning'. In this way, the new MRS* might induce *students* to think not just about what they aspire to (their motive), but also about *the link* between this motive and learning (their meaning).

Table 5.11
Proposed redefinition of known MRSs and introduction of new MRSs based on our survey outcomes.

Schwinger et al.'s eight MRSs (2009)	Definition of known MRS	Motivational elements reflected in students' thoughts	Refined or new MRS that deals with motivational problems in real time
		Existing MRSs that can be combined to form a new MRS:	
Performance-approach self-talk	Emphasising the need to complete a task in order to achieve a good score ('I attempt to call myself to intense work by focusing on obtaining good grades').	*The meaning of learning.* The student mainly considers the positive impact studying has on their future in general and on their grades. For instance, 'Before I can go for a walk, I first need to do my homework faster'; 'If I don't do my homework, there will be no grades'.	*1. Lending meaning to learning* The student creates links between their motives and learning: they analyse how their learning actions can help them to reach what they want, for instance to satisfy their curiosity, obtain good grades, get something pleasant, develop competence, perform a task, fulfil an obligation or meet a deadline ('I try to find out what I want and how a specific learning action could help me get there').
Enhancement of personal significance	Connecting an unpleasant activity with individual interests and searching for links with real life ('I look for connections between the tasks and my life as such').		
Self-consequating	Promising oneself some kind of reinforcement or reward after completion of the task ('I tell myself that after work I can do something nice, if I first keep on learning now').		
Mastery self-talk	Challenging and orienting oneself to master the skill ('I persuade myself to work intensely for the sake of learning').	No thoughts reflected this MRS	
		Proposed redefinition of existing MRSs:	
Performance-avoidance self-talk	Emphasising that one needs to learn in order not to be disgraced or worse than others ('I tell myself that I have to push me more if I do not want to make a fool of myself').	*The meaning of* not *learning.* The student considers the negative consequences not studying has for their future, their scores and for their relationships with others. For instance, 'It's time to start preparing, otherwise I will have to run after the teacher and beg for another chance to pass everything. I was eating when these thoughts came to me'; 'I thought I didn't want the teacher to be angry with me'.	*2. Lending meaning to* not *learning* The student contemplates the consequences of *not* learning. In doing so, the student creates links between their motives and neglecting to perform learning actions and how the latter could move them away from what they want, such as good grades, a good relationship with the teacher, the chance to land an attractive job ('I try to find out what I want and how not performing a specific learning action could move me away from it').

Table 5.11 *Continued.*

Schwinger et al.'s eight MRSs (2009)	Definition of known MRS	Motivational elements reflected in students' thoughts	Refined or new MRS that deals with motivational problems in real time
Environmental control	Eliminating distractions ('Prior to beginning with work, I strive to eliminate all possible distractions').	*Means and beliefs.* The student considers various means and beliefs that their study requires: schedule, a facilitating environment, tools, prerequisite knowledge, time, a favourable physical and psychological state, personal habits and traits, and completed activities that take priority. For instance: 'I was thinking about why I can never get up early to study'; 'Now there is time for this work; if I get tired, I will do something else'.	*3. Preparing the means necessary for learning and optimising beliefs* The student organises means and activates beliefs that are needed to learn successfully ('I organise my schedule, time, environment, tools and prerequisite knowledge that are needed for learning and also form a favourable physical and psychological state, personal habits and traits').
		New MRS:	
		Motive hierarchy. The student contemplates the different actions they can perform as well as their order of priority. For instance: 'I was lying in bed thinking, should I get up and study or go to sleep?'; 'I was thinking about priorities'.	4. 4. *Prioritising different motives for learning or not learning* The student performs an alternatives analysis and prioritises between competing motives and corresponding activities (' I think about priorities and what I want to do first').
		MRSs that cannot be refined on the basis of our survey:	
Proximal goal-setting	Dividing a large task into smaller subtasks ('I break down the workload in small segments so I get the feeling that I can handle it more easily').	No thoughts reflected this MRS.	
Enhancement of situational interest	Adding game elements to a tedious task or modifying it so as to increase pleasure ('I make learning more pleasant for me by trying to arrange it playfully').	No thoughts reflected this MRS.	

Next, based on our analysis of students' reflections, we propose to reformulate two other existing MRSs - performance-avoidance self-talk and environmental control. More specifically, we suggest that the former MRS be redefined as '*lending meaning to not learning',* because students were not only concerned about being discredited (as was the case in the performance-avoidance MRS) but also about other negative effects of not learning, such as jeopardising relations with the teacher or the chance to land a desirable job. Similarly, we have redefined the environmental control MRS to read '*preparing the means necessary for learning and optimising beliefs'*, because students were concerned with more than the mere elimination of distractions mentioned in the environmental control MRS. Apart from targeting the environment, students also focused on the various means their study required, including *personal resources* (e.g. *prerequisite knowledge and a favourable physical and psychological condition),* schedule, tools, time *and* the completion of activities *that took priority, as well as on activating beliefs that facilitated effective learning (e.g.* personal beliefs, traits and habits affecting their study). As such, these two refined MRSs together might empower students to analyse the various consequences of not learning and to better organize different aspects of the student's environment and psychological state through an approach that is broader in scope than that of the original MRSs s which only focused on concerns about being discredited and eliminating distractions.

Finally, we suggest the introduction of an entirely new MRS coined '*prioritising different motives for learning or not learning'. Our analysis revealed that* students contemplated several alternatives to learning and their order of priority, which, in activity theory, is referred to as 'motive hierarchy' (Leont'ev, 1971/1978). This hierarchy implies that students can have different motives, some of which may be more significant than others, and that pursuing one motive could drive the student away from another. It is our contention that this prioritisation between competing motives and the associated changes in students' activities calls for a new MRS that enables them to analyse the different motives that play a role in their life and to manage them appropriately. We welcome future researchers to study and improve the MRSs redefined above and to find out whether they correspond to different motivational problems and whether any one of them has the potential to improve student motivation.

Our study has several limitations. First, our sample was drawn from only one Russian university and most of the respondents were female, which may limit the generalisability of our results. Second, we measured students' motivation halfway the semester, whilst outcomes might have been different had we measured it just before the exams. Third, the variety of motivational problems students could possibly experience may have been limited by the design of the educational programme which consisted of theoretical lectures combined with discussions and workshops. Fourth, the SRL microanalysis survey may have influenced student's motivation, simply by making them think about it. And finally, our specific use of questionnaires rather than interviews could explain why we did

not find a relationship between students' motivational problems and their motivational elements during motive formation. We therefore welcome future replications of our study in a broader context that are based on larger samples and additional instruments to improve triangulation.

With respect to the practical implications of our research, we believe that students whose motivation is threatened while planning and performing learning actions could benefit from the use of our refined MRSs as presented in the right column of Table 10. Whereas the eight known MRSs (presented on the left; Table 10) make them reflect on learning in general, the newly proposed MRSs encourage students to focus on their specific context and on how to improve their particular situation. The existing MRSs, however, could still be helpful in improving their overall motivation to learn, that is, when in doubt about studying in general without lacking the motivation to plan and perform their learning actions. The motivational problems identified in this study and the proposed redefinition of MRSs may possibly help students to better self-regulate their motivation while planning and performing learning actions. The onus is on us to make students aware of this.

To our knowledge, this study is the first to analyse real-time motivational problems in relation to students' motivation and their concomitant MRS uptake. We found that these relations were ambiguous and could be mediated by the level of activity and motivation. Our most surprising finding was that students whose motivation was threatened did *not* think about how they could improve their motivation; they did not use the MRSs. Yet, our scrutiny of students' reflections yielded cues as to how to refine the existing MRSs in order to render them useful during planning and performing learning actions. As such, the proposed MRSs might help students to better regulate their motivation in real time.

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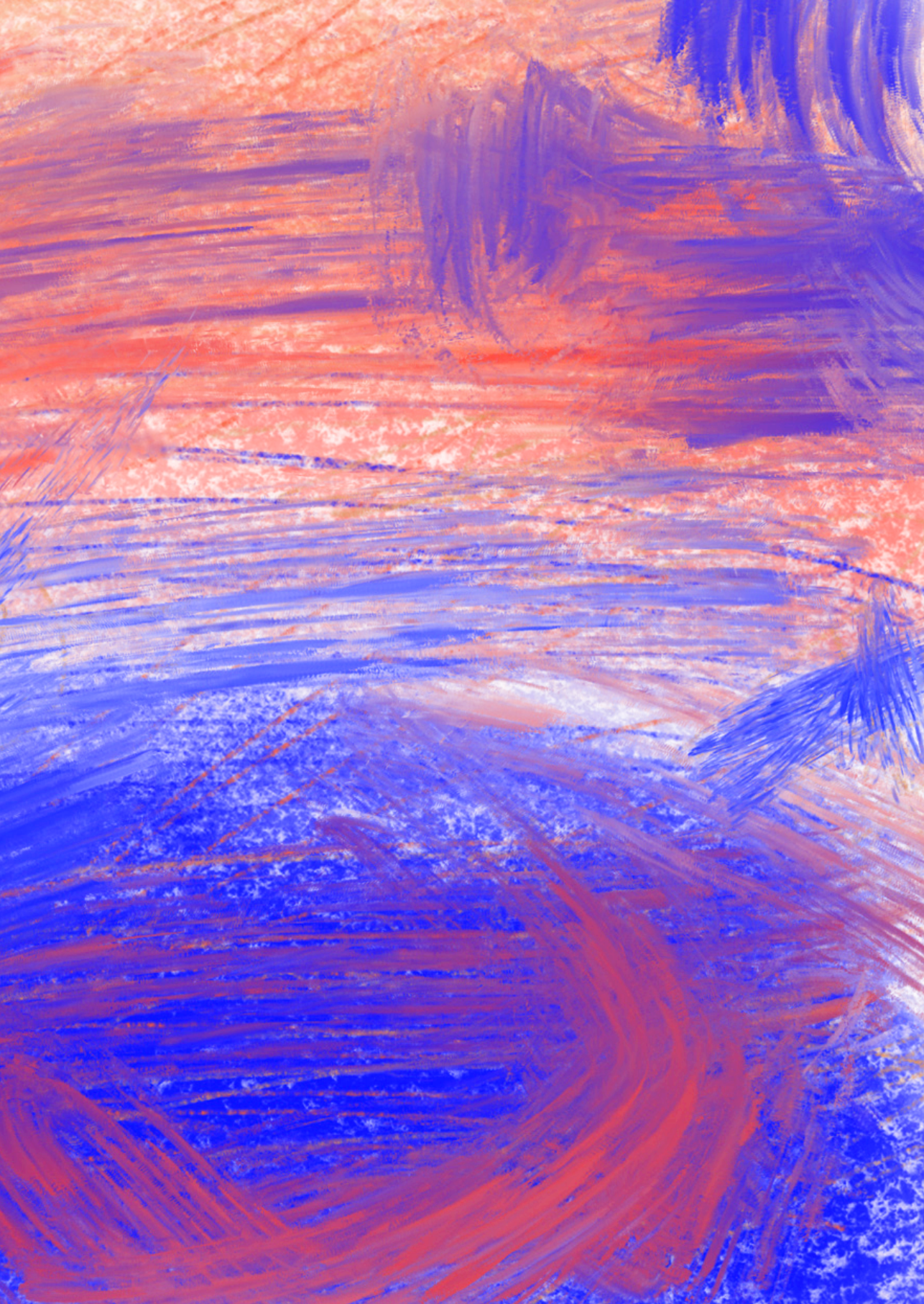


