Like a bridge over troubled water

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Measuring self-regulation deficits in school children via ambulatory assessment and intervening by means of mental contrasting and if-then plans

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If you need a friend I'm sailing right behind, like a bridge over troubled water I will ease your mind[1]

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Sail on, silvergirl, sail on by, your time has come to shine

All your dreams are on their way, see how they shine [1]

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[1] Songtext hier sowie im Titel zitiert aus „Bridge over troubled water" des Duos Simon&Garfunkel (veröffentlicht 1970)

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List of Abbreviations

ADHD	Attention deficit hyperactivity disorder
MCII	Mental Contrasting with Implementation Intentions
WOOP	Wish, Outcome, Obstacle, Plan

List of Manuscripts

This dissertation is based on the following three manuscripts*:*

Schwarz, U., Sevincer, A. T., & Gawrilow, C. (2019). Wenn-Dann Pläne und mentale Kontrastierung als Strategien zur Förderung der Selbstregulation. In H. Gaspard, U. Trautwein, & M. Hasselhorn (Eds.), Jahrbuch Tests und Trends 2019: Motivation und Volition im Schulkontext. Göttingen, Germany: Hogrefe.

Schwarz, U., Gawrilow, C. (2019). Measuring and compensating for deficits of self-regulation in school children via ambulatory assessment. Psychology in Russia: State of the Art, 12(4), 8-22. DOI: 10.11621/pir.2019.0401

Schwarz, U., Reuter, M., Kühnhausen, J., Haas, P., Gawrilow, C. (2020). Variability of ADHD Symptoms and Self-Regulation Skills in Schoolchildren and the Influence of Self-Regulation Trainings. *Manuscript in preparation*

ABSTRACT

Self-regulation is a significant ability with important (positive) implications in the course of a lifetime (Mischel et al., 1988). Due to its lifelong relevance, this ability to strive for goals in the long-term, to inhibit non-intended actions and to act in a situationally appropriate manner (Guderjahn et al., 2013; Wirth et al., 2015) is being researched in a wide range of areas, for example in developmental and motivational psychology (e.g. Suchodoletz et al., 2014; Oettingen & Gollwitzer, 2015c). Hence, on the one hand self-regulation is a predictor of academic success (Blair, 2002), early self-regulation deficits, on the other hand, can cause difficulties at school (Blair & Razza, 2007).

Self-regulation deficits are particularly at the root of ADHD (i.e., attention deficit hyperactivity disorder; Rueda et al., 2004), which is characterized by symptoms of inattention, hyperactivity and impulsivity. Recent studies carrying out daily measurements of constructs using portable devices, called ambulatory assessment (Bugl et al., 2015), show that children and adolescents exhibit daily variations in their ADHD symptoms (Schmid et al., 2016). Therefore, ADHD and its symptoms should be viewed as a dimensional construct (Shaw et al., 2011). In order to alleviate in particular the extreme of high symptom expression, a modification with support of a training to improve self-regulation for daily use is recommended.

Self-regulation deficits can be positively altered by short-term training, for example Mental Contrasting with Implementation Intentions (*MCII*; Adriaanse et al., 2010; Gawrilow, Schmitt, & Rauch, 2011). Mental Contrasting with Implementation Intentions is a mental strategy that supports individuals in formulating and setting their goals through mental contrasting and – through a final if-then plan – in implementing goal-oriented behaviour changes (Gollwitzer, 1999; Oettingen & Gollwitzer, 2010). The thereby induced reduction of self-regulation deficits can lead to long-term improvements in academic and social areas (Reid et al., 2005; Tangney et al., 2004).

The aim of this thesis is to present an existing self-regulation strategy, especially with regard to the school context, and to measure self-regulation in the everyday life (applying an ambulatory

assessment; see Bugl et al., 2015) of children and adolescents. These illustrations are supplemented by an empirical study in which school children are taught a self-regulation strategy and its connection with ADHD symptoms is researched. Finally, this training will be examined empirically additionally with an increased focus on the dimensionality of ADHD symptoms.

Key words: self-regulation, ´Mental Contrasting with Implementation Intentions (MCII / WOOP), Attention deficit/hyperactivity disorder (ADHD), fluctuations, Ambulatory assessment, if-then plans

1 INTRODUCTION

Imagine you are a football player at a final game. The score is still tied. Much of the season has already passed, your strength is waning, the stadium is raging. All of a sudden, you receive the ball and the chance to pass it to your teammate, which could be the deciding factor in the game, opens up. The noise is deafening, you are tired, the coach is waving at the sidelines and your teammates are shouting at you. You know this is important for winning, now you have to be alert. You have been told in training what to do now. One more look at the sidelines and – the ball is gone, caught by an opponent. You missed your chance.

We are not always able to recall previously shown behaviour, and often we cannot transfer our intentions into actions. Now imagine not being on the grass in your home Olympic stadium, but a sixth-grader at the end of schoolday. Your teacher is just telling you which topics will be important in the upcoming exam. The day has been exhausting, the last minutes of the lesson begin. The person sitting next to you is tipping his or her chair, there is someone whispering next to him or her, and in the classroom above you, you can hear chairs moving. You know that this is important for a good grade, now you have to be attentive. Your teacher told you last week that writing down notes for the exam is good and important. A fire engine is roaring past the window outside and – the explanations are over, everyone is rushing out of the classroom. You missed the information of what will be important for the exam.

Many students find that they know in fact which behaviour would be appropriate, but do not show it in the corresponding situation. They are inattentive and, therefore, do not receive information that would be beneficial for a better performance. Or they disturb the lessons by their not very controlled behaviour and are thus often not the most popular ones, which in turn is detrimental to school cooperation.

As the two very different situations mentioned above illustrate, people do not always show self-regulation in the usual way, no matter how often they have been in a similar situation or how firmly they have decided to act accordingly. Thus, many New Year's resolutions come to a quick end every year.

Although the goal (for example *win* and *be attentive* as in the examples above) is clear, people do not always act in a goal-oriented way, even when an opportunity presented itself.

The situation-appropriate control of actions, thoughts and emotions defines self-regulation (see page 4). Self-regulation in turn helps to pursue long-term goals and thus to be more successful, healthier and socially integrated. However, some people are persistently highly inattentive, impulsive and hyperactive due to a fundamental self-regulation deficit. Thus, it is argued that attention deficit/hyperactivity disorder is caused by deficits in self-regulation (see page 7). However, there are fluctuations in the self-regulation of each person, and the possibility of training one's self-regulation by means of strategies would be beneficial to everybody (see page 10).

The main aim of this dissertation is to provide an intervention strategy for children with self-regulation deficits to bridge these problems (see *Manuscript 2*). Thus, deficits could be compensated for at an early stage and a positive subsequent development can be expected. In addition, a further focus is on recording the daily fluctuations of self-regulatory abilities (see *Manuscript 3*) in order to show the dimensionality of this ability and of any secondary diseases caused by it. This should help to ensure that symptoms and deficits are perceived on a continuum, sometimes more, sometimes less pronounced, and calls for a future individualisation of interventions.

2 THEORETICAL AND EMPIRICAL BACKGROUND

"Learning self-regulation is one of the key skills young children need to start on the path to academic success. Children are better able to access knowledge and practice learning skills if they understand that they can control their ability to pay attention, resist distractions, and develop social emotional skills. Self-regulation can help students begin to develop a clear intent about what they want to achieve. " . These words spoken by Donna Wilson and Marcus Conyers (2016, p.1), who internationally conduct professional development for teachers and administrators, illustrate the relevance of a person's ability to regulate themselves. The analysis of the above words shows: (1.) self-regulation is accompanied by various positive outcomes in life; (2.) especially children still find it difficult to regulate themselves, so they need help to bridge these self-regulatory deficits; (3.) from simple wishes to the implementation of a goal, a person goes through various stages. Now these findings concerning self-regulation cannot simply be accepted from a scientific point of view because an individual described them that way. Rather, they occupy an entire field of research in psychology.

One aim is the examination of the question regarding the significance of self-regulation for the life course. It was found that self-regulation as an ability to control one's thoughts, emotions and actions in a situationally appropriate way (Calkins, 2007) helps to achieve better academic performance and to live healthier and more socially comfortable lives (see Tangney et al., 2004). Of course, not every person initially possesses high self-regulatory skills – these normally develop with increasing age. However, some people always show a high degree of self-regulation deficits (Gawrilow et al., 2018). Attentiondeficit-/ hyperactivity disorder (*ADHD*) is particularly caused by these deficits lack of self-regulation and its symptom variations are related to it (Hartmann et al., 2017).

For this reason, it seems indispensable to introduce interventions to reduce these deficits in order to give all children and adolescents equal opportunities to achieve their goals through self-regulated action. This achievement of objectives can particularly be promoted through Mental Contrasting with

Implementation Intentions (*MCII* [2]). According to this technique self-regulation can be enhanced by considering various obstacles on the way to achieving the goals (Oettingen & Gollwitzer, 2019).

The current aim is to gain a new perspective on the implementation of strategies for pursuing goals by using them within the everyday life of pupils. This is expected to be more natural and accordingly more successful than previous interventions in laboratory settings. In summary, the intention of the present work is to demonstrate that the daily measurement of self-regulation and the application of an appropriate promotional strategy can increase this ability or respectively diminish deficits in self-regulation of students.

2.1 Definition of self-regulation in learning contexts

According to William James (1890) self-regulation is understood as follows: "We understand self-regulation as helping people deal with resistance and conflict, such as with obstacles and temptations standing in the way of attaining desired future outcomes." (p.5). Thus, self-regulation is the ability of a person to change their thoughts, emotions and activities to achieve a desired result (Wirtz, 2014). Self-regulation therefore represents the regulation of behaviour, feelings and attention when facing distractions and seductions (Gollwitzer & Oettingen, 2007). It helps people in conflict situations to deal better with obstacles or temptations (Gawrilow, 2013a) as well as to redirect high incentives and high expectations towards goal-oriented behaviour (Heckhausen & Gollwitzer, 1987). Self-regulation is central for interrupting and restraining undesired behaviour (Tangney et al., 2004).

In the literature, we sometimes find the differentiation of the terms self-regulation and self-control. The term self-regulation can be understood as a broad term. It includes conscious and unconscious processes and refers to behaviour that is motivated by personal as well as social standards and various objectives. Self-control, on the other hand, is defined more narrowly. It refers to the conscious effort to

[2] Currently, this term is being replaced by the acronym *WOOP*, which illustrates the 4 steps of this overall strategy in the English original - Wish, Outcome, Obstacle, Plan (Oettingen 2014)

change behaviour and control impulses (Baumeister, 2002)[3].

Good self-regulatory skills help individuals in being successful over their entire life span. Self-regulation is an important factor for success at school and at work, and is relevant in all areas of life (Duckworth & Seligman, 2005). There is a wealth of empirical evidence linking positive behaviour with high levels of self-regulatory ability: People with high self-regulation show fewer impulse control problems (as is the case with eating attacks and alcohol abuse), better psychological adjustment (including higher self-esteem) and better interpersonal relationships (self-regulated people are perceived as better partners; Heatherton & Baumeister, 1991, Tangney et al., 2004). Self-regulation is related to academic performance in the sense that students with high self-regulation achieve better grades than those with low levels (Tangney et al., 2004). The predictive importance of self-regulation for academic performance (Blair & Razza, 2007; Duckworth et al., 2011, Duckworth & Seligman, 2005; Wirth et al., 2015) as well as a positive correlation between the two concepts has been shown many times (e.g. Gollwitzer et al., 2011; Ridder et al., 2012). Self-regulation for example predicts performance in reading and arithmetic better than intelligence test scores (Blair, 2002; Blair & Razza, 2007).

Especially in learning contexts self-regulation as the regulation and modification of thoughts, actions and emotions is essential, and helps to conform to values and norms, to strive for long-term target states, to carry out actions persistently and to monitor performance (Baumeister et al., 2007; Bertrams & Dickhäuser, 2009; Rauch et al., 2014). These aspects are necessary in situations requiring continuous motivational and volitional effort, such as when dealing with long-term tasks or overcoming unwanted habits (Bertrams & Dickhäuser, 2009; Tangney et al., 2004; Wirth et al., 2015). Children with high self-regulatory skills can work more continuously and persistently, and they cope better with failure (Bertrams & Dickhäuser, 2009). Self-regulation enables flexible behaviour and makes learning success at school

[3] In the present study, both terms (self-control and self-regulation) are considered and used as equivalent due to the lack of differentiation in the literature.

more likely, as it is related to how students plan their time, weight information and materials, distinguish between essential and detailed information, apply solution strategies flexibly and monitor their own learning progress (Kubesch & Walk, 2009).

Consciously influencing the regulation of one's own emotions, for example emotionally dealing with failures, enables a regulated social interaction in many situations – including school (Baron, 2011; Wirth et al., 2015). In the academic context, this could mean, for example, that a student works on the current topic actively, listens attentively to the teacher's explanations about the requirements, and does not interfere or distract others – regardless of his or her tension and concern about the next exam. Self-regulation is therefore a very advantageous personality trait (Ridder et al., 2012).

2.1.1 Development of self-regulation

Self-regulation is differently pronounced in individuals and first differences have been shown to occur as early as at the age of three years (Moffitt et al., 2011). At this age, girls seem to have a more pronounced self-regulation than boys. It seems the development of self-regulation is a central developmental task of early childhood (Lessing et al., 2016). Children learn to regulate their actions even before they enter school as they develop sensorimotor and cognitive abilities (Kopp, 1982). For example, because they remember and adhere to rules and suppress spontaneous impulses for action (Blair & Razza, 2007). If children are able to suppress their impulses, they can assess possible behavioural consequences and reflect on alternative behaviour (Bodrova & Leong, 2008). Future potential behaviours, as well as social, cognitive and emotional states that are not directly perceptible, can be expressed linguistically in emerging fictional games by children from around 4 years of age (Wygostki, 1987). The acquisition of these skills is closely related to self-regulation, as they serve to identify desires and goals that are desirable states that do not currently exist and are sought through regulation (Milgram & Riedel, 1969).

Important components of self-regulation as the ability to control impulses and to postpone rewards (Gawrilow, Schmitt, & Rauch, 2011) are already differently developed in children at pre-school age. In the popular marshmallow test first published by Mischel, Shoda and Rodriguez in 1989, children were

given the choice in the laboratory: either to eat a marshmallow placed in front of them immediately, or to wait a while and then receive a second marshmallow. If the child chose the first option and did not wait, this was an indication of low self-regulation; if the child chose the second option and waited through the entire waiting time, this indicated higher self-regulation. Depending on the type of decision and thus on the extent of the self-regulatory abilities, developments in the further course of the children's lives could be predicted. Children who waited and therefore had a higher degree of self-regulation, achieved better school grades in later life and were better in their cognitive performance and social functions (Mischel, 2014). Furthermore, they showed higher self-esteem scores, were more tolerant of stress and negative emotions and pursued their goals more effectively than those with lower self-regulatory abilities (Mischel, 2014).

2.1.2 Deficits in self-regulation

Individuals have varying levels of self-regulating abilities and this seems to be of particular importance when resistance or conflicts arise, as for example when wanting to achieve a desired goal in the face of obstacles (Oettingen & Gollwitzer, 2015c). While high self-regulatory skills contribute to a successful and healthy life, low self-regulatory skills are at the centre of many social problems (Ridder et al., 2012). In a longitudinal study, it was shown that low self-regulatory skills in childhood have a negative impact on physical health, substance dependence and personal finances in adulthood, and lead to more criminal offences (Moffitt et al., 2011). Low self-regulatory skills are associated with emotional problems, lack of stamina, social difficulties and underachievement at school, or rather, in the case of a child, with a lack of social skills (Baumeister et al., 2007).

Furthermore, effects of self-regulatory skills have been demonstrated to be particularly strong on academic performance (Ridder et al., 2012), which increases the evidence of the importance of self-regulation in the school context. Female students were found to be less successful if they could not resist distractions and were more likely to act impulsively (Bertrams & Dickhäuser, 2009). In particular, research with students with behavioural problems, mostly within the spectrum of attention deficit hyperactivity

disorder (ADHD), i.e. with people whose self-regulation is impaired, shows a connection between low self-regulatory abilities and ADHD symptoms (Gawrilow, Guderjahn, & Gold, 2013). Furthermore, it was found that the effect of ADHD on school performance is entirely mediated by self-regulation, in the sense that it is not so much the existing ADHD diagnosis that is responsible for poorer school performance, but the self-regulation deficits associated with the disorder (Wirth et al., 2015).

2.2 Description of ADHD symptoms

Attention deficit hyperactivity disorder (ADHD) is one of the most common disorders in childhood and is characterized by the core symptoms of inattention, hyperactivity and impulsivity (American Psychiatric Association, 2015). There are three subtypes of ADHD: predominantly inattentive type, predominantly hyperactive-impulsive type and a mixed type.

Inattention is characterized by a lack of concentration, forgetting things and having difficulty following what is happening because one is quickly distracted. Impulsivity and hyperactivity are characterized by motor restlessness and a feeling as if one was being teased, as well as a reluctance to let others finish speaking (Gawrilow, 2016). According to a longitudinal study on the health of children and adolescents (KiGGS) conducted in Germany, the current prevalence rates among children with ADHD are 4.4%, making ADHD one of the most common clinical behavioural disorders in children and adolescents (Robert Koch-Institut, 2018). ADHD is classified as a neural and mental developmental disorder in the US American Diagnostic Classification System DSM-V (American Psychiatric Association, 2015). Inattention, hyperactivity and impulsivity are associated with impaired development of functional level as well as deficits in executive functions. These executive functions are cognitive processes that enable the achievement of a desired goal through the control, regulation and coordination of various subprocesses (e.g. working memory, inhibition, cognitive flexibility; Seiferth et al., 2007). In this context, self-regulation can also be regarded as a component of executive functions. This means that people with ADHD symptoms, and especially students, have deficits in their executive functions. Thus, it is difficult for them

to focus their attention on a task, to remember the task, not to be distracted, to regulate their emotions, and to remain calmly seated in their chair (e.g. Gawrilow, 2016).

2.2.1 Variations of ADHD symptoms

As will be explained in the following, the causes influencing factors and symptoms of ADHD are heterogeneous and differ both in their course and in their manifestation. Consequently, the disorder should be understood less as a fixed category and more as a dimension on which the symptoms can take on different forms (Larsson et al., 2012; Millenet et al., 2013). This perspective is further supported by findings of previous studies that show inter- and intraindividual variability of symptoms (Bugl et al., 2015). The authors used an outpatient assessment to determine the daily self-assessment of children regarding their ADHD symptoms. The severity of the symptoms differed both between children and within a child. Extended findings on variability also showed changes in the ADHD core symptoms within a day as well as between days (Schmid et al., 2016). This reinforces the recommendation of a future in-depth consideration of ADHD symptoms on an individual level as well as a related assessment of self-regulation abilities closely adapted to everyday life.

2.2.2 Aetiology of ADHD symptoms

Children with ADHD symptoms have a deficit in their self-regulation and find it difficult to regulate their behaviour, i.e. they show multiple deficits in action control (Gawrilow, 2005). The biopsychosocial model by Döpfner and Banaschewski (2013) see the primary causes of ADHD symptoms lie in an impairment of the genetic disposition and the central nervous system, which causes a disturbance of the neurotransmitter metabolism. Unfavourable psychosocial conditions can intensify the symptoms and also cause comorbid disorders.

In addition to classical explanatory models, such as the biopsychosocial model, there is the assumption that children with ADHD symptoms have a self-regulation deficit (Gawrilow et al., 2018; Wirth et al., 2015). Children with ADHD symptoms show a lower degree of self-regulation, as a result of which they achieved poorer academic performance in German, mathematics, general knowledge and

science (Wirth et al., 2015). Parents attribute a lower degree of self-regulation to their children with ADHD symptoms than parents of children without ADHD symptoms (Rauch et al., 2014). Due to the importance of self-regulation for the life course, it seems advisable to support children with self-regulation deficits. Nowadays, there are methods for increasing self-regulation that can support children with ADHD symptoms in everyday life and help them to pursue and realise their goals (Gawrilow, 2016). These strategies for improving self-regulation deficits and a corresponding reduction of ADHD symptoms are explained below.

2.3 Strategies to promote self-regulation

Even if people are good at striving towards their desired future, they sometimes need some help in clearly defining their goals (Oettingen & Gollwitzer, 2015c). Besides the so-called goal intentions which define what result a person wants to achieve (Sheeran et al., 2005), a tool is needed to bridge the gap between wanting and doing something, and thus to strengthen self-regulation. Research shows that if-then plans and mental contrasting as well as the combination of these two strategies facilitate the initiation of action by creating a link between the automated display of goal-oriented behaviour and a pre-defined situation (Faude-Koivisto & Gollwitzer, 2009).

Using effective self-regulation strategies helps individuals to better deal with obstacles or conflicts. It includes the functions of self-observation, self-evaluation and reaction (Oettingen et al., 2013). Self-observation provides information about the actual state of the goal pursuit process. Self-evaluation assesses this information by comparing it with one's own and social standards. Reactions promote the achievement of objectives, both in the form of intended reactions, e.g. rewards, and unintended reactions, e.g. emotional reactions. According to previous research, these three functions (self-observation, self-evaluation and reaction) can be influenced by medium to long-term interventions (Oettingen et al., 2013). More recent research on self-regulation strategies shows that the pursuit of goals and, accordingly, the self-regulation of a person can be influenced immediately by the application of mental contrasts and by the formation of resolutions (Oettingen et al., 2013).

The European psychology has long been influenced by the theoretical assumptions of Narciss Ach (Heckhausen & Gollwitzer, 1987). Here, a fixed intention guides the person towards a desired action. Under this assumption, especially processes in the moments before the decision for a goal is made, become relevant for the achievement of the goal. Subsequent research traditions focused further on processes and conditions that occur during and after the decision-making process. The question arose as to whether the willingness to make an effort, the stamina and the willingness to perform a task can be explained by the same motivational intention that was used before for the task selection (Heckhausen & Gollwitzer, 1987). In this respect, Heckhausen and Gollwitzer (1987) restructured motivational processes into two successive psychological states: The motivational status is characterized by the making of a decision. The volitional status involves considerations of when and how to act in order to fullfil the intention to carry out the desired course of action (Heckhausen & Gollwitzer, 1987). It is assumed that once a decision has been made, further deliberative thinking becomes superfluous. The authors Heckhausen and Gollwitzer (1987) relate this to a principle which Julius Caesar is said to have already used successfully – "Alea iacta est"(The die is cast). With this sentence he crossed the Rubicon river and decided to fight. This is why the model is further referred to as the Rubicon-Model.

2.3.1 Action phases model (Rubikon model of action)

Self-regulation assists the achievement of goals by helping to bridge the gap between intention and behaviour (intention-behaviour-gap; Sheeran & Webb, 2016). Often people know which behaviour would be appropriate in a situation and want to implement it, e.g. a student would like to keep quiet during a lesson in class. However, this intention cannot be transferred to their behaviour and they are then disturbed in their well-meant intention, for example by events at other worktables. The phases relevant for moving from intention to action and thus closer towards goal achievement and self-regulated action are described in the action phase model (also known as the Rubicon model of action phases; Gollwitzer, 1990; Gollwitzer, 2012). The Rubicon model of action phases (see *Figure 1*) according to Heckhausen and Gollwitzer (1987) represents two processes on the way to a goal-oriented action - that of goal-setting and that of goal-striving

(Locke & Latham, 2006; Oettingen & Gollwitzer, 2001). It consists of four successive phases. The phase of weighing up (predecisonal), the phase of planning (preactional), the phase of action (actional) and finally the phase of evaluation (postactional). There are clear transitions between these phases, which separate them from one another. First, a decision is made (the Rubicon is crossed). Then, follows the initiation of the respective action. Afterwards, the result is recorded and the action is terminated (Gollwitzer, 1990). *Figure 1* illustrates how the course of action extends over these phases.

In the first phase of the model (pre-decision phase), different goals and desires of a person compete with each other, so that the person has to first weigh up which goal he wants to pursue. Goals are still formulated relatively diffusely in this phase (Achtziger & Gollwitzer, 2010). The pre-decision phase is a motivational phase in which the desire to achieve a goal and energy for the pursuit of success is built up (Achtziger & Gollwitzer, 2010). In the school context, children might formulate goals such as having a better grade, wanting to cooperate more, or following lessons more attentively. If a goal is found that appears promising, the expectation of success increases and the transition to the preactional phase is successful.

In the preactional phase, the goal is concretized in content and scope and a plan for the implementation of the goal is formulated in order to generate behaviour from the intention and to stimulate the goal aspiration (Sniehotta, Scholz, & Schwarzer, 2005). This phase, as well as the following one, is a volitional phase, since the conscious, deliberate conversion of goals into results takes place by means of the purposeful control of thoughts, emotions and actions (Brandstätter et al., 2009). For example, a child who previously had difficulty following lessons attentively might decide to remember that learning is important whenever his thoughts wander, and then focus back on the teacher. It is this phase in which self-regulation is increasingly needed and in which training is therefore required, since the goal-oriented action is thought ahead and implemented more quickly and frequently by means of pre-designed plans (Faude-Koivisto & Gollwitzer, 2009).

The action is then carried out in the third phase (action phase) according to the plan devised (Achtziger & Gollwitzer, 2010; Kruglanski et al., 2015). For example, a child may have difficulty being attentive in class and therefore aim to change this. In the pre-actional phase it has considered strategies to achieve this goal, e.g. *Then I look at the class teacher* to achieve the goal of *being more attentive*. The previously easily distracted child now has a direct option for action at hand through the preceding considerations and now shows the goal-oriented action. The previously drawn up plan facilitates the initiation of action, and thus the gap between wanting and doing is bridged (Heckhausen & Heckhausen, 2010).

