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Self-perceptions of Self-Regulatory Skills in Children aged eight to 10 Years: Development and Evaluation of a New Self-rating Scale[1]

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ABSTRACT

Insufficient self-regulation and reduced awareness of self-regulatory skills have been discussed as possible explanations for academic difficulties. However, instruments for assessing metacognitive knowledge of self-regulation in young school children have been lacking so far and it has been questioned whether younger school children are able to make accurate self-judgments on their regulatory skills. We present a new age-appropriate self-rating scale for the assessment of self-regulatory skills in young school children – the Self-rating of Self-regulatory Function (SelfReg) – which was validated on a representative sample of 107 school children aged 8 to 10 years. Confirmatory factor analysis of the scale offered evidence for a one-dimensional rather than a multidimensional model. In a second step, self-ratings on the SelfReg of 21 children with impaired self-regulatory skills and various types of behavioural, developmental, or academic difficulties were compared to self-ratings of 21 normal controls. Children with dysfunctional self-regulation rated themselves as significantly more impaired on the SelfReg than control children. Analyses of discrepancies between parents' and/or teachers' ratings and self-ratings of the children did not discriminate between the two groups, indicating that self-ratings in children with dysfunctional self-regulation and control children, though significantly different, were equally accurate. It is concluded that children as young as 8 to 10 years are able to make differential and accurate judgments on their self-regulatory skills when assessed with an age-appropriate instrument.

Key words: Self-rating-scale, self-regulation, metacognition, executive functions, awareness

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INTRODUCTION

The study of self-regulation has captured the interest of child development researchers from different scientific points of view (see the monograph by Baumeister & Vohs, 2004; for reviews of the different concepts see Cole et al., 2004; Kochanska et al., 2000; Welsh, 2002). According to the definition by Blair and Diamond (2008), self-regulation is "a primarily volitional cognitive and behavioural process through which an individual maintains levels of emotional, motivational, and cognitive arousal that are conducive to positive adjustment and adaptation, as reflected in positive social relationships, productivity, achievement, and a positive sense of self." Many researchers agree that self-regulatory skills enclose a cognitive and an emotional/motivational dimension (Zeidner et al., 2000; Schunk & Ermter, 2000; Brooks, 1997) which closely interact. Motivation is particularly important in tasks that demand sustained attention; delay of gratification may be needed when it comes to setting and maintaining a goal.

There is considerable overlap between the concept of self-regulation and the neuropsychological construct of executive function (EF), especially with models comprising "hot" executive functions, that is emotional-motivational aspects of self-regulation (Kerr & Zelazo, 2004; Zelazo & Müller, 2002), as well as "cold" executive functions. The latter refer to the more traditional concept of EF with cognitive subcomponents such as working memory, inhibition, shifting, goal-setting, planning, monitoring, attentional control, and others (for reviews see Anderson, 2008; Eslinger, 1996; Levin & Hanten, 2005). In temperament research, self-regulation has been linked to processes that modulate reactivity, including effortful control of behaviour based on the executive function system (Rothbart et al., 2004). From a clinical perspective, deficient self-regulation is considered as one of the core features of several psychopathological syndromes of childhood, especially of ADHD (Barkley, 1997, 2006). In educational psychology, researchers have increasingly focused on the role of self-regulatory skills in students' academic functioning (Ponitz et al., 2008; Blair & Razza, 2007). Evidence is accumulating for the primary sources of children's difficulties during the first years at school being self-regulatory difficulties and not poor academic skills as presumed (e.g. Blair & Diamond, 2008; Zimmermann, 2001).

Self-regulation is significantly influenced by children's self-perceptions of regulatory skills. In an educational context the process which enables students to coordinate the use of current knowledge and a repertoire of reflective strategies in order to accomplish a goal has been referred to as metacognition (Palincsar & Brown, 1987). Metacognition serves as a regulatory function and permits selecting, combining and coordinating strategies in an effective manner (Boekaerts, 1999), an ability that is impaired in poor learners (Lockl & Schneider, 2003). From an executive function perspective, metacognition can be related to monitoring, that is, the control of ongoing task processing and of its result, as well as to self-awareness (see Stuss, 1991), and to planning / problem-solving, which encompass a subcomponent of appropriate strategy selection. "Metacognition" has also been used in a divergent meaning as a superordinate term for "cool" executive functions in the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia et al., 2000) (see Denckla, 2007 for a criticism).

Three general methods have been used to assess metacognitive knowledge of self-regulatory skills: interviews (Zimmermann & Martinez-Pons, 1988; Swanson, 1990), think aloud protocols (Cerro & Baker,1993; Garner & Alexander, 1982), and self-reports (Schraw & Dennison, 1994; Pereira-Laird & Deane, 1997) (for a detailed review see Schraw, 2000). Recent studies have turned to observing children's behaviours in naturalistic settings (Whitebread et al., 2005; Shamir et al., 2009). Self-report inventories, if methodological difficulties are considered, are in some ways the least problematic technique (see Sperling et al., 2002) as they are easily administered and scored. A number of different self-report inventories have been developed, focusing on metacognitive skills, such as the 'Metacognitive Awareness Inventory' (MAI) (Dennison et al., 1996), 'Motivated Strategies for Learning Questionnaire' (MSLQ) (Pintrich et al., 1991), the 'Learning and Study Strategies Inventory' (LASSI)" (Weinstein et al., 1987), and the students' surveys from the Metacognitive Awareness System (MetaCOG, Meltzer et al., 2004). Other instruments focus on behavioural and cognitive self-regulation ('Strength and Difficulty Questionnaire-Self report', Goodman et al., 1998; 'Conners-Wells Adolescent Self-Report Scale', Conners & Wells, 1997), or on executive functions ('Behavior Rating Inventory of Executive Function- Self Report Version' BRIEF-SR) for children and adolescents aged 11- to 18 years (Guy et al., 2005).