CHAPTER 6

General discussion

GENERAL DISCUSSION

Students in higher education can oftentimes lack the motivation to study. It is therefore imperative that they be able to self-regulate their motivation to learn. How they actually do this, however, is still largely unknown. Previous scholars (Wolters, 1998, 1999, 2003; Schwinger and colleagues, 2009) did already identify eight motivational regulation strategies (MRSs). They did so by conducting a literature review and asking students open questions about how they regulate their motivation. Yet, these MRSs did not seem to fully cover the whole range of problems that students experience in real life. Moreover, whether and how these MRSs actually help students to self-regulate their motivation to learn remained unclear. To understand how these MRSs work, other researchers have zoomed in on specific aspects of motivation, such as students' motives or their degree of self-efficacy (Schwinger et al., 2007; Teng, 2021; Trautner & Schwinger, 2020; Wang et al., 2017; Wolters, & Benzon, 2013). However, as Hattie and colleagues pointed out in their review (2020), it is likely that multiple, interacting aspects of motivation are at play. We therefore chose to adopt a systematic view on motivation with the aim to close these gaps and answer the following overarching question: How adequately does the existing set of MRSs cover the full range of motivational elements and improve students' motivation to learn? In this chapter, I will summarize the main findings of our four studies and discuss their respective theoretical considerations, strengths and limitations, as well as their practical implications. Finally, I will conclude by presenting the key insights gained from the dissertation at hand.

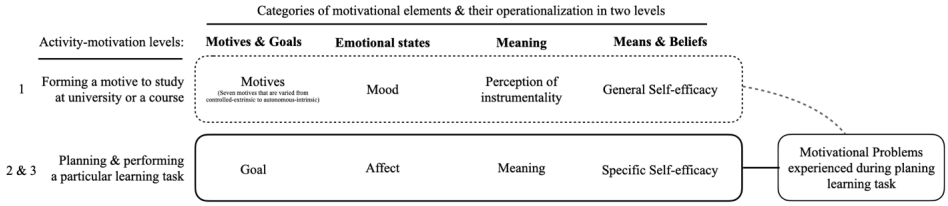
MAIN FINDINGS

To answer the main question stated above, we must first explain that students' motivation to learn can be construed as a multilevel structure. In the following subsection, we will elucidate this structure and connect it to the results of all four studies. In the subsequent paragraphs, we will describe in what way the eight known MRSs fail to sufficiently cover the said structure and, consequently, to address the full range of students' motivational problems.

Relationships Between Motivational Elements and Motivational Problems.
As the findings of all four studies suggested, students' motivation to learn consists of at least the following six categories of motivational elements: Motives, goals, emotional states, meaning, means, and beliefs. Theoretically, these categories exist on three levels of activity and motivation, namely at the level of: (1) studying in university or for a course, (2) planning, and (3) performing a particular learning task. As we did not empirically separate the latter two levels, in the following we will describe the results of levels two

and three combined. Figure 6.1 depicts the above-mentioned categories of motivational elements and the way we operationalized them.

Figure 6.1.
The motivational elements (categories), their operationalization on two levels, and the relationships we found.



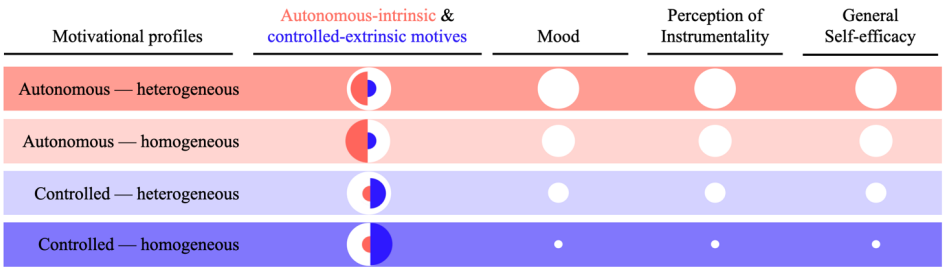
Note: Straight lines point to the presence, dotted lines to the absence of relationships.

We found various relationships between students' motivational elements and their motivational problems. As for the first level, we found that intrinsic motives had a stronger relationship with mood, perceptions of instrumentality, and general self-efficacy than had extrinsic motives (Study 1). The dotted line in Figure 1 points to another distinction: The first-level motivational elements were unrelated to the experience of motivational problems, whereas the second-level elements were (Study 4). More specifically, at this second level, motivational problems were accompanied by a decrease in students' goals, affect, meaning, and specific self-efficacy. Interestingly, it did not matter whether students did or did not succeed in solving their motivational problems. From this, we may infer that the elements in this whole motivational system likely have different "weights" or importance and that their relationship with motivational problems depends on the specific level of activity and motivation. This explains, for instance, that changes in students' self-efficacy may affect fewer motivational elements than would changes in intrinsic motives, for they have weaker interrelationships. The fact that we could not find any relationships between students' motivational problems and their motives, mood, perceptions of instrumentality, and general self-efficacy at the first level does not mean they do not exist. We therefore invite future researchers to continue clarifying the overall picture of motivation by finding motivational problems for the said level and determining the weight of its motivational elements - that is, whether intrinsic motives are, indeed, more powerful than extrinsic motives in changing the other three motivational elements at this level.

In addition to the relationships identified at the first level, we also found that students exhibited different constellations of the respective motivational elements. That is to say, they showed different combinations of motives, mood, perceptions of instrumentality,

and general self-efficacy, which resulted in four unstable motivational profiles. Half of the students (50%) changed their motivational profile during a course (Studies 2 and 3). This goes to show that motivation is dynamic in nature and that it is therefore vital that students self-regulate their motivation throughout their studies. Figure 6.2 gives an overview of the motivational profiles identified.

Figure 6.2.
Students' motivational profiles.



Note: The bigger the circle, the stronger the presence of the respective motivational element.

As the figure 6.2 illustrates, the presence of mood, perceptions of instrumentality, and general self-efficacy was strongest in students with an autonomous-heterogeneous motivational profile. Hence, a combination of autonomous and heterogeneous motives yielded the strongest motivational profiles. A logical assumption might be that, in order to improve their motivation to learn, students should make their motives not only more autonomous, but also more heterogeneous. We welcome future studies that further compare the above two student groups to understand when and why this combination of autonomous and controlled motives yields better outcomes, for instance, in terms of more interest and efforts, better achievements, and less disorganization.

To recapitulate, we identified four motivational profiles and found that its constituent motivational elements were variously interrelated. The motivation of students who had leading autonomous intrinsic motives combined with a smaller proportion of extrinsic motives was the most beneficial. The fact that students changed their motivational profiles indicates that motivation is inherently dynamic. However, the motivational elements of the motive formation level that constitute these profiles were not related to motivational problems. We only established a link between motivational problems and students' motivational elements of the planning and performance levels. These motivational elements were suboptimal when students experienced motivational problems.

Motivation, MRSs, and Motivational Problems

Now that we understand that motivation is a multilevel system of motivational elements,

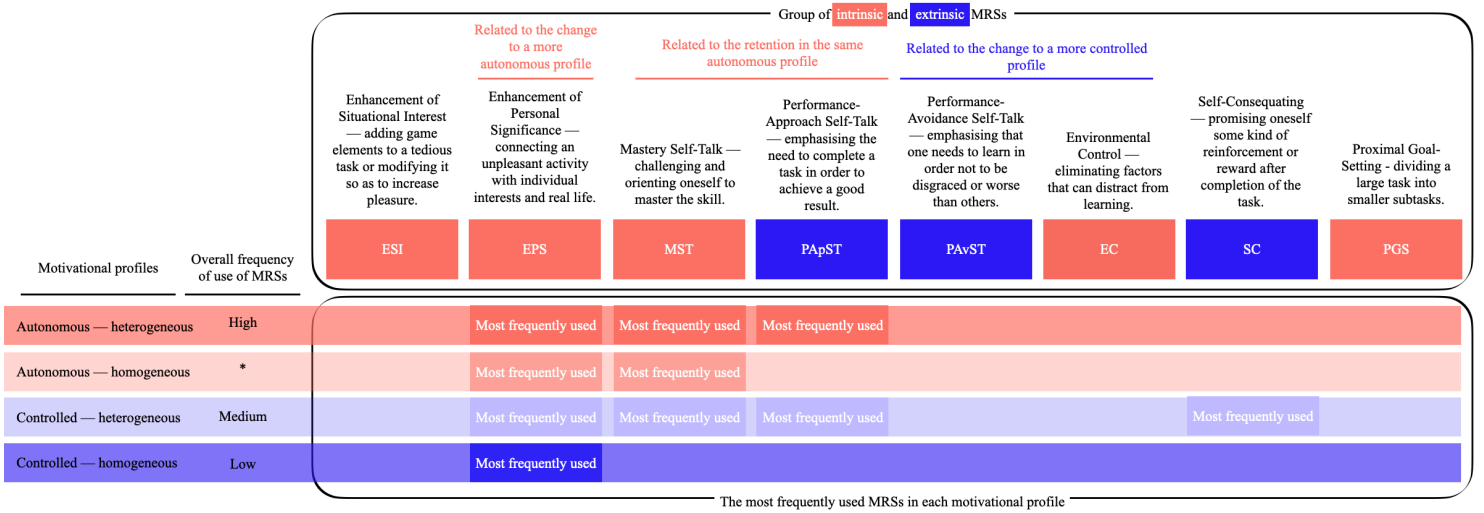
we can answer the key question of whether the existing set of MRSs adequately covers the full range of motivational elements and improves students' motivation to learn. We found that the eight known MRSs indeed had a few limitations: They only addressed the first level of activity and motivation, and they did so only in part, and not all of them were conducive to motivational change. Moreover, when students were planning and performing a concrete task and experienced problems, they did not even consider the use of MRSs, even though these second and third levels of activity and motivation are crucial, recurring phases in higher education. Nevertheless, a scrutiny of their thoughts gave us clues as to what types of motivational problems they experienced and, consequently, about potential new and adjusted MRSs that can help them to maintain or restore their motivation.

In terms of the associations with students' motivational elements, we found that the MRSs only had a strong relationship with students' motives (Study 1). More specifically, students differed in their preference for and uptake of MRSs depending on their autonomus-controlled motives' ratio (Study 2). We also found that only three MRSs (enhancement of personal interest, mastery self-talk, and performance-approach self-talk) played a key role in positively changing students' motivational elements at the first level of motivation and activity (Study 3). Figure 6.3 shows how the four motivational profiles differed in terms of students' MRS uptake.

