

“I’m the best! Or am I?”: Academic self-concepts and self-regulation in kindergarten

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Abstract

In this paper, we examined how kindergarteners’ self-evaluation biases are related to behavioural self-regulation (SR) and learning goal orientation (GO). According to educational research and practice, fostering high and optimistic academic self-concepts promotes the setting of challenging goals and initiates effective behavioural SR processes. However, research on metacognition states that it is a match between academic self-concept and abilities that provides the optimal conditions for behavioural SR and a learning GO. There is theoretical and empirical evidence in favour of both positions, yet the correlates of self-evaluative tendencies may differ with children’s different levels of achievement, which are rarely considered. This cross-sectional study used response surface analysis, an innovative research methodology capable of assessing the complex interaction of academic self-concept and academic abilities on the behavioural SR and GO of 147 kindergarten children ($M = 6.47$ years, $SD = 0.39$ years). Polynomial regression models were used to test the presence of a fit pattern in empirical data and offer a new perspective on the interaction of academic self-concept and academic abilities. Results showed that a fit is generally associated with better behavioural SR and a learning GO but that correlates of academic self-concept differ with different achievement levels and outcome measures. This study extends current knowledge, as it offers important insights on how to conceptualise and pursue questions regarding self-concepts and behavioural SR. At an applied level, the findings indicate that interventions with kindergarteners that target SR should take the interactions between self-evaluation biases and ability level into account.

Keywords: Self-concept, behavioural self-regulation, goal-orientation, kindergarten, response surface analysis



1. Introduction

Supporting students in their acquisition of positive self-concepts is generally accepted as a pedagogical goal (Dickhäuser, 2006; Hellmich, 2011), but the strong positive self-image of kindergarteners still raises questions for researchers and teachers on whether and how to deal with it. To date, the educational research literature supports two contrasting positions on the role of academic self-concepts in supporting students' behavioural self-regulation (SR) and achievement (Bouffard & Narciss, 2011; Praetorius et al., 2016). Specifically, educational research often describes a positively biased self-concept as desirable for promoting the setting of challenging goals and initiating effective behavioural SR processes (Bouffard et al., 2006; Dupeyrat et al., 2011; Taylor et al., 2000). However, research on self-regulated learning (SRL) and metacognition highlights the importance of non-biased self-concepts. A fit between students' self-concepts and an external criterion of academic abilities suggests that students effectively engage in metacognition, which supports children in setting appropriately challenging learning goals and becoming effective self-regulated learners (Butler & Winne, 1995; Roebers et al., 2012).

There is empirical evidence in support of both positions. The contradictory findings have been discussed concerning differences in terms used (Bouffard & Narciss, 2011), outcome measures (Pinxten et al., 2010), measurement (Bouffard et al., 2006; Praetorius et al., 2016), and costs and benefits (Butler, 2011; Destan & Roebers, 2015; Narciss et al., 2011). The widely accepted reciprocal effects model (Marsh & Martin, 2011) posits that self-concept and achievement mutually reinforce each other through SR mechanisms, yet the intermediating SR mechanisms remain understudied. Additionally, in the instructional context a differentiated view is needed, especially with research on young children, since the correlates and consequences of self-evaluative tendencies may differ at different achievement levels (Butler, 2011). In kindergarten, where self-concepts tend to be overoptimistic, the relation with early SR as an important predictor of school success has yet to be investigated (Blair & Raver, 2015; Perry et al., 2017).

With the lack of a well-developed theoretical framework, there is little insight into whether kindergarteners' self-evaluative tendencies towards a positive bias (positive bias hypothesis), a fit (fit hypothesis) or differential correlates at different academic ability levels (differential hypothesis) are associated with better learning behaviour. Although the differential hypothesis may be integral to resolving the inconsistencies in our other hypotheses, we propose an exploratory approach that allows us to describe and test fit patterns in empirical data. We therefore employed response surface analysis, an innovative research methodology that computes and visualises polynomial models (Humberg et al., 2018; Schönbrodt et al., 2018) to compare the three different hypotheses (Humberg et al., 2017) and to take into account some shortcomings of the previous methods employed in self-concept research. As such, the present study examined the interaction of kindergarteners' academic self-concepts and an external criterion of academic ability in explaining differences in their goal orientation (GO) and behavioural SR. Before describing our study, we outline previous theoretical and empirical research on self-concepts, behavioural SR, and learning GO.

1.1 Self-Concepts in Kindergarten

The academic ability self-concept is an individual's cognitive representation of their academic abilities (Dickhäuser, 2006). Efklides (2011) describes self-concepts as trait-like characteristic at the person level that interact with their competences, motivation, affect, volition and metacognition. As such, self-concepts set goal-directed top-down and bottom-up SR processes in motion (e.g. behavioural SR) and are closely linked to metacognition (i.e. cognition about cognition; Flavell, 1979). Metacognition can be differentiated into metacognitive knowledge, metacognitive experience and metacognitive skills. Metacognitive knowledge is understood as a person's awareness of their strengths and weaknesses and is often conceptualised similarly to self-concepts. In contrast, metacognitive experience is conceptualised as feelings and judgments about cognition, and it provides feedback on



children's ability self-concept during learning tasks (Efklides, 2011). For example, children who have a positive self-concept of their mathematic abilities might choose to play a difficult numbers game, use different strategies and expect to succeed in this task. Therefore, self-concepts are understood as an antecedent of SR processes and as motivational beliefs with great significance for academic learning (e.g. Schunk & Green, 2018). Children experiencing failure may adjust their self-concept in dependency on that metacognitive experience. Therefore, a person's development of their self-concept is also the result of metacognitive experiences, knowledge and skills during the self-regulation process. In kindergarteners, self-concepts tend to be biased towards overconfidence; self-concepts then become more accurate throughout primary school (Arens et al., 2016; Hasselhorn, 2005; Jacobs et al., 2002; Lipko et al., 2012). According to Hasselhorn (2005), when asked to list the three highest-performing children in their class, 95% of kindergarteners name themselves. Plausible reasons for this overconfidence are their poorly developed metacognition, the lack of opportunity for social comparison, limited formal feedback within the learning environments and praise for accomplishing easy tasks (Hasselhorn, 2005; Hellmich, 2011). Although kindergarteners' self-concepts are biased towards overconfidence, they are related to academic ability (Cimeli et al., 2013; Marsh et al., 2002). Findings demonstrate that young children are more capable and accurate in gauging their own abilities than previously believed (Whitebread et al., 2007), especially when assessed with a domain-specific measure (Cimeli et al., 2013) or on the same scale with the same reference standards (Müller et al., 2015). Like adults' self-concepts, kindergarteners' self-concepts are composed of several domain-specific facets (Shavelson et al., 1976). For example, in Swiss kindergarteners a self-concept for combined academic abilities in math and language can be distinguished from social and play-based self-concepts (Cimeli et al., 2013). This reflects that in Switzerland, domain-specific, formal instruction and assessment in reading and writing do not typically begin before primary school. Rather, kindergartens emphasize free play in an open learning environment, allowing children to plan what to play and where, and for how long and with whom (Hauser, 2013). This setting gives children opportunities to employ and improve their SR (Timmons et al., 2016); given their relation to metacognition, motivation and academic ability, self-concepts may play an important role in early SR (Cimeli et al., 2013; Marsh et al., 2002). Since few studies have examined the correlates of self-concepts in this age group (Butler, 2011), there is a paucity of research examining the role of self-concepts in explaining early SR.