Most of these inventories have been designed for older children and adolescents, probably due to the fact that questionnaires relating to abstract verbal concept are too difficult to be understood by younger children. Furthermore, it may be questioned whether metacognitive knowledge of self-regulatory skills is sufficiently developed in young school children to permit the assessment of differentiated profiles. A majority of studies indicates that metacognitive skills emerge at the age of 8 to 10 years and develop thereafter (e.g. Veenman et al., 2006, Lockl & Schneider, 2006), but metacognitive behaviours have also been described in children as young as three (e.g. planning, reflection) (Whitebread et al., 2005). Research indicates that the younger children are, the more they overestimate their competences in various domains (Helmke, 1998; Jacobs et al., 2002). Experiments with children aged up to eight years indicate little convergence between children's self-judgments of learning strategies and their real approach in relevant learning situations (see Artelt, 1999, 2000).

In addition, some disabilities in the area of executive function may be difficult to be perceived by affected children because this requires precisely those monitoring skills which are potentially impaired. This phenomenon has been observed in adults with frontal lobe dysfunction (Prigatano & Altmann, 1990; Hart et al., 2004; Schmitz et al., 2006). Studies of self-perception in children with ADHD and/or learning disabilities have yielded mixed results. Several studies indicate inflated self-ratings of self-concepts in affected children (Vaughn et al., 1992; Vaughn, 2007; Dyson, 2003; Gresham et al., 2000; Stone & May, 2002; Heath & Glen, 2005; see Owens et al., 2007 for a review). These results are often based on the analysis of discrepancy scores, calculated by subtracting a criterion (e.g. parent report) from the child's report of self-competence, with large differences indicating overestimations by the child (see Gresham et al., 1998; Hoza et al., 2002; Hoza et al., 2004; Owens & Hoza , 2003; Diener & Milich, 1997). In these studies, however, self-reports of affected children usually do not differ from those of controls.

In contrast, several other studies report that young children with various types of behavioural, developmental or academic difficulties, which may lead to negative feedback from teachers and parents, are quite well aware of their problems and have a clear notion of being different and less apt than their peers (Chapman, 1998; Bear et al., 2002; Zeleke, 2004; Treuting & Hinshaw, 2001; Ialongo et al., 1994; see Hoza et al., 2002 for a review). It has been argued that repeated difficulties in regulating behaviour in learning situations and interactions with others may result in a child to developing negative self-images, which in turn may result in a decrease of motivation, self-fulfilling prophecy as a poor self-regulator, and school failure (Blair & Diamond, 2008). Therefore, early assessment and intervention promoting self-regulation, accurate self-perception and metacognitive skills are crucial.

The aim of the present study was to develop and to evaluate an instrument for the assessment of metacognitive knowledge of regulatory functions in school children. We hypothesized that young school children are able to rate self-regulatory skills accurately when items are presented in an ecologically valid and age-appropriate form (see Schneider & Lockl, 2002). To that aim we developed a new self-rating instrument, the Self-rating of Self-regulatory Function (SelfReg). Instead of relating to abstract verbal statements, children compare their own behaviour to that of others in concrete daily-life scenarios. In accordance with certain models of EF / self-regulation (e.g. Kerr & Zelazo, 2004), we expected to find an underlying two-factorial scale structure, one factor encompassing cognitive aspects, the other factor comprising behavioural / emotional aspects of self-regulatory skills (study 1). We further assumed that when comparing their behaviour to that of other children on the SelfReg, a majority of children with dysfunctional self-regulatory skills would be able to report their problems accurately (study 2).

STUDY 1
CONSTRUCTION AND VALIDATION OF THE SELFREG

We describe the construction process of the Self-rating of Self-regulatory Function (SelfReg), its first evaluation on a sample of school children (construction sample), the ensuing reduction of items, and the validation of the definitive scale on a second sample of school children (validation sample).

1. Construction of the SelfReg

Method

SelfReg: Items and scales were derived from reviews and experimental studies on executive function and self-regulation in children and from the examination of existing rating scales. In creating item content, we considered the following criteria. 1) It had to be part of children's everyday experience (ecological validity). 2) It had to be transferable into concrete situations. 3) The content had to reflect the underlying construct unambiguously (content validity).

In a first step, all created items were rated by four experts (teachers, child psychologists) for developmental appropriateness, comprehensiveness, adequacy of the situations described, and appropriateness of the survey instructions. The experts' appraisal of the instrument overall was positive and suggestions (e.g., wording) were integrated into the survey. Out of an initial pool of 112 items the SelfReg-preform was developed, comprising the following 9 subscales: emotion (11 items), motivation (12 items), motor activity (15 items), inhibition (12 items), organization/planning (12 items), monitoring (12 items), speed of processing (10 items), distractibility (14 items), and sustained attention (14 items).

The SelfReg was subdivided into two main scales encompassing behavioural/emotional regulation (emotion, motivation, motor activity, inhibition), and cognitive regulation (organization/planning, monitoring, speed of processing, distractibility, sustained attention). In this model, "inhibition" was ascribed to the behavioural domain, following the segmentation of the BRIEF-subscales (Gioia et al., 2000), though inhibition may include both an emotional as well as a cognitive aspect and can be attributed to either one. Table 1 displays the scale structure of the SelfReg-preform (112 items) and the SelfReg definitive version (28 items).