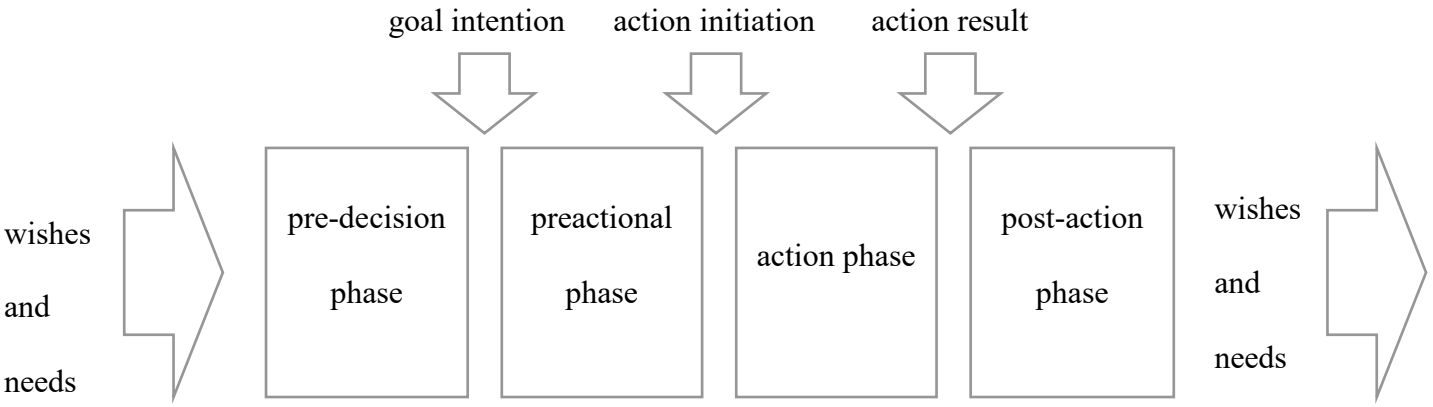

Figure 1. Rubicon model of the action phases (based on Achtziger & Gollwitzer, 2010; Heckhausen & Gollwitzer, 1987)

In the final post-action phase, the assessment is whether and to what extent the previously defined goal has been achieved, or whether it still seems desirable (Heckhausen & Gollwitzer, 1987). For the example given, this means that the child planning to be more attentive request feedback from the teacher, e.g. asking whether he noticed a change in behaviour or consider whether he had more homework meetings. It is advantageous to have already defined the target check in advance, for example to halve the warnings due to missing homework or the warnings due to being distracted on the part of the teacher.

In summary, the action phase model illustrates the objective and aspiration of a goal, the path to action and that plans supporting self-regulated action (Achtziger & Gollwitzer, 2010). In order to overcome more easily the gap between wanting and doing in the first two phases of the model, mental contrasting can be of help.

2.3.2 Mental contrasting

Mental contrasting is a strategy to support self-regulation (Sevincer et al., 2017). At the beginning of her research career, Gabriele Oettingen intensively dealt with how people would pursue goals. She and her colleagues noticed that in psychology, and thus also in civil society, the general opinion prevailed that with positive thinking a person could achieve any goal (Oettingen, 2014). However, she was able to show that this premise tends to make people lose themselves in reverie rather than focus them the realistically considering difficulties and strategies when achieving their goals (Sevincer et al., 2015). Thinking about the aspired future as well as the existing obstacles in achieving it, produces a more effective goal commitment in the present than mere dreaming about the longed-for future or one-sided brooding about present conditions (Oettingen, Hönig, & Gollwitzer, 2000). Through the concrete confrontation with a future wish and possible obstacles, an awareness is created that the wish has not yet been fulfilled and that it requires effort to realize it. This makes people feel more committed to their goal and they are willing to make an effort to achieve it (Oettingen, 2017). "Mental contrasting means that the idea of the fulfilled wish is confronted with the question "What is stopping me? What stands in my way of actually implementing this wish?" Once the obstacle is identified, you can imagine it and the energy required to tackle it increases. So, it means confronting the desire with a real obstacle." (Keil, 2016, p.1). Thereby, one imagines the desired future. Directly afterwards, one identifies and thinks about reality. This means that through mental contrasting the desired goal and its results are already "seen", so that the commitment to the goal (*goal commitment*), the striving towards the goal (*goal striving*) and the achievement of the goal are strengthened (Johannessen et al., 2012). Unlike mere "dreaming", a hoped-for goal is not only dreamt of here and a loss of energy occurs, instead striving towards the goal increases (Oettingen, 2014).

Mentally, i.e. in thoughts, the future and reality are contrasted against each other. Aspects of one's own reality should be perceived as obstacles that stand in the way of achieving the goal. In a further step, it can be considered how these obstacles can be overcome.

The technique of mental contrasting has shown to be effective in various areas and environments of life (Oettingen & Gollwitzer, 2015c). Students who claim to have a high degree of self-regulation in an academic context are more likely to use mental contrasting when asked to express their main academic desire than students who claim to have a lower degree of self-regulation (Sevincer et al., 2017). Students learn more vocabulary after an intervention with mental contrasting, compared to the condition in which only the desired future should be thought of. This again illustrates the scepticism towards mere indulgence and positive thinking as a technique for achieving goals. Nevertheless, this cognitive step is essential for the effectiveness of mental contrasting. Only if a person is able to conceive a positive and desirable future that goes hand in hand with the achievement of goals, the commitment to the goal will be high enough to strive for it (Oettingen et al., 2013). The authors also stress that mental contrasting is most effective when the feasibility and desirability of achieving the goal are high.

It is interesting to note that in one study, people who wanted to focus on one aspect of healthy eating by means of mental contrasting ended up eating healthier overall, not only in the originally focused area of nutrition (Johannessen et al., 2012). This suggests an independent application and generalisation of the effects of mental contrasting for other areas of life and the automation of the underlying thought steps.

In summary, mental contrasting can make the commitment to a goal and its realisation more likely, and also positively influence self-regulation. These are important mechanisms of action in if-then plans, which will be explained in the next subchapter. A combination of both strategies in order to achieve the most effective results in the achievement of goals and the strengthening of self-regulating abilities seems logical in this train of thought.

2.3.3 If-then plans / Implementation Intentions

When talking about initiating action, a distinction must be made between *goal intention* and *implementation intention*. A goal intention defines a desired final state. An implementation intention serves as a plan to realize this intention. For this purpose, an actor defines an intentional act in a situation, in which a certain behaviour is to be shown (Achtziger & Gollwitzer, 2010). Implementation intentions according to Gollwitzer (1999) have the following form: *If situation X occurs, then I show behaviour Y!*. These if-then plans connect certain situations in the if-part with concrete goal-relevant response behaviour in the then-part (Oettingen & Gollwitzer, 2000). These if-then plans give a person control over the realization of the goal and facilitate targeted action initiation in response to certain cues (Oettingen, Hönig, & Gollwitzer, 2000)[4]. If-then plans help with four central challenges of goal pursuit: (a) the beginning of goal-oriented behaviour, (b) holding on to the goal, (c) detaching from meaningless goals, and (d) avoiding exhaustion (Oettingen & Gollwitzer, 2000). They define the beginning and end of an action and through them a person can effectively identify and control distractions (Gollwitzer & Sheeran, 2006). This is achieved by formulating a specific situation in the "if" part of the plan in which a goal-oriented action is to be shown - this is then part of the "then..." clause.

If-then plans can support all kinds of goals (Gollwitzer & Sheeran, 2006), but it is important that they help a person make a specific situation, as defined in the "if"-part, more salient and stimulate the action initiation of the "then"-half-sentence (Gawrilow, Gollwitzer, & Oettingen, 2011b). If-then plans result in a high level of activation when the defined situation occurs, so that the automation of action – immediate, efficient and unconscious – occurs (Faude-Koivisto & Gollwitzer, 2009). In addition, if-then plans have an effect even when the situational conditions are unfavourable (e.g. in the case of highly

[4] Note that the goal should have been formulated in advance using the SMART criteria (specific, measurable, achievable/ attainable, realistic/ relevant, time-bound) in order to be better evaluated afterwards (Birgmeier, 2009).

employed individuals; Parks–Stamm et al., 2007), and even when actions defined in the "then"-part are unpleasant and easy to forget. In other words, if-then plans make people more aware of situational cues, set the levers for action execution, establish a situational-behavioural connection and create habits that are shown in the appropriate context – sometimes even without the respective cues (Cohen & Gollwitzer, 2008). Important prerequisites for the effect of if-then plans are the existence of a pronounced goal-commitment, the concrete formulation of the critical situation or obstacle, and the formulation of the specific goal-oriented action (Schwörer & Oettingen, 2018).

If these conditions are met, long-term verifiable effects of if-then plans can be observed (Oettingen & Gollwitzer, 2009). By means of if-then plans, people more often achieve goals and act in a goal-oriented manner (Oettingen, Hönig, & Gollwitzer, 2000). A goal intention therefore requires if-then plans to get people to act. For example, students pursued their goals more successfully if they formulated them in an if-then plan (Gollwitzer et al., 2011). The concrete formulation of a critical situation and the corresponding obstacles mentally represent, activate and make them easier to recognize in the real situation (Gollwitzer, 1999). Particularly challenging goals, such as writing a term paper during the holidays, were achieved more often by students using if-then plans than easy goals such as reading a novel during the holidays (Gollwitzer & Brandstätter, 1997). Students who formulated a corresponding if-then plan in advance participated more often in lectures than those without an if-then plan (Webb et al., 2007). Moreover, students were less easily distracted by diverting stimuli if they formulated an if-then plan beforehand than those who had only formulated a goal intention (Wieber et al., 2011). Furthermore, if-then plans lead to increased classroom participation, especially among students with little or average conscientiousness (Webb et al., 2007).

2.3.3.1 If-then plans and self-regulation

In the course of the text it has become clear that deficits in self-regulation prevent people from achieving their goals. It was described that the planning phase is particularly important in achieving goals (Heckhausen & Gollwitzer, 1987) and if-then plans were highlighted as a possible planning strategy. With

if-then plans, an intended goal-directed action is implemented, especially in people who show deficits in self-regulation (Gawrilow, Gollwitzer, & Oettingen, 2011b). The result is an automatization of goal-oriented behaviour (Gawrilow, Gollwitzer, & Oettingen, 2011b). In conclusion, it should be noted that if-then plans to improve self-regulation are more effective compared to pure target intentions (medium to large effects $d = 0.65$, J. Cohen, 1992; Gollwitzer, 1999). The effect of plans depends on specific situational cues and the strength of the relationship between these cues and the response to be shown (Webb & Sheeran, 2008). This refers to the general mode of action of if-then plans described above.

In the previous section it has become clear that if-then plans can train a person's self-regulation. In particular, people with self-regulation deficits benefit from this method because their self-regulation is strengthened and they are supported in overcoming their self-regulation deficits by means of if-then plans (Gawrilow, Schmitt, & Rauch, 2011; Guderjahn et al., 2013). For example, teachers of children with ADHD symptoms report a reduction of symptoms and increased self-regulation when children selected a goal in advance and formulated an if-then plan compared to children who did not use an if-then plan (Guderjahn et al., 2013). Further findings also indicate the effectiveness of if-then plans in children with ADHD symptoms (Gawrilow, Gollwitzer, & Oettingen, 2011b). Boys with ADHD symptoms solved math problems in less time if they had previously formulated an if-then plan with the aim of not being distracted by a disturbing stimulus during the processing of the tasks, than those who did not create an if-then plan and were also exposed to a disturbing stimulus. The group of boys with ADHD symptoms who formulated an if-then plan and were not exposed to a disturbing stimulus also solved the math problems faster than those who formulated a pure goal intention (Gawrilow, Gollwitzer, & Oettingen, 2011b). Moreover, these children made fewer mistakes on computer-based tasks if they previously formulated goal-oriented if-then plans and solved math tasks better afterwards than other children with ADHD symptoms who previously formulated pure goal intentions (Gawrilow, Gollwitzer, & Oettingen, 2011a). The effect of if-then plans even seems to be an alternative to medication for children with ADHD symptoms (Paul et al., 2007), as they are better able to regulate and inhibit their impulsive behaviour (Gawrilow & Gollwitzer, 2008). In a

comparable task, such as the marshmallow test presented at the beginning of chapter 2.1.1, the group of children with ADHD symptoms that had previously formulated an if-then plan achieved better results in reward delay in a corresponding reward delay situation than those without a plan (Gawrilow, Gollwitzer, & Oettingen, 2011a). This is not only an expression of if-then plans, but also a confirmation of the change in self-regulation caused by them, since it is known that such situations can reflect a person's ability to self-regulate.

Apart from this, the effect of if-then plans is moderated by the impulsivity of a person, in the sense that a high level of impulsivity, i.e. less self-regulation, worsens the adherence to planned intentions and changes unfavourable behaviour less. This has already been suggested by the reported findings from research including people with symptoms of attention deficit hyperactivity disorder, i.e. self-regulation deficits (Churchill et al., 2008).

As a concluding remark, it is important to note that if-then plans have an effect beyond the field of ADHD research. They can even help to control stereotypical prejudiced reactions (Stewart & Payne, 2008), and show effects even when obstacles on the way to achieving the goal are encountered (Gollwitzer et al., 2005).

2.3.4 Mental contrasting with Implementation Intentions (MCII/ WOOP).

Oettingen and Gollwitzer recognized the potential of their mutual research in the 1980s and combined their strategy to *Mental Contrasting with Implementation Intentions* (*MCII*; Oettingen, 2014). Mental Contrasting with Implementation Intentions combines the application of if-then plans with mental contrasting and includes all steps necessary for the successful realization of large or small, and long- or short-term goals (Oettingen, 2017). The first step is to formulate a personal wish that is feasible and challenging (wish). The second step is to indulge in what would be the most beautiful thing that could happen if the wish were fulfilled / the goal was achieved (outcome). Then, in the third step, the greatest obstacle that could arise on the way to the realisation of the wish is generated and formulated (obstacle). Finally, the behaviour or thought that makes it possible to overcome the obstacle is drafted (plan) and this

action plan is finally formulated in an if-then format (Schwörer & Oettingen, 2018). With the help of this strategy, students were able to reduce their unhealthy consumption of sugar and calorie snacks (Adriaanse et al., 2011), and partners were able to show less unwanted behaviour, so that relationship satisfaction increased (Houssais et al., 2013). Gawrilow and colleagues (2013b) conducted a field experiment among children with ADHD symptoms. Children were randomly assigned to conditions, with all receiving learning strategy training and only some additionally receiving MCII intervention. In this condition there was the following procedure: First, the most urgent school goal was considered, followed by mental contrasting (considering positive consequences in reaching the goal and obstacles on the way there) and finally the establishment of an if-then plan like this goal should be completed within the next 2 weeks. At the end of these 2 weeks, the parents of the participating children assessed their self-regulation ability. The results show that the children in the additional MCII intervention group were rated higher on their self-regulation (especially those at high risk of ADHD) than those who had only gone through the learning strategy intervention.

Mental Contrasting with Implementation Intentions is superior to the individual strategies mental contrasting or if-then plans in its effect on improving self-regulation (e.g. Adriaanse et al., 2010; Duckworth et al., 2013). In students, MCII increased self-regulation, supported the achievement of long-term goals (Duckworth et al., 2011), and increased exercise compared to the control group, which did not write down their goals and obstacles (Duckworth et al., 2011). Mental Contrasting with Implementation Intentions reduced disruptive behaviour of students, and improved their school performance and punctuality in contrast to students who indulged in positive fantasies only (Duckworth et al., 2013). Fifth-graders who were asked to imagine their wishes regarding their school career or school-relevant topics by means of MCII were able to improve their grades, behaviour and participation in class compared to the control group (who exclusively practised positive thinking, i.e. were only optimistic about their goals and did not consider any obstacles; Duckworth et al., 2013).

Especially for individuals with self-regulation difficulties MCII is beneficial to reduce this deficit. The increase in self-regulation is reflected, for example, in children with ADHD symptoms after an MCII intervention in a more organised school routine. Children with ADHD symptoms packed their school bags more independently, tidied their desks more often, and did their homework more regularly than those who received an intervention on learning strategies (Gawrilow, 2013b).

It can be noted that mental contrasting and if-then plans improve and automate goal retention and action initiation (Oettingen & Gollwitzer, 2015c). Their individual effects on self-regulation are only surpassed by their joint outcome, when used as MCII. The ability to self-regulate has far-reaching consequences for a person's life and educational path (Oettingen & Gollwitzer, 2015c). It is therefore recommended that MCII should be taught to children and adolescents directly in their daily life as a self-regulation strategy for successful goal attainment (Duckworth et al., 2011). In the school context, MCII could, for example, be used as follows: A student has the goal of listening more attentively to the teacher in order to be better prepared for the next exam (wish). The best thing that could happen would be that afterwards, in celebration of a good grade, there would be a joint visit to the cinema with the parents, and the student would feel liberated (outcome). A possible obstacle could be the person sitting next to the student distracting him or her by whispering (obstacle). In order to overcome this obstacle, the pupil names a concrete behaviour and formulates the following if-then plan (plan): *If my seat neighbour addresses me in class, then I tell him 'No, not now' and continue to listen to the teacher*. The use of MCII in the everyday school context to improve the self-regulation of pupils and those with self-regulation deficits seems advisable.

2.4 Symptom variations

Recent studies show that the manifestations of psychological states do not occur every day to the same extent and intensity. For example across days, individuals experience varying levels of negative affect, control of attention, and motivation (Brose et al., 2012; Leonhardt et al., 2016). Moreover, working memory performance, one of the components of executive functions, fluctuates from day to day (Galeano

Weber et al., 2018). Teachers, especially in the school context, often experience that students show fluctuations in their performance (Dirk & Schmiedek, 2017). Also, individuals differ not only in the type of strategies they use to process a text, but also intraindividually in the use of strategies to retrieve information, whereby those with a high degree of variability tend to benefit most in their performance (Hertzog et al., 2017). Therefore, there are differences in the symptoms between persons and within a person.

These fluctuations in psychological states are interrelated. For example, working memory performance of young adults is lower on days with higher levels of negative affect, reduced control of attention, and reduced task-related motivation (Brose et al., 2012). Furthermore, there is a connection between daily physical activity (measured by motion sensors, so-called accelerometers) and daily affect in children, so far as on days when participants engaged in more activity than usual, they reported not only less depressed and angry evening affect but also more vigour and serenity in the evening, i.e. showed both less negative and more positive affect on days with more activity (Haas et al., 2017; Kühnhausen et al., 2013).

ADHD symptoms and the associated self-regulation of individuals also fluctuate[5]. In a longitudinal study the influence of ADHD symptoms on reading development in elementary schoolchildren was investigated (Ehm et al., 2016). Repeated assessments of ADHD symptoms (teacher ratings of inattention, hyperactivity, and impulsivity) and reading achievement were collected, with the result that ADHD symptoms were associated with lower levels and less growth in reading. Furthermore, individual differences in changes in ADHD symptoms and reading performance were negatively associated.

2.4.1 Measurement of symptom variations via Ambulatory Assessment.

Ambulatory assessment is currently an increasingly used method to detect changes in symptoms (e.g. Lydon-Staley et al., 2017). It is defined as a process that records the characteristics of variables and

[5] as already described in chapter 2.2.1

their fluctuations within one day or over several days, usually by using portable devices (e.g. beepers, smartphones, motion sensors or online diaries; Bugl et al., 2015). Ambulatory assessment is used to investigate mental and physical conditions in everyday life according to a defined question and measurement strategy (Fahrenberg, 1996). This enables a new view of everyday life by means of repeated measurements taken in close succession (Bugl et al., 2015). Ambulatory assessments are particularly suitable for examining processes in natural contexts from an intraindividual perspective, are sensitive to fluctuations in psychological and physical conditions, and are ecologically valid (Bugl et al., 2015).

For example, the interaction of sleep and affect in children's everyday school and extracurricular activities can be directly measured by ambulatory assessment (Könen et al., 2016). For this purpose, 8-11-year olds used smartphones for 31 days to provide information about their sleep the night before and reported their affect four times a day (including during school hours). From these data, the relationship between night sleep and affect the next day (morning, noon and afternoon) as well as the relationship between evening affect and subsequent sleep was analysed (Könen et al., 2016). In another ambulatory assessment study, primary school children performed working memory tasks on smartphones. The children worked three times a day for a few minutes on a task in which they had to remember the positions of figures and do mental arithmetic. They solved these tasks for four weeks, three times a day, once in the morning, once during school time and once in the evening. The analyses of the progression of the results of the working memory tasks showed differences between the children in their working memory performance, but also fluctuations in the working memory performance of one child occurring between the measuring points on different days. In other words, the results showed substantial intraindividual fluctuations in children's daily working memory performance (Dirk & Schmiedek, 2016).

In summary, many studies today recommend that mental states should be considered on a more individualized level as well as measured on a dimensional level of expression. These findings form the basis for the necessary research to initiate an individualised assessment of self-regulation and its deficits.

3 RESEARCH AIMS

The present dissertation has the goal of consolidate the relevance of self-regulation training, with a special focus on train school children in their everyday life and the ambulatory assessment of self-regulation skills. Furthermore, the present dissertation is intended to derive practical implications for the individualized development of these interventions, especially for individuals with self-regulation deficits, and to strengthen the consideration of symptoms away from a categorical to a dimensional view. The contents of the three manuscripts included in the present dissertation contribute to these goals.

Manuscript 1 describes the gap between intentions school children have and their actual behaviour, as well as one training method that supports them in the pursuit of their goals. Subsequently, the steps of this training of self-regulation, Mental Contrasting with Implementation Intentions (MCII), are exemplified. Furthermore, important practical implications for the future application of this self-regulation training are derived and an increased application in the educational context is recommended. This manuscript serves the purpose of gaining a comprehensive insight into this self-regulation strategy and to provide a review for the training of self-regulation in order to further improve this strategy in the future, based on this knowledge.

Manuscript 2 describes an empirical study in which the effectiveness of an MCII training for children was examined in comparison to a control training condition. Therefore, a sample of 5th graders (German secondary schools) was either assigned to an MCII training or underwent a similar training without mental contrasting (the positive thinking condition). After being trained, the children were repeatedly reminded of their goal (once a day), and completed the training, during the following 18 days by means of an App that was installed on smartphones which we handed out to the children. Data about the children's individual self-regulatory skills was assessed through self-assessment before the start of the training (pre) and 18 days later (post) via questionnaires. Further, data about self-regulation deficits was collected by daily online assessment of symptoms of attention deficit hyperactivity disorder through the parents via online diaries. Research objectives of the study were, on the one hand, to measure daily self-

regulation of school children and, on the other hand, to promote their self-regulation in everyday life using a training. The results provide information about the effectiveness of MCII and broaden the view for measuring and strengthening self-regulation skills on a daily basis.

Manuscript 3 aims to deepen the research findings described in the second manuscript by focusing on the evaluation of the training effect on a dimensional level of the expression of symptoms of inattention, hyperactivity and impulsivity. For this purpose, it is necessary to look closely at the children's daily assessments. This new insight into the character of the fluctuations of the reports of symptoms, which is consistent with recent research, aimed to provide a further argument for the dimensional consideration of symptoms. These results will allow to design more individualized trainings. Furthermore, the *Manuscript 3* will aid the recommendation of the measurement of abilities and symptoms on a natural and everyday level in order to derive methodological implications for self-regulation training.

The following abstracts (and the respective attached chapters) are designed as independently readable manuscripts. As a result, there are overlaps in content with this introduction (Chapter 1 - 3) and between the three manuscripts.

4 SUMMARY OF MANUSCRIPTS

4.1 Manuscript 1: Self-regulation interventions for school children

Schwarz, U., Sevincer, A. T., & Gawrilow, C. (2019). Wenn-Dann Pläne und mentale Kontrastierung als Strategien zur Förderung der Selbstregulation. [If-then plans and mental contrasting as strategies to promote self-regulation.] In H. Gaspard, U. Trautwein, & M. Hasselhorn (Eds.), Jahrbuch Tests und Trends 2019: Motivation und Volition im Schulkontext. Göttingen, Germany: Hogrefe.

Abstract [6]

Self-regulation includes the goal-oriented and situationally appropriate control of thoughts, emotions and actions. In the school context, high (vs. low) self-regulation skills predict better academic performance and more successful learning. Using the Rubicon model of action phases, we discuss the role of self-regulation for action initiation. We illustrate how self-regulation can help learners to better translate intentions into actual actions and thus bridge the gap between intentions and actions. We also describe strategies for improving self-regulated action, in particular the mental contrasting of future and reality and if-then plans, as well as the combination of both strategies, called WOOP (derived from the steps Wish, Outcome, Obstacle, Plan). We present empirical evidence for the effectiveness of strategies to promote learning and success in school. Finally, we present an example of the application of if-then plans in the school context.

[6] Translated from German

4.2 Manuscript 2: Measuring and improving self-regulation on a day-to-day-level

Schwarz, U., Gawrilow, C. (2019). Measuring and compensating for deficits of self-regulation in school children via ambulatory assessment. Psychology in Russia: State of the Art, 12(4), 8-22. DOI: 10.11621/pir.2019.0401

Background. Children with deficits in self-regulation often perform worse in school and are less accepted by peers. However, self-regulation can be trained and developed by making detailed plans to achieve specific goals. One such strategy is WOOP (it includes thinking about *w*ishes, *o*utcomes, and *o*bstacles, and creating a *p*lan to achieve a goal), known in the literature as MCII, or if-then plans.

Objective. Noting the encouraging results of the WOOP method, we aimed to evaluate whether WOOP has the potential to ameliorate self-regulation deficits on a day-to-day-level.

Design. In total, 49 school-aged children (M = 11.2 years, SD = 8.4 months) were randomly assigned to one of two groups: 1) Condition 1, underwent a WOOP intervention; and 2) Condition 2, performed the intervention without contrasting obstacles and planning. The self-regulation abilities were assessed each day over an 18-day survey period by both the children themselves and their parents. ADHD symptom-severity was assessed as a proxy for self-regulation; specifically, we used six items from the Conners 3 scale and the German adaptation of the Brief Self-Control Scale.

Results. The children in both conditions demonstrated increased self-regulation, according to their self-reports at the beginning and end of the survey period. The parents reported different progressions of the two conditions over the survey period, but these did not differ significantly. In addition, both conditions are helpful to improve children's self-regulation in daily life.

Conclusion. Further research on implementing practicable interventions in schoolchildren´s daily life is highly recommended.

