Effects of (Meta)Cognitive Strategy Instruction on the Development of Self-Efficacy for Self-Regulation in Academic Writing

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Abstract

Academic writing is a complex task and writers need to be adequately supported to master its demands. Previous studies have shown that strategy instruction supports writers and influences writing performance. This paper investigates the development of students' self-efficacy for self-regulation in academic writing (SSAW) in an experimental intervention study. We examined the effects of three strategy instruction treatments in a randomized sample of 128 university students. Selected cognitive and metacognitive strategies were trained. We used latent neighbor change analyses including multiple group comparisons to track down short- and long-term effects among three points of measurement (pre, post, and six-week follow-up). We also accounted for the influence of writing beliefs that were assessed prior to the intervention. Results provide evidence for a beneficial impact of metacognitive strategies in writing instructions.

Keywords: self-efficacy, self-regulation, academic writing, metacognition, cognition, latent neighbor change

Academic writing is a form of student writing that paves the way for scientific writing (Russel & Cortes, 2012). It holds manifold functions and comes along with complex demands especially for novice academic writers (Rogers, 2008, p. 171). It covers relevant aspects of students' learning with respect to both their knowledge acquisition (Bangert-Drowns, Hurley, & Wilkinson, 2004) and its assessment (e.g., in case of writing assignments such as term papers). Moreover, academic writing is an important instance for students' academic enculturation (Prior & Bilbro, 2012) in which students are introduced to the demands and standards of writing and to the aspects of sharing knowledge in a disciplinary discourse.

Academic writing is a complex and demanding task that requires novice writers to improve their writing skills continuously. Based on a cognitive developmental perspective, Kellogg (2008) introduced a model that differentiates between the three stages of *knowledge telling*, *transforming*, and *crafting*. Knowledge telling applies to a stage of writing in which writers are focusing on how they can tell what they know. In the stage of knowledge transforming, writers focus on revising the text in order to compose a text that transports the writers' thoughts and intended message. In the knowledge crafting stage, writers aim to meet their own standards for the text as well as the anticipated needs of their audience. Thereby writers need to juggle and interact with the representations of themselves as authors, the text, and the reader. Writing can be characterized as a goal-directed process including problem solving procedures that are handled individually by the writer (e.g., Bereiter & Scardamalia, 1987; Hayes & Flower, 1986). The first two stages of cognitive writing development are typically mastered during high school and college (Bereiter & Scardamalia, 1987; Kellogg, 2008, p. 3f.).

Various conceptualizations of the writing process provide insight on the interplay of cognition, metacognition, self-regulation, and motivation (e.g., Bereiter & Scardamalia, 1987; Hayes & Flower, 1980; Hayes, 1996, 2012; Zimmerman & Kitsantas, 2007). Success in

mastering the writing process depends on how each of these components is handled by the writer. Many students struggle with dealing with the demands and express various difficulties in academic writing (Dittmann, Geneuss, Nennstiel, & Quast, 2003). Previous research has identified several factors that have an impact on the writing process and on writing performance, such as self-regulation, self-efficacy, and writing beliefs. In the following sections, we will describe those factors and outline in which way they influence writing and academic writing performance.

Self-Regulation and Writing

Self-regulation is a prerequisite for successfully managing the dynamic writing process and the transitions between its recursive phases of planning, initiating, performing, and evaluating writing activities (Hidi & Boscolo, 2006; Zimmerman & Kitsantas, 2007). According to prominent models of self-regulation (cf. Boekaerts, 1999; Zimmerman, 1994, 2000), self-regulation comprises cognitive, motivational, and metacognitive components. Cognitive components include conceptual and strategic knowledge. Motivational components are essential for initiating and maintaining actions. Metacognitive components are inherent for monitoring and evaluating the actions. Self-regulation and metacognition are both fundamental for implementing, regulating, and adapting strategies in order to achieve goals. In all instances, cognitive processes are involved. However, self-regulation in contrast to metacognition can be regarded as the more comprehensive construct (Alexander, Graham, & Harris, 1998). Not only does self-regulation comprise the cognitive regulation of actions, it also addresses the regulation of affective, motivational, and volitional processes during a course of action (Boekaerts, 1999; Schwinger, von der Laden, & Spinath, 2007; Zimmerman, 1994, 2000).