Table 1: Preform and definitive scale structure of the SelfReg

Preform	No. of Items	Definitive Form	No. of Items
Behavioural Regulation		**Behavioural Regulation**	
Emotion	11	Emotion	4
Motivation	12	Motivation	4
Motor Activity	15	Motor Activity	4
Inhibition	12	Inhibition	4
Cognitive Regulation		**Cognitive Regulation**	
Organization/Planning	12		
Monitoring	12		
Speed of Processing	10	Speed of Processing	4
Distractibility	14	Distractibility	4
Sustained Attention	14	Sustained Attention	4
Total	**112**	**Total**	**28**

Each item begins with the description of a typical everyday situation, followed by two ensuing opposing types of behaviour shown by children: One example of good regulatory skills and one of poor self-regulation. Starting with "what about you?" the child is then asked whether he or she is likely to show the same behaviour as in one of the presented alternatives (for an example see Figure 1). To facilitate understanding and enhance motivation the situations are illustrated by pictures. For the same reasons and to facilitate scoring, items are presented on a computer-screen and responses are collected in a response box. However, an equivalent paper-pencil-form of the instrument is also available. The items in the computerized version are presented randomly. The texts are read aloud by the experimenter. A boys' and a girls' version were created for each item, with gender-specific pictures and names. To avoid one-sided answers, half of the items are formulated negatively. Answers are given on a 5-point Likert-scale ranging from 1 (= very often) to 5 (= never). The child enters the answer on a 5-button response box. Items of the definitive form are listed in the appendix.

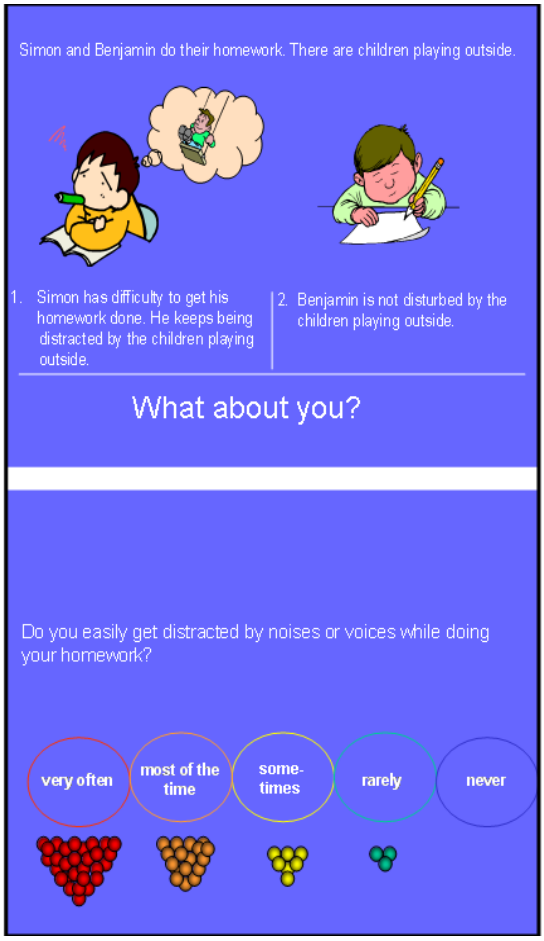

Figure 1: Item examples of the SelfReg

Additional instruments: Children's Intelligence (IQ) was measured individually by a short form of the German version of the revised Wechsler Intelligence Scale for children (HAWIK-III), which includes the subtests Block Design, Picture Arrangement, Arithmetic, and Vocabulary (Schallberger, 2005).
Participants: The SelfReg-preform (112 Items) was tested in a sample of 50 school children aged 8 to 10 years recruited via public schools in the surrounding regions of the city of Zurich. Sample characteristics are shown in Table 2.

Table 2: Description of the construction and validation sample

	Construction Sample N=50		**Validation Sample N=107**	
Mean age (SD)	9.0 (0.7)		9.6 (0.6)	
IQ (SD)	108.8 (13.2)		108.3 (15.9)	
Boys / Girls		*p*		*p*
N	25 / 25		57 / 50	
Mean age (SD)	8.8 (0.7) / 9.1 (0.7)	*n.s.*	9.7 (0.6) / 9.6 (0.6)	*n.s.*
IQ (SD)	110.2 (11.2) / 107.5 (15.0)	*n.s.*	112.2 (15.6) / 105.0 (15.7)	*n.s.*

Notes: SD = standard deviation; *n.s.*= not significant

Procedure: Due to the large number of items in the SelfReg-preform, the instruments (SelfReg-preform and short form of the HAWIK-III) were administered to all participants in three testing sessions. Items were presented in a random order. Sessions took place individually in a separate room at school.
Data Analysis: Reliability analysis based on Cronbach's coefficient alpha (Cronbach, 1951) was performed using SPSS 14. A first inclusion criterion was an item-remainder correlation of r_{it}>.40. Second, in order to meet brevity criteria, only those four items of each subscale with the highest internal consistency were included in the instrument. In the case of items with equivalent internal consistencies within one scale, we included those items which were closest with regard to content.

Results

As expected from a sample of unselected children, distributions of items were positively skewed, except for three items (skewness between -1.72 und -0.05, Kolmogorov-Smirnov-test: KS-test: p <.05). Two subscales (organizing/planning, monitoring) were excluded from subsequent analyses due to small item-remainder correlation of their scale items. The remaining scale items demonstrated good item-remainder correlations within scales with values ranging from .42 to .72 (see Table 3).