As presented in the upper part of Figure 6.3, the MRSs could be broken down into two groups: MRSs that had stronger relations with students' intrinsic motives, and those related to extrinsic motives (Study 1). The MRSs relationships with the other motivational elements on the first level, however, were much weaker (Study 1). It follows that the MRSs hitherto known do not adequately cover the full range of motivational elements and, as such, might be less useful when students struggle with motivational elements other than motives (Why do I study?). An important line for future research and the further development of SRL models is therefore to identify new MRSs that specifically target these other motivational elements, including students' emotional states, meaning, goals, means, and beliefs. For example, what MRSs should one use when s/he lacks the self-efficacy? In the next section, we will tentatively propose a redefinition of the MRSs based on our findings.

Next, students' overall MRS uptake (left column of Figure 6.3) showed that the more often students used the MRSs, the more their autonomous intrinsic motives prevailed over controlled extrinsic ones (Study 2). What's more, the MRSs most frequently used in each profile were also the most effective (Study 3), as they guided students toward more autonomous profiles (see upper part of Figure 6.3). This did not hold true for all cases, however, as the *least preferable* performance-avoidance self-talk (Pav-ST) MRS was also among the two MRSs that guided students toward more controlled profiles. Hence, "frequency" did not necessarily equal "strength," for the uptake of a suboptimal strategy, however infrequent, could still erode students' motivation.

Figure 6.3.
Differences between the four motivational profiles in terms of students' MRS uptake.



(*) The autonomous-homogeneous profile did not fit this categorization: Students with this profile used the PAvST and ESI MRSs the least (comparable to the controlled-homogeneous profile), whereas they used the other MRSs on a medium level (comparable to the controlled-heterogeneous profile).

In addition to categorizing the MRSs according to their frequency of use, we can also group them based on their function: helping students to either *retain* or *change* their motivation. If we consider the three MRSs that were most beneficial, we find that the enhancement-of-personal-significance (EPS) MRS guided students toward a more autonomous profile, whereas the mastery self-talk (MST) and performance-approach self-talk (PApST) MRSs - both goal-directed MRSs - guided students to retain their autonomous profile. We invite future researchers to explore the working mechanisms of the most (EPS, MST, and PApSt) and least (PAvST and EC) beneficial MRSs.

As stated before, also on the planning and performance levels of activity and motivation, we found that students' thoughts were much broader in scope than the known MRSs accounted for. When confronted with problems of motivation, they reflected upon their motives, goals, meaning, means, and beliefs, but not on their emotional states. Figure 6.4 (red-shaded areas) shows that students reflected mostly on their motives and goals, that is, on "Why am I doing this?"

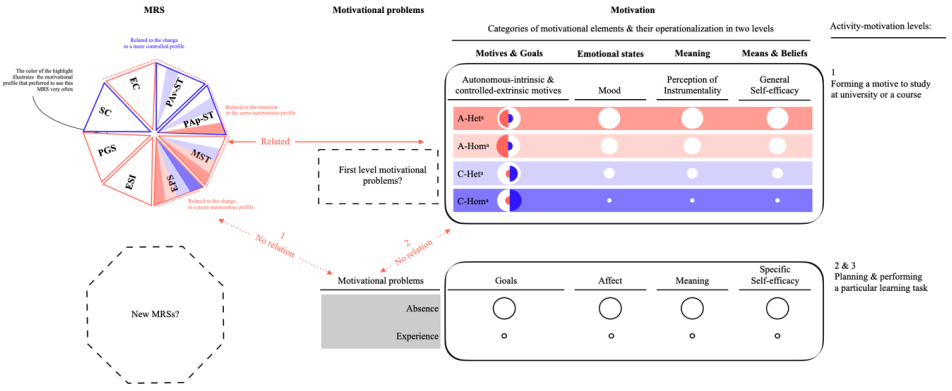
Figure 6.4.
Types and numbers of students' thoughts when confronted with problems of motivation.

For example, while experiencing motivational problems, students thought about accomplishing the learning task, their obligations, and meeting deadlines. None of the known MRSs involves working with these goals and motives, which again supports the above-mentioned idea that the MRSs do not sufficiently cover all motivational elements.

Another major downside our study unearthed is that students did not consider any of the MRSs when confronted with problems of motivation. For instance, in writing down what they wanted to achieve (e.g., good scores), which reflected their motives and goals, they did not mention what was needed to achieve this, as would be the case when invoking the performance-approach self-talk MRS (I tell myself that I should keep on learning if I wish to reach a good exam). We therefore invite future researchers to examine students in their natural context to find out whether they effectively use the MRSs. If it turns out they do not, we might need to teach them what motivation is and how they can self-regulate it. Furthermore, the different types of student thoughts we identified in our study could serve as a starting point for redefining existing MRSs and formulating new ones.

Overall, this dissertation has demonstrated that students changed their motivation to learn throughout the course and that an overwhelming majority (87.6%) experienced motivational problems when planning and performing learning tasks, albeit in relatively small numbers per student. However, the relationships between students' problems of motivation, their motivation, and the eight known MRSs were neither totally aligned, nor all-encompassing. Figure 6.5 summarizes the overarching results gathered from all studies.

Figure 6.5.
The relationships identified between students' uptake of the eight MRSs, their motivational elements, and motivational problems as well as cues for other potential relationships.



[a]Motivational profiles: A-Het = Autonomous-heterogenous; A-Hom = Autonomous-homogenous; C-Het = Controlled-heterogenous; C-Hom = Controlled-homogenous.

As the upper part of the Figure 6.5 shows, five of the eight MRSs related to changes in students' motivational elements at the first level. At the same time, however, they bore no relation to the motivational problems, nor to the motivational elements of the second and third levels combined, as the first red-dotted arrow indicates. In a similar fashion, the second red-dotted arrow illustrates that students' motivational problems were, in turn, unrelated to the motivational elements of the first level. What stands out is that, even though the MRSs related to changes in students' motivational elements at the first level, students did not consider them at all when they lacked the motivation to plan and perform tasks. Overall, these findings lead us to assume that, on the one hand, students might lack the motivation to study at university in general (e.g., because they doubt that they chose the right study program). Yet, on the other, we may need to devise new MRSs that are more closely connected to each of the motivational elements on different levels of motivation and activity.

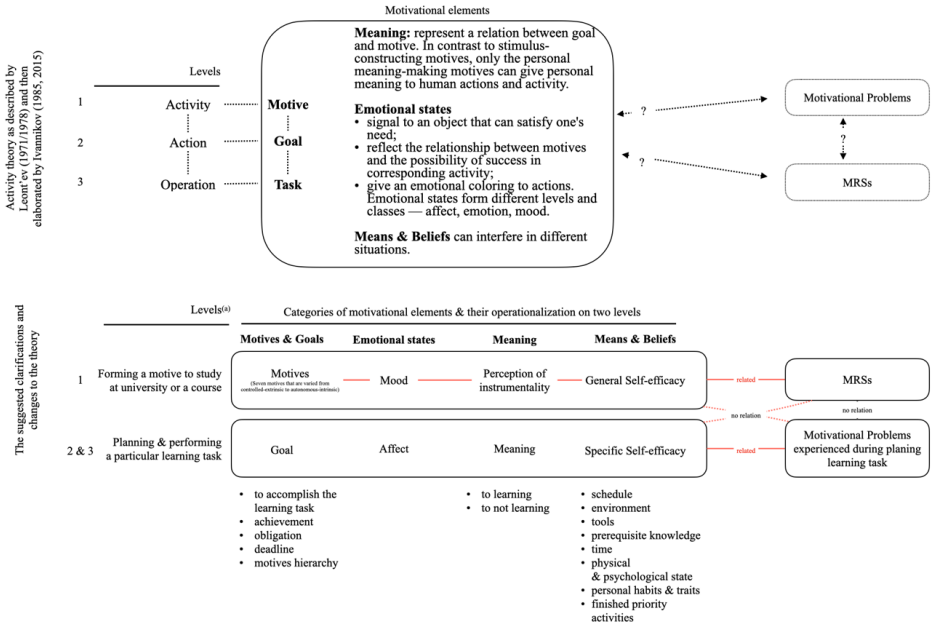
The Motivation to Learn and Motivational Self-regulation Through the Lens of Activity Theory

In the present dissertation, we embraced Hattie and colleagues' (2020) view that current motivation research is lacking a systematic view on what exactly constitutes the "motivation to learn." We did so by considering motivation as a complex system and investigating how students regulate this system from the perspective of activity theory. It was through this lens that we attempted to clarify the motivation system (its constituent elements and relationships) and offer insights to improve students' self-regulation, by revealing the limitations of existing MRSs and suggesting new ones.

Motivational Elements

To our knowledge, this was the first attempt to empirically investigate the range of motivational elements in full including their relationships as posited by activity theory (Leont'ev, 1971/1978; Ivannikov, 1985, 2015). According to this theory, motivation and activity are two sides of the same coin that together form a system of motivational elements spanning three levels: (1) forming a motive to perform an activity, (2) planning the said activity, and (3) performing the activity. Acting on Hattie et al.'s (2020) recommendation to link different theories of motivation, we used insights from various theories that focused on single aspects of motivation to specify the motivational elements postulated in activity theory. In the following, we will again discuss the results of levels two and three combined. Figure 6.6 first presents the activity-theoretical model as it was originally developed by Leont'ev (1971/1978) and then elaborated by Ivannikov (1985, 2015). The bottom part subsequently depicts how we propose to refine and expand the theory based on our findings.

Figure 6.6.
Suggested refinement to the original activity-theoretical model as developed by Leont'ev (1971/1978) and subsequently elaborated by Ivannikov (1985, 2015).



(a) As we did not empirically separate the planning and performance levels, we have presented the results of levels two and three combined.

This dissertation supports the suggestion of activity theory to construe motivation as a multilevel system of motivational elements. In doing so, however, it goes one step further by considering these elements as categories that can variously manifest themselves at each level of motivation. The thoughts students had when confronted with a lack of motivation in their natural context confirmed that these elements do not only exist in theory. Their thoughts reflected all motivational elements except emotional states. Moreover, they led us to clarify several motivational elements as depicted in the bottom part of Figure 6.6. We also found that students' motivational problems and their concomitant MRS uptake differed in accordance with the level of motivation (see the red lines in Figure 6.6), which supports the idea that the motivational elements do stretch across multiple levels. Future investigations of the relationships between motivational elements at different levels and the corresponding types of motivational problems and MRSs will help to find better ways to self-regulate motivation.

The research in this dissertation also provided empirical support for the assertion that there is more to motivation than mere motives and that students differ in how they value each motivational element. The correlations we found between these elements (see red lines in Figure 6.6) support this idea. Moreover, when we examined

students' motives in relation to the other motivational elements, the presence of mood, perceptions of instrumentality, and general self-efficacy appeared stronger in students with heterogeneous motives than in those with homogeneous autonomous intrinsic motives. Strangely, these results are at odds with the taxonomy of motives postulated by self-determination theory (Ryan & Deci, 2020), according to which autonomous intrinsic motives are associated with the greatest well-being. Because of their strong relationships with other motivational elements, however, autonomous intrinsic motives could still carry more "weight" in motivation. Hence, by adopting a systematic view on motivation, we learned about the importance of students self-regulating their different motivational elements which may carry different "weights" in the whole motivational system. Based on these findings, we may need to reconsider what type of student motivation is the most valuable.