Models conceptualizing self-regulatory processes outline various conditions of

strategy selection, implementation, and adaptation in order to achieve goals or fulfill tasks by managing one's thoughts and actions. Strategies can be characterized as goal-oriented cognitive operations that are fundamental for processing a task (Pressley, Forrest-Pressley, Elliott-Faust, & Miller, 1985, p. 4). Strategies serve the purpose of solving problems (Pressley et al., 1985; Alexander et al., 1998). They consume mental resources and comprise cognitive, motivational, and metacognitive aspects (Alexander et al., 1998).

Regarding the writing process and in order to accomplish writing tasks, all the abovementioned aspects can be retrieved in models conceptualizing the (self-)regulation of writing processes. Zimmerman and Kitsantas (2007) developed a cyclical model of self-regulation for writing. It proposes three phases in which the writing process is planned, carried out, and evaluated. In each phase, writers can apply various strategies to manage their thoughts and actions (Zimmerman & Kitsantas, 2007). For instance, when writers plan and prepare writing activities, they might decide to analyze the writing assignment in order to identify single operations needed to handle the assignment. Based on these analysis writers are able to set specific writing goals for the consecutive performance phase. Both strategies are instances of cognitive strategies applied in the forethought phase of writing. In the performance phase, writers might monitor their progress and check whether they will achieve or miss established goals. Thereby, writers make use of metacognitive strategies. The performance phase is followed by a reflection phase in which writers evaluate various aspects, such as one's line of actions as well as the outcomes. If writers did not meet their anticipated outcomes and perceived themselves as inhibited during the performance phase, they might attribute this to high standards they set for themselves. Consequently, they might decide to write a draft in the next performance phase (and thereby lower self-set standards) or not to check standards while writing to keep up fluency and postpone judgements of quality.

Research consistently acknowledges the importance of cognitive and metacognitive strategies for writing performance. Cognitive and metacognitive strategies applied for managing the writing phases are associated with better academic writing performance (Karlen, 2017; Wischgoll, 2016). Furthermore, metacognition is a key instance for successfully applying cognitive strategies in the writing process (Karlen, 2017; MacArthur, Philippakos, & Ianetta, 2015). On school level, it has been shown that teaching writing strategies in combination with self-regulatory ones is more conducive for writing performance than to solely train writing strategies (Brunstein & Glaser, 2011; Glaser & Brunstein, 2007; Graham & Perin, 2007). Similar findings also pertain to academic writing (MacArthur et al., 2015).

Self-Efficacy and Self-Efficacy for Self-Regulation in Writing

Self-efficacy is a powerful predictor yielding strong associations to performance in various domains, such as career success (Abele-Brehm & Stief, 2004) and academic performance (Multon, Brown, & Lent, 1991). It encompasses individual beliefs of one's abilities to perform and succeed in distinct tasks or situations (Bandura, 1997). To succeed in a task and to experience oneself as being competent in mastering assignments can enhance self-efficacy beliefs. Self-efficacy beliefs about individual writing abilities are strongly associated with writing performance (Pajares, 2003; Schunk & Swartz, 1993).

Self-efficacy beliefs can also refer to self-regulatory skills. In this case, the self-efficacy for self-regulation determines how well skills, such as focusing on a task or motivating oneself, are coordinated and maintained (Bandura, 1997, p. 38). Those beliefs also predict actual performance. Regarding writing, self-efficacy for self-regulation has been shown to be a predictor of students' writing competence (Pajares, Valiante, & Cheong, 2007). However, students' efficacy beliefs for regulating their writing activities have not been assessed directly (Pajares et al., 2007). Research often focused on self-efficacy in writing and