Table 3: Descriptives of the definitive SelfReg (28 items) version (N=50)

	Emotion			**Motivation**			**Motor Activity**			**Inhibition**			**Speed of Processing**			**Distractibility**			**Sustained Attention**		
	M	(SD)	r_{it}	M	(SD)	r_{it}	M	(SD)	r_{it}	M	(SD)	rit	M	(SD)	rit	M	(SD)	r_{it}	M	(SD)	r_{it}
Item 1	4.2	(0.7)	.60	3.8	(1.2)	.53	3.9	(0.9)	.66	3.8	(0.8)	.47	3.9	(0.9)	.50	3.6	(0.9)	.49	3.6	(0.9)	.62
Item 2	3.8	(0.7)	.47	3.9	(0.8)	.50	4.0	(0.9)	.72	4.2	(0.9)	.68	4.0	(0.8)	.55	3.9	(0.8)	.43	4.1	(0.8)	.59
Item 3	4.1	(0.7)	.55	4.2	(0.8)	.54	3.9	(0.9)	.69	3.8	(1.0)	.61	3.9	(0.7)	.64	3.9	(0.9)	.42	4.2	(0.7)	.60
Item 4	3.9	(0.8)	.57	4.3	(0.7)	.49	3.5	(1.2)	.59	4.3	(1.0)	.63	3.9	(0.8)	.61	3.9	(0.8)	.55	3.9	(0.9)	.62
	M	(SD)	α	M	(SD)	α	M	(SD)	α	M	(SD)	α	M	(SD)	α	M	(SD)	α	M	(SD)	α
Scale	16.2	(2.3)	.75	16.3	(2.8)	.72	15.4	(3.3)	.83	16.2	(3.1)	.79	15.8	(2.7)	.77	15.4	(2.6)	.69	16.0	(2.6)	.79

Notes: M = mean; SD = standard deviation; r_{it} item-remainder correlation; α = Cronbach's alpha

The whole reduction process resulted in the final version of the SelfReg with a total of 28 items (see Table 1). Descriptives of the SelfReg definitive version (28 items) are displayed in Table 3. Cronbach's alpha for both SelfReg (28 items) a priori main scales covering behavioural regulation and cognitive regulation was .88, demonstrating good homogeneity among the scale items. Internal consistency for the 7 subscales ranged from .69 to .83. The entire SelfReg showed good internal consistency with Cronbach's alpha coefficient of .92.

2. Validation of the SelfReg

In a second step, the 28-item version of the SelfReg was validated on a new sample of school children.

Method

Instruments: The definitive SelfReg (28 items) and the short form of the German adaptation of the WISC III (HAWIK III, Schallberger, 2005, see scale construction) were administered.
Participants: The validation sample consisted of 107 unselected schoolchildren aged 8 to 10 years. To ensure generalisability, 12 schools from different rural and urban school districts were selected covering a broad socioeconomic range and including students from a variety of social, ethnic, and economic backgrounds. No significant age or IQ difference was found for girls and boys (see Table 2 for sample characteristics).
Procedure: The SelfReg (28 items) and IQ-tests were administered individually in a separate room of the schools. The administration of the SelfReg took approximately 15 to 20 minutes.
Data Analysis: A second reliability analysis was carried out with the SelfReg (28-items). A two-factorial scale structure with one factor encompassing behavioural aspects and the other factor comprising cognitive aspects of self-regulative skills was analyzed via maximum likelihood confirmatory factor

analysis using the AMOS 6 program (Arbuckle & Wothke, 1999). The mean raw scores of the scales were entered as measured variables in the a priori postulated model. The confirmatory factor analyses were conducted on the covariance matrix as all SelfReg subscales share the same metric. The adequacy of fit was tested using Hu and Bentler's (1998, 1999) recommended approach to fit criteria: comparative fit index (CFI) .95, goodness of fit (GFI) .90, root mean squared error of approximation (RMSEA) .06 (=good) respectively .08 (=acceptable), X^2-value = *n.s.* and X^2/df ratio .5

Results

Cronbach's alpha for the Self-Reg (N=107; 28 items) was .84. The confirmatory factor analysis of the SelfReg showed that the a priori postulated two-factor model fitted the data poorly with a CFI of .561, a GFI of .791, a RMSEA of .228, X^2 = *n.s.,* and a X^2/df ratio of 6.17. Given the important overlap of the two latent factors (r=.76) a second CFA with one latent variable specified for the seven observed variables was considered. In this model, the seven scales (emotion, motivation, motor activity and inhibition, speed of processing, distractibility, and sustained attention) loaded on the latent single factor "self-regulation". The latent factor solution for the one-latent factor model is depicted in Figure 2. The correlations between the seven variables and the latent factor ranged between r=.54 and r=.76. The goodness of fit indices (CFI = .962, GFI = .944, RMSEA = .069, X^2 = *n.s.*, X^2/df ratio = 1.50) indicated a very good fit.