1.2 Early Self-Regulation

Young learners' early SR is a known predictor of school adjustment and academic success (Blair & Raver, 2015; Gestsdottir et al., 2014; Moffitt et al., 2013). Research on SR—and SRL as extension of SR during learning—emphasizes metacognition, motivation, affect, volition and cognition as key components to regulate and control behaviour (for a discussion on different models of SR and SRL, see Efklides, 2011; Panadero, 2017). Children are seen as agents of their own SR processes, through which they set goals and engage in learning tasks, monitor and evaluate their cognition, behaviour and learning outcomes and reflect on themselves as learners, which includes updating their self-concepts (Efklides, 2011). Based on Efklides' model (2011), interactions between personal characteristics (e.g. self-concepts, motivation, ability) guide SR processes. For kindergarteners, behavioural SR refers to the child's abilities of "focusing and maintaining attention on tasks, following instructions, and inhibiting inappropriate actions" (Sektan et al., 2010, p. 466). These abilities are a result of the child's inhibitory control, working memory and attention flexibility, which are known as basic executive functions: a family of top-down, domain-general skills that guide and control thought and behaviour and are implicit in SR (Diamond, 2016; Garner, 2009; Perry et al., 2017). To train them, repeated practice and increased challenge to executive functions is mandatory (Diamond & Lee, 2011). Being motivated to engage in challenging learning tasks to increase competencies and acquire or master new skills reflects a learning GO (Dweck & Leggett, 1988), which is sometimes termed a mastery approach GO (for a discussion on the different terms, see Zimmerman & Schunk, 2008). A learning GO is associated with children's incremental motivational framework (Compagnoni et al., 2019), which indicates that learning requires time and effort (Perry et al., 2019). For example, a kindergartener with a learning GO might choose to



play a new difficult game with numbers rather than replay a familiar game, even though it requires attention and persistence and success is not guaranteed. In contrast, a performance orientation is associated with engaging in easy tasks that one can master quickly with minimal effort; it conveys the desire to achieve success and outperform others (Bakadorova & Raufelder, 2020). A learning GO seems to be a hallmark for training SRL, since students with well-developed SR tend to engage and persist in challenging tasks (Hutchinson, 2013; Perry, 2013). In the autonomous, open learning environments in Swiss kindergartens this raises the question as to the role of self-concepts. Who is more likely to be learning goal oriented, therefore engaged in challenging tasks and show better behavioural SR: children with positively biased self-concepts or children with more congruent self-views? And does it differ for high or low achievers?

1.3 Self-Concept and Self-Regulation

Given that early SR is a predictor of successful school adjustment and learning (Butler, 2011), and because researchers agree that self-concept can influence one's SR through interactions with GO and cognitive resources at a personal-level (Efklides, 2011), it is crucial to gain insight into the interaction of self-concepts with self-regulation for learning in young children (Diamond, 2016; Efklides, 2011; Perry et al., 2017). Researchers recognise two effects regarding self-concepts: a self-enhancement effect, which suggests that positively biased self-concepts have a positive effect on the development of abilities (positive bias hypothesis) through self-affirmation or SR mechanisms (Taylor & Brown, 1988; Valentine et al., 2004), and a skill-development effect, which suggests that with increasing metacognitive development, self-concepts adapt to abilities (Roebbers et al., 2012), resulting in an increased fit, which is related to better SR (fit hypothesis). Studies on these two effects are often conducted in longitudinal panel studies, where both self-concept and achievement are measured, but the mediating SR mechanisms are neglected. Based on these studies, most researchers assume a reciprocal relationship, where self-concept and achievement mutually reinforce each other (Arens et al., 2016; Marsh & Martin, 2011; Pinxten et al., 2010), although the skill-development effect is more pronounced (Helmke & vanAken, 1995; Muijs, 1997; Praetorius et al., 2016). For example, Praetorius et al. (2016) reported no or only a small self-enhancement effect at the start of primary school, suggesting that self-concept might only have a motivational effect when the environment is challenging and new. In the instructional context, it is especially important to tease these two effects apart; kindergarten teachers need to know how (and whether) to deal with their pupils' strong positively biased self-concepts. As such, it is important to explore and understand how these competing effects can be disentangled and examine whether there is a unique relation with behavioural SR and GO.

Positive bias hypothesis. Self-concept theory (Marsh & Martin, 2011) posits that positive beliefs act as an internal resource that fuels motivational-emotional learning and initiates effective behavioural SR processes (Bouffard & Narciss, 2011). Studies with school children and adolescents demonstrate a link between positively biased self-concepts and higher intrinsic motivation (Bouffard et al., 2003; Dupeyrat et al., 2011), higher interest (Gonida & Leondari, 2011), higher effort to persist and maintain motivation (Dermitzaki et al., 2009), higher expectations of success (Dickhäuser, 2006) and higher learning gains (Shin et al., 2007). Longitudinal findings during adolescence indicate that the effect of academic self-concepts on achievement is partially mediated by learning GO (Bakadorova & Raufelder, 2020). This pattern suggests that positive beliefs promote the setting of challenging goals and the employment of effective learning behaviours despite set-backs, and they may ultimately support adaptive SR. Regarding GO, cost and benefits of a positive bias are discussed (Butler, 2011). Gonida and Leondari (2011) reported that a positive bias is related to a higher mastery, performance-approach and performance-avoidance GO and an orientation towards pleasing significant others. These findings suggest that children with a positively biased self-concept are more likely to choose challenging learning tasks over easy learning tasks, but the motivation may be externally sourced or may be the desire to outperform others.