implemented instruments focusing on self-efficacy (for an overview cf. Mitchell, Rieger, & McMillan, 2017). Only a handful instruments combine self-efficacy and self-regulation (cf. Golombek, Klingsieck, & Scharlau, 2018; MacArthur, Philippakos, & Graham, 2016; Zimmerman & Bandura, 1994). Some of those scales are limited as they underrepresent essential aspects of self-regulating the writing process (e.g., evaluating the writing process; Zimmerman & Bandura, 1994) or because they do not feature comprehensive evidence regarding their validity (e.g., no confirmatory factor analysis on independent samples; MacArthur et al., 2016). Nonetheless, studies assessing self-efficacy for self-regulation of academic writing (SSAW) indicate that SSAW is correlated with academic achievement (Zimmerman & Bandura, 1994), academic self-efficacy, and self-regulated learning strategies (Golombek et al., 2018). Moreover, SSAW is a predictor of academic achievement (Zimmerman & Bandura, 1994) and writing performance (MacArthur et al., 2016).

We previously outlined that efficacy beliefs increase due to the individual experience of success and mastery (Bandura, 1997). This assumption also applies to specific domains and might be transferred to the domain of academic writing. By applying self-regulated strategies, students experience themselves as successful and competent in regulating their writing activities. Consequently, to examine whether self-regulatory skills have been trained effectively, self-efficacy for self-regulation of academic writing can be used as an indicator. Research gives support to this assumption by showing that students report higher self-efficacy beliefs for regulating themselves in academic writing activities after participating in a writing intervention (Jöhren, Klingsieck, & Scharlau, 2025).

Writing Beliefs as an Antecedent of Writing Performance

Beside the beliefs about one's abilities, individuals can also hold beliefs about the nature of things. Those beliefs influence cognitive, motivational, and behavioral aspects (Bandura, 1986). In the domain of writing, writing beliefs comprise knowledge and attitudes

about writing and the writing process (Graham, Schwartz, & MacArthur, 1993). They can influence for instance how the writing process is handled and determine the engagement as well as performance in writing tasks. White and Bruning (2005) differentiated between *transactional* and *transmissional* beliefs. Both influence writers' affective and cognitive engagement. Writers with transactional beliefs believe that writing is about transforming and integrating knowledge while writing (White & Bruning, 2005, p.172). Writers holding transactional beliefs are thus highly engaged in the writing process. In contrast, writers holding transmissional beliefs are less engaged because they see writing as a process in which knowledge is transferred from one medium to another. Transaction beliefs are associated with higher text quality (White & Bruning, 2005). Sanders-Reio, Alexander, Reio, and Newman (2014) extended this distinction based on Kellogg's (2008) model of cognitive writing development by suggesting the two additional belief components *recursive process* and *audience orientation*. The belief component recursive process (e.g., writing performance depends on multiple revising; Sanders-Reio et al., 2014) covers characteristics of the developmental stage of knowledge transforming whereas the belief component audience orientation (e.g., writers compose in a way that they assume to suit their readers' needs; Sanders-Reio et al., 2014) covers those of the knowledge crafting stage.

Kellogg (2008, p. 10) stated that on 'advanced level, academic writers know their disciplines deeply enough to be able to anticipate their readers' responses to the text they are composing and revising'. Thereby Kellogg indirectly stresses the importance of the two belief components recursive process and audience orientation for the outcomes of academic writing processes. This assumption is supported by research showing that both belief components are positively correlated with university students' writing performance (Sanders-Reio et al., 2014). In contrast, transmissional beliefs were negatively correlated with writing performance

and transactional beliefs were not associated with writing performance at all (Sanders-Reio et al., 2014).

Instructional Principles for Fostering Writing

Theory and research have outlined effective approaches for supporting writers and thereby enhancing writing performance. For instance, Kellogg (2008) suggests combining learning by observing with learning by doing to promote writers' cognitive development and foster their writing skills. Accordingly, approaches such as cognitive apprenticeship and deliberate practice can be implemented and combined with one another (Kellogg, 2008). A beneficial feature of cognitive apprenticeship is that this approach provides guided participation in which a model or mentor introduces the learner to task specific demands or strategies. As 'both observing and doing are essential to the learning of complex skills' (Kellogg, 2008, p. 17), guided participation can be regarded as a reasonable approach to deal with a complex task such as academic writing.