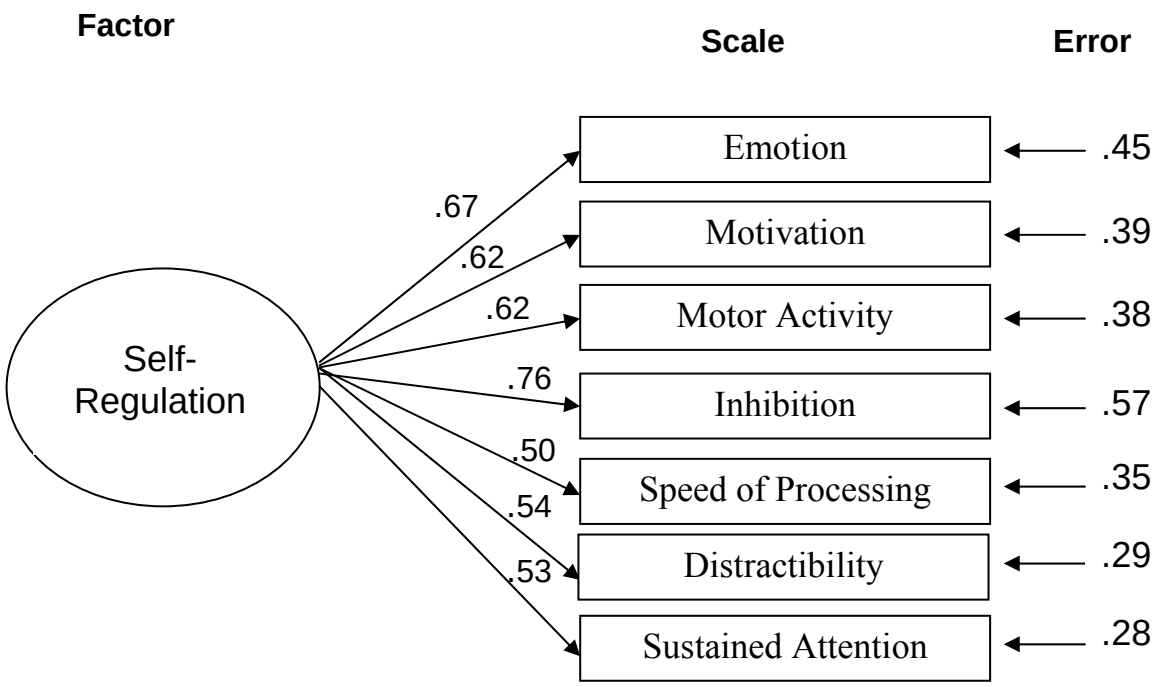

Figure 2: Confirmatory factor analysis factor solution (N=107)

STUDY 2

SELF-RATINGS ON THE SELFREG BY CHILDREN WITH DYSFUNCTIONAL SELF-REGULATION COMPARED TO SELF-RATINGS BY NORMAL CONTROLS

Self-ratings by children with dysfunctional self-regulatory skills (DSR) and various types of behavioural, developmental or academic difficulties on the SelfReg were compared to self-ratings by typically developing control children (CTL). We hypothesized that both groups would rate their self-regulatory skills accurately. In contrast to studies which described biased self-perceptions in clinical groups of children based on discrepancies between self-report and others' ratings (Gresham et al., 1998; Hoza et al., 2002; Hoza et al., 2004; Owens & Hoza, 2003; Diener & Milich, 1997), although the self-ratings raw scores of the children in the clinical group were similar to those of the control group, we expected to find the opposite pattern: children with impaired self-regulatory skills should rate themselves (accurately) as more impaired than control children. In consequence, discrepancy scores between self- and parent-ratings should not discriminate between the groups.

Method

Instruments: The children's IQ was measured individually by the short form of the German version of the revised Wechsler Intelligence Scale for children (HAWIK-III) described in study 1. Children's parents completed the Behavior Rating Inventory of Executive Function (BRIEF, Gioia et al., 2000), the Strength & Difficulty Questionnaire (SDQ, Goodmann, 1999), as well as a short checklist on the child's regulation of motivation and speed of processing. This checklist had been created in order to collect parents' ratings that matched the subscales of the SelfReg. Teachers completed the teachers' version of the BRIEF (Gioia, et al. 2000).

Participants: The clinical sample included 21 children with dysfunctional self-regulation (DSR). Selection criteria were at least two out of four BRIEF main indices (BRIEF Parent Behavioral Index, BRIEF Parent Metacognition Index, BRIEF Teacher Behavioral Index, BRIEF Teacher Metacognition Index) within the clinical range (T-score$\geq$60), with at least one elevated index score coming from the teacher's rating. In addition, children had to have been referred for behavioural, developmental and/or academic difficulties to specialized clinical psychologists or child psychiatrists.

One of the children had received the diagnosis of dyscalculia, five children had dyslexia, three were learning disabled, one child had a language development disorder, six children had attention-deficit/hyperactivity disorder, and five children had academic difficulties without any further diagnosis. CTL were selected from the validation sample and matched pairwise according to sex, age and IQ. Children with elevated scores (*T-score* > 60) on any of the four main BRIEF indices were excluded from the CTL. Children with DSR and CTL did not differ with reference to age, IQ and gender distribution. Parents of all the children participating in the study gave written informed consent. Data collection was permitted by a research ethics committee.

Procedure: The SelfReg (28 items) and IQ-tests were administered individually in a separate room in the schools.

Data Analysis: For the analyses of group differences, all scores from negatively formulated items on the SelfReg were transformed before entering the analysis, so that low scores on the SelfReg indicate dysfunctional self-regulatory skills. A MANOVA was performed in order to analyze group differences between children with DSR and CTL on the SelfReg subscales. Post-hoc comparisons were analyzed by T-tests. Accuracy of self-perceptions was examined by comparing the self-perceptions of DSR and CTL relative to the parent's and teacher's perceptions. In order to achieve the same scaling of the parent and teacher scales (BRIEF parent and teacher, SDQ parent), negatively formulated items of the SelfReg were reversed in exclusively positively formulated items ranging from 1 = "very often" to 5 = "never" (high scores indicate more regulatory difficulties) and all data were z-transformed. Discrepancy scores were computed separately for each competence domain by subtracting the parent or teacher rating of the child from the child's self-rating. Larger difference scores indicate greater overestimation of competence on the part of the child. Group differences were compared by *T-tests*. Results are presented in Table 4.

Table 4: Description and behavioral data of children with dysfunctional self-regulation (DSR, N=21) and controls (CTL, N=21)