4.3 Manuscript 3: Variation of self-regulation deficits and options for daily interventions

Schwarz, U., Reuter, M., Kühnhausen, J., Haas, P., Gawrilow, C. (2020). Variability of ADHD Symptoms and Self-Regulation Skills in Schoolchildren and the Influence of Self-Regulation Trainings. *Manuscript in preparation*

Abstract

Children with ADHD symptoms (i.e. inattention, hyperactivity- impulsivity), experience difficulties due to self-regulation deficits. The present study investigated whether the fluctuations of schoolchildren´s self-reports of inattention and hyperactivity-impulsivity as well as self-regulation skills could be measured, thus, whether fluctuations of the self-reports over a longer period of time occur. Furthermore, self-regulation skills can be modified by using self-regulation training. To achieve this, we used a Mental Contrasting with Implementation Intentions (*MCII* or *WOOP*; e.g. Oettingen, 2004) training.

An ambulatory assessment study has been carried out in which 49 schoolchildren (M_{age} = 11.2) rated their symptoms of inattention and hyperactivity-impulsivity and self-regulation skills three times a day (morning, afternoon, evening) over a period of 18 days on smartphones. In addition, the children took part in a self-regulation training session before the start of the observed survey period. In one condition a MCII training was conducted; while in another condition a positive thinking training was implemented.

Daily fluctuations of self-reported ADHD symptoms well as of self-reported self-regulation occurred. It was shown that children who reported higher self-regulation skills on average reported fewer ADHD symptoms on average compared to children who reported lower self-regulation skills. In addition, there was no difference in daily variations of ADHD symptoms and self-regulation skills between children in the MCII condition and children in the positive thinking condition.

The necessity of an individual and dimensional consideration of ADHD symptoms is discussed and pleads for an tailored, individual training approach to combatself-regulation deficits.

Keywords: ADHD, self-regulation, Mental Contrasting with Implementation Intentions, WOOP, ambulatory assessment

5 GENERAL DISCUSSION

The ability to regulate and control one's own thoughts, emotions and actions is essential for the life course of a person. This ability, known as self-regulation, helps a person to behave in a more socially appropriate manner in situations that require it, leads to increased attention to rules and important things being forgotten less often (Baumann & Kuhl, 2013). Especially in the learning context, this ability is of great importance and can - if it is present to a high degree - lead to more academic success (Tangney et al., 2004). However, if self-regulation skills are deficient, as for example in the case of individuals with diagnosed attention deficit hyperactivity disorder (ADHD), this can hinder a learning career from an early stage (Döpfner et al., 2014; Duckworth & Carlson, 2013). For this reason, it is important to focus on self-regulation early in the educational context, and to compensate for self-regulation weaknesses with support of a training in order to ensure equal opportunities in learning for all children. If self-regulation is so important for the life course, self-regulation deficits should be compensated for as early as possible, preferably at school age.

The aim of the present dissertation was therefore to strengthen self-regulation skills with new results about the changeability of self-regulation (*Manuscript 1*). Many parents and teachers are familiar with the phenomenon that school children work very attentively on a task in one lesson or on one day and in the next lesson or on the next day they do not have capacities to finish this task. The self-regulating ability of a person therefore seems to fluctuate from time point to time point, from day to day (Schmid et al., 2016). In order to test this hypothesis empirically, the method of ambulatory assessment was used to record the self-regulation of school children directly in their everyday school life. On the one hand, it was implemented to establish a stronger link between the children's experience and behaviour in real life as well as the measures collected and, on the other hand, to measure the fluctuations in self-regulation (*Manuscript 2*). If self-regulation reports fluctuate, it is also necessary to consider the dimensionality of associated clinical symptoms such as inattention and hyperactivity-impulsivity (*Manuscript 3*). In this context, the aim was not only to measure self-regulation in everyday life but also to train self-regulation

with the goal of enhancing self-regulation skills (*Manuscripts 1-3*). Hence, an overall goal of this dissertation was to carry out a self-regulation training in the everyday life of school children in order to be able to provide compensatory support, especially for those with self-regulation deficits.

In the following, the contents and results of the manuscripts arising from the goals of the dissertation will be presented, and the procedures of the empirical studies will be described in more detail (5.1). Subsequently, the limitations of the work carried out are discussed (5.2) and the strengths are pointed out. From this knowledge of limitations and strengths, implications for future research are derived (5.3) and the ideas guiding future implications of the dissertation are formulated (5.4).

5.1 Summary and discussion of the Manuscripts' main results

The aim of this dissertation was to measure self-regulation in everyday life and to explore how to ameliorate self-regulatory deficits through training. In addition, the fluctuations in self-regulation skills and the associated symptoms of attention deficit hyperactivity disorder were to be portrayed. These objectives were pursued by presenting in *Manuscript 1* a special training of self-regulation called Mental Contrasting with Implementation Intentions (MCII; Oettingen, 2014) within the classroom. In *Manuscript 2*, this training was then empirically examined in the everyday life of school children where self-regulation and its variability were assessed on a daily basis by means of ambulatory assessments. *Manuscript 2* shows that the self-regulation of school children improved with the help of appropriate training. The fluctuations in self-regulation reports were then examined in more detail in *Manuscript 3* where the daily responses of children to their self-assessed self-regulation were analysed and linked to their rating of ADHD symptoms. *Manuscript 3* deepened the existing evidence that, when considered over a longer period of time, self-regulatory fluctuations and, accordingly, inattention and hyperactivity-impulsivity fluctuations occur.

Going into more detail about the findings *Manuscript 1* provides an overview of existing research on goal pursuit, if-then plans and the associated training of self-regulatory skills using the example of MCII. Self-regulation is described as an essential ability of an individual to achieve long-term goals and academic success in life. One component of self-regulation - the ability to delay rewards/ gratifictaions,

which means the ability to postpone a positive event to enhance it - is developed at an early age and varies in strength among children (Mischel et al., 1989). For example, the Marshmallow Test (Mischel, 2014) is used an operationalisation of self-regulatory skills by making children withhold from one marshmallow to obtain a second marshmallow after a pre-defined waiting period. The Marshmallow test has shown that pre-school children differ in their self-regulatory skills. A striking finding is that individuals who endured this situation longer and, thus, are assumed to have skills to regulate their actions better, were shown to be healthier, more successful and socially more satisfied in the later course of their lives than those who did not resist the first marshmallow (Mischel, 2014).

Self-regulation is therefore important for every person throughout life and should be trained early on. As illustrated by the Rubicon model of action phases, which is used to model action steps on the way to a goal (Heckhausen & Heckhausen, 2010; see chapter 2.3.1), self-regulation is particularly helpful when obstacles occur on the way to a desired goal. It helps overcoming these obstacles and the gap between intention and behaviour (Sniehotta et al., 2005) that opens up between the pre-actional phase and the actional phase.

These bridging self-regulation strategies, in the case of mental contrasting, focus on the one hand on indulging in positive goal attainment fantasies in order to draw from them the motivation to overcome obstacles on the way to a goal. On the other hand, in the case of if-then plans, they focus on activating goal-oriented action in a corresponding goal-oriented situation (Gollwitzer & Sheeran, 2006; Oettingen & Kluge, 2009). Both strategies help strengthen self-regulation and, in particular, help pupils to become more attentive, improve their performance, and complete tasks more consistently (Duckworth et al., 2013; Oettingen et al., 2015a). The combination MCII (or WOOP; Oettingen, 2017) of these two self-regulation strategies is explained in *Manuscript 1* with the help of an implementation example in a teacher-student interaction. Based on the manual by Gawrilow and colleagues (2018), in this exemplary teacher-student interaction the steps of MCII (1. goal/ desire getting, 2. metacognitively anticipating the most beautiful thing after goal fulfilment, 3. realising obstacles, 4. setting up an if-then plan to overcome the obstacle,

and working towards the goal) have been decribed while being adjusted specifically to the school context for a school-related goal (unlike many other studies with MCII, e.g. Mutter et al., 2020; Oettingen & Gollwitzer, 2010) and advocated for an adaptive individual application in everyday school life.

The idea of gaining an insight into the effects of the training on the everyday school lifes of children was pursued in *Manuscript 2*. Here, an empirical evaluation of a training of self-regulation by means of MCII (condition 1; desire, ideal result, obstacle, if-then plan) in comparison to a similarly structured positive thinking training without the step of mental contrasting (condition 2; desire, ideal result, ideal feeling, plan) is illustrated. Children were randomly assigned on one of these two conditions. At the beginning of the study (pre) both conditions were trained in a small group using workbooks. The children in the MCII condition wrote down an if-then plan for their individually set educational goal, after they had contrasted mentally. The children in the positive thinking condition also named a goal and thus formulated positive associations (pure indulgence) and recorded this in their plan. Every day, for 18 days, the children were visually reminded of the strategy of their training condition via smartphones. The post-measurement of self-regulation took place afterwards.

The first goal of the study was to train the self-regulation of school children. This goal was achieved, because all children rated themselves better in their self-regulation in comparison from pre- to post-training measurement. However, it should be noted that there were no differences between the training conditions with regard to the improvement of self-regulation values, that is the MCII condition was not superior to the condition without the step of mental contrasting (positive thinking condition) in opposition to our previous expectations. In contrast to Gawrilow and colleagues (2013b), it was not possible to introduce a "classical" control condition, for example in the form of a learning training, due to ethical concerns about using training during an important developmental phase in adolescence, in a longitudinal setting as in this study. Since it was assumed that MCII training leads to an improvement in self-regulation, it would have been ethically unacceptable for a group of children to deny it completely over a period of 3x 18 days, especially at an age when (emotion) regulation is an issue (Silk et al., 2003).

For this reason, in addition to the MCII condition, the compromise of a positive thinking condition was chosen, which is usually associated with pointing out the direction in which to act (Oettingen, 2000). Thus, both conditions (MCII, positive thinking) can be seen as goal-oriented self-regulatory strategies, whereby an advantage was expected for the training of the self-regulating skills in MCII, as this is an extension of positive indulgence in the future through mental contrasting (Oettingen & Kappes, 2009) .

What should be emphasized about the study is that the self-regulation training explicitly focused on school-relevant self-chosen goals of the children in order to ensure a concrete framework of action applicable to all participating children, and also to maintain motivation through a goal that is considered personally relevant. For example, one child's plan was: goal - *better math grades*; the most beautiful thing when the goal is attained - *my parents are happy, I get a book as a reward*; my obstacle (mental contrasting) - *that I find learning boring and I cannot move while learning*; overcoming action - *taking little breaks in which I exercise;* if-then plan - *If boredom occurs while learning for math, then I take a short exercise break*. This individual level in setting of goals and formulation of an if-then plan extended ideas from Oettingen and Gollwitzer (2010), suggesting that self-set goals are needed to implement motivation compared to pre-formulated goals set by others.

The second aim of the study was to observe the development of self-regulation using MCII over a period of 18 days. This carries forward the implications of Gawrilow and colleagues (2013b), where MCII training was also conducted and daily reminders were provided via an online link. Gawrilow and colleagues (2013b) found that children benefited from MCII more than from a learning style intervention only and the benefits of MCII were particularly strong for children at risk for ADHD. In the current study, reminding the participants of their self-regulation strategies was carried out by means of an app on handed out smartphones and online evening diaries for parents. This ambulatory assessment allowed to map the varying course of the parents' assessments of their children's ADHD values over 18 days. The individual ADHD symptom values given by the parents did not differ significantly between the training conditions,

but they reinforced - in their tendency to show fluctuations in magnitude - the indication of a dimensional structure of self-regulation ability and ADHD symptoms.

Assuming a dimensional structure of the constructs, *Manuscript 3* examined with special emphasis the daily individual data (summed and averaged over the day from morning, noon and evening measurements) on the self-regulation skills of children and their ADHD symptoms of inattention and hyperactivity-impulsivity over 18 days, which were evaluated via smartphones. This was conducted according to the known state of research for these variables and for the first time over such a long period of time. Initially, an individual variation value in form of the *Relative Variability Index* (Mestdagh, Pestman, Verdonck, Kuppens, & Tuerlinckx, 2018) as a measure of variability, was calculated for each child over the entire period of 18 days. This Relative Variability Index showed fluctuations in the children's reports of their stated self-regulatory skills and their ADHD symptoms. These findings allowed further evidence to be collected for the fluctuations in both of the variables (as described by Kofler, Rapport, & Alderson, 2008; Purper-Ouakil et al., 2004, Rapport, Kofler, Alderson, Timko, DuPaul, 2009). In addition, children with on higher average self-regulation skills reported on average fewer ADHD symptoms, which further strengthens the hypothesis adopted by Gawrilow and colleagues (2018) among others that ADHD symptoms are caused by self-regulation deficits.

Subsequently, the fluctuations in the children's self-regulation values and ADHD symptoms were examined in relation to the different training conditions already described in *Manuscript 2* (MCII condition; positive thinking condition). For this purpose, a group mean value of each condition was calculated from the individual Relative Variability Indices, and the self-regulation training conditions were compared against each other. Contrary to our assumptions, children in the MCII condition did not show significantly fewer fluctuations in their self-regulation values or in their values of ADHD symptoms assessed through daily self-report via smartphone than children in the positive thinking condition. The data does therefore not point in the direction assumed so far that the traditional MCII is superior in bridging the fluctuations of reports in self-regulation skilly and ADHD symptoms on a daily basis than a

comparable self-regulation training. Nevertheless, the results once again underline the importance of the measurement of self-regulation skilly and the associated ADHD symptoms close to everyday life as well as the need of individual training and enhancement of self-regulation ability.

5.2 Limitations

Although all three manuscripts could properly create new perspectives for further understanding the daily use of self-regulation strategies in everyday school life, they seem to be restricted especially in their generalizability. For example, the tested samples in *Manuscript 2* and *Manuscript 3* are not large enough to draw conclusions for all schoolchildren in general. The composition of the sample in terms of educational background and learning performance was explicitly heterogeneous in order to reflect a typical class structure. For this reason, recruitment took place primarily at community schools. This is contrary to the approach of Duckworth and colleagues (2013), which specifically targeted families with economically weaker backgrounds. Nevertheless, our sample did not specifically include children diagnosed with ADHD (although they were by all means allowed to participate), so all fifth-graders of the schools that had agreed to participate were invited to take part in the study. The idea behind this recruitment method was to illustrate the dimensionality of self-regulation and ADHD symptoms – away from the diagnostic categorization *yes* (ADHD) / *no* (no ADHD) – and to approach an average class composition. With regard to the diagnosis of ADHD the sample seemed to be satisfactorily representative, as 5 of 49 participants were diagnosed with ADHD. With a rate of 10%, this is above the assumed prevalence of ADHD in this age group (5 %, Banaschewski et al., 2017). However, due to the random assignment of the children to the training conditions in *Manuscript 2* and *3*, the general statements on the effect of self-regulation training are limited, as the groups only consisted of $n = 31$ (MCII condition) and $n = 18$ (without mental contrasting, positive thinking condition) individuals.

The next point that needs to critically be discussed is that the training conditions might have had limitations in their conception. The MCII condition contained the proposed four steps - following the recommendations of Oettingen and Gollwitzer (e.g., 2015a) - to overcome the intention-behaviour-gap

and to improve self-regulation skilly. These steps (thinking about a wish, indulging in the best result of wish fulfilment, becoming aware of obstacles on the path to obtain the goal, and drawing up a plan of action when the obstacle occurs) were taught in age-appropriate language in small groups with help of posters and workbooks by skilled trainers. In the MCII condition participants were trained on the basis of a personal goal and were visually reminded of these strategic steps on the way to achieve their goal for 18 days via smartphone. A post-test showed that the majority of children remembered the steps of the strategy even after the 18 days of the study. The same procedure took place in the positive thinking condition, except that these participants were not instructed in mental contrasting. That is, after indulging in the best result, participants in the positive thinking condition did not think about obstacles, but kept a positive mindset and continued to associate positively, describing the feeling of reaching the goal in the following step. From this, a plan was then created, which literally contained the components *if* and *then*, but did not, in the sense of Gollwitzer (1999), link a triggering situation with a goal-oriented action. In the plan of the positive thinking condition the goal should be mentioned again (*when I have reached x, ...*) and the positive feeling (*..., then I feel y...*) should be remembered. This goal orientation of the comparative training condition is based on Guderjahn and colleagues´ study (2013) where participants were assigned to a condition with either a goal intention only or with a goal intention and a goal-directed if-then plan leading towards it. In contrast to Gawrilow and colleagues (2013a), we deliberately did not employ a training condition that was equal in terms of time and materials but different in content. Since no comparable study was found after a thorough search of research literature at the beginning of the investigation, the possibility of training children over a long period of time with just control training without expected changes did not seem justifiable. However, this may have had the limiting effect of making the training conditions (too) similar, which may explain the lack of advantage of the MCII condition over the positive thinking condition in *Manuscript 2* and *3*, contrary to what was expected from the literature. It may be that the children of the positive thinking condition implicitly contrasted mentally (Sevincer et al., 2017). Another possibility is that these children gained motivation to address their goals because of the more positive

perspective in the positive thinking condition, thus, assessing their abilities more positively because of this (Adriaanse et al., 2010; Oettingen & Chromik, 2018; Oettingen & Gollwitzer, 2019).

In particular when children self-rate their own abilities, as in *Manuscripts 2* and *3*, overestimation errors and the positive illusion bias, saying that children with ADHD symptomps tend to overestimate their abilities (Hoza et al., 2002), should always be taken into account. Thus, children might overestimate their abilities, especially their self-regulatory abilities (Hughes et al., 2009). For this reason, in addition to the children themselves, in *Manuscript 2* parental assessment of the ADHD symptoms was also used in order to gain the perspective of a significant other and, accordingly, an additional assessment perspective of self-regulation deficits. However, it should again be noted that the parents were not blind to their children's participation in the study, and, consequently, the mere knowledge of their children's participation in a self-regulation training programme may have distorted their assessments (see Wachs & Sheehan, 1988). Euphemistic distortions due to a desire for improvement are just as conceivable as highly critical evaluations due to an increased awareness of the measures collected. A further perspective for example both parents or additionally teacher ratings for the consolidation of self-regulation values and ADHD symptom assessments in *Manuscript 2* and *3* would have been desirable for the analyses. After all, in order to make a diagnosis, ADHD symptoms are indeed assessed in clinical practice not only from one perspective or in one context (American Psychiatric Association, 2015). The same assessment standards should also be shared by a dimensional assessment of ADHD symptoms.

The current dissertation has therefore not only evaluated a self-regulation training but also investigated fluctuations of ADHD symptoms and self-regulation skills of schoolchildren´s self-reports. For this study, we used ambulatory assessment, that is the collection of variables in everyday life using portable devices (Ebner-Priemer & Trull, 2009). Participants were asked to answer daily in the morning, afternoon and evening (children, *Manuscript 3*) and once a day in the evening (parents, *Manuscript 2*) questions about their ADHD symptoms and self-regulation using an app on a smartphone (children, *Manuscript 3*) and questions about their children's ADHD symptoms and self-regulation using an online

diary (parents, *Manuscript 2*[7]). Despite this method of recording ADHD symptoms and self-regulation - after extensive literature research - being considered as very new and innovative, it is not free of limitations. On the one hand, the low values of the item scales demonstrate the necessity to improve them in the future by means of adding further and more selective items. In the current research, this limitation had to be accepted in favour of test economic aspects (measurement time should not be too long in order to not be a burden in everyday life). On the other hand, despite the fact that the willingness to participate in the item response was assessed as high (80% - approximately the results from adult patient samples; see for example Mehl & Holleran, 2007; Stone et al., 2003), not all participating families were always able to answer the items. As a result, although the survey times were coordinated with the daily plans of the family before the start of the study, various missings were recorded. This was especially the case with the daily data regarding the fluctuations of reports of self-regulation and ADHD symptoms (*Manuscript 3*). In this context, it should also be considered that, due to the lack of suitable adaptive technical options, accompanying the children in the conditions of the training could not be integrated more strongly into everyday life (e.g., by daily reminding them of their individual personal goals). Thus, in the present study it was daily only possible to visually remember the strategy to achieve the goal in combination with the query of further measures, but not, for example to interactively query experiences regarding the handling of obstacles (a step of mental contrasting from the MCII training) on this specific day. This would have been advantageous for an increased training of the self-regulation ability, because daily training adapted to the individual level, for example via app, increases working memory, attention and concentration compared to non-adaptive training (Holmes et al., 2009; Pedullà et al., 2016).

The training of self-regulation, as empirically investigated in the present paper, is to be considered with special focus in the interpretation of the results. In addition to the contributions to behavioural change

[7] for *Manuscript 2* the daily interviews with parents were carried out by Soscisurvey (Leiner, 2019) for *Manuscript 3* the children were questioned using an application (developed in cooperation with the Goethe University, Frankfurt Main) on Motorola MotoG4plus© smartphones

in various areas of life found in the research literature on MCII, for example changes in eating habits, physical activity routines, and social relationships (McClelland & Cameron, 2012; Tangney et al., 2004), it is only in recent years that the strategy MCII has been increasingly used in the school context with children and adolescents (Oettingen & Gollwitzer, 2015a; Spinrad et al., 2020). During the pilot phase of our study which served to improve the training materials and the preparation of the posters for the training conditions, many ideas were developed. In this process, the pilot sample was involved in order to find an age-appropriate language for the MCII steps and to clarify the strategy steps based on the ideas of the sources mentioned above. A constant further development of this self-regulation intervention is advisable.

Finally, it should be considered that the reported self-regulation ratings were relatively high on average, and that the reported fluctuations shown were rather in the lower ADHD symptom range (*Manuscripts 2* and *3*), indicating ground effects. The lack of significant results of MCII training compared to the positive thinking condition could therefore be due to the fact that there was already a high level of self-regulation in our sample that reports varied only slightly from day to day and between participants. Therefore, the training might have offered little additional help to children with high self-regulation skills, as it is usually most useful for people with self-regulation deficits (Baumeister & Vohs, 2004; Gawrilow et al., 2013b). Furthermore, none of the expected long-term benefits, as described by Mischel (2014) for children with higher self-regulation abilities, can be derived from the current data. While the length of the self-regulation training (18 days) could at least be easily integrated into everyday school life, long-term supervision of the training after the survey period is still advisable.

5.3 Strengths and implications for future research

The aim of this dissertation was to promote the use of self-regulation training in the everyday life of school children in order to bridge corresponding deficits which are in turn accompanied by further disadvantages. This has been implemented by the strategy of MCII, by discussing individual goals and ways to overcome obstacles on the path of achieving these goals by using age-appropriate materials. The school children were then reminded of this self-regulation strategy every day by visualization of the

training steps on their smartphones. To the best of our knowledge, the evaluation of the effect of the training was accompanied for the first time by an ambulatory assessment design, and the observed measures such as self-regulation and ADHD symptoms were collected on a daily basis using digital devices (*Manuscript 2* and *3*). In addition, the parents' perspective on the self-regulation and ADHD symptoms of their children was recorded via online parental diaries (*Manuscript 2*). This method is integrated into everyday life (Bugl et al., 2015) and has a high potential for long-term monitoring of training effects. For the different training conditions, improvements were found in comparison of the self-reported values of children's self-regulation before and after the survey period (18 days). MCII can therefore be designed in a more individualised way and integrated into everyday school life. It is also conceivable to broaden the focus of the training on constructs related to self-regulation such as emotion regulation (which is often a weakness of adolescents; Diamond et al., 2007; Westphal & Bonanno, 2004) or to measure the success of the training by means of performance explicitly associated with school, such as grades and participation (Duckworth & Carlson, 2013).

In view of these promising findings, which provide indications of associations between training and self-regulation skills or ADHD symptoms, possible mechanisms of impact should be investigated more closely in further investigations in order to adapt self-regulation training accordingly. To this end, in addition to the already well-documented effect of MCII, the positive thinking condition, which included establishing positive associations with the goal, should also be investigated in further studies. So it would be conceivable to offer the condition of positive fantasy next to MCII as a choice for participants of a training. The children of the positive thinking condition in *Manuscripts 2* and *3* exclusively indulged their (positive) feelings and thoughts in the third step of the training. Focusing on inner feelings or thoughts is a typical exercise used in the context of psychotherapeutic mindfulness exercises (Berking & Känel, 2007). By means of appropriate mindfulness exercises attention (i.e. a core criterion of ADHD) can be increased (Crescentini et al., 2016; Van de Weijer-Bergsma, E., Formsma, A. R., Bruin, E. I. de, Bögels, S. M., 2012). After several weeks of meditation training in which children focused, among other things, on observing

their own thoughts and feelings, teachers reported a reduction in inattention among the children, and a decrease in other problems associated with ADHD (Crescentini et al., 2016). Regarding the positive effect of mindfulness exercises to increase attention, the mechanism of action of positive indulging as implemented in the positive thinking condition of the training in our research, should be investigated more thoroughly in the future. For instance, a comparison of MCII and mindfulness trainings might illuminate the effects of both.

Furthermore, in this work it was possible to strengthen the perspective of the dimensionality of self-regulation and ADHD symptoms. ADHD symptoms and the associated deficits of self-regulation do not seem to be present to the same extent every day (Purper-Ouakil et al., 2004). By means of an ambulatory assessment over 18 days, fluctuations in these two constructs could be depicted in the children participating in the present study (*Manuscript 3*). Thus, in the current manuscripts, the self-regulation and ADHD symptoms reports by children and their parents were assessed individually every day, with some participants showing greater fluctuations in their reports than others. In addition, a connection between the self-regulation and ADHD symptoms was discernible in that children who on average reported high self-regulation reported fewer ADHD symptoms. This emphasises that self-regulation and ADHD symptoms are related and are not perceived to the same extent every day. This speaks in favour of a future, more dimensional consideration of self-regulation deficits, ADHD symptoms, and correspondingly adapted interventions.