Another prominent example for instructional approaches aiming at learning how to write is the self-regulated strategy development (SRSD) program (Graham & Harris, 1993; Harris & Graham, 1996). At school level, SRSD can be considered as an evidence-based instructional approach (Graham, Harris, & McKeown, 2013, 2013; Graham, McKeown, Kiuhara, & Harris, 2012; Graham & Perin, 2007). Recent research in higher education provides first evidence that principles of SRSD can also be transferred to the context of academic writing. MacArthur and colleagues (2015) developed a curriculum based on principles of SRSD in which college developmental writers got to know a variety of strategies. They comprised cognitive as well as metacognitive strategies. Results show positive effects on text quality. Nonetheless, interactions of those strategies with one another have not been examined and evaluating the effects of distinct strategies is not yet possible.

Findings of another study tap into this gap by showing that instructions using a combination of cognitive and metacognitive strategies are more conducive to text quality and writing skills than those solely incorporating cognitive strategies (Wischgoll, 2016). The study focused on psychology students being in the first or second year of their course of studies. In contrast to MacArthur et al.'s (2015) classroom-embedded instructional approach, Wischgoll (2016) used a computer-based one-to-one approach. Students were engaged in a modelling phase (including writing strategies introduced by a fictional peer model) and a deliberate practice phase (including a writing assignment on which the new strategies were used). Both studies revealed positive effects regardless of their conceptual differences, such as implementing a longitudinal (MacArthur et al., 2015) or a short-term (Wischgoll, 2016) intervention that was offered either to students of various disciplines (MacArthur et al., 2016) or to students in a distinct discipline (Wischgoll, 2016). Samples in both studies had in common that they consisted of being beginning or developmental academic writers. Both studies used pretest-posttest designs and stability of effects of the writing interventions have not been examined.

Writing interventions incorporating principles that foster writers' self-regulatory skills seem to be promising and effective approaches for supporting academic writers. Taken together, these studies support the notion that beginning academic writes benefit from instructional principles incorporating cognitive and metacognitive strategies and that those strategies can be training using different instructional approaches. However, research needs to examine which strategies are also conducive for academic writers that cannot be characterized as beginning academic writers.

Aims and Hypotheses

The present study evaluates a writing intervention by examining its effects on the development of self-efficacy for self-regulation in academic writing (SSAW) in an

experimental intervention study conducted with prospective teachers enrolled in a master's program. The intervention makes use of selected principles of self-regulated strategy development (SRSD) in combination with learning by observing and deliberately practicing the newly learned strategies (Wischgoll, 2016). Indicators for the effectiveness of the intervention were text quality and SSAW. We expected:

- Text quality to be significantly higher after the intervention (H 1).
- The group receiving a combined instruction of cognitive and metacognitive strategies (cognitive metacognitive combination strategy group, CM-group) outperforms the other two groups that learned either to apply a single cognitive (single cognitive strategy group, C-group) or a combination of two cognitive strategies (double cognitive strategy group, CC-group) after the treatment (H 2).
- The group that received a strategy training including a combination of a cognitive and a metacognitive strategy (CM-group) shows significantly more gain in SSAW than the other two groups receiving trainings that solely focus on cognitive strategies (C- and CC-group) (H 3).
- Students believing in writing as a recursive process report a stronger development in SSAW (H 4).
- Students that indicate a strong audience orientation to report a stronger development in SSAW (H 5).

At present, little is known about the long-term effects of writing interventions. Thus, the third point of measurement functioned as follow-up in order to investigate whether the expected gains in SSAW within each group and the differences in gain between the groups were stable.

Method

Participants

A total of 128 students (mean age = 24.87; *SD* = 1.85; 78.1% female) participated in the study. All participants were prospective teachers enrolled in a master's program at a mid-sized German University. We recruited participants who were enrolled in a course that is mandatory for students in the master's program for prospective teachers. The course focused on comprehending and discussing empirical research articles. All participants indicated they speak German fluently. At point of participation, mean total study duration was 9.73 semesters (*SD* = 2.61) and 4.99 semesters (*SD* = 3.15) in the master's program. Prior to the intervention, all participants provided verbal informed consent.

Experimental Design and Procedures

Intervention

The intervention aimed at teaching and training academic writers strategies for improving text quality. Participants were randomly assigned to three treatment conditions focusing on different strategy trainings. The design of the intervention relies on Wischgoll's (2016) study that was conducted with beginning academic writers. The experiment consisted of two phases: a modeling phase and a deliberate practice phase.