Motivation and MRSs

In this dissertation, we offered insights into what it means to successfully self-regulate motivation, revealed the limitations of known MRSs, and suggested new ones. In expanding activity theory, Ivannikov (1985, 2015) already pointed out that students' motivational elements could be disrupted, sometimes causing them to discontinue learning altogether if they do not restore the respective elements. In doing so, however, he did not specify what such "disruption" and "restoration" actually entailed. Our findings bring us to the tentative conclusion that, in order to restore their motive, goal, or meaning, students should try to find an alternative autonomous intrinsic and/or autonomous extrinsic motive, goal, or meaning. In a similar fashion, restoring their emotional states would entail experiencing a more positive mood and affect, while feeling more self-efficacy would help them to restore their means and beliefs. The above suggestions could guide students in self-regulating the motivational elements that were disrupted with the ultimate aim to improve their motivation.

Another contribution of this dissertation is that it enriches Ivannikov's (1985, 2015) assertion that successful self-regulation requires a proper fit between the MRSs and the specific motivational elements they target, by suggesting that the motive hierarchy matters. For instance, while the enhancement-of-personal-significance MRS helped students to make their motives more autonomous, the two goal-oriented MRSs were only able to help them retain their motives if these were already autonomous. The motive hierarchy could explain this difference. More specifically, all three MRSs correlated more strongly with motives than with the other motivational elements. Consequently, students might first need to find their higher-order leading autonomous motives, or meaning-making motives in activity theory parlance, by asking themselves "Why is learning important to me and for my life?" Only after finding these motives, will it make sense to think about motives that rank lower in the hierarchy mastery and achievements (Why do I want to master these skills? Why do achievements matter to me?). If the student

does not have any leading autonomous motives, it could be ineffective to target lower-level motives. Hence, taking the motive hierarchy into account could enrich the self-regulation process.

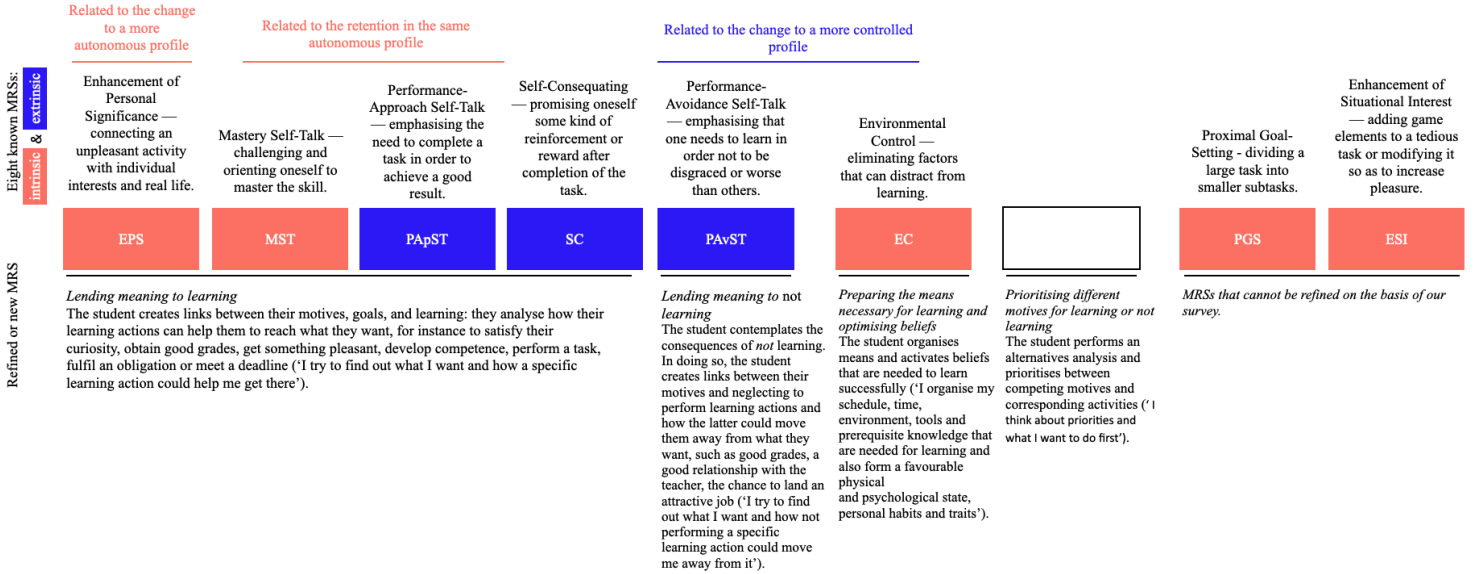
Furthermore, we also exposed the limitations of the existing MRSs as well as the problems with the whole process of self-regulating one's motivation. We found that the MRSs only worked at the first level of motivation (to study in university or for a course). Even more strikingly, the MRSs potentially only target students' motives, ignoring the other elements - meaning, emotional states, means, and beliefs. The fact that students changed their motivation throughout the course demonstrated that motivation as such is inherently dynamic. Consequently, students' use of the MRSs should be equally dynamic. Our finding that students with the most beneficial profiles made most frequent use of all the MRSs reinforces this conclusion. For example, to enable such dynamic uptake of MRSs, students could reflect on their motives (Why am I studying?) each time they start a new course or study year.

Calling to mind that students did not consider any of the MRSs, neither known nor new, when planning and performing a task and that the MRSs did not address the full range of their thoughts, we suggest that new MRSs are needed. These should ideally target all elements across all levels in the system of motivation, and students should probably learn how to use them. Their thoughts gave us clues about how we might improve the existing MRSs to make them more congruent with students' motivation (see Figure 6.7).

Consequently, we used the known MRSs, students' thoughts, and the motivational elements postulated by activity theory as an empirical and theoretical basis to propose a new set of MRSs (Study 4). Figure 6.7 gives an overview of this proposed redefinition. First, we suggest that the first four existing MRSs be combined to form a new MRS coined "*Lending meaning to learning*" that targets students' motives, goals, *and* meaning. First, making the respective MRS less specific might give students more freedom to contemplate all potential motives and goals. Second, our results indicated that students looked for meaning when confronted with problems of motivation, and also from activity theory perspective motives or goals only work when they have meaning. This is why we suggest that students should try to find a link between their goals and motives. More specifically, rather than asking themselves "what do I want?", they could benefit from asking: "How will this particular learning goal and corresponding action get me closer to what I want?"

In a similar fashion, we suggest that the performance-avoidance self-task MRS be reformulated to read "*Lending meaning to* not *learning"*. We found that students avoided more than just bad performance. As the MRS helps to reduce students' motivation to learn, it might also be called an "anti-MRS." On the other hand, however, if students understand that this MRS is not only about avoiding performance, they might be better able to identify their own avoidance thoughts and stop them accordingly.

Figure 6.7.
Proposed redefinition of the eight known MRSs.



(a) In Chapter 5, we defined the new "Lending meaning to learning" MRS as a strategy to create links between motives and learning. However, after considering the dissertation in full, we also added goals (i.e., creating links between motives, *goals*, and learning), as meaning works with both activity and actions, that is, with corresponding motives and goals.

Our third suggestion was to add an entirely new MRS that could help when students had conflicting motives: *"Prioritizing different motives for learning or not learning*." We found that students sometimes struggled when they contemplated such conflicting motives. In most cases, they were unsure about whether to learn or not to learn, but in others they also hesitated between two learning motives. Examples of such dilemmas were deciding whether to prepare for class or spend time with friends, to study or to work, and even between two different assignments. These dilemmas could pressurize and overload students. If students were familiar with this new, more appropriate MRS, they would be able to solve such dilemmas more effectively.

Finally, to cater to the two remaining motivational elements that were also reflected in students' thoughts, their means and beliefs, we suggest that the environmental control MRS be reformulated to read "*Preparing the means necessary for learning and optimizing beliefs*." Students were concerned with more than the mere elimination of distractions that the "old" MRS focused on. This new MRS therefore also encourages them to analyze the various means their study requires, such as *personal resources,* schedules, tools, time, *and* the completion of activities that take priority, as well as to activate beliefs that facilitate effective learning.

This new set of MRSs that draws from existing MRSs, students' thoughts, and their motivational elements as an empirical and theoretical basis might be better placed to help students self-regulate their motivation. In their redefined form, they are more congruent with students' motivation. Nevertheless, we should not forget that motivational self-regulation is a complex authentic problem that students must learn to solve. Our proposed redefinition of the MRSs therefore by no means offers an exhaustive solution to all students' potential problems of motivation. Motivational self-regulation is a complex authentic problem that students need to learn how to solve.

6 STRENGTHS AND LIMITATIONS

In the following paragraphs, we would like to call attention to the strengths and limitations of the present dissertation. A first strength is that we aimed to contribute to the improvement of motivational self-regulation by students in higher education. We did so by conducting longitudinal and mixed-methods studies in an ecologically valid context using highly diverse student samples - with students from different study programs and universities and having multiple nationalities from the former Commonwealth of Independent States.

Second, we integrated different perspectives on motivation and used the lens of activity theory to clarify its constituent elements (Chapters 2 and 5). More specifically, we conceptualized motivation as encompassing not only a willingness to learn, but also other aspects such as students' motives, goals, meaning, emotional states, means, and beliefs.

By looking at motivation as a complex system, we identified a change in the taxonomy of motives as postulated by self-determination theory (Ryan & Deci 2020; Chapter 3): Students who had the strongest presence of mood, perceptions of instrumentality, and general self-efficacy had *heterogeneous* motives rather than homogeneous autonomous intrinsic ones.

Third, by adopting a systematic view on motivation, we were able to expose the limitations of the eight MRSs described in the literature: They only address the elements at the first level of motivation, with particular emphasis on students' motives but less so on the other elements (Chapters 2 and 5). The fourth strength of this dissertation is that we took a dynamic stance toward the MRSs and motivation. This approach helped us to understand the role of MRSs in changing students' motivation. More specifically, the studies reported in Chapters 3 and 4 revealed that only three MRSs effected positive changes in their motivation: The enhancement of personal significance, mastery self-talk, and performance-approach self-talk MRSs. We also found that an enhanced MRS uptake was not necessarily conducive to changes in motivation.

As a final strength, we should like to emphasize that we explored students' motivation and their concomitant MRS uptake in a natural setting on two levels: On the more general level of studying in university or for a course and on the specific level of performing the learning activity. By construing motivation as a multilevel structure, we were able to redefine the existing MRSs and propose a new one so as to make the MRSs more congruent with students' motivation, thereby rendering them more effective.

Several limitations are worth noting as well. First, our sample was drawn from only Russian universities, where education essentially consists of teacher-centered plenary lectures, teacher-facilitated seminars in which students discuss different cases and questions in smaller groups, and homework such as reading textbooks, writing essays, or conducting projects. This may limit the generalizability of our results. Also, our longitudinal study into the relationships between students' MRSs uptake and motivational changes (Chapter 4) had a high percentage of missing data because many students did not attend part of the classes. We therefore invite scholars to replicate our study in different settings, such as problem- or project-based programs, and to subsequently compare the problems of motivation that students experience to those experienced in our lecture- and discussion-based programs.