Not only the monitoring of training, but also the diagnosis of self-regulation deficits and ADHD symptoms should in future be made with a dimensional view, for which the current study provides indications. This means that more questionnaires like the Strengths and Weaknesses of ADHD Symptoms and Normal Behavior (SWAN) rating scale should be used. The SWAN-rating scale is based on observations of normal and abnormal distributions of attention skills in diverse population samples (Brites et al., 2015; Swanson et al., 2012). On a practical level, dimensional diagnostics would lead to changes, for example in a school psychological counselling request regarding behavioural problems. Instead of

distributing a standard retrospective questionnaire, the symptoms could be recorded daily on the client's smartphone and at the end of a week this information could be discussed together with, for example, a graphic representation of the course of the values. This in turn offers specific starting points for discussing "good and bad days" and discovering resources to support self-regulatory abilities (e.g. *What was different on Monday, when you were more regulated, than on Tuesday, when it was harder for you to regulate?*). Even further thought can be given to adaptive software which, in the event of high fluctuations in values or values that deviate greatly from the personal average value, would send a direct reminder of pre-set goals. The software would thereby remind the individual of the obstacle-overcoming strategy or establish a connection to rapid psychotherapeutic help, for example through a chat (for more information on mental health apps, see Marley & Farooq, 2015).

The successful application of self-regulation training in the school context is supported by both the present studies and comparable research (Guderjahn et al., 2013; Oettingen, Hönig & Gollwitzer, 2000). For application in the school context, it should be noted that the self-regulation training needs to be carried out step by step together with the children. It is therefore essential that instructors carrying out the training are trained in advance, and thus that internal school *specialists* for the topic are trained. A possible training approach could be the concept of peer tutoring, which includes the elements of reciprocal information, counselling and the offer of mutual support among peers (Kalkowski, 1995). This approach has proven each other, orient themselves towards each other, and perceive each other as helpful problem solvers (Heyer, 2010). For the training presented in this dissertation, this could mean that students who know the training and tried it out themselves might be trained to become multipliers of the MCII strategy, and carry it out together with their classmates (Leyener; 2016; Merhofe, in press; Schwarz, 2016). Conversely, teachers would be relieved in the implementation and by the positive effects of the training. Aditionally, in the present study, limiting the group size to a maximum of five children per instructor and using a separate room for this purpose has proven to be useful. This allows the children to work undisturbed in a

quiet atmosphere. Those organizational implications should be taken into account when teaching the self-regulation strategy.

Finally, some recommendations for the future MCII application in research and practice: First of all - continuing the idea of the digital implementation of the MCII strategy, as it has been done with the WOOP app[8] for several years now - learning the training in a virtual reality would be conceivable. ADHD symptoms can be measured in a virtual classroom and training can be practiced to alleviate them (Adams et al., 2009; Rizzo et al., 2000). Thereby, in a virtual seminar room a participating person accompanied by a trainer avatar could first set a goal, associate indulgences and obstacles to this goal, and create an if-then plan. Afterwards, the person could take part in a math lesson with distractions and more or less goal-obstructing situations (depending on the conception/ manipulation of the setting by the test administration). In this way, conditions similar to learning situations could be created in an economic way and personnel resources could be saved compared to a real-life training. Finally, due to the great relevance of a person's ability to self-regulate for further development, it is conceivable that MCII could be implemented also in a playful manner at an early age, which is in kindergarten. Trainings of executive functions already exist (e.g. Tools of the Mind, see Bodrova & Leong, 2019) for this age group in order to compensate deficits at an early stage. In addition to cognitive trainings, for example of working memory, training of socio-emotional development is also important. Socio-emotional problems are common in children with ADHD symptoms, independent of the children's executive functions and are probably caused by poor prosocial behaviour (Hay et al., 2010; Wåhlstedt et al., 2009). In this context, it would be imaginable, depending on the interest and verbal abilities of the children, to engage them to at least find out about their and their friends wishes and goals, for example by means of painting or pretend-play-activities, to consolidate a kind of precursor skill of the entire MCII strategy. It might be interesting for future research to investigate

[8] see https://woopmylife.org/ (by Gabriele Oettingen and colleagues) for further information

under what circumstances children succeed in identifying obstacles on the way to their goal and in setting realistic goals.

5.4 Conclusion

The ability of self-regulation has significance in all areas of life (Baumeister & Vohs, 2004; Oettingen & Gollwitzer, 2015a). In academic and social contexts, a deficit in self-regulation is often accompanied by disadvantages (Tangney et al., 2004). Students often find it difficult to control their actions in a goal-oriented manner in particular, to hold back until it is their turn to answer, and to follow the lessons attentively (Gawrilow, 2016). Especially, people with ADHD symptoms are inattentive, which is probably caused by a deficit in self-regulated behaviour (Barkley, 2005). However, these ADHD symptoms as well as self-regulation abilities are not present every day with the same intensity as they fluctuate from day to day (Schmid et al., 2016). For this reason, the aim of this dissertation was to provide students with a training to improve their self-regulation skills. In addition, the fluctuations in the reports of self-regulation and ADHD symptoms of children were supposed to be recorded by means of ambulatory assessment in order to justify a dimensional consideration of these constructs.

The attached manuscripts illustrate a self-regulation training: Mental Contrasting with Implementation Intentions (MCII). In this training concept an individually significant goal is considered, participants indulge in the achievement of this goal, obstacles on the way to achieving the goal are mentally contrasted, and an if-then plan for initiating action is drawn up (Oettingen & Gollwitzer, 2015b; *Manuscript 1*). In the presented research, this training was carried out in small groups of students at different ages for an 18-day survey period. During these 18 days, the children's self-regulation and ADHD symptoms were reported via smartphone by the children themselves multiple times a day and every evening online by their parents. The results showed that in both training conditions (the classic MCII training; and a training similar to the MCII without mental contrasting, the positive thinking condition), all children reported higher self-regulation abilities after the end of the survey period (post) than before the 18 days (pre). The training conditions did not differ in their results, comparing the self-regulation

abilities pre to post. The evaluation of the parents' daily ratings of the children´s ADHD symptoms also showed no significant differences between the training conditions over the 18 assessed days (*Manuscript 2*). The daily data of the children over the entire survey period made it possible to map fluctuations in their reports of self-regulation and ADHD symptoms by using the Relative Variability Index (*Manuscript 3*). In addition, it was found that children who reported high self-regulation on average reported fewer ADHD symptoms on average. Again, there was no significant effect of the MCII training, as their reported values of self-regulation and ADHD symptoms did not significantly differ from those of children in the positive thinking condition in their daily self-report.

Although this approach of accompanying the MCII training with daily reminders and the increased dimensional view on self-regulation and ADHD symptoms is innovative, the present results are limited in their generalisability. On the one hand, there are methodological limitations (sample size, reliability of the measuring instruments). On the other hand, a classical control condition as well as an additional assessment perspective would have been desirable.

Nevertheless, the present dissertation can make a contribution to implementing self-regulation training in the everyday school life of children and to bridging associated deficits. These findings could be implemented in the future by means of peer tutoring or by advanced digital learning environments (apps, virtual reality; see Adams et al., 2009). Finally, this dissertation achieved its goal of broadening the perspective for a varying view of ADHD symptoms by illustrating daily fluctuations in the reports of self-regulation and ADHD symptoms. This offers room for future research for more dimensional diagnostics, such as the use of SWAN scales (Swanson et al., 2012) and new individualized intervention approaches.

GERMAN SUMMARY

Selbstregulation ist eine bedeutsame Fähigkeit im Verlauf des Lebens (Mischel et al., 1988). Diese Fähigkeit auf Ziele langfristig hinzustreben, dem Ziel konträr gegenüberstehendes Verhalten zu inhibieren und situationsangemessen zu handeln (Guderjahn et al., 2013; Wirth et al., 2015) ist ein Prädiktor für akademischen Erfolg (Blair, 2002); frühzeitige Selbstregulationsdefizite hingegen können schulische Schwierigkeiten hervorrufen (Blair & Razza, 2007).

Selbstregulationsdefizite liegen insbesondere der Aufmerksamkeitsdefizit- / Hyperaktivitätsstörung (*ADHS*) zugrunde (Rueda et al., 2004), welche sich durch Symptome der Unaufmerksamkeit, Hyperaktivität und Impulsivität kennzeichnet. Neuere Arbeiten die tagtägliche Messungen von Konstrukten mittels portabler Geräte durchführen, Ambulantes Assessment genannt (Bugl et al., 2015), zeigen, dass Kinder und Jugendliche tagtägliche Schwankungen in ihren ADHS-Symptomen aufzeigen (Schmid et al., 2016). Folglich sollten die ADHS und ihre Symptome als ein dimensionales Konstrukt betrachtet werden (Shaw et al., 2011). Um insbesondere die hohen Extreme der Symptomausprägung zu mildern, ist eine Modifikation mithilfe von Trainings zur Verbesserung der Selbstregulation für den täglichen Einsatz angeraten.

Selbstregulationsdefizite können mittels kurzzeitiger Trainings, beispielsweise Mentales Kontrastieren mit Implementation Intentions (*MCII*), positiv verändert werden (Adriaanse et al., 2010; Gawrilow, Schmitt, & Rauch, 2011). Mentales Kontrastieren mit Implementation Intentions ist eine mentale Strategie, die Personen bei der Formulierung ihrer Ziele mittels Mentalem Kontrastieren und - durch einen abschließenden Wenn-Dann-Plan - in der Umsetzung zielführender Verhaltensweisen unterstützt (Gollwitzer, 1999; Oettingen & Gollwitzer, 2010). Die Verringerung von Selbstregulationsdefiziten kann langfristige Verbesserungen in akademischen und sozialen Bereichen nach sich ziehen (Adriaanse et al., 2010; Reid et al., 2005; Tangney et al., 2004).

Aus dem aktuellen Forschungsstand leiteten sich drei Kernziele für die vorliegende Dissertation ab: 1. die empirisch fundierte Recherche von Selbstregulationstrainings für Schulkinder, 2. die Messung

und Verbesserung der Selbstregulation auf täglicher Ebene und 3. die Erfassung von Fluktuationen der Selbstregulation und damit einhergehender -defizite im Alltag.

Im *ersten Manuskript* wurde deshalb review-artig aufgezeigt, dass im Schulkontext hohe (vs. niedrige) Selbstregulationsfähigkeiten eine bessere akademische Leistung und mehr Erfolg beim Lernen vorhersagen (Wirth, Reinelt, Gawrilow & Rauch, 2015, Zimmermann, 1990). Anhand des Rubikon-Modells der Handlungsphasen wurde weiterhin die Rolle der Selbstregulation für die Handlungsinitiierung diskutiert und verdeutlicht, wie Selbstregulation Lernenden helfen kann, Intentionen besser in tatsächliches Handeln umzusetzen (Heckhausen & Gollwitzer, 1987). Dadurch wird die sogenannte Absichts-Verhaltenslücke (*intention-behaviour-gap*, Sheeran & Webb, 2018; Sniehotta, Scholz, & Schwarzer, 2005), also die Lücke zwischen Intentionen und Handlungen überwunden. Außerdem beschrieb das *Manuskript 1* Strategien zur Verbesserung selbstregulierten Handelns, insbesondere das Mentale Kontrastieren von Zukunft und Realität und Wenn-Dann Pläne, sowie die Kombination beider Strategien, MCII oder WOOP genannt (abgeleitet aus den Schritten Wish, Outcome, Obstacle, Plan; Oettingen, 2014; Oettingen & Gollwitzer, 2015). Dazu wurde ein erläuterndes Anwendungsbeispiel im Schulkontext dargestellt. Zusammengefasst führte das *Manuskript 1* empirische Evidenz für die Wirksamkeit von MCII Trainings zur Förderung von Lernen und Erfolg in der Schule an.

Im *zweiten Manuskript* wurde darauf Bezug genommen, dass Kinder mit Defiziten in der Selbstregulation in der Schule oft schlechtere Leistungen erzielen und von Gleichaltrigen weniger akzeptiert werden (Tangney, Baumeister & Boone, 2004). Da die Selbstregulation jedoch trainiert werden kann, indem detaillierte Pläne zur Erreichung bestimmter Ziele erstellt werden, wurde ein entsprechendes Training durchgeführt. Die Selbstregulationsstrategie war MCII/ WOOP (dazu gehört das Nachdenken über Wünsche, Ergebnisse und Hindernisse und das Erstellen eines Plans zur Erreichung eines Ziels; Oettingen, 2014; Oettingen & Gollwitzer, 2015), mittels der darauf abgezielt wurde Selbstregulationsdefizite auf Alltagsebene zu verbessern. Insgesamt wurden 49 schulpflichtige Kinder (M = 11,2 Jahre, SD = 8,4 Monate) nach dem Zufallsprinzip einer von zwei Trainingsbedingungen zugeordnet:

MCII oder positives Denken (welches nicht beinhaltete über Hindernisse auf dem Weg zur Zielerreichung nachzudenken). Die Selbstregulationsfähigkeiten wurden einmal prä vor, und einmal post, nach 18 Tagen von den Kindern, sowie jeden Tag über einen Erhebungszeitraum von 18 Tagen auch von ihren Eltern beurteilt.

In den Ergebnissen zeigten die Kinder in beiden Trainingsbedingungen eine erhöhte selbstberichtete Selbstregulation im Vergleich von vor Beginn (prä) des Trainings zu 18 Tagen später (post). Die Eltern berichteten unterschiedliche Verläufe der ADHS-Symptomeinschätzungen ihrer Kinder in den beiden Trainingsbedingungen während des Erhebungszeitraums, die sich jedoch nicht signifikant voneinander unterschieden.

Im *dritten Manuskript* (noch unveröffentlicht) wurde untersucht, ob die Fluktuationen der Selbstberichte von Schulkindern über Unaufmerksamkeit und Hyperaktivität-Impulsivität sowie ihrer Selbstregulationsfähigkeiten gemessen werden können, ob also Fluktuationen der Selbstberichte über einen längeren Zeitraum auftreten. Darüber hinaus wurde angenommen, dass die Selbstregulation durch ein Selbstregulationstraining modifiziert werden kann. Um dies zu überprüfen, wurde eine ambulante Assessment-Studie durchgeführt, in der 49 Schulkinder (M = 11,2) dreimal täglich (morgens, nachmittags, abends) über einen Zeitraum von 18 Tagen ihre Symptome von Unaufmerksamkeit und Hyperaktivität-Impulsivität und Selbstregulationsfähigkeiten mittels Smartphones bewerteten. Darüber hinaus nahmen die Kinder vor Beginn des beobachteten Erhebungszeitraums an einem Selbstregulationstraining teil. In einer Bedingung wurde ein MCII-Training durchgeführt, während in einer anderen Bedingung ein Training für positives Denken durchgeführt wurde.

Die Ergebnisse veranschaulichten Schwankungen in den Selbstberichten der ADHS-Symptome sowie der Selbstregulationsfähigkeiten der Schulkinder. Es zeigte sich, dass Kinder, die im Durchschnitt über höhere Selbstregulationsfähigkeiten berichteten, im Vergleich zu Kindern, die über geringere Selbstregulationsfähigkeiten berichteten, im Durchschnitt weniger ADHS-Symptome aufwiesen. Es gab keinen Unterschied in den Schwankungen der Angaben der ADHS-Symptome und

Selbstregulationsfähigkeiten zwischen Kindern der MCII-Bedingung und Kindern der Bedingung des positiven Denkens.

Die vorliegende Dissertation kann einen Beitrag dazu leisten, ein Selbstregulationstraining im Schulalltag von Kindern zu implementieren. Dieses Training könnte in Zukunft durch Peer-Tutoring oder durch fortgeschrittene digitale Lernumgebungen (vgl. Adams et al., 2009) erweitert werden. Die Dissertation erreichte ihr Ziel, die Perspektive für eine dimensionale Betrachtung der ADHS-Symptome zu erweitern, indem sie die täglichen Fluktuationen der Berichte von Kindern zu ihren Selbstregulationsfähigkeiten und ihren ADHS-Symptomen veranschaulichte. Dies bietet zukünftiger Forschung Ansätze eine verstärkt dimensionale Erfassung von Selbstregulation und ADHS-Symptomen sowie individualisierte Trainingsansätze zu implementieren.

Stichwörter: Selbstregulation, Mentales Kontrastieren mit Implementation Intentions (MCII / WOOP), Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS), Fluktuationen, Ambulantes Assessement, Wenn-Dann Plan

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STATEMENTS ON PERSONAL CONTRIBUTIONS

Manuscript 1: Self-regulation interventions for school children

Schwarz, U., Sevincer, A. T., & Gawrilow, C. (2019). Wenn-Dann Pläne und mentale Kontrastierung als Strategien zur Förderung der Selbstregulation. [If-then plans and mental contrasting as strategies to promote self-regulation]. In H. Gaspard, U. Trautwein, & M. Hasselhorn (Eds.), Jahrbuch Tests und Trends 2019: Motivation und Volition im Schulkontext. Göttingen, Germany: Hogrefe.

The manuscript, reviewing self regulation trainings in the school context, was particularly drafted by U.S. . C.G. and A.T.S. provided critical revisions. A.T.S. and U.S. revised the manuscript. All authors approved the final version of the paper.

Manuscript 2: Measuring and improving self-regulation on a day-to-day-level

Schwarz, U., Gawrilow, C. (2019). Measuring and compensating for deficits of self-regulation in school children via ambulatory assessment. Psychology in Russia: State of the Art, 12(4), 8-22. DOI: 10.11621/pir.2019.0401

The reported study was part of the AttentionGO-Project (Adaptive dynamics of cognitive and behavioral variability in children with symptoms of attention deficit hyperactivity disorder), which was designed by C.G. and colleagues from the DIPF research centre in Frankfurt. All authors were involved in planning, and preparing the used training conditions. U.S. was particularly responsible for collecting data, data analyses, and drafting the manuscript. C.G. supported U.S. in drafting the theoretical part of the

manuscript. C.G. provided critical revisions and discussed the comments of external peer-reviewers. U.S. revised the manuscript. Both authors approved the final version of the paper.

***Manuscript 3*: Variation of self-regulation deficits and options for daily interventions**

Schwarz, U., Reuter, M., Kühnhausen, J., Haas, P., Gawrilow, C. (2020). Variability of ADHD Symptoms and Self-Regulation Skills in Schoolchildren and the Influence of Self-Regulation Trainings. *Manuscript in preparation*

The reported study was part of the AttentionGO-Project (Adaptive dynamics of cognitive and behavioral variability in children with symptoms of attention deficit hyperactivity disorder), which was designed by C.G. and colleagues from the DIPF research centre in Frankfurt. C.G. and U.S. developed the idea of the used self-regulation training in schoolchildren´s daily life. M.R. and U.S. were involved in planning, and preparing the used smartphone feature. M.R. and U.S. were particularly responsible for collecting data. J.K. was particularly responsible for data analyses. U.S. was particularly responsible for drafting the manuscript. C.G., J.K., and P.H. provided critical revisions. U.S. revised the manuscript. All authors approved the final unpublished version of the paper.

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APPENDIX

A. Manuscript 1: Self-regulation interventions for school children

Schwarz, U., Sevincer, A. T., & Gawrilow, C. (2019). Wenn-Dann Pläne und mentale Kontrastierung als Strategien zur Förderung der Selbstregulation. [If-then plans and mental contrasting as strategies to promote self-regulation.] In H. Gaspard, U. Trautwein, & M. Hasselhorn (Eds.), Jahrbuch Tests und Trends 2019: Motivation und Volition im Schulkontext. Göttingen, Germany: Hogrefe.

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Wenn-Dann-Pläne und Mentale Kontrastierung als Strategien zur Förderung der Selbstregulation

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Zusammenfassung

Selbstregulation beinhaltet die zielführende und situationsangemessene Steuerung von Gedanken, Emotionen und Handlungen. Im Schulkontext sagen hohe (vs. niedrige) Selbstregulationsfähigkeiten eine bessere akademische Leistung und mehr Erfolg beim Lernen vorher. Anhand des Rubikon-Modells der Handlungsphasen diskutieren wir die Rolle der Selbstregulation für die Handlungsinitiierung. Dabei verdeutlichen wir, wie Selbstregulation Lernenden helfen kann, Intentionen besser in tatsächliches Handeln umzusetzen und somit die Lücke zwischen Intentionen und Handlungen zu überwinden. Außerdem beschreiben wir Strategien zur Verbesserung selbstregulierten Handelns, insbesondere das mentale Kontrastieren von Zukunft und Realität und Wenn-Dann-Pläne, sowie die Kombination beider Strategien, WOOP genannt (abgeleitet aus den Schritten Wish, Outcome, Obstacle, Plan). Dabei präsentieren wir empirische Evidenz für die Wirksamkeit der Strategien zur Förderung von Lernen und Erfolg in der Schule. Schließlich stellen wir ein Anwendungsbeispiel für Wenn-Dann-Pläne im Schulkontext vor.

I. Selbstregulation- eine Definition

Selbstregulation wird verstanden als die Fähigkeit Gedanken, Emotionen und Aktivitäten anzupassen, um ein Ziel zu realisieren (Kanfer, Reinecker, & Schmelzer, 2005). Ein Ziel ist eine mentale Repräsentation eines erwünschten Ereignisses, das eine Person zu erreichen versucht (Heckhausen & Heckhausen, 2010). Selbstregulation ist insbesondere dann wichtig für die Zielerreichung, wenn sich Widerstände oder Schwierigkeiten auf dem Weg zum Ziel auftun (Oettingen & Gollwitzer, 2015). Die Idee, dass die Überwindung von Hindernissen eine zentrale Funktion selbstregulierten Verhaltens ist, formulierte William James bereits im 19. Jahrhundert in seiner bis heute weitgehend akzeptierten Definition von Selbstregulation: „We understand selfregulation as helping people deal with resistance

and conflict, such as with obstacles and temptations standing in the way of attaining desired future outcomes.“ (James, 1890, S. 5). Der Umgang mit Hindernissen, Ablenkungen und Versuchungen sowie das selbstregulierte Lernen sind insbesondere in Bildungskontexten Schwerpunkte aktueller wissenschaftlicher Diskussionen (s.a. Einführungskapitel).

II. Selbstregulation in Bildungskontexten

Selbstregulation ist relevant für viele Lebensbereiche – denn ob eine Person ihr selbstgesetztes Ziel (z.B. sich gesünder ernähren, weniger streiten oder befördert werden) erreicht oder nicht, hängt in hohem Maße davon ab, ob sie ihre Gedanken, Gefühle und Handlungen kontrollieren kann (Guderjahn, Gold, Stadler & Gawrilow, 2013). Besonders im akademischen Bereich ist eine gute Selbstregulation zentral für erfolgreiche Zielverfolgung. So sind hohe Selbstregulationsfähigkeiten neben hoher Intelligenz ein wesentlicher Prädiktor für gute (vs. schlechte) Schulleistungen (Wirth, Reinelt, Gawrilow & Rauch, 2015; Zimmerman, 1990; Meta-Analyse von Sitzmann & Ely, 2011). In ihrer Studie erfassten Duckworth und Seligman (2005) die Selbstregulationsfähigkeiten von Schulkindern sowohl durch Selbstberichte als auch durch Lehrkraft- und Elternberichte und fanden, dass eine hohe Selbstregulation gute Schulleistung, gemessen durch Noten, Anwesenheit und Anstrengung bei Hausaufgaben, sogar besser vorhersagte als Intelligenz. Eine bessere Selbstregulation geht außerdem einher mit effizienterem Arbeitsgedächtnis und gesteigerter Aufmerksamkeit (McClelland & Cameron, 2012) und Jugendliche mit gut (vs. schlecht) ausgeprägter Selbstregulation arbeiten kontinuierlicher und ausdauernder und bewältigen Misserfolge besser (Bertrams & Dickhäuser, 2009).

Selbstregulation spielt eine Rolle, wenn Personen einen unmittelbaren Impuls zugunsten eines langfristigen Ziels unterdrücken müssen (Hartig & Kanfer, 1973). In Studien zum Belohnungsaufschub (delay of gratification) konnten Vorschulkinder entweder einen Marshmallow sofort bekommen (eine unmittelbare, kleine Belohnung), oder sie warteten bis der Versuchsleiter, der den Raum verlassen hatte, wieder zurückkehrte und bekamen dann zwei Marshmallows (eine verzögerte, größere Belohnung). Jene Kinder, die es schafften, dem Impuls den ersten Marshmallow zu essen, zu widerstehen und auf den

zweiten Marshmallow zu warten, wiesen als Jugendliche bessere Schulnoten und bessere kognitive sowie soziale Kompetenzen auf (berichtet von den Eltern), zum Beispiel konnten sie sich besser konzentrieren und fanden schneller Freunde (Mischel, 2014; Mischel, Shoda & Rodriguez, 1989).

Mischel und Kollegen vermuteten, dass der Zusammenhang zwischen einer guten Belohnungsverzögerung im Vorschulalter und hohen Kompetenzen im Jugendalter dadurch erklärt wird, dass jene Kinder, welche sich gut regulieren können, spontan geeignete Selbstregulationsstrategien anwenden (z.B. lenken sie ihre Aufmerksamkeit von Versuchungen ab). Allerdings scheinen die Ergebnisse zum Teil auf andere Einflüsse zurückzuführen zu sein als die spontane Anwendung von Selbstregulationsstrategien, z.B. auf Unterschiede in kognitiver Leistungsfähigkeit und in den Verhältnissen, in denen die Kinder aufgewachsen sind (frühkindliche Umgebung; Watts, Duncan & Quan, 2018). Außerdem ist bisher unklar, ob der Zusammenhang zwischen Belohnungsverzögerung und späteren Kompetenzen auch in Stichproben aus heterogenen Bildungs- und Einkommensschichten und aus anderen Kulturen auftritt (der Marshmallow-Test untersuchte Kinder hochgebildeter weißer Eltern aus den USA; Henrich, Heine & Norenzayan, 2010; Lamm et al., 2017).

Beim Belohnungsaufschub geht es darum, eine automatische Handlung (den ersten Marshmallow zu essen) *nicht* auszuführen. Selbstregulation ist jedoch auch wichtig, um nicht-automatische, zielfördernde Handlungen zu planen und auszuführen, beispielsweise Lernmaterialien durchzugehen um sich auf eine Prüfung vorzubereiten.