Fit hypothesis. Research in self-regulated learning highlights the importance of a fit between self-concept and abilities. As students gain control over their cognitive abilities, they are better able to form and evaluate representations of their abilities (metacognition), which is central to adaptive SR (Destan & Roebbers, 2015; Diamond, 2016). Children showing a fit between their self-concept and abilities are assumed to be able to adapt to task conditions and set challenging learning goals and are therefore more likely to adopt and train effective behavioural SR (Destan & Roebbers, 2015; Flavell, 1979; Perry et al., 2017). As studies have demonstrated that students' self-concept is informed and refined by their metacognitive processes (Diamond, 2016; Efklides & Tsiora, 2002), positively and negatively biased self-concepts may be both the cause and result of poor SR abilities and may signal a developmental lag in metacognition. Researchers commonly agree that negatively biased self-concepts are related to only costs and no benefits (Bouffard et al., 2003; Gonida & Leondari, 2011). However, positive biases may also come at a cost, with overconfidence being described as a powerful cognitive bias that leads to poor monitoring and control abilities (Destan & Roebbers, 2015), self-handicapping (Young-Hoon et al., 2010), a performance GO, and avoidance of challenging tasks as a means of performing well and preserving one's positive self-views (Butler, 2011; Dupeyrat et al., 2011). Although there is little evidence that children's accurate self-views have more benefits than costs compared to a positive bias (Butler, 2011), researchers examining dyadic effects point out that an optimal fit might not be exactly on the line of numerical congruence (Schönbrodt et al., 2018), and a slightly positively biased self-concept might better support behavioural SR.

Differentiation hypothesis. Since a bias or a fit in academic self-concept may represent different meanings for high and low achievers (Butler, 2011; Marsh et al., 2002), we propose a third hypothesis that may be integral to resolving the inconsistencies in the literature on children's self-concept in relation to behavioural SR and GO. Some authors suggest that positively biased self-concepts act as motivational boost in challenging or threatening situations (Praetorius et al., 2016), similar to the preference for downward comparison in threatening situations described by early social comparison theory (Guyer & Vaughan-Johnston, 2018). If we assume that low-achieving children see the academic environment as challenging, we would expect that the effects of the positive bias position would be especially applicable. Although a positive bias might lead to more persistence for children with low academic ability levels, it may also lead to a performance GO, since children might prefer easy tasks that they have already mastered so as to keep their positively biased self-concept (Dweck, 2017). Therefore, it may act as a self-defence mechanism against poor performance (Loveless, 2006). A negative bias in children with low academic ability levels is likely to be related to helpless behavioural patterns and disengagement and should therefore be consistently related to maladaptive behaviour (Eckert et al., 2006). Some researchers argue that for competent children, a negative bias might also have positive motivational consequences, resulting in better monitoring and control abilities (Destan & Roebbers, 2015), more effort and investment in deep learning strategies (Blanton et al., 1999), and—based on social comparison theory—upward comparison as a need for self-improvement (Collins, 1996).

For children with higher academic ability levels, a fit between self-concept and ability is associated naturally with higher abilities and should be more conducive to adjustment and motivation (Butler, 2011). Therefore, it is not the absolute level of the self-concept in an inter-individual comparison that is relevant for correlations with behavioural SR and GO but rather an intra-individual approach in which self-concept and ability level are calculated from a person-centred perspective. Longitudinal studies or studies using difference scores might therefore neglect the achievement level or the proposed non-linear relation as proposed in the fit hypothesis.

2. The Present Study

This study aims to disentangle the roles that kindergarteners' academic self-concepts play in explaining differences in behavioural SR and GO, by examining kindergarteners' self-concept biases



with an intra-individual approach and to take the general ability level into account as well as assumed non-linear correlations. Three competing hypotheses have been suggested, which all have sound empirical and theoretical bases but have never been tested simultaneously for different SR outcomes: (1) The positive bias hypothesis suggests that a positively biased self-concept is related to better behavioural SR and learning GO than a negatively biased self-concept or a fit between self-concept and ability level; (2) The fit hypothesis suggests a fit between self-concept and ability level is related to better behavioural SR and learning GO; and (3) The differential hypothesis suggests differential effects for different ability levels. Specifically, a fit between self-concept and ability level is the most beneficial for behavioural SR and a learning GO for students with medium ability levels. For students with low ability levels, a slightly positive bias is associated with higher behavioural SR than a fit or a negative bias is. Lastly, for students with high ability levels, a slightly negative bias is related with higher behavioural SR than a fit or a positive bias is. We proposed that the differential hypothesis may be the most representative of the actual dynamics between these variables.

3. Method

3.1 Context of the Study and Participants

In Switzerland kindergartens are part of the public education system, and 95% of children attend a two-year kindergarten program in their local public schools starting at age 4 or 5 (EDK, 2017). Classes are comprised of age-mixed children with diverse socioeconomic (SES) backgrounds, ethnicities and first languages. Kindergarten education is highly interdisciplinary, and an open learning environment and play are of great importance; children are slowly introduced to domain-specific learning like math and literacy. Nineteen kindergartens from different schools ($M = 7.4$ children per class) in urban and rural areas participated in the study and reflect the demographic composition of the German-speaking part of Switzerland. The kindergarteners' first languages were: 45% Swiss German, 10% Albanian, 7% Serbian/Croatian, 5 % Turkish, 3% for Portuguese, English, German and Arabic, respectively, 2% Spanish; the rest had other first languages. Teachers reported that 72% of the children were of Swiss nationality, which matched official data. Parents and children's informed consent to participate was received from 91%, and refusals were unsystematic. The final sample consisted of 147 children (52% girls) in the second year of kindergarten ($M = 6.47$ years old, $SD = 0.39$). Missing data was due to children who were ill at one of the two measurement times or due to technical failures.

3.2 Materials

Academic abilities and academic self-concept. Children provided assessments of their academic abilities (i.e. knowing letters, reading, writing, knowing numbers, arithmetic, and counting) by selecting their rank position out of 9 stickmen in a row that represented their classmates (Cimeli et al., 2013). They were told that the stickman on the right represented the classmate with the best abilities in e.g. counting, whereas the stickman on the left represented the classmate with the poorest abilities, whereupon children marked the stickman that was most representative of their own position. This approach counteracts children's positively biased self-concept ratings (Cimeli et al., 2013). Teachers provided ratings of their students' math and literacy abilities on the same scale, to take social comparisons into account (Pinxten et al., 2010). Raw scores ranged from 1 (poorest in the class) to 9 (best in the class) for academic self-concepts ($M = 6.66$, $SD = 1.75$, $\alpha = .77$), and for teacher ratings of academic abilities ($M = 6.19$, $SD = 2.05$, $\alpha = .84$). Residual scores were used to calculate the absolute and relative deviation of children's self-concept from teacher ratings. Residuals represent the part of the self-concept that cannot be explained by the corresponding teacher rating.