Second, we measured students' motivation halfway through the semester, while outcomes might have been different had we measured it just before the exams. Additionally, the variety of motivational problems students could possibly experience may have been limited by the design of the education program, which consisted of theoretical lectures combined with discussions and workshops.

Third, our operationalization of the activity theoretical model may not have done full justice to the original theory, as we did not separate means and beliefs in the first three studies (Chapters 2-4) or distinguish between the second and third levels of planning

and performance in any of the studies. Moreover, we exclusively focused on students' motivation in their natural setting, without considering their broader context such as the university, the higher education system, or society. This is not consonant with activity theory which postulates that each activity is part of a higher-order system, such as society.

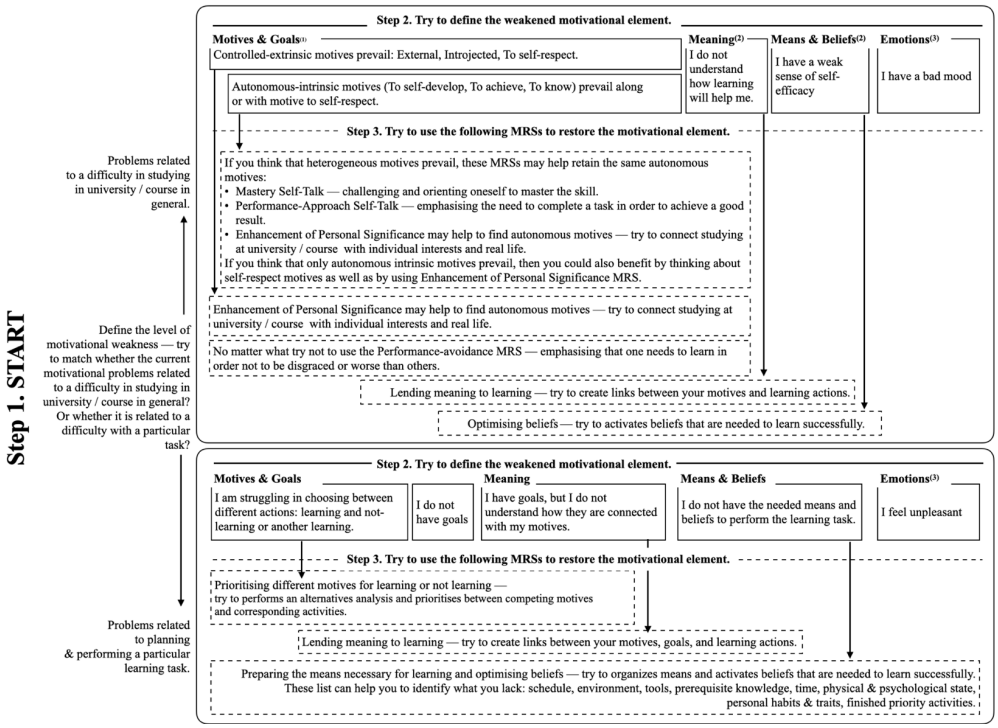
Fourth, since four items of the original Perceptions of Instrumentality Scale showed low reliability, low standardized coefficients, and poor model fit, we had to omit these items and unite two scales into one (Chapters 2-4). Moreover, the SRL microanalysis survey described in Chapter 5 may have influenced students' motivation, simply by making them think about their motivational problems. And finally, the results of this dissertation are largely based on questionnaires rather than interviews or think-aloud methods which could have exposed the thinking processes involved in solving motivational problems better. We therefore welcome future replications of our study in a broader context that are based on larger samples and additional instruments to improve triangulation.

PRACTICAL IMPLICATIONS

The primary practical aim of this dissertation was to help students self-regulate their motivation to learn. We have demonstrated that motivational self-regulation can be construed as a mental process of solving a complex motivational problem that could include different motivational elements and levels. In the following, we propose several rules of thumb or heuristics that can support students in this process. These include prompting students to check on their motivational elements, consider the multilevel structure of motivation, and to adopt specific strategies when one or more of these elements are absent or weakened. Figure 6.8 presents the approach and rules of thumb we propose based on our results. They could serve as a starting point for the development of more elaborate supportive rules of thumb.

As depicted in the Figure 6.8, motivational self-regulation ideally consists of three steps: 1) Identify the level at which motivation is weakened, 2) Identify which element is weakened, and 3) Choose the appropriate MRS. More specifically, we advise students to first identify the level at which they experience reduced motivation: Does it apply more generally to their study in university or for a course or does it set in when planning and performing a specific task? (Step 1). After determining the level, they should focus on that relevant level and find the weakened motivational element (Step 2). This self-analysis can then be followed by selecting an appropriate MRS and testing it (Step 3).

Figure 6.8.
Rules of thumb to help students self-regulate their motivation.



(1) The following are examples of each motive taken from Gordeeva, Sychev, and Osin's (2014) Academic Motivation Scale questionnaire. The motive to know: "I like to study"; the motive to achieve: "I like to solve difficult problems and invest intellectual effort;" the motive to self-develop: "I like to know how to increase my competence and knowledge;" the extrinsic motive to self-respect: "To prove to myself that I am a smart person;" introjected motive: "Because it is embarrassing to do poorly in studying;" and external motive: "I have no other choice, as they will check my attendance."

(2) As the existing MRSs were found to correlate more strongly with motives, we cannot suggest that students use them to improve their meaning, means, or beliefs. A scrutiny of students' thoughts, however, led us to propose new MRSs that might be able to assist students at this first level of motivation.

(3) The research in this dissertation did not yield any data that supports the recommendation of an MRS to enhance students' emotions.

It is important to keep in mind that all students, even those with leading autonomous intrinsic motives, can experience problems of motivation and transition to a more controlled motivational profile. In such cases, we recommend that students use MRSs that help to retain their autonomous motives (see the upper part of Figure 6.8). With respect to the first level of motivation, we suggest that students with leading autonomous intrinsic motives focus on enhancing only one of their motivational elements, as we expect the other elements to follow suit due to their correlation. For extrinsically motivated students, on the other hand, it might be more beneficial to try and find their leading autonomous or meaning-making motive first. In any event, we

expect all students, regardless of their motives, to benefit from these rules of thumb. Also teachers, student advisers, and training program developers can use them to help students regulate their motivation. In doing so, they must realize that students' motivation may vary over time. Hence, to create a learning environment that fosters students' motivation to learn, educators should embed activities in courses that prompt students to reflect on both their motives and other motivational elements.

CONCLUSION

This dissertation has demonstrated that all higher education students changed their motivation during their studies and experienced motivational problems. The most surprising finding at first glance is that students who experienced motivational problems when planning and performing learning tasks did not consider ways to improve their motivation. They did not use any of the MRSs, neither the ones that have been reported in the literature nor the new one we proposed. What also complicated the whole process of motivational self-regulation is that the relationships between the existing MRSs and students' motivation were ambiguous. Moreover, they were mediated by the level of motivation and students' specific values for each motivational element (motives, goals, emotion, meaning, means, and beliefs). Hence, considering the fact that motivation is a highly complex, dynamic, multilevel system of motivational elements that is not fully covered by the existing MRSs, it is comprehensible that students do not contemplate ways to improve their motivation. Only over an extended period of time will students be able to learn the complex cognitive task of self-regulating their motivation. We made an important step in helping students to self-regulate this complex motivational system by specifying for which motivational elements the known MRSs are most beneficial and by suggesting new strategies that potentially address a broader range of elements. The better we understand the complex, multifaceted system of motivation (its elements and rules of functioning), the more suitable MRSs we can develop.

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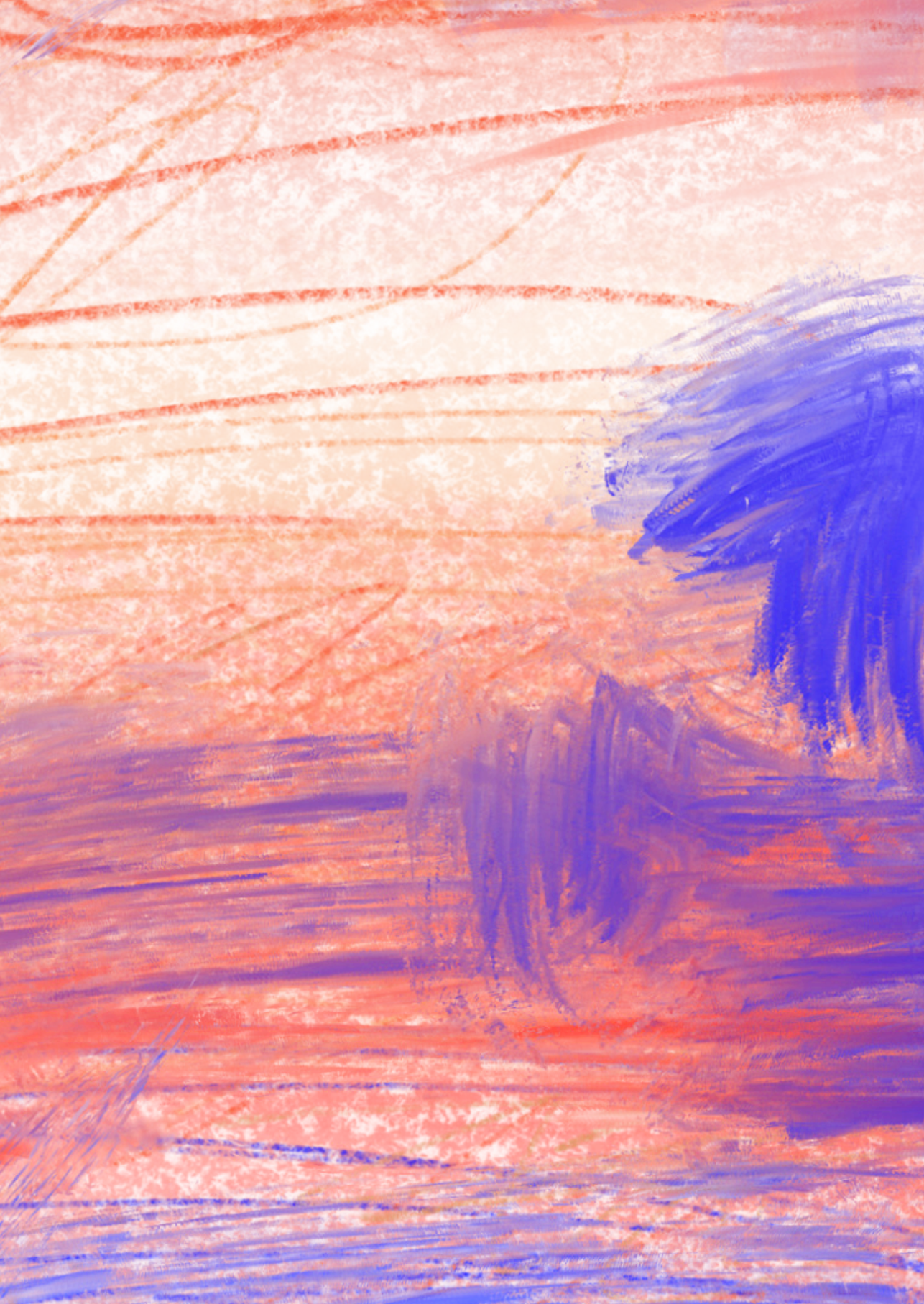


Summary
Nederlandse samenvatting
Impact chapter

SUMMARY

This dissertation describes four studies investigating how we can help higher education students to better self-regulate their motivation. The study findings revealed gaps between existing motivational regulation strategies (MRSs) and students' motivation, and gave clues to formulate new MRSs that help to close these gaps. The General Introduction (Chapter 1) first introduces the said MRSs and reveals in what way research on their application is falling short. The first gap is that the MRSs were based on students' answers to imaginary motivational problem situations and literature review, and, consequently, they might lack ecological validity (Wolters, 1998, 1999, 2003; Schwinger and colleagues, 2009). Moreover, there could be other MRSs that were unknown to students. The second gap is that studies on MRSs essentially focused on only one aspect of motivation, such as motives or self-efficacy, whereas it is likely that multiple aspects of motivation are at play. Chapter 1 therefore views motivation through the lens of activity theory, by considering it a system that is composed of multiple elements, so as to help us understand whether and how the known MRSs appropriately address the full range of motivational elements and whether new MRSs are needed.