III Vom „Wollen“ zum „Tun“ – das Rubikon Modell der Handlungsphasen

Der Prozess der Handlungsausführung ist im Rubikon-Modell der Handlungsphasen beschrieben (Heckhausen & Gollwitzer, 1987; siehe Einführungskapitel S. XX). Das Rubikon-Modell erklärt sowohl, wie sich Personen Handlungsziele setzen, als auch, wie sie ihre Ziele verfolgen und erreichen können (Gollwitzer, 1990). Insgesamt beschreibt das Modell vier aufeinanderfolgenden Phasen der Handlungsausführung: Abwägen (prädezisional), Planen (präaktional), Handeln (aktional) und Bewerten (postaktional). Die zwei äußeren Phasen des Modells, Abwägen und Bewerten, sind motivationale

Komponenten. Bei ihnen geht es um die Zielsetzung oder Auswahl eines Ziels (goal setting). Die mittleren Phasen, Planen und Handeln, sind volitionale Komponenten. Bei ihnen geht es um die Zielverfolgung oder dem Streben nach dem Ziel (goal striving; Faude-Koivisto & Gollwitzer, 2009).

In der ersten Phase, dem Abwägen, stehen Wünsche im Fokus. Wünsche sind Gedanken, die unmittelbare oder in der Ferne liegende Sehnsüchte betreffen wie positive Fantasien über die Zukunft (Oettingen & Mayer, 2002). Menschen besitzen meistens mehr Wünsche als Zeit und Gelegenheit vorhanden sind, diese zu verwirklichen. Daher müssen sie abwägen, welche Wünsche wichtig sind und auch realisiert werden können (Gollwitzer, 1990). Schätzen Personen einen Wunsch als wichtig und realisierbar ein, dann entscheiden sie sich eventuell diesen Wunsch zu verfolgen (Atkinson, 1957; Kruglanski et al., 2015). Aus einem bloßen Wunsch wird nun ein verbindliches Ziel. Dieser Prozess wird auch als Überschreiten des Rubikons bezeichnet. Er kennzeichnet den Übergang von der ersten Phase der Handlungsausführung, dem Abwägen (prädezisionale Phase), zur zweiten Phase, dem Planen (präaktionale Phase). Beim Planen überlegen Personen, wie sie ihr Ziel am besten erreichen können. Ob die Planung der Zielverfolgung zu einer zielrelevanten Handlung führt, hängt zum einen von der Stärke der Zielintention ab, zum anderen davon, wie günstig die Gelegenheit ist, zielrelevantes Handeln umzusetzen (Gollwitzer, 1990). In der dritten Phase, dem Handeln (aktionale Phase), müssen Personen ihre zielführenden Handlungen dauerhaft aufrechterhalten und gegen andere, konkurrierende Ziele abschirmen bis das Ziel erreicht worden ist. Bei der letzten Phase, dem Bewerten (postaktionale Phase), beurteilen Personen schließlich die Ergebnisse ihrer Handlungen. Zum Beispiel reflektieren sie, ob sie das Ziel zufriedenstellend erreicht haben, ob noch weitere Handlungen nötig sind oder aus welchen Gründen sie das Ziel gegebenenfalls nicht realisiert haben (Achtziger & Gollwitzer, 2010). Im wirklichen Leben ist diese Abfolge der Phasen allerdings die Ausnahme. Personen verfolgen meist mehrere Ziele gleichzeitig, wechseln zwischen den einzelnen Phasen hin und her und lassen auch Phasen aus. So führen sie automatische, gewohnheitsmäßige Handlungen (z.B. Zähne putzen) typischerweise ohne vorheriges Planen aus.

Insbesondere während der ersten drei Phasen, dem Abwägen, dem Planen und dem Handeln, können Schwierigkeiten auftreten. Beim Abwägen können Personen sich zu viele Ziele auf einmal setzen und so ihre begrenzten Ressourcen (z.B. Zeit, Anstrengung, Geld) bei der Verfolgung zu vieler Ziele aufbrauchen (Neal, Ballard & Vancouver, 2017). Oder sie unterschätzen beim Planen die Ressourcen, die sie brauchen, um ein Ziel erfolgreich zu erreichen (Planungsfehler; Buehler & Griffin, 2018). Auch der Übergang vom Planen zum Handeln kann Probleme bereiten. So setzen Personen nur ungefähr die Hälfte ihrer Intentionen in tatsächliche Handlungen um (Sheeran & Webb, 2018; Meta-Analyse von Webb & Sheeran, 2006). Die Lücke zwischen dem Wollen, also der *Absicht* eine zielführende Handlung auszuführen, und dem Tun, also der tatsächlichen *Umsetzung* der beabsichtigten Handlung, wird auch als Intentions-Verhaltens Lücke bezeichnet (intention-behavior gap; Sheeran & Webb, 2018; Sniehotta, Scholz, & Schwarzer, 2005). Dieser Unterschied zwischen Wollen und Tun wird oft offenkundig, wenn Menschen daran scheitern, ihre Neujahrsvorsätze einzuhalten.

Personen können diese Schwierigkeiten besser meistern um langfristig auf Ziele hinzuarbeiten indem sie effektive Selbstregulationsstrategien einsetzen (Lazoski & Hulleman, 2016). Zwei einfach anzuwendende, zeit-und kostenökonomische Selbstregulations-Strategien, deren Wirksamkeit in angewandten Bildungskontexten belegt wurde, sind das mentale Kontrastieren von Zukunft und Realität (mental contrasting; Oettingen, 2014) und Wenn-Dann-Pläne (implementation intentions; Gollwitzer, 1999). Mentales Kontrastieren hilft beim Abwägen (prädezisionale Phase) sich an machbare Ziele zu binden und von nicht-machbaren Zielen Abstand zu nehmen. Außerdem hilft mentales Kontrastieren die Umsetzung der machbaren Ziele besser zu planen (präaktionale Phase) und durchzuführen (aktionale Phase). Wenn-Dann-Pläne helfen, starke Zielintentionen besser in zielführende Handlungen umzusetzen (präaktionale Phase und aktionale Phase).

IV Mentales Kontrastieren

Wie im Rubikon-Modell dargestellt, beginnt der Prozess der Handlungsausführung mit einem Wunsch, einer Fantasie über eine mögliche Zukunft. Am Beispiel der Neujahrsvorsätze ist deutlich

geworden, dass sich Menschen oftmals in Fantasien und Träumereien über ihre Wünsche verlieren, ohne Schwierigkeiten in der Realität oder Wege zur Zielerreichung zu bedenken (Sevincer, Schlier & Oettingen, 2015; Sevincer, Mehl & Oettingen, 2017). Entgegen der verbreiteten Auffassung, dass positives Denken über die Zukunft hilft, Ziele besser zu erreichen, legt Forschung nahe, dass das bloße Imaginieren einer idealisierten Zukunft (Fantasieren ohne mögliche Hindernisse zu bedenken) zu weniger, statt mehr, Erfolg bei der Zielverfolgung führt (Oettingen, 2014; Sevincer, Wagner, Kalvelage & Oettingen, 2014). Dies ist der Fall, weil sich Personen beim Fantasieren oft vorstellen, sie hätten das Ziel bereits erreicht. Daher bereiten sie sich nicht auf mögliche Schwierigkeiten vor und entspannen sich, anstatt Anstrengung zu mobilisieren, um das Ziel auch tatsächlich zu verfolgen (Kappes & Oettingen, 2011).

Wie beim Fantasieren stellen sich Personen beim mentalen Kontrastieren zunächst eine erwünschte Zukunft vor (z.B. eine gute Note zu bekommen). Anders als beim bloßen Fantasieren, denken sie direkt danach jedoch über mögliche Hindernisse nach, die ihrer erwünschten Zukunft im Weg stehen (z.B. nicht zu wissen, wie sie mit dem Lernen anfangen sollen). Dieser Kontrast, einerseits das Nachdenken über die angestrebte Zukunft und andererseits die Besinnung auf die gegenwärtigen Hindernisse, führt dazu, dass Personen Anstrengung mobilisieren und handeln, um die Hindernisse zu bewältigen (Oettingen, Mayer, Sevincer, Stephens, Pak & Hagenah, 2009; Sevincer, Busatta & Oettingen, 2014). Das ist jedoch nur der Fall, wenn die Personen annehmen, die Hindernisse auch bewältigen zu können, das heißt, wenn sie hohe Erfolgserwartungen (Bandura, 1997) haben. Haben sie niedrige Erfolgserwartungen, dann lassen sie von ihrem Ziel ab und können ihre Anstrengung, Energie und Zeit somit für andere, erfolgversprechendere Ziele verwenden.

Kurzum, mentale Kontrastierung hilft zum einen, Ziele besser zu priorisieren (d.h. Ressourcen in machbare Ziele zu investieren statt sie für nicht-machbare Ziele zu verschwenden) und zum anderen, die machbaren Ziele effektiver zu verfolgen. Diese Effekte der mentalen Kontrastierung auf die Priorisierung und Verfolgung von Zielen konnten bisher in vielen Studien in unterschiedlichen

Kontexten belegt werden (Zusammenfassung von Oettingen & Sevincer, 2018). In Bildungskontexten führte experimentell induzierte mentale Kontrastierung (vs. mentale Kontroll-Übungen) bei Schulkindern mit hohen Erfolgserwartungen zu mehr Anstrengung, gemessen durch Selbst- und Lehrkrafturteil und besserer Leistung beim Lernen einer Fremdsprache (Oettingen, Hönig & Gollwitzer, 2000). In einem anderen Experiment führte mentale Kontrastierung bei jungen, erwachsenen Teilnehmern eines Computerkurses mit hohen Erfolgserwartungen zu mehr Anstrengung und einer besseren Leistung beim Bewältigen des Kursmaterials (Oettingen, Pak & Schnetter, 2001). Schließlich lernten Schulkinder mehr Vokabeln nach einer Intervention mit mentalem Kontrastieren, im Vergleich zu einer Kontrollbedingung, in welcher sie ausschließlich über die erwünschte Zukunft fantasieren sollten (Gollwitzer, Oettingen, Kirby, Duckworth & Mayer, 2011).

Zwei großangelegte, kulturübergreifende Studien mit zusammen fast 18.000 Probanden aus 86 Ländern (Kizilcec & Cohen, 2017) induzierten mentale Kontrastierung (zusammen mit Wenn-Dann-Plänen) als online Kurzintervention (vs. eine Kontrollaktivität) im Rahmen von offenen Massen-Online-Kursen (MOOC) im Bereich Erwachsenenbildung. Bei Probanden aus individualistischen Kulturen führte die Intervention zu einer Verbesserung der Abschlussquoten von 15-32% im Vergleich zur Kontrollbedingung. Der Effekt trat jedoch nicht bei Probanden aus kollektivistischen Kulturen (z.B. Indien) auf. Möglicherweise konnten sich die Angehörigen kollektivistischer Kulturen nicht so sehr mit dem individualistischen Ziel, einen Kurs zur persönlichen Verbesserung abzuschließen, identifizieren. Dies mag die Wirksamkeit der Intervention eingeschränkt haben. Inhaltsanalysen der genannten Hindernisse ergaben außerdem, dass die mentale Kontrastierung besonders dann effektiv war, wenn die Hindernisse kontrollierbare Alltagshindernisse waren (z.B. alltägliche Verpflichtungen nicht zu vernachlässigen), nicht jedoch wenn es unkontrollierbare, praktische Hindernisse waren (z.B. keinen regelmäßigen Internetzugang zu haben).

Eine weitere selbstregulative Strategie, die zur verbesserten Zielerreichung führt und für die empirische Evidenz vorliegt, sind Wenn-Dann-Pläne (Gollwitzer, 1999).

V „The power of planning“ - Wenn-Dann-Pläne zur Förderung der Selbstregulation

Um eine Handlung auszuführen, ist es oft hilfreich einen konkreten Handlungsplan aufzustellen (Gollwitzer, 2015). Wenn-Dann-Pläne sind einfache Handlungspläne, die folgende Form haben: "*Wenn* Situation Y auftritt, *dann* werde ich das Verhalten Z ausführen" (Gollwitzer, 1999). Im Wenn-Teil des Plans wird eine spezifische Situation formuliert, in der eine zielführende Handlung ausgeführt werden soll – diese Handlung wird im Dann-Teil des Plans spezifiziert. Diese Struktur unterscheidet Wenn-Dann-Pläne von bloßen Zielintentionen, welche die Form: „Ich möchte X erreichen“ haben.

Durch die Verknüpfung einer Situation mit einer bestimmten Verhaltensweise erwirbt die Situation einen Auslösecharakter: Sobald die Situation eintritt, wird das Verhalten automatisch ausgelöst. Für die Auslösung genügt die vorhergehende mentale Repräsentation der Situation, also das Nachdenken über das wann, wo und wie des beabsichtigten Verhaltens (Stalbovs, Scheiter & Gerjets, 2015). Es ist keine neuerliche Entscheidung und keine bewusste Steuerung notwendig, um das so kognitiv „angewöhnte“ Verhalten in Gang zu setzen (Aarts & Dijksterhuis, 2000). Wenn-Dann-Pläne lenken die Aufmerksamkeit auf situative Hinweisreize, setzen die Hebel zur Handlungsausführung, stärken mentale Verbindungen zwischen einer Situation und einem Verhalten und etablieren so Gewohnheiten, die im entsprechenden Kontext automatisch ausgeführt werden, auch ohne das Hinweisreize präsent sind (Cohen & Gollwitzer, 2008).

Durch diese Mechanismen erleichtern Wenn-Dann-Pläne das Umsetzen von Absichten in die Tat und führen zu mehr Erfolg bei der Zielerreichung (Gawrilow, 2005; Oettingen, Hönig & Gollwitzer, 2000). Eine Meta-Analyse mit 94 Studien evaluierte die Wirksamkeit von Wenn-Dann-Plänen für das Erreichen von Zielen und fand eine mittlere bis große Effektstärke (d = .65; Gollwitzer & Sheeran, 2006). In Bildungskontexten fördern Wenn-Dann-Pläne die Selbstregulation insbesondere in folgenden drei Bereichen, die als individuelle Voraussetzungen für erfolgreiches Lernen beschrieben werden (INVO-Modell, Hasselhorn & Gold, 2017):

Selektive Aufmerksamkeit und Arbeitsgedächtnis. Kindern gelang es, Ablenkungen die ihnen in Form von kurzen Filmen gezeigt wurden, schneller auszublenden, wenn sie einen durch die Studienmitarbeitenden vorgegebenen Wenn-Dann-Plan befolgten („*Wenn* es eine Ablenkung gibt, *dann* ignoriere ich sie.“) als wenn sie nur eine Zielintention verinnerlicht hatten („Ich ignoriere die Ablenkung.“). Dieser Unterschied war besonders stark, wenn die Ablenkungen attraktiv waren (Wieber, von Suchodoletz, Heikamp, Trommsdorff & Gollwitzer, 2011). Außerdem sind Wenn-Dann-Pläne besonders effektiv für Menschen, die Defizite mit der Aufmerksamkeitskontrolle haben (Webb & Sheeran, 2008): Vorformulierte Wenn-Dann-Pläne halfen Kindern und Jugendlichen mit Aufmerksamkeitsdefizit-/Hyperaktivitätsstörung (ADHS) ihr Verhalten besser zu regulieren und zwar insbesondere ungewolltes Verhalten zu *inhibieren* (z.B. während des Lösens von Mathematikaufgaben, auf Ablenkungen nicht zu reagieren; Gawrilow, Gollwitzer & Oettingen, 2011a; Gawrilow, Gollwitzer & Oettingen, 2011b).

Strategien und metakognitive Regulation. Vorgegebene Wenn-Dann-Pläne („*Wenn* ich einen Abschnitt zu Ende gelesen habe, *dann* verknüpfe ich diesen mit abgebildeten Inhalten.“) halfen Lernenden (multimediale) Lerninhalte tiefgreifender zu verarbeiten (Stalbovs et al., 2015). Außerdem konnten vorformulierte Wenn-Dann-Pläne Studierende vor Self-handicapping bewahren (Thürmer, McCrea & Gollwitzer, 2013). Self-handicapping ist eine maladaptive Strategie, welche Leistung und Motivation in Prüfungssituationen beeinträchtigt. Dabei rechnen Personen sich selbst im Vorfeld einer Prüfungssituation eine Schwäche an (z.B. übermüdet sein, weil man am Abend vorher lange aus war), um bei eventuellem Misserfolg eine Ausrede parat zu haben und so ihren Selbstwert zu schützen.

Volition und lernbegleitende Emotionen. Eigenständig formulierte Wenn-Dann-Pläne erhöhten die Anwesenheit im Unterricht und führten so zu besseren Abschlussnoten, insbesondere bei Lernenden mit wenig gewissenhafter Persönlichkeit (Webb, Christian & Armitage, 2007). Außerdem zeigten Studierende, die sich mit einer Lernsoftware auf eine Klausur vorbereiteten, eine bessere Klausurleistung wenn sie aufgefordert wurden, zum Lernen mit der Software idiosynkratische Wenn-

Dann-Pläne selbstständig zu bilden („*Wenn* ich mich am Computer von Facebook, Youtube oder Sonstigem ablenken lasse, *dann* werde ich vermeiden, am Computer zu lernen.“) als wenn sie keine Aufforderung bekamen. Interessanterweise führten Wenn-Dann-Pläne nicht zu einer längeren Lernzeit mit der Software. Möglicherweise führten die gebildeten Wenn-Dann-Pläne zu gesteigerten Lernaktivitäten außerhalb der Software (z.B. mit Lehrbüchern) und verbesserten so die Klausurleistung (Janson & Dickhäuser, 2018).

Beim eigenständigen Aufstellen aber auch beim Vorgeben von Wenn-Dann-Plänen gilt es generell zu beachten, dass die Ziele die mittels der Pläne erreicht werden sollen, herausfordernd, persönlich, selbstgesetzt, realistisch, konkret und evaluierbar sind (Gollwitzer & Brandstätter, 1997).

VI WOOP als Selbstregulationsstrategie

Wenn-Dann-Pläne sind vor allem dann erfolgreich, wenn Personen eine hohe Zielbindung, also Entschlossenheit oder Interesse ein Ziel zu erreichen, aufweisen (Guderjahn, Gold, Stadler & Gawrilow, 2013; Locke, Latham & Erez, 1988). Da mentales Kontrastieren bei hohen Erfolgserwartungen zu einer verstärkten Zielbindung führt, wurden die beiden Strategien zu der Gesamtstrategie WOOP kombiniert. Das Akronym WOOP bildet die vier Schritte der Gesamtstrategie im englischen Original ab: **W**ish, **O**utcome, **O**bstacle, **P**lan (Oettingen, 2014). Bei WOOP werden zunächst eigene Wünsche und Ziele, aber auch Dinge, die an der Erreichung dieser Ziele hindern, reflektiert. Anschließend unterstützt das Erstellen von Wenn-Dann-Plänen das Erreichen, trotz der Hindernisse. Zusammengefasst beinhaltet WOOP folgende vier Schritte: Wish – einen Wunsch/ein Ziel festlegen; Outcome – sich das beste Ergebnis vorstellen; Obstacle – das eigene Hindernis bei der Wunscherfüllung identifizieren; Plan – einen Plan machen, um das Ziel dennoch zu erreichen. Der Einsatz der WOOP-Strategie half Schulkindern aus ökonomisch benachteiligten Haushalten ihre Leistung und ihr Betragen in der Schule zu verbessern und ihre Fehlzeiten zu verringern (*Duckworth, Kirby, Gollwitzer & Oettingen, 2013)*, Studierenden, ihre Zeit zum Lernen effizienter einzuteilen und ihren akademischen Alltag besser zu bewältigen (Oettingen, Kappes, Guttenberg & Gollwitzer, 2015) und Medizinstudenten, sich besser auf

Prüfungen vorzubereiten (Saddawi-Konefka, Schumacher, Baker, Charnin & Gollwitzer, 2016). Bei Kindern mit ADHS-Symptomen verbesserte ein WOOP-Training die Selbstregulation, gemessen durch Einschätzung der Eltern direkt vor und zwei Wochen nach dem Training und zwar insbesondere bei denjenigen Kindern, denen die Eltern höhere ADHS-Symptome bescheinigt hatten (Gawrilow, Morgenroth, Schultz, Oettingen & Gollwitzer, 2013). Insgesamt legen die Ergebnisse nahe, WOOP als Selbstregulationsstrategie zur erfolgreichen Zielerreichung Schulkindern direkt im Schulkontext zu vermitteln (Duckworth, Grant, Loew, Oettingen & Gollwitzer, 2011).

VII Ein Anwendungsbeispiel für den Schulkontext

Wenn-Dann-Pläne und mentales Kontrastieren, beziehungsweise deren Kombination WOOP, führten zu langfristigen Veränderungen in akademischen aber auch in anderen Kontexten, z.B. in Form besserer Mathematiknoten, besserem Umgang mit zwischenmenschlichen Konflikten, einer gelungeneren work-life-Balance und dem erhöhten Einsatz von Copingstrategien bei Stress (Oettingen & Gollwitzer, 2009). Wenn-Dann Pläne sind besonders effektiv, wenn sie mit einer begleitenden Unterstützung, z.B. einem Tutor oder einer Lehrkraft, erstellt wurden (Hagger & Luszczynska, 2014). Deswegen schildern wir im Folgenden eine Anwendungshilfe für Wenn-Dann-Pläne in einer Lehrkraft-Lernende-Interaktion (Gawrilow, Guderjahn & Gold, 2013).

Mit der Anwendungshilfe möchten wir Tutoren und Lehrkräfte dabei unterstützen, die wissenschaftlichen Erkenntnisse über die Wirksamkeit von Wenn-Dann-Plänen zu nutzen, um die selbstregulativen Kompetenzen von Lernenden gezielt zu fördern. Die Inhalte der Wenn-Dann-Pläne sollten aus diesem Grund den Bedürfnissen und Fertigkeiten der Lernenden entsprechen. Dazu gehört, dass in einem ersten Schritt ein Ziel festgelegt wird, das für die Lernenden sinnvoll und erreichbar ist. Dabei kann eine Zielhierarchie helfen, einen Überblick zu bekommen. Meist gibt es mehrere Ziele, die als relevant erachtet werden. Zunächst sollten diese Ziele dahingehend, wie dringlich oder wichtig sie sind, sortiert werden. Wichtig ist, dass die Lernenden verstanden haben, was mit einem „Ziel“ genau gemeint ist. Das heißt zum Beispiel, dass die Lernenden dazu angeregt werden, über die erwünschte

Zukunft (möglicherweise in einem vorgegebenen Zeitrahmen, wie „bis zum Schuljahresende“ oder „bis in 2 Wochen“) nachzudenken und diese zu formulieren.

Nun bekommen die Lernenden genügend Zeit, über mögliche Zielsetzungen nachzudenken. Dies kann erfordern, dass mehrere Besprechungen zu dieser Thematik erfolgen, da die persönliche Identifikation mit einem Ziel eine Vorrausetzung für die erfolgreiche Zielerreichung ist. Hierbei kann die Lehrkraft die Lernenden an Interessen und Langzeitziele (z.B. an Berufswünsche) erinnern. Sobald die Lernenden entschieden haben, welches konkrete persönliche Ziel sie verfolgen möchten, wird dieses Ziel verbindlich. Ein mögliches Ziel könnte beispielsweise sein: „Ich will bis Schuljahresende eine gute Englisch-Note haben.“

Lehrkraft und Lernende überlegen dann, was momentan die persönlichen Hindernisse der einzelnen Lernenden sind – warum gelingt es ihm oder ihr beispielsweise nicht, die Vokabeln regelmäßig zu lernen und/ oder sich auf angekündigte Tests ausreichend vorzubereiten? Ist das Hindernis identifiziert, überlegen sich die Lernenden was sie tun könnten, um das Ziel dennoch zu erreichen. Es wird unterschiedliche Dinge geben, um dem Ziel näher zu kommen. Nicht alle Verhaltensweisen sind vermutlich gleich gut für alle Personen geeignet und einige werden im Allgemeinen auch zielführender sein als andere. Dies ist einerseits von den Ressourcen abhängig, welche die Lernenden mitbringen und andererseits auch vom Kontext und Umfeld (z.B. Schule, zu Hause, weitere Lernumgebungen), in dem sie sich bewegen. Ressourcen könnten in diesem Falle persönliche, soziale und auch materielle Ressourcen sein, wie kognitive Fähigkeiten, Unterstützung durch die Eltern oder Freunde, Erinnerungshilfen oder auch das Vorhandensein von Software oder Büchern zum Vokabellernen.

Nachdem einige Handlungsmöglichkeiten auf dem Tisch liegen, muss nun überlegt werden, in welchen Situationen die zielführenden Handlungen überhaupt durchgeführt werden können. Beispielsweise können die Lernenden sich vornehmen, Karteikärtchen mit Vokabeln zu schreiben. Unter Situationen, in denen die Vokabel-Kärtchen geschrieben werden könnten, nennen sie „täglich nach dem Mittagessen“, „direkt nach den Hausaufgaben“ und „jeden Samstag nach dem Frühstück“. In einem

Wenn-Dann-Plan wird nun genau festgelegt, wie, wo und wann jeder oder jede Lernende handeln will, um dem formulierten Ziel näher zu kommen.

Angenommen ein oder eine Lernende hat sich dafür entschieden, Vokabelkärtchen zu schreiben, um dem Ziel einer besseren Englisch-Note, näher zu kommen. Er oder sie kann sich vorstellen, dies am besten jeden Schultag direkt nach dem Mittagessen zu erledigen. Gemeinsam mit der Lehrkraft legt der oder die Lernende genau fest wie viele Vokabeln in der angepeilten Zeit realistisch zu bewältigen sind. Das Schulkind formuliert nun den Wenn-Dann-Plan: „Immer wenn ich mit dem Mittagessen fertig bin, dann schreibe ich sofort fünf Vokabeln auf Kärtchen und lerne sie."