Behavioural self-regulation. The new version of the Head-Toes-Knees-Shoulders (HTKS) measure was used as a direct observational indicator of behavioural SR, as it measures inhibitory control, working memory and attention flexibility (McClelland et al., 2014). In the HTKS, the children were asked to play a game where they must do the opposite of what the experimenter says. For example, if the experimenter instructed the students to touch their toes, they had to touch their head instead. The first 10 items included two paired commands (head – toes); the next 10 items added two new paired commands (shoulders – knees); and for the last 10 items, the four commands were paired differently than before. For children to be successful in these tasks, they must focus on the instructions and commands (attention flexibility), remember the paired rules (working memory) and stop a dominant response tendency and replace it with the opposite response (inhibitory control). Each of the 30 items was scored as 0 for an incorrect response, 1 for a self-correction, or 2 for a correct response. As instructed in the test manual, the five children who scored very low on the first tasks were not allowed to finish, and scores were adjusted accordingly. Total scores on the HTKS ranged from 12 to 57 points ($M = 41.71$, $SD = 10.35$, $\alpha = .86$), where higher scores indicated higher levels of behavioural SR.

Learning goal orientation. To assess children’s learning GO, a self-report method was used based on the Berkeley Puppet Interview (see Figure 1; Measelle et al., 1998) with items derived from the motivational framework measures from Gunderson et al. (2013). Learning goal orientation therefore was assessed as preference for challenging versus easy tasks in service of learning goals. Children listened to two elephant puppets on a touchscreen: One elephant expressed a high learning GO (e.g. “I prefer to do very hard tasks so I can get better”) and the other a low learning GO (e.g. “I prefer to do easy tasks that I’m good at”). Children indicated on a 5-point semantic differential scale how well they could identify with one of the puppets. As suggested by Marsh et al. (2002), a double binary response strategy was used, where the identification with one puppet (by pressing a button) was always followed by a second probe (“Do you totally agree with this puppet, or do you agree only a little?”) to counter the tendency to select endpoints and neglect intermediate points. Total scores ranged from 1 to 5 points ($M = 3.68$, $SD = 1.16$, $\alpha = .88$), where higher scores indicated higher levels of learning GO.



Figure 1. Learning goal orientation measurement instrument.

3.3 Procedure

Data collection took place in the spring semester of 2017. Since the entire assessment took more than 50 minutes per child and would have exceeded their attention span, each kindergarten was visited twice within a period of 2-4 weeks. Given the students’ lack of reading and writing skills, the first author and two trained research assistants administered each measure with each child separately during regular



classroom hours. Order of exposure to each measure was the same for all students, but items on measures of self-concept and GO were counterbalanced to control for any effects of order. Teachers completed an online questionnaire on the children's demographics and academic achievement in a session that lasted 4 minutes per child.

3.4 Data Analytic Approach

Research on self-concept bias often uses difference or residual scores, which represents the part of the self-concept that cannot be explained by the corresponding external criterion. However, this procedure is not recommended, as it does not take linear major effects into account (Humberg et al., 2017) and relies on the assumption that the optimal fit is exactly on the line of numerical congruence (Schönbrodt, 2016). Since linear regression models impose linear constraints on the parameters and would fit our anticipated non-linear data pattern poorly, polynomial regression models were employed to test our hypotheses. The response surface analysis (RSA) package for R (Schönbrodt, 2016) allowed for the comparison of different polynomial models using a path modelling approach (Humberg et al., 2017). We predicted the impact of the interaction of two predictors collected with comparable scales (academic self-concept and academic ability rating) on an outcome measure (behavioural SR and GO), so non-linear effects could be modelled. The different hypothesised models could be expressed as constrained multiple regressions, and data were analysed to detect fit patterns that would confirm one of the competing hypotheses. Three models were tested: (1) the rising ridge model, examined if a fit (a ridge) between academic self-concept and ability rating is related to positive behavioural SR and a learning GO (fit hypothesis); (2) the shifted rising ridge model, tested if the positive bias hypothesis best describes our data (we assumed additionally a shifted ridge; positive bias hypothesis); and (3) the shifted and rotated rising ridge model, which tested differential effects for high and low academic ability levels (allowing the ridge to rotate; differential hypothesis). The mean level (*bM*) effect was incorporated in the three models—a linear major effect of the predictors on the outcome, so that the ridge is inclined in a direction that high/high combinations of self-concept and academic ability is related to higher values of the outcome than low/low combinations. The RSA package additionally computed an additive model with linear main effects of the two predictors and an interaction model (IA). For a full review of RSA and associated equations for all models, see Humberg et al. (2017) and Schönbrodt et al. (2018).

4. Results

4.1 Preliminary Analyses

Table 1 shows descriptive information and correlational analyses for self-concept, ability ratings, behavioural SR, GO, residual scores and covariates measures. For small class sizes, ICC scores for the main constructs between 0.11 and 0.08 are considered reasonably small (Hox, 2002). Power analysis conducted with the variance inflation factor and these sample sizes showed a Type I error of .05, and a power of 0.80. Residual scores revealed that the more positive the bias, the more learning-oriented the children were, also when gender and age was controlled for ($r_s = .182, p = .035$). There was no significant effect of residual scores on behavioural SR ($r_s = -.026, p = .762$). Absolute residuals scores demonstrated that the more incongruent children rated themselves with teacher ratings the higher their behavioural SR score was ($r_s = -.145, p = .085$) and the more learning oriented they were ($r_s = -.281, p = .001$). However, results derived from residuals have serious shortcomings (see above) and should be interpreted carefully. RSA can take non-linear effects and mean level effects into account and compare the different polynomial models.



Table 1

Descriptive Statistics and Correlations for Study Variables

	<i>n</i>	<i>M</i>	<i>SD</i>	95% CI	1	2	3	4	5	6	7	8
1. Behavioural SR	140	41.71	10.35	[39.73, 43.26]	–	.22*	.10	.36*	.02	-.13	-.12	.12
2. Learning GO	145	3.68	1.16	[3.48, 3.88]	.22*	–	.35*	.28*	.28*	-.29*	.17*	.11
3. Academic self-concept	139	6.66	1.75	[6.41, 7.00]	.06	.33*	–	.30*	.96*	-.34*	.12	.16
4. Academic ability level	141	6.19	2.05	[5.82, 6.52]	.35*	.30*	.34*	–	.00	-.18*	.02	.15
5. Residuals	136	0.00	1.66	[-.28, .28]	-.03	.24*	.94*	.03	–	-.30*	.12	.12
6. Absolute residuals	136	1.40	0.88	[1.25, 1.55]	-.15	-.24*	-.13	-.18*	-.07	–	.10	-.01
7. Gender	145	1.48	0.50	[1.39, 1.56]	-.11	.22*	.14	.00	.15	.09	–	.14
8. Age	141	77.16	4.66	[76.28, 77.86]	.12	.12	.17	.16	.14	.06	.12	–

Note. CI = confidence interval; SR = self-regulation; GO = goal orientation. Pearson correlations are presented above the diagonal, Spearman correlations below the diagonal.

**p* < .05 two-tailed.

4.2 Response Surface Analyses

Tables 2 and 3 report model indices. As Schönbrodt (2016) suggested for model comparison, we focused on the corrected form of the Akaike information criterion (AICc), which corrects for a bias when the sample size is small compared to the number of model parameters (the model with the smallest AICc is considered the best model; Schönbrodt, 2016).