	DSR (N=21)	CTL (N=21)	p
Mean age (SD)	9.8 (0.7)	9.6 (0.5)	*n.s.*
Mean IQ (SD)	100.8 (21.5)	106.0 (9.7)	*n.s.*
Boys / Girls	15 / 6	15 / 6	*n.s.*
BRIEF Parents *(T-Scores)*			
Inhibit	51.7 (13.0)	42.0 (6.5)	0.01
Shift	52.1 (12.7)	44.6 (9.4)	0.05
Emotional Control	54.2 (13.0)	43.2 (7.1)	0.01
Initiate	55.8 (13.4)	45.2 (7.8)	0.01
Working Memory	61.8 (11.9)	44.1 (6.1)	0.001
Plan/Organize	61.1 (13.5)	42.7 (6.8)	0.001
Organization of Material	52.5 (13.7)	45.5 (8.2)	*n.s.*
Monitor	57.3 (12.3)	41.8 (6.6)	0.001
Behavioral Index	53.2 (13.4)	41.8 (5.5)	0.001
Metacognition Index	59.6 (13.2)	42.6 (5.9)	0.001
Global Executive Composite	57.5 (13.3)	42.1 (5.5)	0.001
BRIEF Teacher *(T-Scores)*			
Inhibit	66.8 (16.7)	47.0 (10.0)	0.001
Shift	64.3 (16.2)	51.1 (7.2)	0.01
Emotional Control	68.4 (19.6)	47.7 (3.0)	0.001
Initiate	65.0 (13.4)	51.5 (6.9)	0.001
Working Memory	71.3 (12.1)	49.8 (9.0)	0.001
Plan/Organize	66.3 (11.1)	51.0 (7.8)	0.001
Organization of Material	66.9 (22.7)	47.0 (7.2)	0.001
Monitor	69.4 (13.4)	50.7 (7.9)	0.001
Behavioral Index	68.4 (18.0)	47.8 (6.4)	0.001
Metacognition Index	70.2 (12.5)	49.9 (7.5)	0.001
Global Executive Composite Index	72.5 (16.2)	51.0 (9.7)	0.001
SDQ Parents *(Raw Scores)*			
Emotional Problems	2.8 (2.4)	1.2 (1.0)	0.01
Conduct Problems	2.2 (2.5)	1.1 (0.9)	*n.s.*
Hyperactivity	5.2 (2.2)	2.5 (1.7)	0.001
Peer Problems	2.5 (2.3)	1.1 (1.3)	0.05
Total Scale	12.8 (7.9)	6.6 (3.6)	0.01

Notes: *n.s.*=not significant

Results

When comparing children with DSR (N=21) to CTR (N=21) (MANOVA: two groups by seven subscales) a significant main effect for group was found (F (0.52) = 4.32, p=.002). Post hoc tests indicated that children with DSR reported significantly lower self-perceptions of regulatory skills than controls across all the SelfReg subscales. Effect sizes (Cohen's d) ranged between 0.093 - 0.332. Results are presented in Table 5.

Table 5: SelfReg subscale scores (raw scores) of children with dysfunctional self- regulation (DSR, N=21) and controls (CTL, N=21)

SelfReg	DSR (N=21)		CTL (N=21)		Multivariate Main Effect	Univariate Tests		Effect Size
	M	SD	M	SD		F	p	
Emotional Control	13.4	3.2	15.2	2.7		4.11	*	. 093
Motor Activity	12.5	2.3	15.4	2.6	Wilks' Lambda	14.98	***	.272
Motivation	12.9	2.9	16.1	2.9	= .529	12.79	***	.242
Inhibition	12.7	3.3	16.8	2.5		19.88	***	.332
Speed of Processing	12.9	2.7	15.5	2.8	F = 4.328	9.44	**	.191
Distractibility	11.9	3.3	15.8	2.9	*p = .002*	15.73	***	.282
Sustained Attention	12.4	4.1	15.6	2.0		9.99	**	.200

Notes: *** $p<.001$, ** $p<.01$; * $p<.05$

No significant difference emerged when comparing discrepancy scores of DSR and CTR. This finding indicates that in relation to parents' or teachers' ratings, self-ratings on the SelfReg of children with DSR are as accurate as those of controls. Results of discrepancy analyses are shown in Table 6.

Table 6: Comparison of discrepancy scores (self vs. parents'/teachers' ratings, *z*-scores) of children with dysfunctional self-regulation (DSR, N=21) and controls (CTL, N=21)

Compared Scales	DSR (N=21)	CTL (N=21)	p
SelfReg and parent BRIEF			
Emotion– Emotional Control	-.131 (1.31)	.131 (1.06)	*n.s.*
Inhibition - Inhibit	.073 (1.70)	-.073 (0.96)	*n.s.*
Distractibility – Working Memory	-.217 (1.22)	.217 (0.77)	*n.s,*
Distractibility - Shift	.173 (1.66)	-.173 (1.25)	*n.s.*
SelfReg and teacher BRIEF			
Emotion– Emotional control	-.299 (1.18)	.299 (0.90)	*n.s.*
Inhibition– Inhibit	-.176 (1.50)	.176 (0.79)	*n.s.*
Distractibility – Working Memory	-.273 (1.19)	.273 (0.90)	*n.s.*
Distractibility- Shift	-.012 (1.16)	.012 (1.11)	*n.s.*
SelfReg and parent SDQ			
Motor Activity - Hyperactivity	-.105 (1.27)	.105 (1.06)	*n.s.*
Distractibility – Hyperactivity	-.285 (1.49)	.285 (0.52)	*n.s.*
Sustained attention - Hyperactivity	-.137 (1.63)	.137 (0.55)	*n.s.*
SelfReg and equivalent parent items			
Motivation - Motivation	-.042 (0.97)	.042 (1.20)	*n.s.*
Speed of Processing – Speed of Processing	.113 (1.16)	-.113 (1.20)	*n.s.*

Notes: *n.s.*= not significant; as a consequence of equal sample sizes and *z*-transformation, both discrepancy score group means are of equal size with opposite algebraic signs. The magnitude of the discrepancy means, negative or positive, indicates the magnitude of the difference between equivalent scales for the full group. In the present case, positive values represent underestimations whereas negative values point to overestimations of problems compared to others' ratings.