Bei der Erstellung des Wenn-Dann-Plans ist es wichtig, darauf zu achten, dass sich die Lernenden mit dem Wenn-Dann-Plan identifizieren. Diese Identifikation erreicht man besonders, indem die Lernenden den Wenn-Dann-Plan eigenständig aufstellen. Nachdem Lehrkraft und Lernende zusammen den Wenn-Dann-Plan erneut auf Realisierbarkeit überprüft haben, schreiben die Lernenden ihre Wenn-Dann-Pläne auf. Damit der Wenn-Dann-Plan gefestigt wird, schreiben die Lernenden den Plan am besten mehrmals nieder. Als Gedächtnisstütze kann es helfen, den Wenn-Dann-Plan auf einen Aufkleber zu schreiben. Dieser kann dann an eine Stelle geklebt werden, welche der oder die Lernende häufig sieht (z.B. auf den Tisch, in das Mäppchen etc.). Hilfreich kann es außerdem sein, wenn die Lernenden ihren Wenn-Dann-Plan verbalisieren, indem sie sich diesen mehrmals laut vorsprechen, in der Intonation zunehmend leiser werden und anschließend still für sich wiederholen (Meichenbaum, 1979; Meichenbaum & Goodman, 1971).

Der letzte Schritt – die Durchführung des Plans – obliegt den Lernenden. Nach einiger Zeit werden sie dann selbstständig einen neuen Plan entwickeln und durchführen können. Letztlich zeigen die Pläne aber ihre volle Wirksamkeit im Alltag der Lernenden, wenn es diesen gelingt, Wenn-Dann-Pläne als Ressource für selbstkontrolliertes Verhalten zu entdecken und zu nutzen.

VIII Schlussfolgerung

Eine gute Selbstregulation ist essentiell für Lernen und Leistung in der Schule. Auf Grundlage des Rubikon-Modells der Handlungsphasen stellten wir dar, wie einfach anzuwendende, zeit- und kosteneffektive, Selbstregulationsstrategien Schülern und Schülerinnen nachhaltig helfen können, sich effektiv Ziele zu setzen, diese zu verfolgen und erfolgreich zu erreichen. Mentale Kontrastierung von Zukunft und Realität hilft, Ziele besser zu priorisieren (prädezisionale Phase), sich stärker an machbare Ziele zu binden (präaktionale Phase) und die Ziele energischer zu verfolgen (aktionale Phase). Wenn-Dann-Pläne helfen, starke Zielintentionen in tatsächliche Handlungen umzusetzen (aktionale Phase). Zusammen können diese Strategien im Rahmen von Interventionen eingesetzt werden, um Schülerinnen und Schülern ihren Schulalltag zu erleichtern und Lernen und Lehren an der Schule zu fördern.

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B. Manuscript 2: Measuring and improving self-regulation on a day-to-day-level

Schwarz, U., Gawrilow, C. (2019). Measuring and compensating for deficits of self-regulation in school children via ambulatory assessment. Psychology in Russia: State of the Art, 12(4), 8-22. DOI: 10.11621/pir.2019.0401

Measuring and compensating for deficits of self-regulation in school children via ambulatory assessment

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Background. Children with deficits in self-regulation often perform worse in school and are less accepted by peers. However, self-regulation can be trained and developed by making detailed plans to achieve specific goals. One such strategy is WOOP (it includes thinking about *w*ishes, *o*utcomes, and *o*bstacles, and creating a *p*lan to achieve a goal), known in the literature as MCII, or if-then plans.

Objective. Noting the encouraging results of the WOOP method, we aimed to evaluate whether WOOP has the potential to ameliorate self-regulation deficits on a day-to-day-level .

Design. In total, 49 school-aged children (*M* = 11.2 years, *SD* = 8.4 months) were randomly assigned to one of two groups: 1) Condition 1, underwent a WOOP intervention; and 2) Condition 2, performed the intervention without contrasting obstacles and planning. The self-regulation abilities were assessed each day over an 18-day survey period by both the children themselves and their parents. ADHD symptom-severity was assessed as a proxy for self-regulation; specifically, we used six items from the Conners 3 scale and the German adaptation of the Brief Self-Control Scale.

Results. The children in both conditions demonstrated increased self-regulation, according to their self-reports at the beginning and end of the survey period. The parents reported different progressions of the two conditions over the survey period, but these did not differ significantly. In addition, both conditions are helpful to improve children's self-regulation in daily life.

Conclusion. Further research on implementing practicable interventions in schoolchildren´s daily life is highly recommended.

Keywords: self-regulation; Mental Contrasting with Implementation Intentions (MCII); WOOP; ambulatory assessment

Introduction

Self-regulation is an important skill that has cognitive, behavioral, and emotional influence on a person´s wellbeing and achievement (Kanfer, Reinecker, & Schmelzer, 2006). It helps individuals work toward long-term goals, regulate emotions according to the situation, plan the implementation and processing of tasks, and control impulses (Guderjahn, Gold, Stadler, & Gawrilow, 2013; Hartig & Kanfer, 1973; Sitzmann & Ely, 2011). Self-regulation is particularly necessary in the learning of competences and the acquisition of knowledge, since self-regulation in learning is associated with increased participation and attention in the classroom (Zimmerman, 1990). Not surprisingly, there is a negative correlation between self-regulation deficits and academic success, as well as with social inclusion (Tangney, Baumeister, & Boone, 2004; Wirth, Reinelt, Gawrilow, & Rauch, 2015). Given the central role of self-regulation in a variety of life-outcomes, any intervention which increases someone's self-regulation would be valuable for society.

One of the core components of self-regulation is the ability to "help people deal with resistance and conflict, such as with obstacles and temptations standing in the way of attaining desired future outcomes" (James, 1890, p.5, according to Oettingen & Gollwitzer, 2015). One prominent instance of such self-regulation is the ability to forgo a small, immediate reward in order to obtain a larger, later reward. Mischel, Shoda, and Rodriguez (1989) studied children's self-regulation by first placing a marshmallow on the table in front of them. The children were then told that they could either eat the marshmallow

immediately, or refrain from eating the marshmallow and, after an interval, receive a second marshmallow. Thus, the children had to deploy self-regulation in order to wait for the larger, later reward. Mischel, Shoda, and Rodriguez found that not all children were able to control themselves and wait for the greater reward. Interestingly, when these same children were tested again upon reaching adulthood, it was found that those who were able to exert self-regulation in childhood (*i.e.,* wait for two marshmallows) were more successful, satisfied, and socially integrated as adults than those who did not (Mischel, 2014). Together, these findings suggest that the degree of self-regulation developed as a child has far-reaching implications for life-outcomes.

Attention deficit/hyperactivity disorder (ADHD), which is characterized by inattention, hyperactivity, and impulsivity, is one clinically relevant example of a deficit of self-regulation maintained over the lifetime of most of those affected (American Psychiatric Association, 2013). Children with ADHD symptoms are more likely to forget their homework, tend to perform worse in the classroom, and are more likely to drop out of school than children without ADHD symptoms (Langberg et al., 2010; Wirth et al., 2015). A common observation about these children is that they lack self-regulation, and this, in turn, often leads to strained student-teacher relationships (Millenet, Hohmann, Poustka, Petermann, & Banaschewski, 2013; Willcutt et al., 2012). For example, a child with symptoms of ADHD interrupts others or walks around the classroom and talks, even though quiet work is ongoing. In summary, deficits in self-regulation are disadvantageous, since self-regulation is essential for the long-term pursuit of a desired outcome, and consequently for the achievement of one's goals (Churchill & Jessop, 2010; Tangney, Baumeister, & Boone, 2004).

Self-regulation assists the achievement of goals by helping to bridge the gap between intention and behavior (see "The Intention-behavior Gap" Sheeran & Webb, 2016). The phases for moving from intention to action, and thus closer to goal achievement and self-regulated action, are described in the action phase model (also known as the Rubicon model of action phases) (Gollwitzer, 1990; Gollwitzer, 2012; Heckhausen & Gollwitzer, 1987). The action phase model illustrates the objective and aspiration,

the path to action, and the plans that support self-regulated action (Achtziger & Gollwitzer, 2010). Mental contrasting can help the individual more easily overcome the gap between wanting and doing.

Mental contrasting is a cognitive strategy investigated by Oettingen (2014); it is divided into two contrasting steps. In the first, the positive future associated with reaching the target is joyously anticipated, thus creating the expectation of success, and motivation to reach the target (Oettingen & Mayer, 2002). For example, a student might have the idea that he wants to be more attentive in order to get better grades so that his parents will be proud of him, he will feel more comfortable overall, or he will be rewarded with a family trip if he graduates with good grades. In the second step of mental contrasting, a person thinks about obstacles in the here and now that stand in the way of this positive future, so that there is a discrepancy between the actual and the desired state, and a need to overcome the obstacles (Oettingen, Mayer, Thorpe, Janetzke, & Lorenz, 2005). Out of this discrepancy arises the desire to change the current circumstances in order to come closer to the desired future (Oettingen, 2012). For example, this means that the student might realize that he is distracted by little things that happen outside his window. Now he could make a plan to act against this obstacle.

A plan helps to execute the action leading to the goal more consistently in the action phase, since the setting of the goal intention alone is not sufficient. In his research Gollwitzer (1999) is concerned with how these plans must be formulated in order to facilitate the achievement of objectives and the initiation of action. The most promising option seems to be to draw up an if-then plan, in addition to setting a goal. This takes the form of "IF situation X, THEN I show behavior Y" (Gollwitzer & Brandstätter, 1997). In the if-then plan, the situation in which a goal-oriented behavior is to be adopted is explicitly addressed, so that a person recognizes this situation quickly as soon as he or she is in it, and can immediately implement the corresponding action (Gollwitzer, Fujita, & Oettingen, 2004). It follows from this that a person does not have to search again for alternative actions – or for the energy to perform an action in the concrete situation – but can "stick to the plan" in a resource-conserving way (Schweiger Gallo & Gollwitzer, 2007). The more frequently a person does this, the sooner the if-then plan, which links a situation to an action,

no longer needs to be conscious; it becomes a habit (Parks-Stamm, Gollwitzer, & Oettingen, 2007). For the previously mentioned inattentive student, this would mean that he would consciously follow the plan: "*If* I look distractedly out the window, *then* I think that learning is important and look at the teacher."

If-then plans have now been studied in a wide variety of applications and have been found to help people keep healthy diets and increased their physical activity (Achtziger, Gollwitzer, & Sheeran, 2008; Gollwitzer & Sheeran, 2006). Children with ADHD symptoms who show self-regulation deficits can use this strategy to act more appropriately and in a targeted manner (Gawrilow & Gollwitzer, 2008), and improve their learning behavior (Gawrilow, Gollwitzer, & Oettingen, 2011; Guderjahn et al., 2013)

In combination with mental contrasting, if-then plans are researched as Mental Contrasting with Implementation Intentions (MCII), also called by the acronym WOOP [1] (Oettingen, 2014). WOOP combines the steps of both strategies by having the individual reflect on their ***w***ishes, ***o***utcomes, and ***o***bstacles, and finally formulate an if-then ***p***lan (Schweiger Gallo, Bieleke, Alonso, Gollwitzer, & Oettingen, 2018). Using WOOP, participants show more self-discipline (Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011) and children with ADHD symptoms have more self-regulating abilities (Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013). Students improve their performance so that, compared to the control group, which was taught only positive thinking as a strategy on the way to achieving goals, 5th graders who practiced WOOP improved their report card grades, their class attendance, and their behavior (Duckworth, Kirby, Gollwitzer, & Oettingen, 2013).

In summary, there are indications that self-regulation deficits of children can be reduced by means of a WOOP intervention in the school context. For this reason, our study investigated whether WOOP has the potential to compensate for self-regulatory deficits associated with ADHD symptoms in everyday life. The two questions posed by the study were: 1) whether children who pursue their goals using WOOP (Condition 1) improve significantly more in their reported self-regulation from the first (pre) to the second

[1] which will be used below for this purpose. For further information see: *woopmylife.org.*

(post) time of measurement than children in Condition 2, who only thought positively and did not mentally contrast (H 1); and 2) whether children who use WOOP (Condition 1) to pursue their goals show fewer fluctuations in their ADHD symptoms as reported daily by their parents than children in Condition 2 (H 2).

Methods

The data collection was carried out by means of an ambulatory assessment design with measurement bursts (Sliwinski, 2008). Ambulatory assessment includes the recording of variables using portable devices directly in the everyday life of the study participants (Fahrenberg, Myrtek, Pawlik, & Perrez, 2007).

Participants

All experimental procedures were considered and approved by the ethics committee of the German Society for Psychology and the Baden-Wuerttemberg Ministry of Culture. The participants (N = 49, 30 female) were children (mean age 11.2, SD ± 8.4 months) who, at the time of the study, were in 5th grade at seven schools in the German state of Baden-Wuerttemberg. Participants were recruited through a multi-step process, beginning with a nationwide call for volunteers via flyers and parent-teacher meetings. Participation in the experiment was incentivized by offering participating families a family excursion to an attraction of their choice (worth 40 euros) and writing materials. The assignment of the schools to the two conditions was randomized with the result that WOOP/ Condition 1 had 31 participants (M = 10.8 years, SD = 0.72, 18 girls), and Condition 2 had 18 participants (M = 11.2 years, SD = 0.37; 12 girls).

Materials

In order to explain to the children all the necessary steps for creating an if-then plan, posters of the dimension 841 x 1189 mm were used for both the WOOP/ Condition 1 (experimental) and Condition 2 (control group). On the posters, all the steps necessary for creating the plan were listed with graphic support, which represented the route to the if-then plan as a hilly bicycle route.

Measures

Paper questionnaires were used in both conditions for the children to assess their own self-regulation both before and after the survey period. The questionnaire contained five items from the German version of the Self-Control Scale (SCS-K-D; Bertrams & Dickhäuser, 2009) to measure self-regulation ability. The items were: "Sometimes I do things I regret later;" "I'm lazy;" "I'm good at pulling myself together;" "I'm good at resisting temptation;" and "I wish I had more self-discipline." The children were to indicate on a five-point-Likert scale to what extent these statements on self-regulation applied to them: "1 = completely inaccurate" to "5 = fits precisely." Inverted items of the scale were not reversed, but all the items that were not actually inverted were, so that consistently high values corresponded to a high degree of self-regulation. The total reliability was .47 (Cronbach's Alpha). The reliability of the individual items was between .28 and .52 (Cronbach's Alpha). A pilot study showed an increased ability to depict symptom fluctuations for the items used.

In addition, one parent of each participating child rated six items on their child's ADHD symptoms daily, between 8 p.m. and midnight, during the 18-day measurement period. They used items from the Conners 3 scale (mean retest correlation at .79, from .75 - .83; Lidzba, Christiansen, & Drechsler, 2013), which were reformulated for a daily survey; *e.g.,* "*Today* my child had trouble organizing his business." (scale level "1 = not at all correct" to "6 = very accurate").

Procedure

The test procedure was identical for both conditions, except for the use of the respective materials. At the time of first contact at the school (intervention and pre-measurement), each investigator was assigned a group of a maximum of five children. The implementation leaders picked up the participating children in their classes and went with them to separate workrooms, which were provided by the school. The intervention took place there: as an introduction, the experimenter addressed the importance of having personal desires and goals, and of the children learning a strategy that helps them achieve their desires and goals. The information poster was then used to discuss the steps relevant to achieving their goals, and the children were asked at each step to think about how to take the step themselves. The children were then

asked to work independently on the workbook they had been given out beforehand. The trainer was still available for answering comprehension questions, and the standardized explanations in the manual were used to answer comprehension questions on individual steps.

The children were then given smartphones, which recorded additional data, which were not part of the present study (*e.g.,* affect, media consumption), three times a day during the entire 18-day period, and reminded the children of their goals (*e.g.,* "Learn more Spanish vocabulary for the next test.") on the 9th and 18th day. Afterwards the children were again verbally asked to think about their goal in the next days. During the second contact time at the school (post-measurement), after the 18 days, the participating children were picked up by implementation leaders during class time, and accompanied to a separate classroom where they completed the paper-questionnaire again in small groups (one implementation teacher took a maximum of five children, with a total group size from 3 to 19, depending on the school).

Condition 1 - WOOP

On the poster of the experimental group, Step 1 was to formulate a goal relevant to the school respectivelly what the child wants to accomplish in school. The starting point comprised two questions: 1) "What is my wish for the school?" and 2) "Which goal do I want to reach in the next nine days?" Step 2 dealt with the desired state after the achievement of the goal and included the question: "What is the most beautiful thing when the goal has been achieved?" Step 3, a personal obstacle or difficulty that stands in the way of the child achieving the goal, was identified using two questions: "What prevents me from reaching my goal?" and "What stands in my way?" Step 4 involved formulating an alternative course of action with the question, "What can I do if the obstacle occurs?" This step was shown graphically on the poster as an alternative cycle path. Finally, the poster contained the if-then plan: "If *the obstacle* occurs, then I *make/think behavior Y.*" (see *Figure 1*).

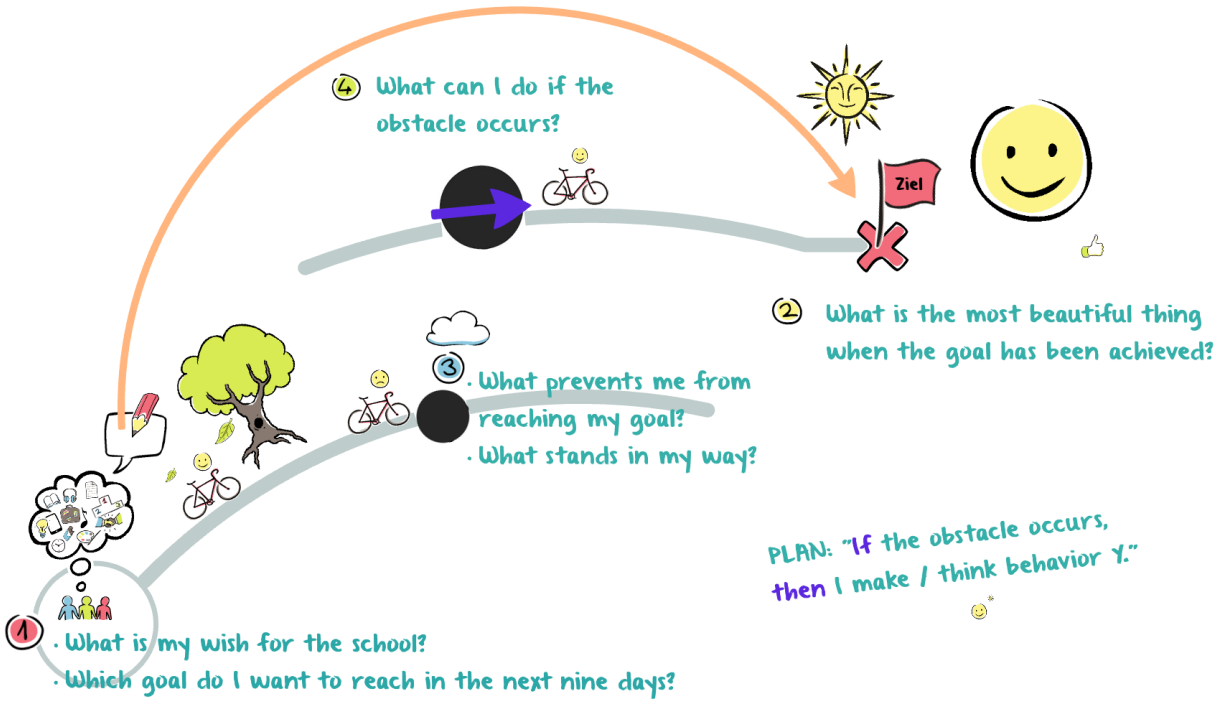

Figure 1. Poster WOOP/ Condition 1 (Used with permission from Prezi Inc.)

Condition 2 – without contrasting

In order to keep the number of work steps the same in both groups, the poster of the control group also included four steps. The first and second steps were identical to that of the WOOP/Condition 1 (experimental group). The third step identified the feeling that arises after the achievement of the goal and included the question, "How do I feel when I have reached my goal?" The fourth step dealt with the condition after the achievement of the goal with the question, "What do I experience when I have achieved my goal?" Finally, the poster included the if-then plan, which is related to the feelings regarding the achievement of the goal: "If *my goal* is achieved, then the *most beautiful thing* happens *and I feel X*" (see *Figure 2*).

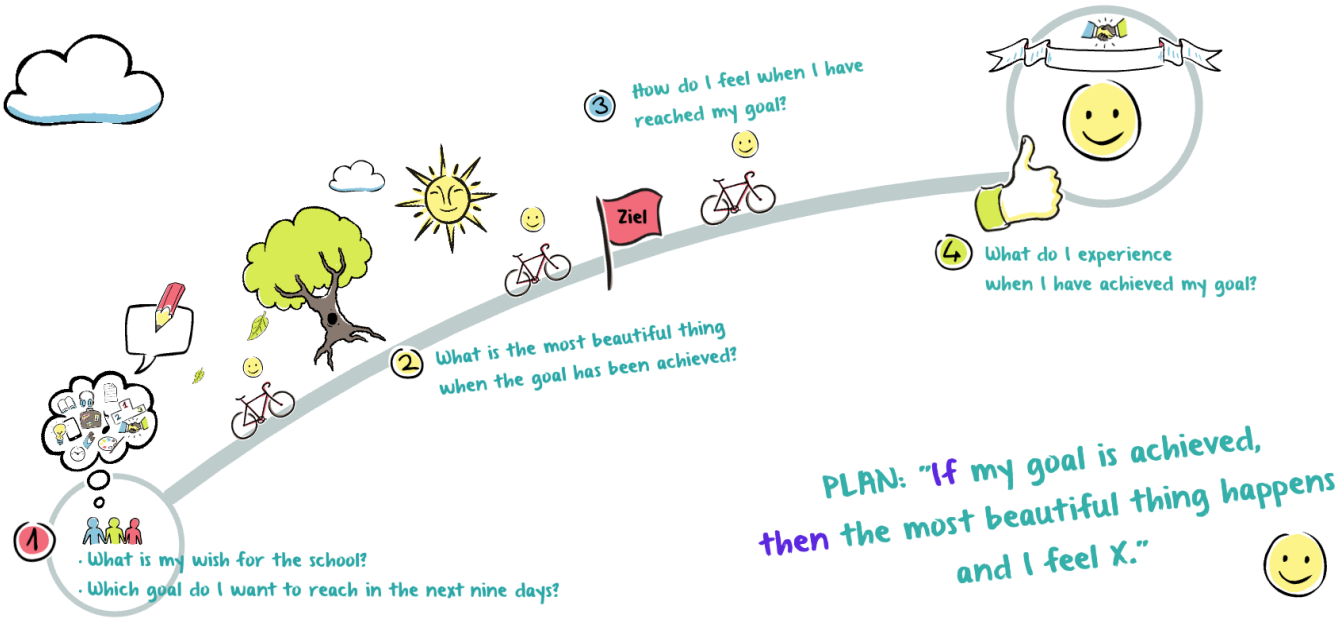

Figure 2. Poster Condition 2, without contrasting (Used with permission from Prezi Inc.)

In order to practice the creation of the if-then plan, workbooks (size of 148 x 210 mm) in which all four steps to the if-then plan shown on the poster were listed again, one after the other, were issued to both groups. Under each step there was space for the independent written processing of the step. On the last pages of the workbooks, the children were asked to create an if-then plan ("Now I'm building my own if-then plan, according to the template below!"): in the workbook of the WOOP/ experimental group, with respect to overcoming an obstacle, and in the control group, with respect to the feelings that arise when they have reached their destination. Thus, the children could fill these in individually, step by step, with their own answers.

Results

The preparation of the data for analysis was carried out using *IBM SPSS Statistics 24* statistical software: If participants did not provide any information, so no answers to the variables to be evaluated, their data was completely removed from the data set and thus excluded from analysis. In total, there were two exclusions for the parent surveys and 14 exclusions of children's self-report, due to their not answering

any survey questions at one of the two measurement dates, or because of absence due to illness on the school survey date. The parents' data on the ADHD symptoms of their children were added together so that 36 represented the highest attainable total score. The actual data analysis was then performed with the analysis tool *RStudio* (version 3.3.0, 2016 - 05 - 03); the significance level was set at $p \leqslant .05$. *Table 1* contains all amounts reported below.

First of all, we should report that no significant interaction between sex and time of measurement was found ($F\ (1, 32) = 1.29$, $p = .264$). A significant main effect of the time of measurement was found ($F\ (1, 32) = 5.83$, $p = .022$). Both sexes reported significantly higher self-control at the time of the second measurement than at the first time of measurement.

The first hypothesis (H 1) – that self-regulation would be improved by the WOOP/ Condition 1 compared to Condition 2 – was analyzed with an ANOVA, comparing the interaction of condition and point in time. No significant interaction was found between WOOP/Condition 1 ($n = 16$) and Condition 2 ($n = 18$) for the self-regulation reported by the children over time ($F(1, 32) = 1.33$, $p = .258$). These results indicate that the conditions did not differ in their effect over time. However a significant effect of the time of measurement was found ($F(1,32) = 5.84$, $p = .022$), as depicted in *Figure 3* (*Condition 1*: pre $M = 3.36$, $SD = 0.73$; post $M = 3.50$, $SD = 0.78$; *Condition 2* : pre $M = 3.44$, $SD = 0.79$, post $M = 3.84$, $SD = 0.67$). In both conditions, the children reported significantly higher self-regulation at the second time of measurement than at the first measurement time.