Behavioural SR. Table 2 shows the model indices for behavioural SR. According to AICc, the best model to predict behavioural SR from self-concepts and teacher ratings was the SRRR model (differential hypothesis) with a model weight of 0.29. The Δ AICc between the SRRR model and the less restricted additive and interaction model was < 2, which indicates that they were equally representative and in the range of plausible models. The χ^2 test indicated that the SRRR, the IA and the additive model were not significantly worse than the full polynomial model and were significantly better than the null model. According to the comparative fit index (CFI), all three models were around the rule of thumb value of .95 and had relatively good fit (Hu & Bentler, 1999). Interpretation of parameter estimates reinforced the notion that both were suitable models to describe the data, but the best fitting model was the SRRR, as it had the lowest AIC. However, the additive model was the simplest well-fitting model. Table 4 (see appendix) shows the regression coefficients *b1* to *b5* for the full polynomial regression models. The parameter for the mean-level effect, *bM*, was significantly different from a flat ridge, meaning that children with high/high combination showed better behavioural SR than children with low/low combinations. Although the parameter *S* for the rotation of the ridge as well as *a'4* for the fit did not show a significant value, according to the AICc criterion they still added to the quality of the model.



Table 2

Model Comparison for Behavioural SR. Ordered by $\Delta AICc$

Model	k	AICc	$\Delta AICc$	Model weight	Evidence ratio	CFI	R^2	SRMR	R^2_{adj}	p_f	p_n
SRRR	4	1011.04	0.00	0.29		1.00	0.159*	0.003	0.133	.834	.000
AM	2	1011.26	0.22	0.26	1.12	0.92	0.131*	0.034	0.118	.240	.000
IA	3	1011.43	0.39	0.24	1.22	0.97	0.143*	0.021	0.124	.297	.000
Full	5	1013.14	2.10	0.10	2.86	1.00	0.159*	0.000	0.127	1.000	.000
SRR	3	1013.24	2.20	0.10	3.00	0.87	0.132*	0.034	0.112	.109	.001
RR	2	1016.29	5.25	0.02	13.80	0.65	0.098*	0.041	0.084	.026	.003
Null	0	1026.24	15.20	0.00	1998.20	0.00	0.000	0.089	0.000	.000	1.000

Note. k = number of parameters; AICc = corrected Akaike information criterion; evidence ratio = ratio of model weights of the best model compared to each other model; CFI = comparative fit index; SRMR = standardized root-mean-square residual; R^2 = variance explained; $p_f = p$ value, model compared to full model; $p_n = p$ value, model compared to null model; R^2_{adj} = adjusted R^2 . Model abbreviations: Full = full polynomial model; SRRR = shifted and rotated rising ridge model; SRR = shifted rising ridge model; RR = rising ridge model; IA = interaction model; AM = additive model; Null = intercept-only model.

* $p < .001$.

Since the results can be hard to interpret, we plotted the regression result as a three-dimensional response surface for the SRRR model (Figure 2) and the additive model (Figure 3). The shape of the coloured area showed how behavioural SR depended on the combination of teacher rating and self-concept, with greener areas displaying higher behavioural SR. For the SRRR model, the restrictions imposed a mean effect of the levels of the predictors and a maximum ridge. Therefore, the area falls off to both sides, but both a rotation and a shift of the ridge is allowed. Results showed a significant mean level effect, which in terms of content means that behavioural SR was higher, the higher the self-concept and the teacher ratings. For children with lower ability levels, behavioural SR was at a maximum when children had a slightly positive bias, with medium levels when there was a fit, and with high levels when there was a negative bias. The graph thus described the hypothesis of congruence, with a linear main effect of self-concept and teacher ratings on behavioural SR but with differing effects for low and high achievers. The additive model results showed a significant linear main effect, which in terms of content means that behavioural SR was higher, the higher the predictors, but the effect was based mainly on teacher ratings.



Mean-level effect = 1.95*** C = 24.81 S = -5.10

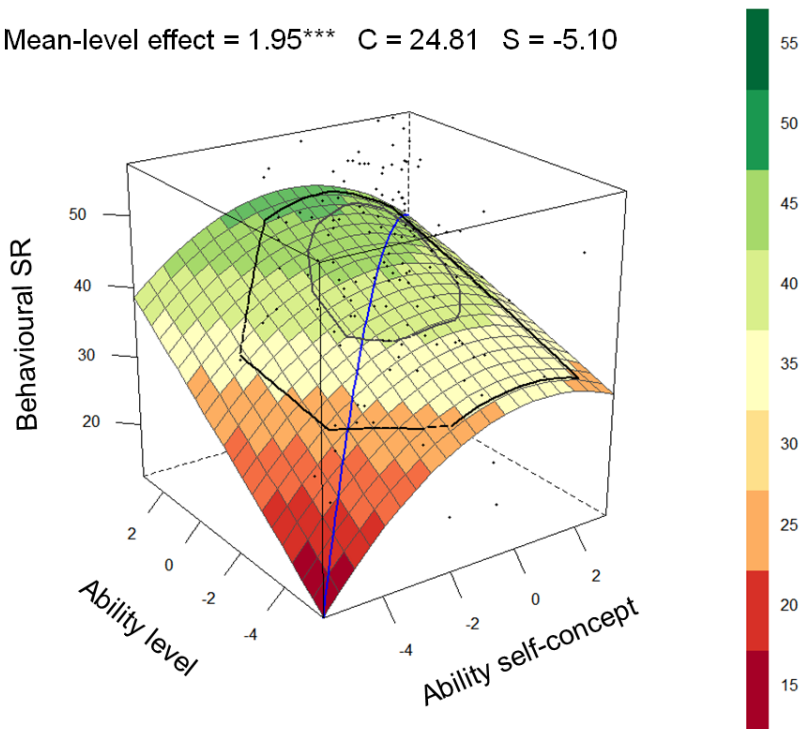


Figure 2. SRRR model for behavioural SR. SRRR model = shifted and rotated rising ridge model. Blue line: line of congruence (LOC). Inner black circle contains 50% of data points. Greener areas display higher behavioural self-regulation than redder areas. C = parameter for the shift of the ridge; S = parameter for the rotation of the ridge.