To discover whether the known MRSs address the full range of motivational elements, how they contribute to changes in students' motivation during their studies, and what new MRSs could be needed to help students maintain or increase their motivation, we conducted four studies. We have reported these studies in Chapters 2–5. The four research questions guiding these respective chapters are:

1) How are students' motives, emotional states, meaning, goal, means, and beliefs interrelated and how do they relate to students' MRS uptake? (Chapter 2).
2) How do students with different motivational profiles differ in their uptake of known MRSs? (Chapter 3).
3) How are long-term changes in students' motivational profiles during the study of a course associated with their uptake of known MRSs? (Chapter 4).
4) How does students' real-time experience of motivational problems relate to the known MRSs, and what MRSs do they actually use? (Chapter 5).

Chapter 2 describes a correlational study that analyzed the relationships between the existing MRSs and students' motivation to study at university. In doing so, we broke students' motivation down into four different motivational elements: Their motives to learn, mood, perceptions of instrumentality, and general self-efficacy. We identified two groups of MRSs that could be distinguished by their relationship to students' extrinsic and intrinsic motives. Five MRSs were typically employed when students had intrinsic motives and targeted their interest, personal significance, mastery of knowledge and skills, goal-setting, and environmental control. Three other MRSs were used by students who were extrinsically motivated and focused on

performance approach/performance avoidance, and self-consequating. By making students aware of their own motives to learn (intrinsic vs. extrinsic), we might help them choose more appropriate MRSs.

Chapter 3 describes the results of latent profile analyses of higher education students' motivation to study for a course, which revealed four motivational profiles: A controlled-homogeneous, controlled-heterogeneous, autonomous-heterogeneous, and autonomous-homogeneous profile. Profiles differed according to students' level of autonomy as well as the dominance of one type (homogeneous) or different types (heterogeneous) of motives. As students' motives became more heterogeneous, they more frequently used all the MRSs under scrutiny and included more of them in their fixed repertoire. Students with heterogeneous profiles regularly used three to four MRSs, while students with homogeneous profiles preferred to use only one or two MRSs on a regular basis. The best profiles with autonomous- heterogeneous motives focused on creating meaning for learning by connecting it with own future, emphasizing importance of mastery and achievement. We propose that heterogeneous motives and considering personal meaning for learning from different perspectives are beneficial for self-regulating motivation.

In Chapter 4, we analyzed the dynamic relationships between higher education students' MRS uptake and any changes in their motivation to learn for a course (from a controlled to an autonomous profile, and vice versa). We measured students' MRS uptake and motivation at three points in time during a course and found that students' motivation indeed changed throughout the course. Depending on students' leading motives, MRSs were variously related to these changes in their motivation. For students with leading controlled motives, only the enhancement-of-personal-significance MRS was associated with enhanced autonomous motivation. For students with leading autonomous motives, in contrast, performance- and mastery-oriented MRSs helped them to remain autonomously motivated. It is important to note that frequent use of the MRSs did not necessarily equal "strength," for the uptake of a suboptimal strategy, however infrequent, could still erode students' motivation. We conclude that not only students' MRS uptake, but also their leading motives play a role in becoming or staying autonomously motivated.

Chapter 5 describes the results of a real-time mixed-methods study that measured how students' motivational problems were related to their specific motivational elements, as well as to their concomitant MRS uptake and thoughts when planning and performing a learning task. To this end, university students completed the same questionnaires as the one we used in previous studies and a one-week self-regulated learning microanalysis survey that probed into their real-time experiences. Surprisingly, we found that students' motivational problems were unrelated to their MRS uptake, although they did coincide with lower quantities of meaning, goal, affect, and specific self-efficacy. Students' reflections indicated that they contemplated the motivational

elements, but *not* how they might use the MRSs to solve their motivational problems. Nevertheless, our results led us to redefine the MRSs as follows so as to make them more applicable to students' specific situation and potentially render them more useful in solving real-time motivational problems: *Lending meaning to (not) learning*, *preparing the means necessary for learning and optimizing beliefs,* and *prioritizing different motives for (not) learning*. Hence, we argue that the above redefinition of MRSs is needed to improve their link with students' individual motivational elements and, consequently, their usability for students who lack the motivation to study.

Chapter 6 synthesizes the main findings presented in this dissertation and elaborates on their theoretical and practical implications. We discuss how the motivation to learn and its self-regulation can be considered through the lens of activity theory. More specifically, we propose to construe motivation as a complex, dynamic system that encompasses many interacting elements across different levels and is subject to changes throughout a course. These elements, being students' motives, goals, emotions, meaning, means, and beliefs, stretch across at least two levels of motivation (the more general level of studying in university and the specific levels of planning and performing learning tasks). This perspective allowed us to reveal the discrepancies between the MRSs hitherto described in the literature and students' motivation. Based on the relationships we found between these MRSs and students' motivation, their experience of motivational problems, and activity theory, we suggested new MRSs that could help to close these gaps. As for practical implications, we made a few recommendations and proposed several rules of thumb that might help students to properly reflect on their motivation and use suitable MRSs. Finally, we also recommended that educators use the proposed system to reflect on and improve education programs and policies so as to render them more supportive of students' motivation to learn.

NEDERLANDSE SAMENVATTING

In dit proefschrift worden vier studies beschreven waarin we onderzochten hoe we studenten in het hoger onderwijs kunnen helpen hun motivatie beter zelf te reguleren. De onderzoeksbevindingen gaven aan dat er tussen de bestaande strategieën voor het reguleren van motivatie (hierna MRS'en te noemen[1]) en de motivatie van studenten hiaten bestonden en gaven aanwijzingen voor het formuleren van nieuwe MRS'en die deze hiaten helpen te dichten. In de algemene inleiding (Hoofdstuk 1) worden deze MRS'en eerst geïntroduceerd en wordt vervolgens aangegeven op welke manier het onderzoek over het gebruik ervan tekortschiet. De eerste hiaat is dat de MRS'en gebaseerd waren op de antwoorden van studenten op fictieve motivatieprobleemsituaties, waardoor ze mogelijk geen ecologische validiteit zouden hebben. Daarnaast zouden er andere MRS'en kunnen zijn die de studenten niet kenden. De tweede hiaat is dat het onderzoek naar MRS'en zich in feite slechts op één deelaspect van motivatie richtte, zoals de beweegredenen van studenten en hun *self-efficacy*, terwijl het aannemelijk is dat er meerdere aspecten van motivatie een rol spelen. In Hoofdstuk 1 wordt er daarom met een activiteitentheoriebril naar motivatie gekeken, door deze als een samenstel van meerdere aspecten te beschouwen, met het doel ons te helpen begrijpen of en hoe de bestaande MRS'en op passende wijze het hele palet aan motivatieaspecten aanspreken en of er misschien nieuwe MRS'en nodig zijn.

Om erachter te komen of de bestaande MRS'en het hele palet aan motivatieaspecten aanspreken, hoe zij helpen om in de loop van de opleiding veranderingen in de motivatie van studenten teweeg te brengen en welke nieuwe MRS'en er nodig zouden kunnen zijn om studenten te helpen hun motivatie te behouden of juist te vergroten, hebben we vier studies verricht. Deze studies worden in Hoofdstuk 2 t/m 5 beschreven. De betreffende hoofdstukken worden geleid door de volgende vier onderzoeksvragen:

1) Hoe verhouden de beweegredenen, emotionele toestand, zingeving, doelstelling, middelen en overtuigingen van studenten zich tot elkaar en tot de wijze waarop zij van de MRS'en gebruikmaken? (Hoofdstuk 2).
2) Op welke wijze verschillen studenten met diverse motivatieprofielen ten aanzien van hun specifieke MRS-gebruik? (Hoofdstuk 3).
3) Hoe houden blijvende veranderingen in het motivatieprofiel van studenten in de loop van een onderwijsblok verband met hun gebruik van bestaande MRS'en? (Hoofdstuk 4).
4) Hoe verhoudt de wijze waarop studenten in real time motivatieproblemen ervaren zich tot de bestaande MRS'en en welke MRS' en gebruiken zij dan eigenlijk? (Hoofdstuk 5).

1 * MRS = de Engelse afkorting van 'motivational regulation strategy'.

In Hoofdstuk 2 wordt een correlationeel onderzoek beschreven waarin de relaties tussen de bestaande MRS'en en de motivatie van studenten om aan de universiteit te studeren, worden geanalyseerd. Hierbij hebben we de motivatie van studenten in de volgende vier verschillende motivatieaspecten opgesplitst: hun redenen om te studeren, stemming, het nut dat zij in de leeractiviteit zagen en algemene *self-efficacy*. We onderscheidden twee groepen MRS'en aan de hand van hun relatie tot de extrinsieke en intrinsieke beweegredenen van studenten. Vijf MRS'en werden doorgaans gehanteerd wanneer studenten intrinsieke beweegredenen hadden en waren gericht op hun interesse, persoonlijke betekenis en de beheersing van kennis en vaardigheden, het stellen van doelen en het beheersen van de omgeving. Drie andere MRS'en werden gehanteerd door extrinsiek gemotiveerde studenten en richtten zich op het behalen van goede prestaties/voorkomen van falen, zelfbeloning op basis van resultaten. Door studenten bewust te maken van hun eigen redenen om te leren (intrinsiek vs. extrinsiek), kunnen we hen mogelijk helpen om meer passende MRS'en te kiezen.