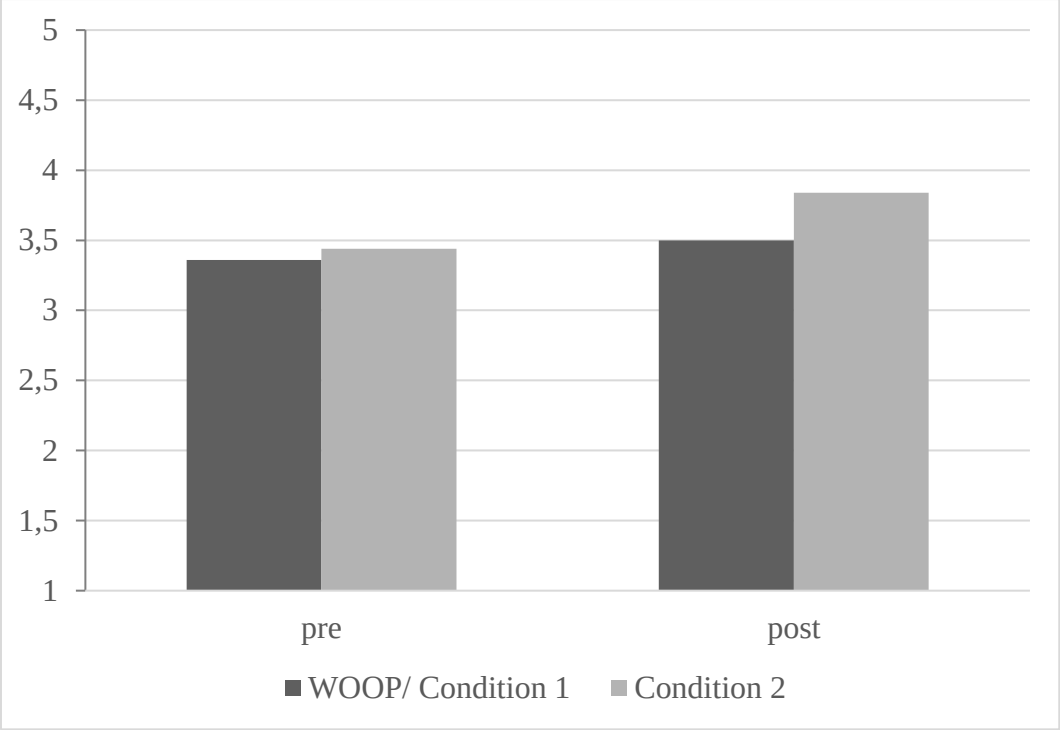

Figure 3. The average self-regulation of children as reported by themselves with the German version of the Self-Control Scale (Bertrams & Dickhäuser, 2009) (y-axis, scale level 1-5), separated for the WOOP/ Condition 1 and Condition 2 at the measurement times pre and post survey (x-axis).

The t-test results on the assumption of hypothesis 2 (H 2) with regard to the ADHD symptoms of the children reported by the parents (n = 47), showed no significant difference for the mean values of the symptoms of all persons in both conditions over the 18 survey days, between WOOP/ Condition 1 and Condition 2 (t = 1.98, df = 39, p = .054; *M Condition 1* = 11.59, *M Condition 2* = 13.62). These results indicate that the conditions did not differ in their averages over time. This is shown in *Figure 4*. There was no major effect for the two conditions over time (*Condition 1* $F(1, 27) = .616$, $p = .439$, *Condition 2* $F(1, 16) = .12$, $p = .745$), indicating that the parents reported on average no changes in their children's self-regulation on a daily basis, independent of conditions. However, the parents' reports on the ADHD symptoms of their children differed depending on which group their child belonged to (see also *Figure 4*). Participants in WOOP/ Condition 1 showed a less severe symptoms than participants in Condition 2. After checking analysis for the standard deviations, we found that the scatter of values of the ADHD symptoms

of all rated children of Condition 1 comparing to Condition 2 over the 18 survey days, were not significant (t = 1.96, df = 34, p = .057, *M Condition 1* = 3.25, *M Condition 2* = 4.42). This suggests that on a person-to-person level, the parents' evaluations of the children of WOOP/ Condition 1, compared to Condition 2, did not differ significantly over the 18 survey days.

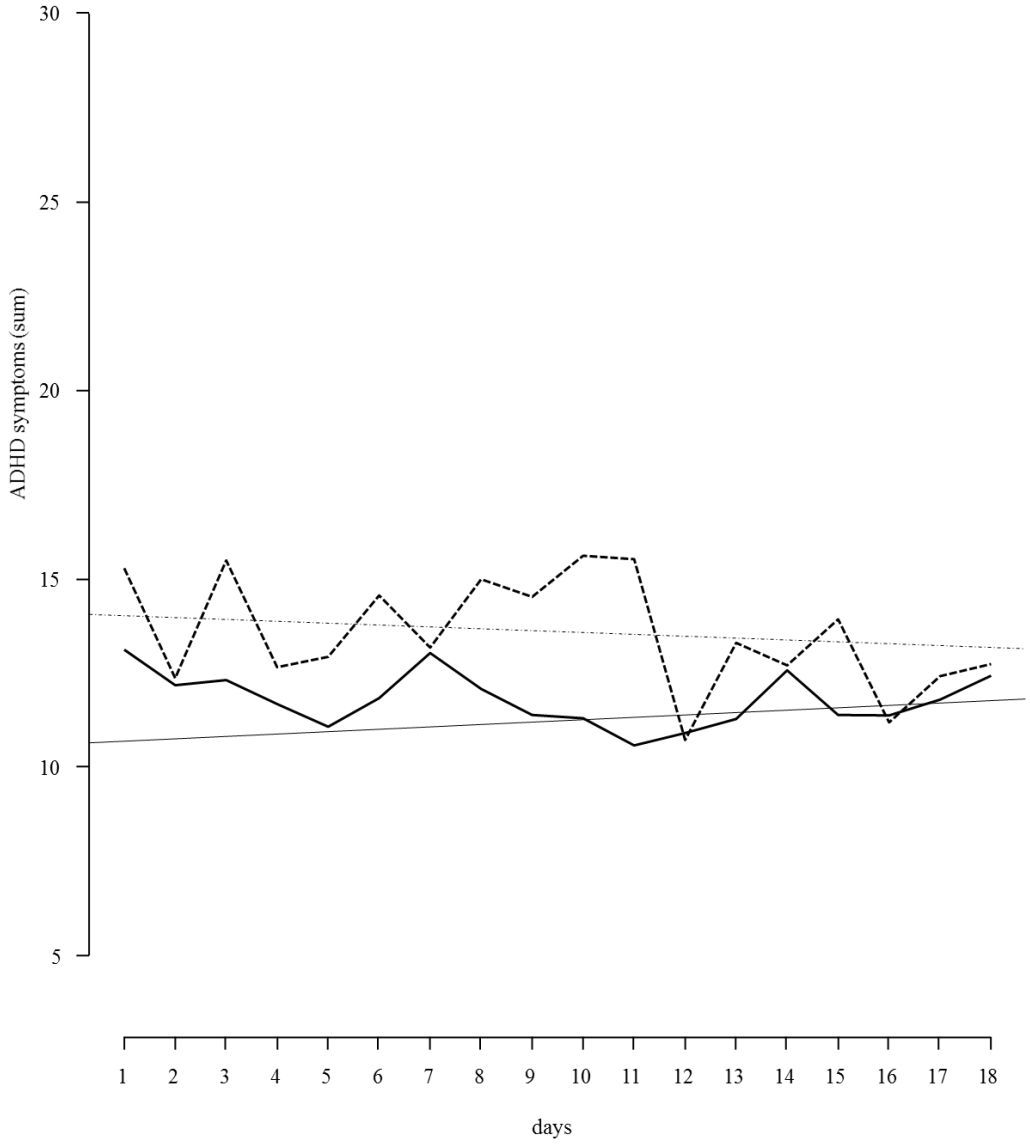

Figure 4. The children's ADHD symptoms reported by the parents with Conners 3 (Lidzba, Christiansen, & Drechsler, 2013) over the 18 survey days, between WOOP/Condition 1 (continuous line) and Condition 2 (dashed line), and their respective mean value changes.

The participating children all showed much joy during the intervention and seemed to enjoy the opportunity to talk about their wishes for achievement in school in the future. We controlled the

commitment (meaning the motivation which is light by the goal) with the individually defined goals (*e.g.*, "I would be disappointed not to achieve my goal."), for which there was no difference between the groups ($F(1, 32) = .30$, $p = .588$). This result suggests that the conditions did not differ in their respective motivation; they are comparable and therefore the commitment could not be an explanation of the measured changes in childrens´s selfregulation

variable	condition	*n*	measurement	
			pre	post
			M (SD)	*M (SD)*
self regulation (self report)	WOOP/ Condition 1	16	3.36 (0.73)	3.5 (0.78)
	Condition 2	18	3.44 (0.79)	3.84 (0.67)
			over all 18 days	
ADHD symptoms (parents report)	WOOP/ Condition 1	18	11.59 (3.25)	
	Condition 2	29	13.62 (4.42)	

Table 1. Average self-regulation of children and the associated standard deviations, separated by groups and measurement times

Discussion

This study aimed to determine whether a WOOP intervention could improve the children's self-regulation. To address this question directly, we trained children and recorded their own reports of their self-

regulation, before and after an 18-day survey period, as well as getting daily information from their parents assessing this ability. We found that children benefited from the WOOP intervention over time. Testing hypothesis 1 (H1) did not produce a significant result since WOOP/ Condition 1 did not lead to a significant improvement compared to Condition 2, which included no mental contrasting (one essential WOOP step). However, our study showed that children in both conditions improved significantly over time, as shown in pre-post comparison of their self-reported self-regulation.

This result is not in line with those of Saddawi-Konefka et al. (2017), who measured goal aspiration and learning towards a goal by means of WOOP, in comparison to a pure goal intention, and reported finding advantages for using WOOP. One possible explanation for the discrepancy between our results and those of Saddawi-Konefka et al, relates to the findings by Sevincer, Mehl, and Oettingen (2017) that participants often automatically mentally contrast, regardless of whether they were instructed to or not. This could be an explanation for the insignificant difference between the conditions, because mental contrasting is essential for training self-regulation (Oettingen, 2014).

In the present study we did not examine whether individuals were able to mentally contrast themselves, so it could be that the children in Condition 2 also contrasted mentally and improved their self-regulation, and thus showed no difference compared to the children in Condition 1. We suspect that the child-friendly materials which, in contrast to Saddawi-Konefka et al. (2017), not only differentiated between goal intention and WOOP, but resembled each other in two of the four steps, could have caused this (Condition 2 did not contrast in step 3, and in step 4, the if-then plan didn't link the situation with the goal-oriented action, but only with a positive feeling toward the outcome).

A positive mood is positively related to the performance of an executive function task (which includes self-regulation, *e.g.*, Gagne & Nwadinobi, 2018) if the motivation for the task processing is high (Phillips, Bull, Adams, & Fraser, 2002). So it is also conceivable that Condition 2 had a positive effect on the mood of the participating children, due to the increased positive connotation of the third training step,

whereby the children's own abilities were assessed better than they would be if they had had a neutral mind set.

Another aim of this study was to determine whether the children's daily ADHD symptom scores would be less variable in WOOP/Condition 1 as compared to Condition 2 (H 2). Lower variability in ADHD symptoms might indicate that the WOOP at least engages the processes underlying self-regulation. We found no difference in the mean variability of ADHD symptom severity between the WOOP and non-WOOP conditions. However, the data show that consideration of a change in ADHD symptoms through self-regulation training may still be appropriate, as the curves are similar to the theoretically expected pattern of amplitude attenuation and reduction of daily variations in ADHD symptoms over time. ADHD symptoms vary in adolescents who are asked about them once a day (Schmid, Stadler, Dirk, Fiege, & Gawrilow, 2016). Compensating for these symptoms by training children's underlying self-regulation abilities still seems to be conceivable and corresponds to considerations put forward by Barkley (2005), according to whom "ADHD represents a developmental disorder of behavioral inhibition that interferes with self-regulation and the organization of behavior torwards the future." (p. 3).

Our study was limited in several ways which may affect its interpretation. We figured that the daily confrontation with questions about one's own child may have sensitized the parents to the skills in question and distorted their judgments. Furthermore, the small sample size, especially when divided into the two conditions, means that the results shown cannot be generalized, since they lack statistical power.

A second limitation is the number of testing items used, since they were presumably too small, and therefore could not adequately represent the variables, which can also be deduced from the quality criteria. Besides, the construct of self-regulation is best represented by the overall scale (Lindner, Nagy, & Retelsdorf, 2015). The idea behind our choice of test items was guided by the desire to keep the duration of the questioning as short as possible, especially since it was being done on a daily basis. In addition, a pilot study showed an increased ability to depict symptom fluctuations for the items used. For analyzing the results of the first hypothesis, we used the self-reported values of children on single items of the

German version of the Self-Control Scale (Bertrams & Dickhäuser, 2009). This could potentially limit the validity of the results, because the children might overrate their abilities (see Hughes, Turkstra, & Wulfeck, 2009), and for this reason we recommend parents as raters of their children's self regulation.

Conclusion

In summary, the present study aimed to evaluate whether WOOP has the potential to reduce self-regulation deficits on a day-to-day-level. We found improvement in self-reported self-regulation for the children over time, but a decrease of self-regulation deficits measured as reduction in ADHD symptoms reported daily by the parents, was not observed. Although we did not get the expected result showing an advantage of the WOOP condition compared to Condition 2, the study showed that self-regulatory interventions can basically help school children formulate and better achieve their school goals, and improve their self-assessed self-regulation. Although this relationship should be investigated again using bigger samples, the results of the present study do indicate that children can benefit from a WOOP intervention. With regard to the usefulness of measuring variables on a daily basis and of using portable devices, the advantages of ambulatory assessments, as Bugl, Schmid, and Gawrilow (2015) recommend, should be emphasized once again: they offer methodological and practical advantages by directly capturing aspects of the participants' interest in the natural environment and mapping processes.

These results contribute to the idea of applying self-regulation strategies on a daily basis, and thus to school psychological practice dealing with children with self-regulation deficits. For the future, we recommend carrying out specific interventions to promote self-regulation in the school setting. This can be done directly by the teaching staff after a training course, or under guidance, and can be integrated into lessons due to the short duration of the intervention (Gawrilow, Guderjahn, & Gold, 2013).

Acknowledgements

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and teachers were surveyed. The present study refers only to the second measurement period, which took place in spring 2018, as the training reported here was carried out for the first time in the course of the project (the first measurement period had not included a training session). We thank all the families and schools for their participation. In addition, we thank Marie Diekmann, Anne Eppinger-Ruiz de Zarate, Lea Igney, Rieke Köpke, Stephanie Natter, Nicolas Oberhauser, Anna Lena Schultz, Caroline Schurz, Jana Welkerling, and Swea Ziegler for their help with collecting, entering, and preparing the data of the second measurement period. We especially thank our team colleagues Merle Reuter and Jan Kühnhausen.

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C. Manuscript 3: Variation of self-regulation deficits and options for daily interventions

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Variability of ADHD Symptoms and Self-Regulation Skills in Schoolchildren and the Influence of Self-Regulation Trainings

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Abstract

Children with ADHD symptoms (i.e. inattention, hyperactivity- impulsivity), experience difficulties due to self-regulation deficits. The present study investigated whether the fluctuations of schoolchildren´s self-reports of inattention and hyperactivity-impulsivity as well as self-regulation skills could be measured, thus, whether fluctuations of the self-reports over a longer period of time occur. Furthermore, self-regulation skills can be modified by using self-regulation training. To achieve this, we used a Mental Contrasting with Implementation Intentions (*MCII* or *WOOP*; e.g. Oettingen, 2004) training.

An ambulatory assessment study has been carried out in which 49 schoolchildren (M_{age} = 11.2) rated their symptoms of inattention and hyperactivity-impulsivity and self-regulation skills three times a day (morning, afternoon, evening) over a period of 18 days on smartphones. In addition, the children took part in a self-regulation training session before the start of the observed survey period. In one condition a MCII training was conducted; while in another condition a positive thinking training was implemented.

Daily fluctuations of self-reported ADHD symptoms well as of self-reported self-regulation occurred. It was shown that children who reported higher self-regulation skills on average reported fewer ADHD symptoms on average compared to children who reported lower self-regulation skills. In addition, there was no difference in daily variations of ADHD symptoms and self-regulation skills between children in the MCII condition and children in the positive thinking condition.

The necessity of an individual and dimensional consideration of ADHD symptoms is discussed and pleads for an tailored, individual training approach to combatself-regulation deficits.

Keywords: ADHD, self-regulation, Mental Contrasting with Implementation Intentions, WOOP, ambulatory assessment

Everyone is familiar with the phenomenon that she/ he is not equally attentive every day and sometimes feel more or less restless. Individuals with symptoms of Attention deficit hyperactivity disorder (*ADHD*) show anomalies in the core symptoms of inattention, hyperactivity and impulsivity (American Psychiatric Association, 2015). The research trend in recent years has been to view ADHD as a dimensional disorder in which the symptoms move on a continuum (Rapport, Kofler, Alderson, Timko, & DuPaul, 2009). In addition to the dimensionality of ADHD symptoms, intra-individual fluctuations have been observed (Rapport, Kofler, Alderson, Timko, & DuPaul, 2009; Schmid, Stadler, Dirk, Fiege, & Gawrilow, 2016). The strength of ADHD symptoms of a person fluctuates over the course of several days (Schmid et al., 2016). For example, teachers often report that children with ADHD symptoms are attentive in class one day and do not even bring all the materials for the next task to school the next (Kofler, Rapport, & Alderson, 2008). These ADHD symptom fluctuations can be measured in the everyday life of individuals using the method of ambulatory assessment with the aid of portable devices such as smartphones and beepers (Bugl, Schmid, & Gawrilow, 2015; Ebner-Priemer & Trull, 2009). Research focusing on the dimensionality and intra-individual variability of ADHD in children is very important as it has important implications. A further confirmation of the variability of ADHD symptoms would require individually tailored trainings which are matched to the momentary capacity of attention, as well as the hyperactivity-impulsivity in order to be potentially successful in reducing ADHD symptoms, as compared to trainings that do not take into account the current condition of a child. One type of training to reduce ADHD symptoms that has proven to be effective is self-regulation training (Gawrilow, Guderjahn, & Gold, 2018)

ADHD and self-regulation deficits

Self-regulation – defined as the control of thoughts, actions, and emotions directed towards a certain goal (Duckworth & Carlson, 2013; Kanfer, Reinecker, & Schmelzer, 2012) – is indispensable for academic and professional success, as well as physical and social well-being (Baumeister & Vohs, 2004; Tangney, Baumeister, & Boone, 2004). Schoolchildren with symptoms of inattention, hyperactivity, and

impulsivity very often do not manage to regulate themselves according to the requirements (Langberg et al., 2010); thus, they have self-regulation deficits (Barkley, 2004). Self-regulation skills and ADHD symptoms are related in the sense that inattention,hyperactivity and impulsivity are caused by self-regulation deficits (Barkley, 2005). Accordingly, self-regulation skills also fluctuate in their strength (Vohs & Baumeister, 2018).

This leads to the conclusion that the fluctuations in self-regulation skills are related to fluctuations in ADHD symptoms. We assume, if self-regulation skills are – by a training – improved (for example in the mean, like Guderjahn, Gold, Stadler, & Gawrilow, 2013 did) thereby fluctuations are also reduced as a result and the fluctuations of the ADHD symptoms also alter.

Self-regulation trainings

In order to compensate for self-regulation deficits, such as learning problems and inappropriate behavior (Zimmerman, 1990), training programmes for improving self-regulation skills exist (Sitzmann & Ely, 2011). These self-regulation trainings are characterized by managing, monitoring, recording, and/or assessing behavior or academic achievement and some of them are designed to support children with ADHD symptoms in their everyday life (Reid, Trout, & Schartz, 2005). For instance, self-regulation interventions, like self-monitoring and self-management can produce meaningful improvements in student on-task behavior, academic productivity and accuracy, and reduction of inappropriate or disruptive behaviors (Reid, Trout, & Schartz, 2005, p.12; (Gagne & Nwadinobi, 2018; Reid, Trout, & Schartz, 2005).

Mental Contrasting with Implementation Intentions (*MCII*M; also known as *WOOP* which stands for wish, outcome, obstacle, plan; Keil, 2016; Saddawi-Konefka et al., 2017; Gollwitzer, 2015; Oettingen, 2014) is a strategy for increasing self-regulation skills (Adriaanse et al., 2010; Oettingen & Gollwitzer, 2010, 2015). Mental Contrasting with Implementation Intentions involves mental contrasting, thus, setting a goal, indulgence in achieving that goal and thinking about obstacles in reality that may stand in the way of achieving that goal (Oettingen, 2014). Mental Contrasting with

Implementation Intentions and its components Mental Contrasting and if-then plans has medium effect sizes (Hagger & Luszczynska, 2014; Oettingen, 2014; Webb & Sheeran, 2008) and is nowadays used in many areas of life, like sports and health, alongside the working group of the inventors of this strategy (Adriaanse et al., 2011; Hagger & Luszczynska, 2014). Mental Contrasting with Implementation Intentions consists of the previously mentioned steps: first a person thinks about a goal that is important to her or him (this should be realistic, and formulated in a timely manner), then the person indulges in having achieved this goal (Oettingen, 2012). This second step creates motivation to deal with the real obstacles on the way to achieving the goal in the next step – the person asks himself why he/ she has not yet reached the goal (Oettingen, 2012). In the next step, possibilities to avoid this obstacle are outlined (Oettingen, 2014). Finally, an if-then plan is created (Oettingen & Gollwitzer, 2001). If then plans have the format of "*If* situation X occurs, *then* I show behavior Y" (Gollwitzer, 1999) and link the previously considered situation with a goal-oriented action (Gollwitzer, 2015). For instance, it was demonstrated in studies that schoolchildren who use an if-then plan are superior in the control of their ADHD symptoms compared to other people who have only formulated a purely goal-oriented plan, since the if-then plan indicates an initiation of action (Guderjahn et al., 2013). Furthermore, people are more successful in achieving their goals using MCII compared to people who only think positively or indulge in the goal (Oettingen, 2014). Only from the contrast between the desired target state and the perceived reality an action towards the goal seems to be initiated, which is made explicit by the if-then plan (Gollwitzer, 2015). Summarising, MCII, as a self-regulation strategy, helps children with symptoms of ADHD more to suppress unfavourable impulses, show more self-discipline and achieve their goals, than pure indulging, positive thinking or goal intention training conditions (Gawrilow & Gollwitzer, 2008; Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013a, 2013b).

Hypotheses

Concluding from the current state of research, the question arises to what extent symptoms of inattention and hyperactivity-impulsivity in schoolchildren fluctuate daily (measured by ambulatory

assessment) and whether these fluctuations can be affected by self-regulation training, which improves the self-regulation skills and thereby possibly the fluctuations. We assume that: (1) the self-reports of ADHD symptoms of children fluctuate; (2) the self-reports of self-regulation skills of children fluctuate. Furthermore, we assume, (3) that children who report higher self-regulation skills on average report fewer ADHD symptoms on average compared to children who report lower self-regulation skills. We presume, that reports of children of MCII condition fluctuate lower (4a) in their ADHD symptoms (4b) in their self-regulation skills than reports of children of positive thinking condition in their daily self-reports via smartphone.

Methods

Data was collected within the framework of the research project „Adaptive dynamics of cognitive and behavioral variability in children with symptoms of attention deficit hyperactivity disorder (AttentionGO! - Playfully becoming more attentive“)[1]. AttentionGO was funded by the German Research Society (GA1277/9-1, project number 283324755) and approved by the ethics committee of the German Society for Psychology as well as the Ministry of Education and Cultural Affairs of Baden-Württemberg. The present study refers only to the second measurement period (there were three measurement bursts in total), which took place in spring 2018, as the training reported here was carried out for the first time in the course of the project.

Participants

Seven schools took part ($n_{\text{secondary school}} = 5$, $n_{\text{community school}} = 2$). The sample consisted of a total of 49 pupils in Grade 5, aged 10 to 12 years ($M = 11.2$, $SD = 0.7$). Five of the participating children had a diagnosis of ADHD ($n_{\text{ADHD}} = 5$, $n_{\text{non-ADHD}} = 44$). Parents and children learned about the possibility to

[1] The research project was conducted at the Department of School Psychology at the University of Tübingen in cooperation with the Goethe University, Frankfurt.

participate in the AttentionGO project through information presentations at schools and registered for the project via the school. Participation was voluntary and only possible with the written consent of the children and their parents. Participants could end their participation in the study at any time without giving reasons. As an expense allowance, each family received a voucher worth 40€ for an excursion destination of their choice (e.g., swimming pool, zoo).

In order to prevent any conclusions regarding personal data, each child was given a pseudonym. All collected data was pseudonymised and stored in a password-protected manner on internal servers of the University of Tübingen. The participating persons were informed about the type of data storage, the handing over of data on request, and the deletion of data in accordance with the Basic Data Protection Regulation (DGSVO).

Procedure

Data collected over a period of 18 days, three times a day via smartphone, which recorded the self-reported ADHD core symptoms and self-regulation skills of the children. Before the children started the survey phase, a group meeting was held where the training was conducted and the smartphones with the individualized ringing times were distributed. For this purpose, the test supervisors came to the school at the agreed time. The children were previously randomized and assigned to the training conditions on a school-by-school basis, so that the test supervisor carried out either the MCII condition or the positive thinking condition. For this purpose, they met the children in a separate room. If more than five children from one school participated, a correspondingly larger number of test administrators conducted the training parallel in separate rooms, so that one test administrator guided a maximum of five children through the training.

Introduction meeting. The meeting took place as follows: After a short welcome, the procedure of the following hour was explained and there was time for further questions. Afterwards, the training started and the test experimenter explained each step on the poster, which was clearly visible to all (Figure 1 and 2). The children had the task of imagining each step and formulating it as precisely as

possible in their thoughts. After all four stages of the training had been completed, all children formulated their personal plan, wrote it twice on the designated pages of their workbook and on a reminder card for their pencil case. Afterwards the children received their smartphones and the answering of questions was practiced together. Before the children returned to the classrooms, they received a small gift as a thank you for their participation (e.g. pen, writing pad, small toy). The next day the 18-day survey period started and the smartphones rang three times a day. After 18 days, the experimenters came back to the schools to take back the smartphones.

Materials

Various materials were used to conduct the training courses. A manual ensured a standardized procedure. The training program was vividly presented on a poster and could be read by the children in small workbooks. To collect data, the children were given a smartphone to answer various questions on a daily basis. The materials and their application are described in more detail below.

Measures

Over the 18-day survey period, the participating children were given a smartphone (Motorola MotoG4plus©), which they used - adapted to their individual daily schedule - to give information about their current symptoms of inattention, hyperactivity- impulsivity and their self-regulation skills three times a day (once in the morning directly after getting up, once in the afternoon after school and once in the evening before going to bed).