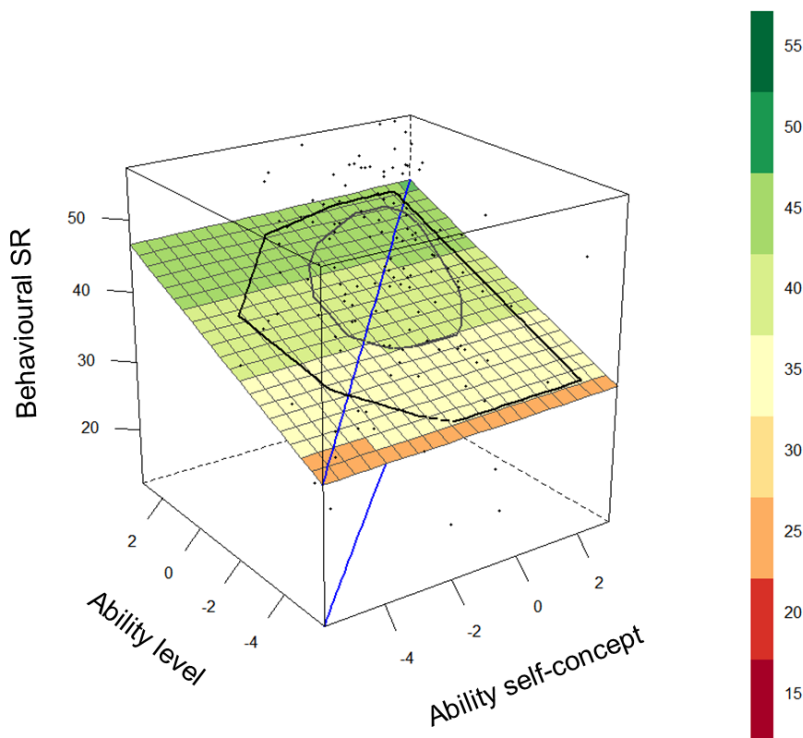


Figure 3. Additive model for behavioural SR. Blue lines: line of congruence (LOC). Inner black circle contains 50% of data points. Greener areas display higher behavioural self-regulation than redder areas.



Goal orientation. Table 3 shows the model indices for GO. According to the CFI, only the interaction model had relatively good fit (Hu & Bentler, 1999). According to the AICc, the best model to predict GO from self-concepts and teacher was also the IA model with a model weight of 0.69. The $\Delta AICc$ between the IA model and the other models was > 2 , which indicates that the IA model may fit the data best. Inspecting the other fit indices, all other models had a CFI < 0.86 . The χ^2 - LR test indicated that the IA model fit the data significantly better than the null model and was not significantly worse than the full polynomial model.

Table 3

Model Comparison for Goal Orientation. Ordered by $\Delta AICc$

Model	<i>k</i>	AICc	$\Delta AICc$	Model weight	Evidence ratio	CFI	R^2	SRMR	R^2_{adj}	p_f	p_n
IA	3	401.38	0.00	0.69		1.00	0.225*	0.015	0.207	.539	.000
Full	5	404.12	2.74	0.18	3.94	1.00	0.233*	0.000	0.204	1.000	.000
SRR	3	406.56	5.18	0.05	13.33	0.85	0.194*	0.039	0.176	.000	.001
SRRR	4	407.06	5.68	0.04	17.12	0.87	0.204*	0.036	0.180	.000	.000
RR	2	407.63	6.25	0.03	22.76	0.78	0.175*	0.050	0.163	.001	.002
AM	2	410.81	9.43	0.01	111.61	0.68	0.156*	0.052	0.143	.013	.000
Null	0	429.78	28.40	0.00	1468864.19	0.00	0.000	0.102	0.000	.000	1.000

Note. *k* = Number of parameters; AICc = corrected Akaike information criterion; evidence ratio = ratio of model weights of the best model compared to each other model; CFI = comparative fit index; SRMR = standardized root-mean-square residual; R^2 = variance explained; $p_f = p$ value, model compared to full model; $p_n = p$ value, model compared to null model; R^2_{adj} = adjusted R^2 . Model abbreviations: Full = full polynomial model; SRRR = shifted and rotated rising ridge model; SRR = shifted rising ridge model; RR = rising ridge model; IA = interaction model; AM = additive model; Null = intercept-only model.

* $p < .001$.

The shape of the coloured area in Figure 4 depicts how GO was related to the combination of teacher judgement and self-concept. The greener the area, the more learning oriented the children described themselves. The restriction of the coefficients of the IA model led to a linear effect of self-concept and teacher ratings on behavioural SR as well as an effect of the interaction. Regression coefficients *b1* to *b5* in Table 5 (see appendix) confirmed a significant effect of self-concept as well as the interaction on learning GO. In terms of content, this means that the learning GO was generally higher, the higher the teacher ratings and the higher the self-concepts. But children with high self-concepts and low academic ability levels (strong positive bias), as well as children with low self-concepts but high academic ability levels (strong negative bias), had a very low learning GO and reported a preference for easy tasks that they already master, so as to get a lot right. This is in contrast to children with high/high and low/low combinations, who were very learning oriented.

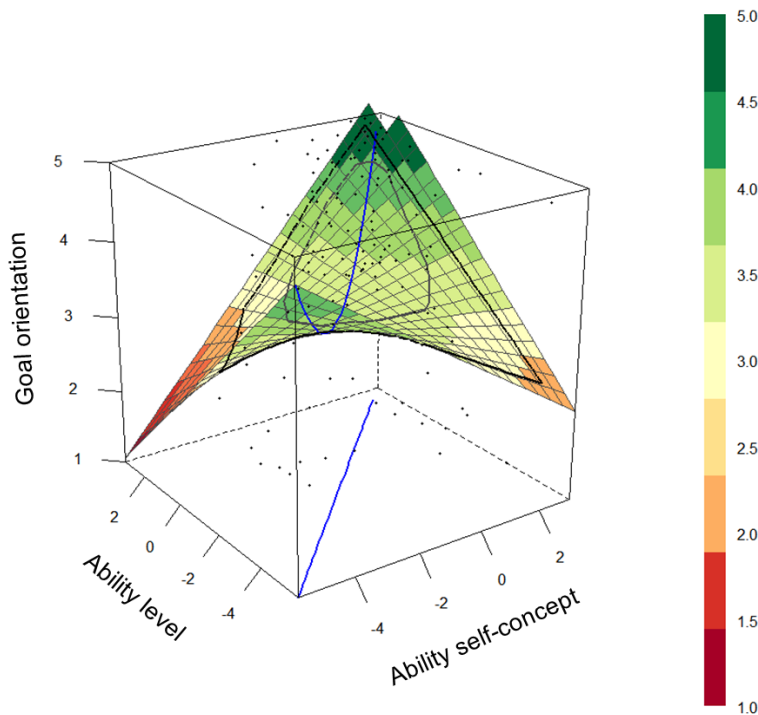


Figure 4. Interaction model for goal orientation. Blue line: line of congruence (LOC). Inner black circle contains 50% of data points. Greener areas display higher learning GO than redder areas.