In Hoofdstuk 3 worden de resultaten beschreven van latenteprofielanalyses van de motivatie van studenten in het hoger onderwijs om voor een onderwijsblok te leren. Hieruit kwamen de volgende vier motivatieprofielen naar voren: een gecontroleerd homogeen, gecontroleerd heterogeen, autonoom heterogeen en autonoom homogeen profiel. De verschillen tussen profielen waren toe te schrijven aan zowel de mate waarin studenten autonoom gemotiveerd waren alsook de dominantie van één type (homogene) of verschillende typen (heterogene) beweegredenen. Naarmate studenten steeds meer heterogene redenen hadden om te leren, maakten zij vaker gebruik van alle MRS'en onder beschouwing en namen zij er meer van op in hun vaste repertoire. Studenten met heterogene profielen gebruikten drie tot vier MRS'en regelmatig, terwijl studenten met homogene profielen er de voorkeur aan gaven om er slechts een of twee regelmatig te gebruiken. Studenten met meer autonome profielen combineerden MRS'en die gericht waren op persoonlijke betekenis met doelgerichte MRS'en. Deze bevindingen maken aannemelijk dat heterogene redenen en aandacht voor persoonlijke betekenis en doelen gunstig zijn voor het zelf reguleren van motivatie.

In Hoofdstuk 4 hebben we de dynamische verbanden tussen de wijze waarop studenten in het hoger onderwijs van de MRS'en gebruik maakten en eventuele veranderingen in hun motivatie om voor een onderwijsblok te leren (van een gecontroleerd naar een autonoom profiel en omgekeerd) onder de loep genomen. Hiertoe hebben we op drie momenten gedurende een onderwijsblok het specifieke MRS-gebruik van studenten en hun motivatie gemeten en kwamen tot de constatering dat hun motivatie tijdens dit blok inderdaad aan verandering onderhevig was. De MRS'en hielden op verschillende manieren verband met deze veranderingen in hun motivatie, afhankelijk van door welke redenen studenten het meest gedreven werden. Voor studenten met hoofdzakelijk gecontroleerde redenen om te leren, hield alleen de MRS 'vergroten van persoonlijke betekenis' verband met een toename in hun autonome motivatie. Bij studenten met

vooral autonome redenen daarentegen hielpen de prestatie- en beheersingsgerichte MRS'en hen om autonoom gemotiveerd te blijven. Hierbij dient te worden opgemerkt dat frequent gebruik van de MRS'en niet per se gelijk stond aan 'efficiëntie', aangezien het gebruik van een suboptimale strategie, hoe incidenteel ook, nog altijd de motivatie van studenten kon aantasten. We concludeerden dat niet alleen het individuele gebruik van de MRS'en door studenten, maar ook hun voornaamste beweegredenen een rol spelen in het al dan niet autonoom gemotiveerd worden of blijven.

In Hoofdstuk 5 worden de resultaten van een realtime *mixed-methods* onderzoek beschreven waarin we maten hoe de motivatieproblemen van studenten verband hielden met hun specifieke motivatieaspecten en met hun bijbehorende MRS-gebruik en overwegingen tijdens het plannen en uitvoeren van een onderwijstaak. Hiertoe vulden universiteitsstudenten dezelfde vragenlijsten in als die we in eerdere onderzoeken hadden gebruikt, alsmede een microanalyse over zelfregulerend leren waarin zij gedurende één week werden gevraagd naar hun realtime ervaringen. Verrassend genoeg ontdekten we dat de motivatieproblemen van studenten geen verband hielden met hun individuele MRS-gebruik, alhoewel deze wel gepaard gingen met een verminderde mate van zingeving, doelstelling, affect en specifieke self-efficacy. Uit de reflecties van de studenten bleek dat zij wel nadachten over de motivatieaspecten, maar níet over hoe zij de MRS'en zouden kunnen inzetten voor het oplossen van hun motivatieproblemen. Desalniettemin brachten de resultaten ons ertoe om de MRS'en als volgt opnieuw te definiëren zodat ze beter op de specifieke situatie van studenten toepasbaar zouden zijn en mogelijk beter bruikbaar zouden zijn bij het oplossen van realtime motivatieproblemen: *betekenis toekennen aan het al dan niet leren*, *het voorbereiden van de middelen die nodig zijn om te leren en het optimaliseren van overtuigingen* en *het prioriteren van verschillende redenen om (niet) te leren*. Wij zijn dan ook van mening dat voornoemde herdefiniëring van MRS'en noodzakelijk is om hun connectie met de individuele motivatieaspecten van studenten te verbeteren en daarmee hun bruikbaarheid voor studenten die onvoldoende gemotiveerd zijn om te studeren.

In Hoofdstuk 6 worden de belangrijkste bevindingen die in dit proefschrift zijn aangereikt, gebundeld en wordt ingegaan op hun implicaties voor de theorie en praktijk. We bespreken hoe er met een activiteitentheoriebril op naar de motivatie om te leren en de zelfregulatie ervan kan worden gekeken. Meer specifiek stellen wij voor om motivatie te beschouwen als een complex, dynamisch samenstel van veel met elkaar samenhangende deelaspecten op diverse niveaus dat gedurende een onderwijsblok aan verandering onderhevig is. Deze deelaspecten, zijnde de beweegredenen, doelstellingen, emoties, zingeving, middelen en overtuigingen van studenten, strekken zich uit over ten minste twee niveaus van motivatie (het meer algemene niveau van studeren aan de universiteit en de specifieke niveaus van plannen en uitvoeren van onderwijstaken). Door er op deze manier naar te kijken, waren wij in staat om de discrepanties tussen de tot nu toe in de literatuur beschreven MRS'en en de motivatie van studenten inzichtelijk te maken.

Op basis van de verbanden die we ontdekten tussen deze MRS'en en de motivatie van studenten, de motivatieproblemen die zij ervoeren en activiteitentheorie stelden we nieuwe MRS'en voor die deze hiaten zouden kunnen helpen dichten. Ten aanzien van implicaties voor de praktijk deden we enkele aanbevelingen en stelden verschillende vuistregels voor die studenten zouden kunnen helpen om goed over hun motivatie na te denken en passende MRS'en te gebruiken. Tot slot bevalen we ook aan dat opleiders de voorgestelde methode gebruiken om over onderwijsprogramma's en -beleid na te denken en deze te verbeteren, zodat deze de motivatie van studenten om te leren beter ondersteunen.

IMPACT CHAPTER

The main aim of this dissertation was to help higher education students better self-regulate their motivation to learn. We sought to achieve this by offering a new perspective on the motivation to learn and its self-regulation through the lens of activity theory. This perspective allowed us to reveal the discrepancies between the motivational regulation strategies (MRSs) hitherto known and students' motivation, and also gave us clues to formulate new MRSs that might close these gaps. Below, I will first describe how the scientific field could benefit from the dissertation findings, before moving on to give recommendations regarding their social and practical impact as well as how we plan to disseminate the results.

Scientific Impact

To our knowledge, the work reported in this dissertation was the first attempt to scrutinize students' motivational elements (motives, goals, emotions, meaning, means, and beliefs) simultaneously at different levels of motivation, consistent with activity theory. These levels were three: 1) Studying in university or for a course; 2) planning; and 3) performing a particular learning task. We have showed that students' motivational problems and the MRSs hitherto known were related to different levels of this structure of motivation. Overall, this dissertation has demonstrated that the type of MRS students used and the motivational problem they encountered were *specific* to each motivational level and motivational element.

In addition, the present dissertation has revealed that the existing MRSs did not fully address the whole range of motivational elements. We observed dynamic changes in students' motivation and MRS uptake within the space of a single module. Another enlighteningly new insight was that the MRSs differed in their function: they caused students to either *retain* or *change* their motivation. Such a change could be positive, by guiding students toward a more autonomous profile, or negative, by directing them toward more controlled motivation. Most strikingly, the existing MRSs essentially targeted only one motivational element, that is, students' motives. Consequently, students might need other MRSs that have not yet been described in the literature to address their remaining motivational elements, being their goals, emotions, meaning, means, and beliefs.

Based on the previous tentative conclusion, we have made an attempt to redefine the existing MRSs to make them more congruent with students' motivation and proposed completely new MRSs to close the aforementioned gaps. We based this revised set of MRSs on the relationships we identified between students' uptake of the existing MRSs and their motivation, their experience of motivational problems, and activity theory. This revised set of MRSs is presented in Table 1.

Table 1.
Introduction of new MRSs based on our survey outcomes.

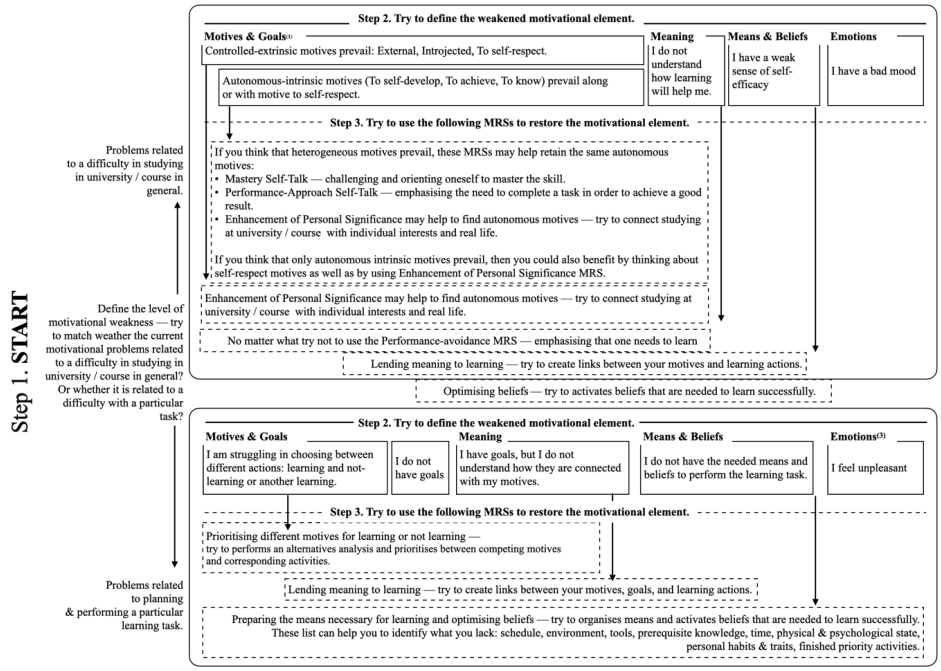
Suggested MRS	Definition	Example
Lending meaning to learning	The students create links between their motives, goals, and learning: They analyze how their learning actions can help them reach what they want, for instance to satisfy their curiosity, obtain good grades, get something pleasant, develop competence, perform a task, fulfill an obligation or meet a deadline.	I try to find out what I want and how a specific learning action could help me get there.
Lending meaning to not *learning*	The students create links between their motives and neglecting to perform learning actions and how the latter could move them away from what they want, such as good grades, a good relationship with the teacher, the chance to land an attractive job.	I try to find out what I want and how *not* performing a specific learning action could move me away from it.
Preparing the means necessary for learning and optimizing beliefs	The student organizes the means and activates the beliefs that are needed to learn successfully.	I organize my schedule, time, environment, and tools, and I recall what I have already learned in order to assimilate new knowledge and also form a favorable physical and psychological state, personal habits, and traits.
Prioritizing different motives for learning or not learning	The student performs an analysis of alternatives and prioritizes between competing motives and corresponding activities.	I think about priorities and what I want to do first.