DISCUSSION

The aim of the present studies was to investigate whether young children aged 8 to 10 years are able to make differential judgments of their self-regulatory skills. For this purpose, a new self-rating scale of self-regulation (SelfReg) was developed in which children have to relate their own behaviour to that of other children (study 1). The items were presented as two opposites in story-like scenarios. According to the analysis of the SelfReg-preform based on the construction sample data, two subscales addressing monitoring and organizing/planning skills had to be excluded from the scale because of insufficient reliability. Several possible reasons may account for this. First, it may be particularly difficult for children of this age to be aware of these types of skills, and this may be especially true for monitoring which emerges rather late in the development of executive functions. In addition, demands put on self-organization and planning may vary between the age of 8 to 10 and also from one family to the next. Items in these subscales referred to home situations as well as to behaviour at school. For children of this age these items may appear unconnected. Finally, in a sample of unselected school children, where problems are less pronounced than in a clinical sample, self-reports of skills (such as monitoring one's progress) that are difficult to perceive may be less systematic and more variable than in a clinical sample and therefore may lead to unsatisfactory reliability of scales.

For the validation of the scale with a second sample of unselected school children, seven subscales remained in the SelfReg. Three subscales belonged to the cognitive domain and four to the behavioural domain of self-regulation. In contrast to our hypotheses, the data did not support a two-factorial scale structure but suggested a more parsimonious one-factor solution. Given the close interrelatedness of executive subcomponents, it may be difficult for children to draw a clear distinction between emotional and cognitive regulation, especially at the ages of 8 to 10, as metacognitive skills undergo important changes between childhood and adolescence (e.g. Anderson, 1998, 2008; Flavell et al., 1999). Different factorial structures across development have been reported for other self-rating scales for children, for example, for an awareness questionnaire of neuropsychological deficit for children (SAND-C, Hufford & Fastenau, 2005).

In study 2 we investigated whether children with dysfunctional self-regulation (DSR) differed in their ratings of self-regulative skills from normal controls. As hypothesized, children with DSR rated themselves as significantly more impaired than CTR across all SelfReg-subscales. Our results thus point to accurate self-perception in young children with behavioural and/or academic problems. This is supported by several studies claiming that young school children are responsive to negative feedback provided by their environment and that negative self-perceptions in children develop early (Chapman, 1998; Bear et al., 2002; Zeleke, 2004; Treuting & Hinshaw, 2001; Ialongo et al.,1994). In line with these results and as predicted by our hypotheses, discrepancy scores calculated by subtracting a criterion (parent report and teacher report) from the child's report of self-regulatory skills did not differ between DSR children and CTR children. In contrast to other studies which used self-report and parent- or teacher-versions of the same questionnaire (Hoza et al., 2002; Hoza et al., 2004; Owens & Hoza, 2003; Owens et al., 2007), SelfReg subcales and external criteria (parent report and teacher report) used here were only roughly matched, which might present a certain limitation. However, our results did not provide evidence for diminished accuracy of self-perception in children with DSR, relative to an external criterion, compared to normal controls.

Although the majority of children with difficulties in the present sample seemed to rate their difficulties appropriately on the SelfReg, we believe that the scale could also be a useful instrument in the detection of specific clinical subgroups presenting a reduced awareness of self-regulatory problems. The sample of children with DSR from the present study was etiologically diverse and not representative of a defined clinical subgroup. It is possible that more circumscribed clinical groups, such as children with ADHD or Oppositional Defiant Disorder, might show characteristic overestimation of competence and misperception of deficits on the SelfReg compared to other children with DSR. This has been described already in the literature (e.g. Evangelista et al., 2008, Owens et al., 2007; Hoza et al., 2002). Therefore, in a next step, the SelfReg will be validated on a group of children with ADHD.

One limitation of the study is probably the age range of the children of the validation sample and in the DSR group, which was closer to the age of 10 than to eight. We would argue, however, that the SelfReg should also be used with even younger children. The lower age limit of eight years in the present

study was also chosen to ensure that all children within the full age-range had already attended school, as the age for school entrance is seven years in the Swiss school system. Currently we are testing the SelfReg on an international sample of school beginners aged six to seven years. Finally, the sample size of the children with DSR was relatively small. Further studies should use larger sample sizes.

CONCLUSION

Children as young as eight to 10 years old are able to make accurate judgments on their self-regulatory skills when they compare their own behaviour to that of others instead of relating their behaviour to abstract verbal statements. The SelfReg has been shown to be a valid and sensitive instrument for the assessment of metacognitive knowledge of self-regulative skills in school children. It can be applied in an educational or a clinical context. It is anticipated that future research will demonstrate its usefulness in the detection of metacognitive deficits in clinical subgroups of children.

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APPENDIX

SelfReg items of the different subscales

Emotional Control

Pascal, Joel and Tim play "Connect 4" at Pascal's home. Pascal is the first to have placed all four figures in the goal.
1. Joel gets angry and throws all figures all over the play ground.
2. Tim thinks "It's a pity I lost", but keeps calm.

What about you? Do you keep calm if you lose a game?

Simon and Benjamin would like to watch a film. Their parents don't allow them to stay up longer than usual.
1. Simon gets angry and can't calm himself down.
2. Benjamin is a bit upset but is able to calm himself down quickly.

What about you? Do you get angry and can't calm yourself down if your parents forbid you to do something?

Dominic has invited Fabian and Nick to his birthday party. Dominic chooses three children to play a game. Fabian and Nick have not been chosen for this game.
1. Fabian tries to keep his good mood telling himself: "I'm sure I'll be chosen for a next game."
2. Nick immediately gets into a bad mood. He leaves the room and shuts the door.

What about you? Do you get into a bad mood if other children don't choose you for a game?

Luca and Michael have discovered a new game in the shop. Their parents don't allow them to buy the game.
1. Luca accepts it and stays calm.
2. Michael gets very upset.

What about you? Do you accept it and stay calm, if your parents don't allow you to buy something?

Motivation

The children have to solve a difficult problem and have difficulty finding the solution.
1. Roman tries to solve the problem for another while.
2. Dario loses his patience after a short while and does not continue. If something doesn't work right away, Dario gives up.

What about you? Do you try to solve a problem for a while, even if it's difficult?