ADHD symptoms. Four items of the Connors Scales (Lidzba, Christiansen, Drechsler & Conners, 2013) on attention and behavior were used for the recording of inattention and hyperactivity-impulsivity and were modified for daily recording (“Since the last time I filled in the form I talked too much.”; “Since the last time I filled in the form I forgot what I was supposed to do.”; “Since the last time I filled in the form I had too much energy to sit still.”; “Since the last time I filled in the form I could hardly concentrate.”). The children gave their statements on a Likert scale, indicating how much the statements applied to them since the last time they filled in the form (1 = *not at all* to 6 = *exactly*),

according to which high values stood for high ADHD symptoms (inattention or hyperactivity-impulsivity) and low values for low ADHD symptoms.

Self-regulation skills. The items measuring self-regulation skills were taken from a German version of the Self-Control-Scale (SCS-K-D; Bertrams & Dickhäuser, 2009). After conducting pilots with the aim of selecting items of the SCS-KD and a scale level that allows a dimensional assessment of self-regulation skills, three items were selected that measure the ability to self-regulate ("Since the last time I filled out the form I did something I regretted"; "Since the last time I filled it out I was lazy"; "Since the last time I filled it out I was able to pull myself together well"). The three selected items had the most favourable Intraclass Correlations in the pilots in a sample of 11-year-olds, indicating that they represented individual differences in self-reports, and a scale level without a centre with a wider response range than the original questionnaire.

The children indicated three times a day how much the statements applied to them since the last time they filled in the form. They gave their statements on a Likert scale from 1 (*not at all*) to 6 (*exactly*). Item three of the self-regulation scale was inverted, so that here also high values stood for a high self-regulation deficit and low values for a low self-regulation deficit.

Trainings

In order to ensure a standardized procedure for the training, the test experimenters were guided by a manual. This manual described all the necessary preparation and follow-up work and contained detailed instructions for the training courses. For the MCII condition and for the positive thinking condition there were separate instructions for performance, which were read verbatim by the test experimenters.

The trainings for increasing self-regulation skills and improving the achievement of goals, MCII and positive thinking, were presented on an A0 size poster (*Figures 1* and *2*). The illustrations described all four steps a child had to take to complete the training and to create a goal-oriented plan at the end. The poster was placed in a position where it was clearly visible to all children so that the test

experimenter could work out all the steps of the training together with the children**.** Both trainings were examined regarding their influence on the fluctuations of the self-reports of the children´s ADHD core symptoms and self-regulation skills.

MCII condition. In the first step, they should think about a personal academic goal or wish, which they would like to achieve or fulfill („What goal do I want to achieve in the next nine days?“ and „What is my wish for school?“). Subsequently, the children considered what would be the most important outcome that could come true if their goal or wish were achieved („What is the most beautiful thing if the wish is achieved/when I have achieved my goal?“). In the third step, they thought about a possible obstacle they might encounter on the way to their goal or wish („What prevents me from reaching my goal?“, „What stands in my way?“). In the last step the children dealt with the question: „What can I do if the obstacle occurs?“. After all steps had been completed, all children formulated their individual if-then plan („If the obstacle occurs, then I do behavior/action Y/think about Z.“).

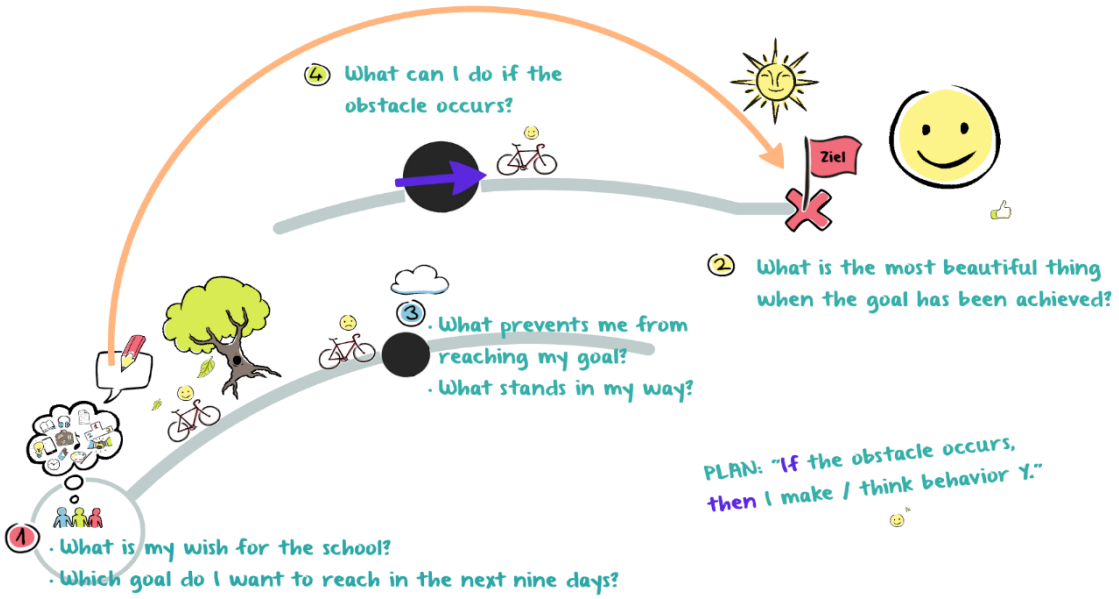

Figure 1. Poster MCII condition (Used with permission from Prezi Inc.)

Positive thinking condition. This training differed from the MCII condition by the absence of the steps „wish“ and „obstacle“. Children were asked to indulge in positive future wishes or goals and to formulate a plan for them at the end. Thus, the first two steps of this training were identical to those of training MCII („What goal do I want to achieve in the next nine days?“ or „What is my wish for the school?“ and „What is the most beautiful thing when the wish is/when I have achieved my goal?“). In the third step, the children thought about how it feels to have reached the previously formulated goal or to have their wish fulfilled („How do I feel when I have reached my goal?“). In the last step they thought about what they would experience if the goal was reached or the wish fulfilled („What do I experience when I have reached my goal?“). Just like the children in the MCII condition, the children in this condition also formulated a personal plan at the end but this one had the format: „When my goal is reached, the most beautiful thing happens and I feel X.“.

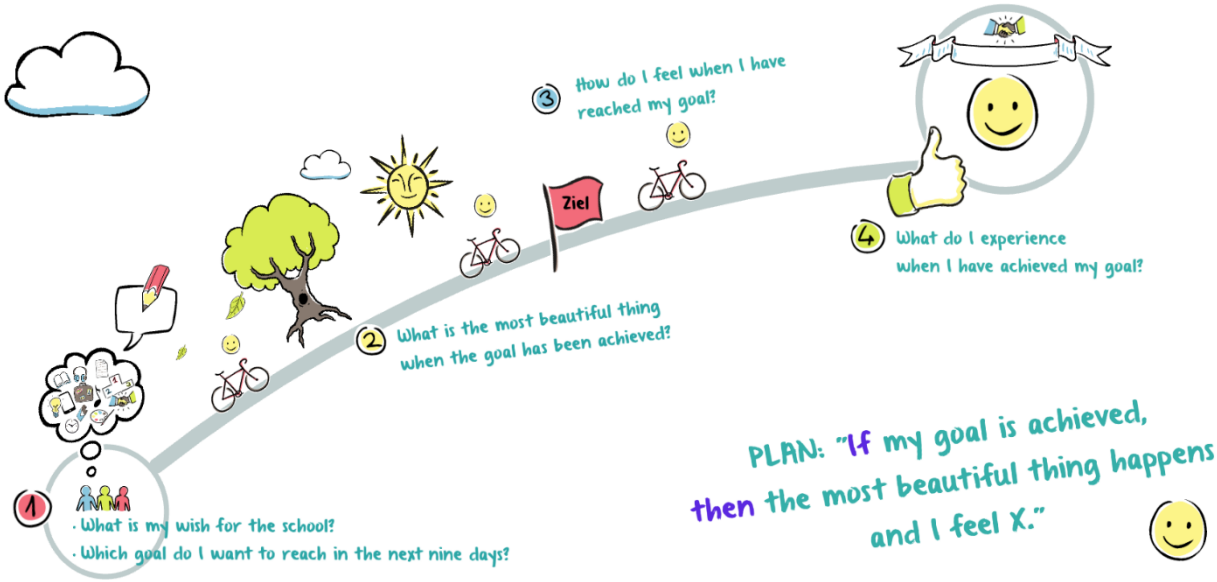

Figure 2. Poster positive thinking condition, without contrasting (Used with permission from Prezi Inc.)

All steps he children went through and were shown on the poster could be read by the children themselves in their own student workbook. After the poster presentation, the children wrote down their personal plan on the last page of the booklet.

Results

The RStudio statistical software (version 1.2.5001, RStudio Team, 2015) was used for data preparation and analysis. An individual daily average value over the three daily measuring points was formed for the scales ADHD symptoms and self-regulation skills for each child, if a child had given answers on at least one session on that day. In addition, the *Relative Variability Index* was calculated as an individual value of the fluctuations of the children´s self-reports of ADHD symptoms and self-regulation skills, according to the recommendations of Mestdagh, Pe, Pestman, Verdonck, Kuppens and Tuerlinckx (2018). In the following, the statistical methods applied to test the respective hypotheses and their results are listed.

Examination of hypotheses

In order to answer the question to what extent (1) the self-reports of ADHD symptoms of children fluctuate, the *Relative Variability Index* (Mestdagh et al., 2018) for the ADHD symptoms of each individual child was calculated and showed a range from 0.00 to 1.00 (*mean* = 0.19, *sd* = 0.22), indicating that the self-reports of ADHD symptoms of children fluctuate from day to day (see *Figure 3*).

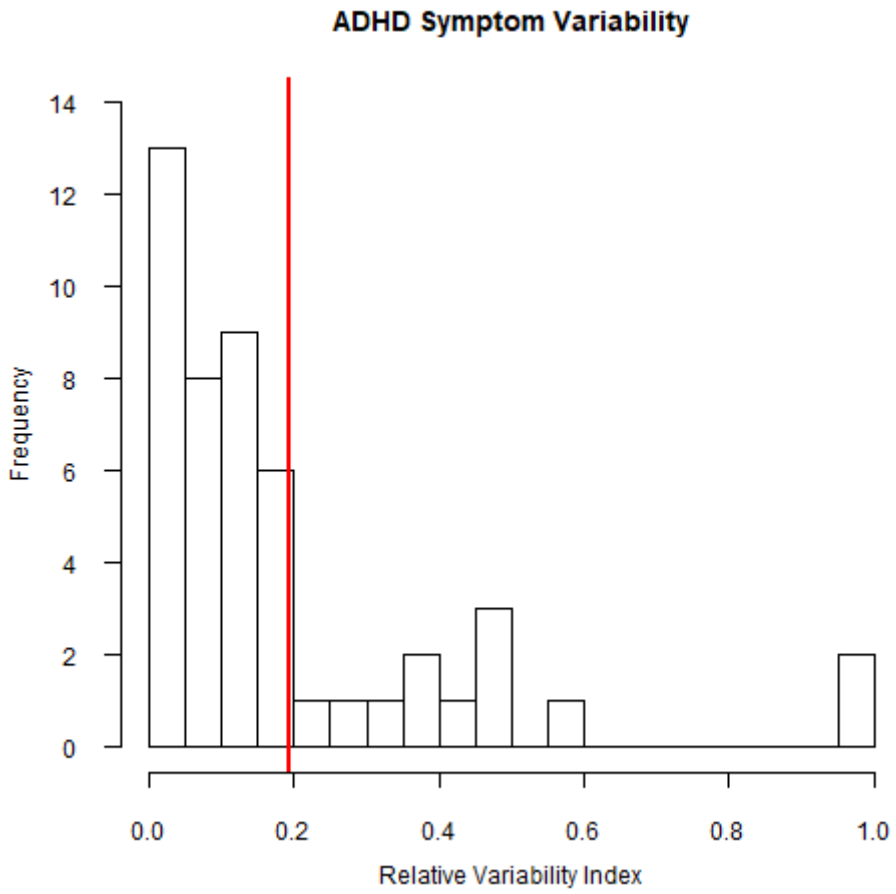

Figure 5 Frequency for the self-reports of ADHD-symptoms (y - axis) of the Relative Variability Index (x - axis, mean value marked with a red line)

In order to investigate the question to what extent (2) the self-reports of self-regulation skills of children fluctuate, the *Relative Variability Index* (Mestdagh et al., 2018) for the self-regulation skills of each individual child was calculated and showed a range from 0.00 to 1.00 (*mean* = 0.15, *sd* = 0.17, see *figure 4*), indicating that the self-reports of self-regulation skills of the children vary daily.

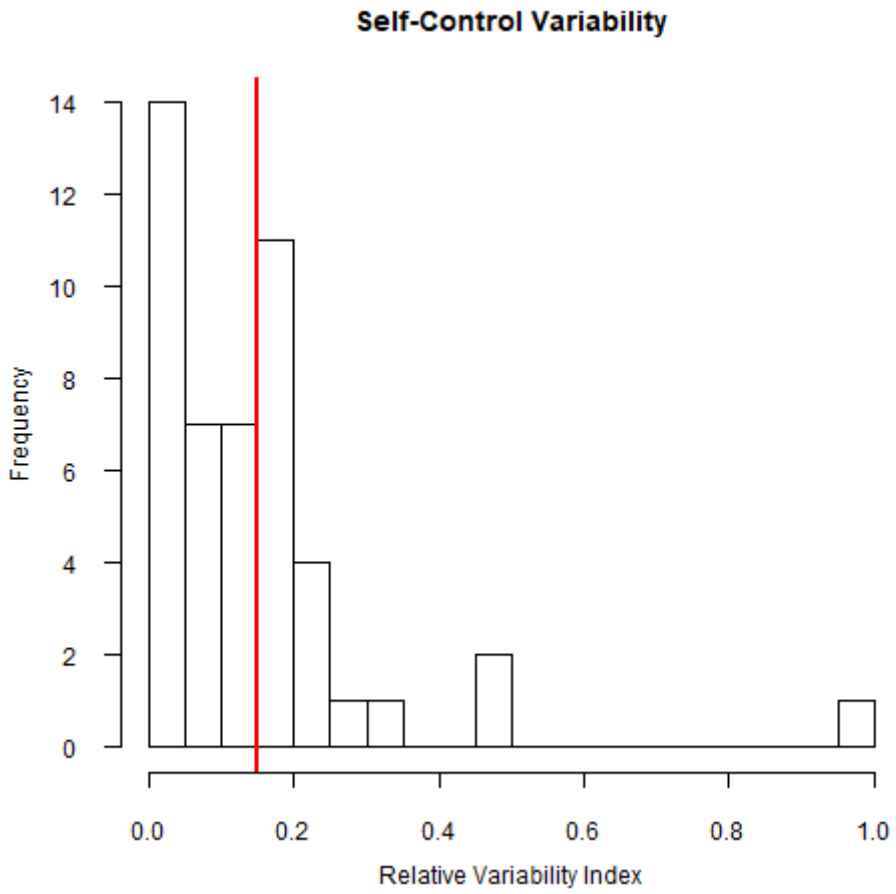

Figure 4 Frequency for the self-reports of self-regulation skills (y - axis) of the Relative Variability Index (x - axis, mean value marked with a red line)

Hypothesis (3) assumed that children who report higher self-regulation skills on average report fewer ADHD symptoms on average compared to children who report lower self-regulation skills. Analyses showed that children´s ADHD symptoms and self-regulation skills on average correlated (as assessed with Spearman's rho) in the sense that high symptoms of inattention and hyperactivity and impulsivity were associated with high self-regulation deficits on average ($\rho = .52$, $p < .05$; see *figure 5*).

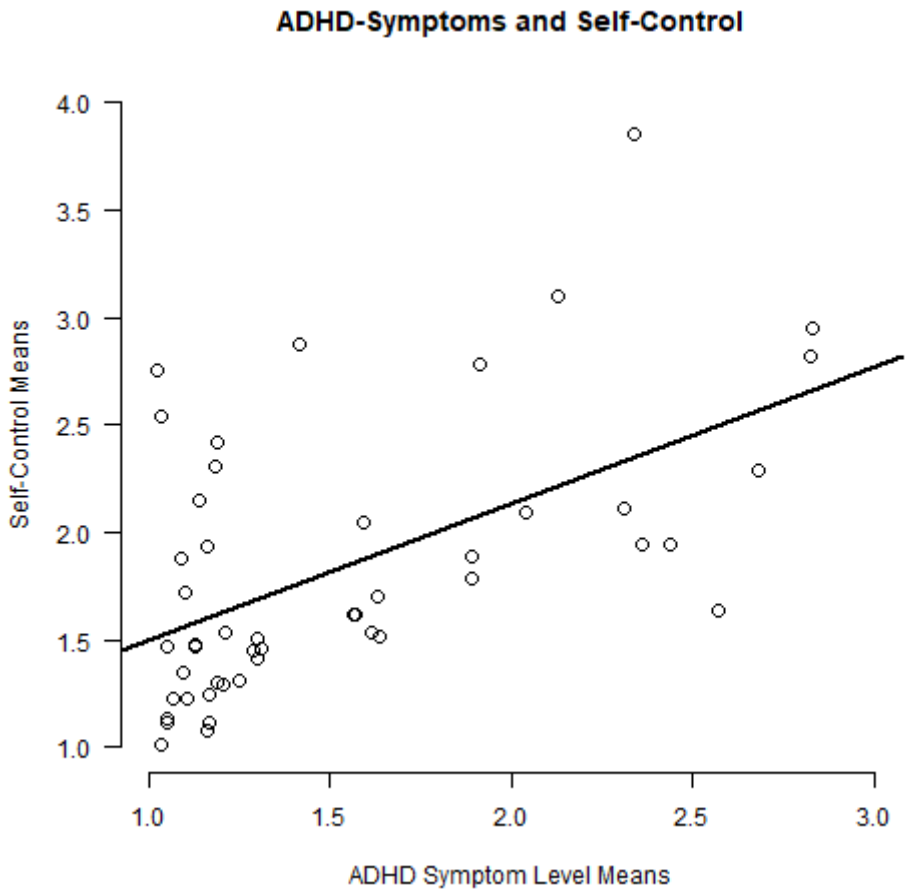

Figure 5 Correlation between self-reported ADHD symptoms (x-axes) and self-regulation skills (y-axes)

Testing the (4) hypothesis that reports of children of the MCII condition fluctuate lower (4a) in their ADHD symptoms and (4b) their self-regulation skills than reports of children of the positive thinking condition in their daily self-report via smartphone, did not show significant results (4a: $t(20.51) = 1.95$, $p = 0.06$; 4b: $t(35.77) = 0.52$, $p = 0.60$).

Discussion

If self-regulation skills are deficient, this can hinder a learning career from an early stage (Döpfner, Gold, & Frölich, 2014; Duckworth & Carlson, 2013). Self-regulation deficits are one of the causes of attention deficit hyperactivity symptoms, like inattention and hyperactivity-impulsivity (Barkley, 2004), which should therefore be compensated with support of a training as early as possible,

preferably at school age. The self-regulating ability of a person and their ADHD symptoms therefore seems to fluctuate from time point to time point, from day to day (Schmid et al., 2016). In order to test this hypothesis empirically, the method of ambulatory assessment was used to record the ADHD symptoms and self-regulation skills of schoolchildren directly in their everyday life. In this context, the aim was not only to measure ADHD symptoms and self-regulation skills in everyday life but also to train self-regulation skills.

Examination of the results

We assumed that the self-reports of ADHD symptoms (1) and the self-reports of the self-regulations skills (2) of the children fluctuate. In line with hypotheses (1) and (2) results showed that the self-reports of the children´s ADHD symptoms and self-regulations skills fluctuated from day to day, albeit in the lower quarter of the possible degree of fluctuation. This result is in line with the empirical evidence proclaiming fluctuations in the self-reports of both variables (Purper-Ouakil, Wohl, Michel, Mouren, & Gorwood, 2004).

In addition, in line with hypothesis (3) children who reported higher self-regulation skills on average reported fewer ADHD symptoms on average compared to children who reported lower self-regulation skills. This result further strengthens the hypothesis adopted by Gawrilow and colleagues (2018) among others, that ADHD symptoms and self-regulation skills are related.

In our last hypothesis (4) we assumed, that reports of children of the MCII condition fluctuate lower (4a) in their ADHD symptoms and (4b) in their self-regulation skills than reports of children of the positive thinking condition in their daily self-reports via smartphone. Subsequently, when testing hypotheses (4a) and (4b) the fluctuations in the children's self-reports of their ADHD symptoms and self-regulation skills were examined in relation to the different training conditions (MCII; positive thinking). For this purpose, a group mean value of each condition was calculated from the individual *Relative Variability Index*, and the self-regulation training conditions were compared against each other. Contrary to our assumptions, children in the MCII condition did not show significantly lower

fluctuations in their self-reports of their ADHD symptoms or their self-regulation skills than children in the positive thinking condition. The data tend to point in the expected direction that MCII is superior to a comparable self-regulation training in bridging fluctuations in self-reported ADHD symptoms and self-regulation skilly on a daily basis, but these results are not statistically significant. Nevertheless, the results once again underline the importance of the measurement of ADHD symptoms and the associated self-regulations skills close to everyday life as well as the need of individual training of self-regulation skills.

Limitations

It should be noted that the fluctuations in the self-reports tended to be in the lower range of ADHD symptoms and the reported fluctuations in the self-reports of self-regulation abilities tended to be in the higher range, indicating floor and ceiling effects with overall rather low ADHD symptoms or high self-regulation skills. The lack of significant results of the MCII condition compared to the positive thinking condition could therefore be due to the fact that there was already a high level of self-regulation skills in our sample and that self-reports varied only slightly from day to day and between participants. Therefore, the training might have offered little additional help to children with high self-regulation skills, as it is usually most useful for people with self-regulation deficits (Baumeister & Vohs, 2004; Gawrilow, Morgenroth, Schultz, Oettingen, & Gollwitzer, 2013).

The current study has therefore not only evaluated a self-regulation training but also investigated fluctuations in their self-reports of ADHD symptoms and self-regulation skills of schoolchildren. For this study, we used ambulatory assessment, that is the collection of variables in everyday life using portable devices (Ebner-Priemer & Trull, 2009). Participants were asked to answer daily in the morning, afternoon and evening questions about their ADHD symptoms and self-regulation skills using an app on a smartphone. Despite this method of recording ADHD symptoms and self-regulation skills - after extensive literature research - being considered as very new and innovative, it is not free of limitations. Although the fact that the willingness to complete the daily reports was assessed as high (80%

approximately the results from adult patient samples; see for example (Mehl & Holleran, 2007; Stone, Shiffman, Schwartz, Broderick, & Hufford, 2003), not all children were always able to answer the items. As a result, although the survey times were coordinated with the daily plans of the family before the start of the study, various missings were recorded. In this context, it should also be considered that, due to the lack of suitable adaptive technical options, accompanying the children in the conditions of the training could not be integrated more strongly into everyday life (e.g., by daily reminding them of their individual personal goals). For example, in the present study it was not possible to measure experiences in dealing with obstacles (a step of mental contrasting from the MCII condition) daily via smartphone on the way to the schoolchildren´s individual goal. This would have been advantageous for an increased training of the self-regulation skills, because daily training adapted to the individual level, for example via app, increases attention-related processes (Holmes, Gathercole, & Dunning, 2009; Pedullà et al., 2016).

Implications

In this work it was possible to strengthen the perspective of the fluctuations of ADHD symptoms and self-regulation skills. ADHD symptoms and the associated deficits of self-regulation skills do not seem to be present to the same extent every day (Purper-Ouakil et al., 2004). By means of an ambulatory assessment over 18 days, fluctuations in these two constructs could be depicted, with some participants showing greater fluctuations in their self-reports of ADHD symptoms and self-regulations skills than others. In addition, a connection between the self-regulation skills and ADHD symptoms was discernible in that children who on average reported high self-regulation values also reported fewer ADHD symptoms. This emphasizes that self-regulation skills and ADHD symptoms are related and are not present to the same extent every day. This speaks in favour of a future, more dimensional consideration of ADHD symptoms and self-regulation deficits and correspondingly individualized interventions.

The present study shows approaches to locate not only the implementation of training, but also the assessment of ADHD symptoms and self-regulation deficits on a dimensional level of everyday life

in the future. Questionnaires should be designed in such a way that both above and below average levels of attention, hyperactivity-impulsivity, and self-regulation skills can be depicted, with more items than used in our study. This means that more questionnaires like the Strengths and Weaknesses of ADHD Symptoms and Normal Behavior (SWAN) rating scale should be used. The SWAN rating scale has dimensionally reformulated the diagnostic ADHD symptom items to cover the full spectrum of behaviour in both the non-clinical and clinical populations and captures strengths and weaknesses (Brites, Salgado-Azoni, Ferreira, Lima, & Ciasca, 2015; Swanson et al., 2012). On a practical level, dimensional diagnostics would lead to changes, for example in a school psychological counselling request regarding behavioural problems. Instead of distributing a standard retrospective questionnaire, the symptoms could be recorded daily on the client's smartphone and at the end of a week this information could be discussed together with, for example, a graphic representation of the course of the values. This in turn offers specific starting points for discussing "good and bad days" and discovering resources to support self-regulatory abilities.

Conclusion

In summary, the present study investigated ADHD symptoms and self-regulation skills in children in everyday life and aimed to map potential variability of ADHD core symptoms and self-regulation skills. In addition, a self-regulation training (MCII compared to positive thinking) was carried out during the survey period with the aim of reducing fluctuations in the schoolchildren´s self-reports of their ADHD symptoms and self-regulation skills.

We found that children indeed reported fluctuations in their self-reports of their ADHD symptoms and self-regulation skills over 18 days via smartphone. However, a reduction of these fluctuations in the ADHD symptoms and self-regulations skills self-reports of children, who received the MCII training was not observed in comparison to children who received the positive thinking training. Furthermore, children´s ADHD symptoms and self-regulation skills on average correlated, in the sense

that high symptoms of inattention and hyperactivity and impulsivity were associated with high self-regulation deficits on average.

The observed results contribute to the idea of a dimensional consideration of the symptoms of ADHD and self-regulation skills. For future research it seems necessary to sensitize and remind more of self-regulation interventions in everyday life.

Acknowledgements

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