5. Discussion

The main objective of the study was to determine the role that self-evaluative tendencies in kindergarteners play for behavioural SR and learning GO, as inconsistent positions exist in the literature and a well-developed framework for this age group is missing. Our review of theoretical and empirical work revealed three positions: First, a positively biased self-concept might act as motivational fuel and lead to a learning GO and better behavioural SR (Taylor et al., 2000). Second, a fit between self-concept and abilities level may signal well-developed metacognition (Destan & Roebbers, 2015), which is known to play a central role in the setting of learning goals and leads to effective behavioural SR (Diamond, 2016; Perry et al., 2017). And third, a differentiated view suggests that correlates of self-evaluative tendencies might differ at different ability levels and for different outcomes (Bouffard & Narciss, 2011; Butler, 2011). Our findings support the hypothesis that the correlates of biased self-concepts in kindergarteners differ for different ability levels.

Regarding behavioural SR, a fit between self-concept and academic ability level is beneficial for children with average abilities. This is in line with previous research in SR which suggests that a fit signals effective metacognition and ultimately better behavioural SR (Butler & Winne, 1995; Roebbers et al., 2012). However, our research extends previous findings, as it demonstrates that for children with high and low academic ability levels, a differentiated view is more appropriate. Specifically, children with a high ability level had the best behavioural SR when they had a slightly negatively biased self-concept, which may indicate that it encourages them to exert more effort and to invest in deep learning strategies (Blanton et al., 1999). Alternatively, children with a low ability level performed best when they adopted a slightly positive bias, which might indicate that positive self-concepts act as a motivational boost to increase effort and persistence in learning (e.g. mastery GO; Gonida & Leondari, 2011). However, the effects were quite small, and teacher ratings of children's academic abilities were



a better predictor of behavioural SR than children's self-concepts were. These findings suggest that kindergarteners' self-evaluative tendencies and absolute level of self-concepts only play a minor role in explaining their behavioural SR. Future research should continue to pursue lines of questioning that anticipate unique relationships between biased self-concepts and SR based on individual students' academic ability levels.

Regarding learning GO, our results extend previous research findings, as they reveal differential relations based on academic ability levels. Linear effects demonstrated that the higher ability levels were and the more positively biased students' self-concepts were, the more the students reported a learning GO. This is in line with previous educational research that suggests that a positive bias may be desirable for promoting learning GO's (Dupeyrat et al., 2011; Taylor et al., 2000). However, when taking non-linear effects into account, our results extend previous research as they demonstrate a significant interaction whereby children with strongly biased self-concepts were more likely to report preferring easy learning tasks that they had already mastered over challenging tasks. Interestingly, this was true for both children with a low ability level who perceive themselves as being among the best children in class and children with a high ability level who perceive themselves as being among the worst children in their class. This may reflect the fact that children with low academic abilities and high self-concepts engage in easy tasks to perform well and avoid possible failure, protecting their positive self-view in front of others and themselves, and this reflects a performance orientation (Dweck & Leggett, 1988). In contrast, children with high ability levels and very low self-concepts might also avoid challenging tasks as a means of buffering against failure but clearly not to protect their self-concept. Reasons might be a high avoidance orientation, fear of failure, pressure to perform or low self-efficacy. Although these children have appropriate behavioural SR abilities in kindergarten, their GO may become a hindrance over time if they continue to avoid challenging tasks, since challenge is critical for training SR (Diamond & Lee, 2011). Children with a fit and with high as well as low academic ability levels showed a high learning GO, which may reflect well-developed metacognitive abilities. Our findings on children with mid-range ability were somewhat inconclusive regarding their GO and may reflect a practice at schools whereby children at the extreme ends receive more resources in terms of attention, feedback and support to set challenging goals than children in the middle range do.

In sum, early behavioural SR deficiencies are known to be problematic for school transitioning and future learning behaviour (Blair & Raver, 2015). Therefore, research on correlates (e.g. self-concepts) in this age group is required to better understand the processes involved in the development of SR. Kindergarteners' self-concepts are slightly positively biased but are related to teacher ratings of their academic abilities ($r_s = .34$), suggesting that kindergarteners do not form unreasonably biased self-concepts. The educational goal of supporting positive self-concepts is certainly valid if positive self-concepts are enhanced by fostering the underlying abilities (e.g. mathematic abilities). However, positive self-concepts alone do not seem to be a solution to behavioural SR deficiencies, as they too have costs (Butler, 2011). A slightly positively biased self-concept might foster a learning orientation, and for low-ability children it seems to be related to better behavioural SR. But for higher achieving children a fit or even a slightly negative bias might set more adaptive SR processes in motion. Children with an extreme self-concept misfit in both directions are the most at risk in their development. The use of an innovative approach like RSA offers a different perspective on how to conceptualise and pursue fit patterns regarding self-concept and external criterion in kindergartens in relation to an outcome such as behavioural SR and GO and should continue to be adopted moving forward.

6. Limitations and Implications for Research and Practice

Although the present study has several advantages, there are four substantial limitations that should be addressed. First, the correlational nature of this study precludes any claims of causation, and the small sample size and reduced power prevented us from employing a structural equation model.



Although our use of RSA accounts for the unique non-linear influence of self-evaluative tendencies on an outcome and takes different ability levels into account, the approach neglects the possible influence of other variables (e.g. demographics). In our preliminary analyses, where we used residual scores and computed univariate analyses of variances, the results did not diverge when gender or age were included as control variables. But continued research is needed to gain insight into the directions and weights of paths between kindergartener's self-concepts, abilities, behavioural SR and GO, and possible interactions between variables such as gender, age or SES. Second, the teacher ratings of students' academic abilities used in this study have advantages and disadvantages. With no formal grades given in kindergarten, teacher's assessment of students' abilities are valid judgments and a congruence is considered relevant for common objectives (Skaalvik & Hagtvet, 1990). They also consider social comparison processes, as teachers in this study used their kindergarten group as social reference norm. This approach allowed us to compare children's and teacher's ability perceptions and led to a small variance across kindergarten classes. However, they cannot be considered objective measures, and they represent more than a mere reflection of students' abilities because teacher ratings also take motivational characteristics into account (Pinxten et al., 2010). Future research should consider the use of both achievement tests and ratings but as separate latent constructs, since they have different psychological meaning (Pinxten et al., 2010). Third, although the assessment of learning GO on a unidimensional scale is acceptable for this age group, future studies should try to capture differentiated GOs (e.g. performance/mastery, avoidance/approach) to fully address the correlates and relations between self-concept, behavioural SR and GO. In the open learning environment in kindergartens, where task demands are not always clear, differentiating performance and mastery GO on two separate scales might be beneficial to gain deeper insights. Fourth, given our small sample of 19 typical Swiss kindergarten classes and the limited power, questions arise regarding the generalisability of our findings to different classes, schools and school levels. Swiss kindergartens emphasize open learning environments, and it may be the case that the interaction of self-concept, ability level and SR is different in more structured environments, where there is less free play and free choice. Future research should employ longitudinal designs with multiple variables to assess developmental patterns after the transition from kindergarten to primary school, where the educational setting often changes dramatically (e.g. open learning environments are rare; regular tests of performance and formal feedback are given). Although different school types may also play a role, the classroom level is next to the individual level the most important pedagogical unit for explaining cognitive and motivational learning outcomes (Wurster & Feldhoff, 2019). It is plausible that teachers' approaches to instruction or differences in classroom climate (e.g. non-threatening teacher feedback, graded work), may lead to differences in the associations between self-evaluation bias and SR in students. As we did not collect data on features of instruction or task design within classrooms and thereby across schools, future research should consider these variables to conduct multilevel analyses to examine differences across kindergartens and the prevalence of different profiles across schools.