Ivo and Nico don't like to do their homework.
1. For Ivo it is important to be good at school. He does his homework right after school.
2. Nico does not care. For him it is not important to be good at school. He always needs to be told to do his homework.

What about you? Do you have to be told to do your homework, even though you know that it is important?

Yves and Allan have read a story for the school. They both think that reading is boring.
1. Yves has read the story only because he is allowed to stay overnight at his friend's.
2. Allan has read the story without being allowed to do something he likes afterwards.

What about you? Do you only do boring things if afterwards you are allowed to do something you like?

The children do their homework.
1. Jeremy only makes an effort if his mother praises him.
2. Jan does not need to be praised by his mother to make an effort.

What about you? Do you make an effort at what you are doing even if your mother does not praise you?

Motor Activity

Yves and Marc go shopping with their parents.
1. Yves runs away all the time and touches all kinds of things in the shops.
2. Marc stays with his parents and does not touch things when he is not allowed to.

What about you? Do you stay with your parents when you go shopping?

Alexander and Manuel are sitting in the classroom.
1. Alexander sits still on his chair during the whole lesson.
2. Manuel swings backwards and forwards on his chair or fidgets with his arms or legs all the time.

What about you? Do you sit still on your chair during the whole lesson?

Lukas and Alessandro do their homework.
1. Lukas repeatedly rises from his chair. He goes to his room to get something or does something else.
2. Alessandro sits still during all his homework time.

What about you? Do you rise from your chair to do other things during your homework time?

It rains and David and Marco can't go outside to play.
1. David is constantly on the move. He jumps on the sofa, runs through the apartment or climbs on the furniture.
2. Marco quietly draws pictures in his room.

What about you? Are you always on the move, so that you jump, run or climb at home?

Inhibition

The teacher asks a question related to today's topic "my family".
1. Daniel raises his hand and answers only when the teacher asks him to.
2. Ivan shouts out the answer in class without raising his hand.

What about you? Do you shout out an answer in class without raising your hand?

Leon and Florian are late. They should have been at home half an hour ago.
1. Leon crosses the road without looking right or left.
2. Florian stops at the road boarder. Before crossing the street he looks right and left.

What about you? Do you first look right and left before crossing the road?

Patrick and Tobias fancy some sweets. Their mother says: "You will have to wait until after lunch for sweets".
1. However, Patrick would like some sweets now. He tries nonstop to get some before lunch time.
2. Tobias accepts it without fussing and waits until after lunch time.

What about you? Can you wait until you are allowed something?

Christmas Eve is approaching and some presents are already under the Christmas tree.
1. Simon does not touch them and waits until Christmas Eve.
2. Luca is excited and starts to scan the presents. He wants to find out what's inside.

What about you? Do you wait until Christmas Eve without touching your presents?

Speed of Processing

The teacher says: "Once you have finished these two math problems you can go for a break!"
1. Alex is playing outside for some time. He was as quick as his friends.
2. Fabian is still solving the math problems while his friends are playing outside.

What about you? Do you still have to finish your task while the other children can go for a break?

Patrick and Lukas solve a problem in the classroom. Lukas finishes before Patrick.
1. If Patrick wants to solve a problem without making mistakes, he needs more time than other children in his class.
2. If Lukas wants to solve a problem without making mistakes, he needs as much time as other children in his class.

What about you? Do you need as much time as other children in your class when you want to solve a problem without making mistakes?

The children have to learn a poem for the school.
1. Leon thinks he needs as much time as other children in his class to learn something new.
2. Nico thinks he needs much more time than other children in his class to learn something new.

What about you? Do you think you need much more time than other children in your class to learn something new?

The children have to solve math problems which the teacher is explaining on the blackboard.
1. Manuel thinks that he understands everything as quickly as other children in his class.
2. Tobias thinks that other children in his class understand everything more quickly than he does.

What about you? Do you think that you understand everything as quickly as other children in your class do?

Distractibility

Simon and Benjamin do their homework. There are children playing outside.
1. Simon has difficulty getting his homework done. He keeps being distracted by the children playing outside.
2. Benjamin is not disturbed by the children playing outside.

What about you? Do you easily get distracted by noises or voices while doing your homework?

The children are making a carnival mask.
1. Leon cuts his finger during handcrafting.
2. Joel has finished his carnival mask without hurting himself.

What about you? Do you ever hurt yourself when you are making things in art and craft?

The children are reading a book.
1. Daniel reads one sentence after another. He always remembers what he just read.
2. Benjamin reads some sentences. Suddenly he notices that he forgot what he just read.

What about you? Do you read one sentence after another and always remember what you just read?

The children are at Marco's birthday party. Marco tells Nick and Yves what he got as a present. Other children next to them are speaking and laughing.
1. Patrick listens carefully to Marco. He does not pay attention to the children next to them.
2. Yves has difficulty to listen carefully to Marco. He notes that he is listening to the other children instead of listening to Marco.

What about you? Are you able to listen for a long time without being distracted?

Sustained Attention

The children are in class.
1. Alessandro frequently chats with his neighbour instead of paying attention.
2. Andreas is able to pay attention for a long time. He rarely chats with his neighbour.

What about you? Are you able to pay attention for a long time without chatting with the person sitting next to you?

The teacher writes some math problems on the blackboard.
1. Allan pays attention and tries to solve the problems on the blackboard.
2. Simon is daydreaming. He can't say what he had just been thinking.

What about you? Do you ever daydream but can't say what you had just been thinking?

The children have to write an essay for school.
1. Manuel writes two sentences. He then has difficulty finishing the essay.
2. Fabian writes until the end of the lesson.

What about you? Are you able to stick to something for a long time?

The teacher says to Michael: “Don’t look out the window all the time. You have to pay attention."

1. The teacher rarely tells Andrin to pay attention.
2. The teacher often tells Ramon to pay attention.

What about you? Does your teacher tell you to pay attention?