Finally, we also revealed that, in order for students to successfully self-regulate their motivation, they need more than the MRSs hitherto known. Sadly, they did not consider them at all when confronted with problems of motivation in planning and performing their learning tasks. Although they reflected upon their motivational state, they did not try to do something about it. We have shown that motivation is a dynamic, multilevel system of motivational elements that each have different weights. Knowing this, it is comprehensible that students did not consider the MRSs. There seems to be more to effective motivational self-regulation than mere knowledge of the MRSs or using them. Rather, it is a complex problem that students should learn to solve, for it makes them more resilient and autonomous from unexpected changes and lays the foundation for lifelong learning.

Social Impact

As said, the main aim of this dissertation was to help higher education students better self-regulate their motivation to learn. Our findings are valuable for students, tutors, educators involved in education program design, and university leaders. First, students could benefit from using the rules of thumb specially drafted to help them self-regulate their motivation (see Figure 1). Tutors, too, can use these guidelines to discuss different aspects of motivation with students and find ways to help them when they are lacking motivation.

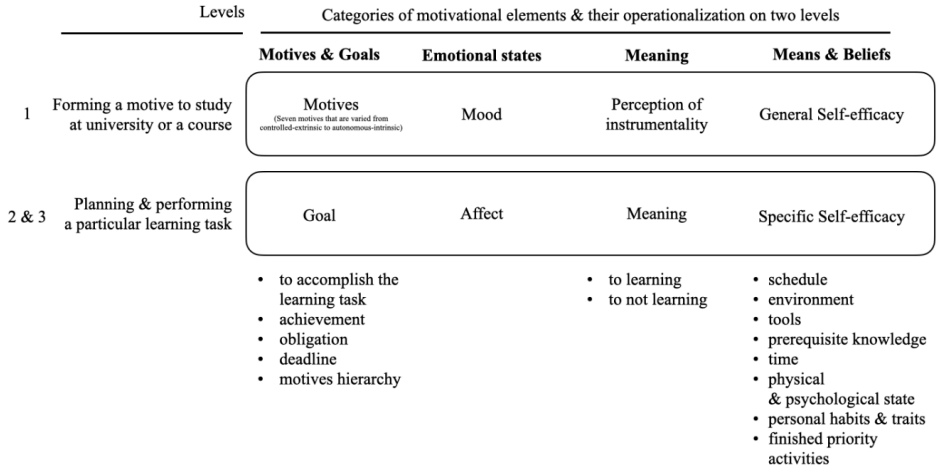
Figure 1.
Rules of thumb for supporting students during self-regulation of motivation.



(1) The following are examples of each motive taken from Gordeeva, Sychev, and Osin's (2014) Academic Motivation Scale questionnaire. The motive to know: "I like to study"; the motive to achieve: "I like to solve difficult problems and invest intellectual effort"; the motive to self-develop: "I like to know how to increase my competence and knowledge", the extrinsic motive to self-respect: "To prove to myself that I am a smart person"; introjected motive: "Because it is embarrassing to do poorly in studying"; and external motive: "I have no other choice, as they will check my attendance".

As depicted in the above figure, motivational self-regulation ideally consists of three steps: 1) identify the level at which motivation is weakened; 2) Identify which element is weakened; and 3) Choose the appropriate MRS. More specifically, we advise students to first identify the level at which they experience reduced motivation: Does it apply more generally to their study in university or for a course or does it set in when planning and performing a specific task? (Step 1). After determining the level, they should focus on that relevant level and find the weakened motivational element (Step 2). This self-analysis can then be followed by selecting an appropriate MRS and testing it (Step 3).

Figure 2.
The structure of activity and motivation.



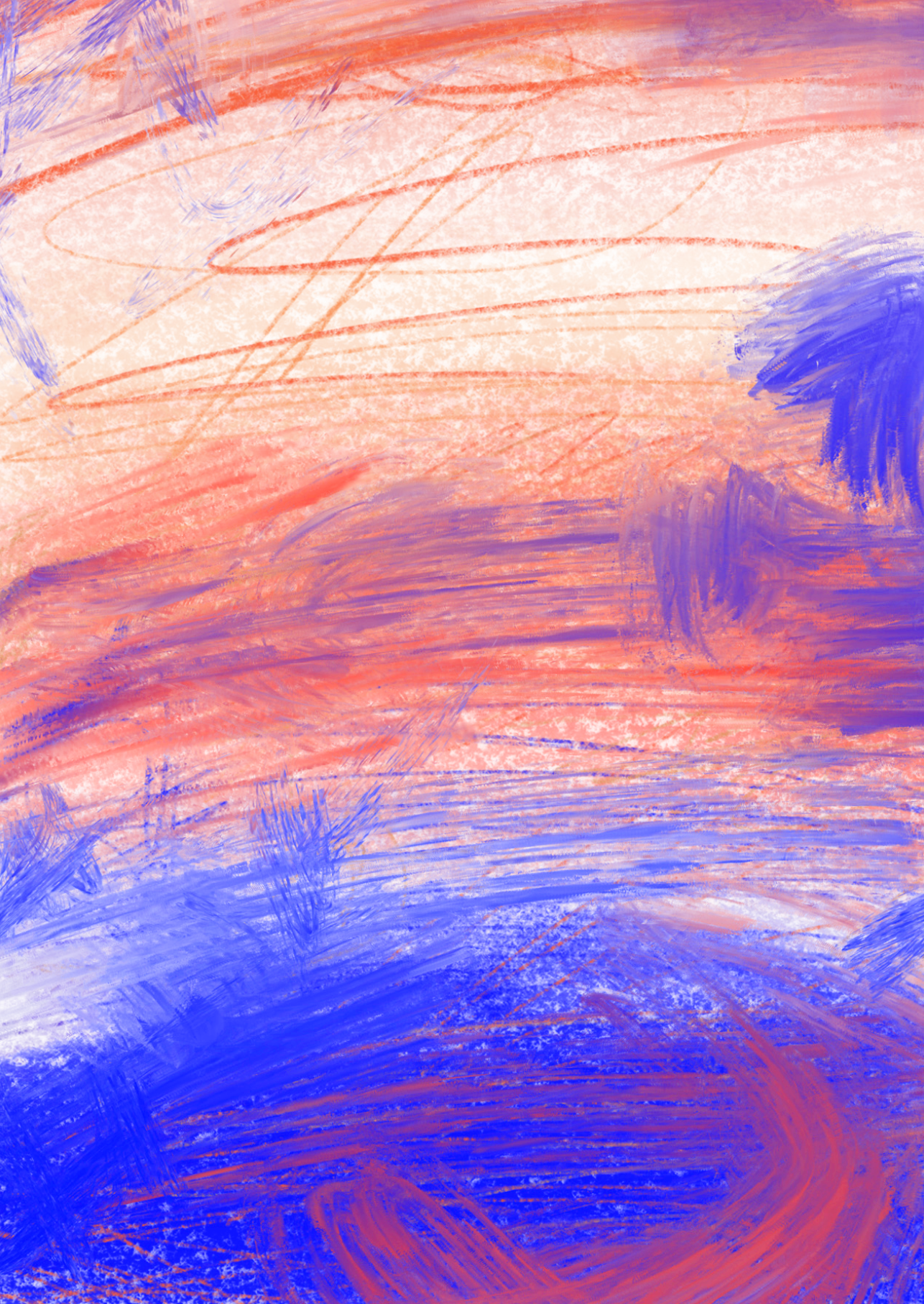
Those involved in education program design could use the system of activity and motivation depicted in Figure 2 to evaluate whether and how the specific program and course design and teaching strategies support or frustrate each motivational element. For instance, they could consider the first level of motivation (upper part of Figure 2), by asking themselves whether any activities help students to create links between their motives and the program or course. In other words, do they allow students to answer the question "Why do I need this program or course?" Next, educators could evaluate whether the program or course offers activities that actualize and support students' beneficial learning beliefs. In a similar fashion, they could evaluate the second and third levels (bottom part of Figure 2), by analyzing each learning task they give to students in terms of whether students accept its goal, whether they have all the means necessary to perform it, and whether the task supports students' beliefs about performing it.

Finally, university leaders could develop policies that support different aspects of student motivation at university level. Discussing the above-depicted system of activity and motivation with staff and students could provide insights into how to support students' motivation from different angles. The motivation to learn is at the heart of learning in university and is fundamental to future lifelong learning. If students are able to self-regulate their motivation, they will be more resilient and autonomous from unexpected changes in the world.

Dissemination of Results

The results from this dissertation have been published in international peer-reviewed journals with a broad readership in the field of educational sciences and educational psychology. In addition to this, I discussed their practical implications with students

during my courses about self-regulating one's motivation and with educators during courses on the motivational design of education programs. The further development of frameworks such as the one presented in Figure 1 would help to make the results more accessible and facilitate their practical application.



APPENDICIES

A

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ABOUT THE AUTHOR

Daria Ilishkina, born on December 9, 1992, in Moscow, Russia, is a dynamic and innovative educator, researcher, and designer dedicated to transforming the landscape of education through her passion and expertise.

Daria embarked on her educational journey at Lomonosov Moscow State University, where she completed her undergraduate studies at the Faculty of Psychology in 2015. Her graduate research project, conducted under the mentorship of the esteemed Dr. Patyaeva Catherine, was a testament to her early dedication to the field. Through qualitative interviews and a quasi-experiment, she explored the factors contributing to students' "flow" state in higher education. Her work revealed that "feedback" was the linchpin of the learning flow experience, leading to a nomination for "Research Courage and Creative Search in Solving Problems of Educational Efficiency."

This pivotal research experience inspired Daria to venture into educational consulting and design, where she could bridge the gap between theory and practice. She launched her education-focused blog, "eduspace.pro," as a platform to share educational science, her insights and expertise.

Over the years, she designed and supported several educational programs for adults and teenagers. Her initiatives include the phenomenon-based educational program "Society, communication, and cryptography" for teenagers at Kryptonite Museum, the inquiry-based program for teenagers "The City of Discovery" for tourism renovation in Moscow, the project-based learning program "Kaskad" for teenagers in the field of contemporary art. Daria is a co-curator and teacher at the "Modern Education Professionals" one-year program for methodologists, designers of educational experience, and T&D/L&D specialists at School of Education Universal University.

In 2016, Daria started her PhD journey at Maastricht University, focusing on higher education students' motivation to learn and motivational regulation strategies. Her research and literature review paved the way for transformative workshops aimed at educators, guiding them in the motivational redesign of their educational programs. Equally committed to empowering students, she conducted workshops on self-regulating motivation to learn. Daria has been actively conducting courses, workshops, and lectures about educational design since 2017, catering to adult audiences.

One of Daria's recent achievements is the creation of the "CRAFT/ed" creative methodology in collaboration with Vasiliy Lebedev, the Founder of IKRA Global, in 2022. Based on frame construction principles, this CRAFT methodology suggests a new way of creative thinking in education. It fosters new ideas and solutions by rethinking traditional

roles, relationships, and contexts within the educational system.

With a rich tapestry of experiences in research and design, Daria is poised to continue her transformative journey in the world of research and education, inspiring educators and learners worldwide to embrace science, motivation, and innovation as cornerstones of the educational process. Her dedication to bridging theory and practice continues to reshape the educational landscape, ensuring that learning remains a dynamic and enriching experience for all.

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