In practical terms, our results highlight the role of self-concepts in supporting motivation in early childhood. Without attention to students' underlying abilities, high self-concepts are not very meaningful in explaining differences in self-regulation. As such, teachers should mainly support students' self-concepts by focusing on the improvement of their students' abilities. Our findings suggest that kindergarten teachers should adapt their instructional approaches (e.g. relevant feedback and task-specific experiences that give students information about their abilities and train their metacognition) to help kindergarteners align their self-concept and abilities, as a fit is related to better behavioural SR for most achievement levels. In students with low achievement levels, teachers could attempt to strengthen their self-concepts to be slightly positively biased (e.g. provide positive feedback and support in selecting tasks that are appropriately challenging and supportive of ability and self-concept), as this may result in better achievement and behavioural SR outcomes. Further, our findings suggest that teachers should be sensitive to personal characteristics that influence learning GO and behavioural SR in the classroom, as these characteristics support learning processes. Although higher self-concepts are related to a learning GO, which is typically preferred in schools, teachers should be particularly sensitive to strongly biased self-evaluations. That is, children with strong positive as well as strong negative biases



report a preference for easy tasks they have already mastered, which may represent a fixed motivational framework where learning is considered something that is preferably quick and easy (Dweck, 2017), and this can have negative consequences for SRL in the long run (Hutchinson, 2013). Researchers, educators and policy makers may integrate these findings into their instructional approaches and interventions that target behavioural SR or SRL to differentially support students based on their academic ability level.

The world is not black or white, and it seems this is also the case with the question of whether a fit or a positive bias better supports learning outcomes. Instead of dichotomising, researchers and educators should consider that there are unique benefits and risks associated with distinct self-concept biases for students with different academic ability levels. Interventions should be designed with these findings in mind, so that low and high achieving students receive well-tailored support in developing their self-concept—that is, support that moves them towards a view of their academic abilities that best supports their behavioural SR. This study provides researchers and educators with new and interesting insights into the belief systems of kindergarteners and contributes to developing the theoretical framing of self-concepts, behavioural SR, GO and ability level in educational psychology research. Considering our findings, it seems crucial for educators to provide children with regular feedback as early as kindergarten to emphasise the setting of challenging yet appropriate learning goals and to promote the development of metacognition and consequently SRL.

Keypoints

- With response surface analysis the article offers an innovative way to measure fit patterns between academic ability self-concepts and academic ability in explaining early SR
- One of the few studies that examines the role that self-evaluative tendencies of kindergarteners plays in explaining behavioural self-regulation and learning goal orientation
- There are unique benefits and risks associated with distinct self-evaluative tendencies for kindergarteners with different ability levels
- When planning and implementing educational interventions that target SR, researchers and practitioners should take young children's self-evaluation biases into consideration based on the children's ability levels.

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Appendix

Table 4

Regression Coefficients b1 to b5 and Derived Model Parameters for the Full Polynomial Model, the Shifted and Rotated Rising Ridge (SRRR) Model and the Additive Model for Behavioural SR

Model	Estimate	Robust SE	95% CI	p
Full polynomial				
<i>b</i> ₁	-0.360	0.484	[-1.308, 0.588]	.457
<i>b</i> ₂	1.947	0.468	[1.029, 2.864]	<.001
<i>b</i> ₃	-0.470	0.247	[-0.954, 0.014]	.057
<i>b</i> ₄	-0.216	0.293	[-0.789, 0.357]	.460
<i>b</i> ₅	0.025	0.209	[-0.385, 0.434]	.905
SRRR model				
<i>b</i> ₁	-0.330	0.519	[-1.347, 0.688]	.525
<i>b</i> ₂	1.883	0.478	[0.946, 2.820]	<.000
<i>b</i> ₃	-0.476	0.244	[-0.953, 0.002]	.051
<i>b</i> ₄	-0.187	0.244	[-0.664, 0.290]	.443
<i>b</i> ₅	-0.183	0.052	[-0.120, 0.083]	.723
<i>C</i>	24.814	72.172	[-116.641, 166.269]	.731
<i>S</i>	-5.095	7.942	[-20.661, 10.471]	.521
<i>bM</i>	1.948	0.508	[0.952, 2.944]	<.000
<i>a</i> '4	-0.073	0.207	[-0.480, 0.333]	.723
Additive model				
<i>b</i> ₁	0.098	0.486	[-0.854, 1.050]	.839
<i>b</i> ₂	1.813	0.467	[0.898, 2.728]	<.000

Note. SRRR model = shifted and rotated rising ridge model; regression coefficients b1 - b5: b1 = academic self-concept; b2 = ability level; b3 = academic self-concept²; b4 = interaction; b5 = ability level²; C = lateral shift of the ridge; S = rotation of the shift; bM = mean effect; a'4 = curvature orthogonal to the ridge; CI = confidence interval. Confidence intervals and p-values are derived from a percentile bootstrap with 10,000 replications.



Table 5

Regression Coefficients b1 to b5 and Derived Model Parameters for the Full Polynomial Model and the Interaction Model (IA) for Goal Orientation

Model	Estimate	Robust SE	95% CI	P
<i>Full polynomial</i>				
<i>b₁</i>	0.184	0.061	[0.065, 0.303]	0.002
<i>b₂</i>	0.101	0.052	[-0.001, 0.203]	0.052
<i>b₃</i>	-0.037	0.029	[-0.095, 0.020]	0.202
<i>b₄</i>	0.095	0.039	[0.019, 0.171]	0.015
<i>b₅</i>	0.008	0.024	[-0.039, 0.055]	0.744
<i>Interaction model</i>				
<i>b₁</i>	0.218	0.058	[0.104, 0.332]	<.000
<i>b₂</i>	0.089	0.050	[-0.009, 0.186]	.076
<i>b₄</i>	0.088	0.029	[0.031, 0.144]	.002

Note. Regression coefficients b1 - b5: b1 = academic self-concept; b2 = ability level; b3 = academic self-concept²; b4 = interaction; b5 = ability level²; CI = confidence interval. Confidence intervals and *p*-values are derived from a percentile bootstrap with 10,000 replications.