In the modeling phase, participants received a learning-journal-based training on writing strategies (i.e., text structure knowledge application strategy, summarization strategy, or monitoring strategy) which they followed individually. In the learning journals, a fictional peer model referred to her own experience of writing an empirical Master's thesis (in Wischgoll, 2016, the peer model is referring to her Bachelor's thesis). Thus, the thesis' structure is similar to an empirical journal article. The model reported challenges she was

confronted with and demonstrated strategies to master these challenges. Each learning journal included the same strategy of applying text structure knowledge. The three strategy training conditions differed regarding the (additional) strategies presented in the learning journals. The content in the three condition was: (1) only text structure knowledge strategy and no additional strategy (single cognitive strategy group, C-group), (2) text structure knowledge strategy and an additional summarization strategy (double cognitive strategy group, CC-group), and (3) text structure knowledge strategy and an additional monitoring strategy (combined cognitive and metacognitive strategy group, CM-group).

The *text structure knowledge strategy* informed the participants how an empirical article is structured and how this text structure knowledge can be applied to write an abstract. The additional *summarization strategy* in the CC-group focused on how to logically reduce and rearrange text content describing relevant steps from macrostructure to microstructure. The additional *monitoring strategy* in the CM-group explained how to become aware of the reader's perspective by self-questioning while preparing and implementing the writing process. Participants were not allowed to take notes. After the modelling phase, there was a 3-minutes-break during which participants stayed on their seats.

In the second phase, the deliberate practice phase, participants worked on a writing assignment. Participants were asked to write an abstract of an empirical research article. Each section of the article (i.e., "Theoretical Background", "Methods", "Results", and "Discussion") was presented separately in the computer-based learning environment. The practice phase was a three-part: First, participants were asked to summarize the article's sections. Afterwards, they were asked to write a draft in order to prepare an abstract for the article. Finally, participants were asked to compile a coherent abstract as the final text. Participants were allowed to use prompt cards that were handed out by the project team and

summarized the presented strategies according to the assigned training condition. The prompt card according to the *text structure knowledge strategy* addressed the use of text structure knowledge with three guiding questions: (1) How is the structure of an empirical article?, (2) How is each section typically characterized?, (3) How can these characteristics be used to assign information to certain text sections? Furthermore, language use conventions were made explicit. The prompt card according to the *text summarizing strategy* addressed the use of selecting and assigning text information with the following four questions: (1) What is the general statement of the text?, (2) Which phrases and word represent the general statement?, (3) Which parts of the selected text might result in a coherent text?, (4) How can text structure knowledge help to form a coherent text out of the selected phrases and words? The prompt card according to the *self-monitoring strategy* learning journal focused on how to check the own writing process: (1) Did I assign information corresponding to the text structure? (2) Does my text impart the author's intention? (3) Is the information presented in a logical array? (4) Can the reader follow my thoughts?

Due to the computer-based one-to-one learning environment, participants were able to follow the instructions and to work on the assignment at their individual pace without interacting with other participants. Each group was assigned to one room and participants were not informed about the nature of their training condition. A maximum of three hours was scheduled for both phases. For more details regarding the intervention, please see Wischgoll (2016).

Data Collection

We implemented several points of measurement. About one week prior to the intervention, participants were assigned a writing task within a regular class they attended. In this task, participants were asked to write a brief summary of an empirical article. Thus, the writing task focused on a genre similar to the one implemented in the intervention. We did

neither provide instructions on how to solve the writing task nor feedback on the assignment. We used these texts as a baseline measure for text quality. After writing the texts, participants answered a questionnaire assessing their writing beliefs. Immediately before the intervention took place, participants reported demographic data and engaged in a pretest assessing their SSAW. Two texts (draft and final text) composed in the deliberate practice phase served as post measurement for text quality. The posttest on SSAW took place after the deliberate practice phase. A follow-up assessing participants' SSAW a third time was implemented six weeks after taking part in the intervention. Figure 1 displays the design, intervention groups, and instruments used at the different points of measurement.

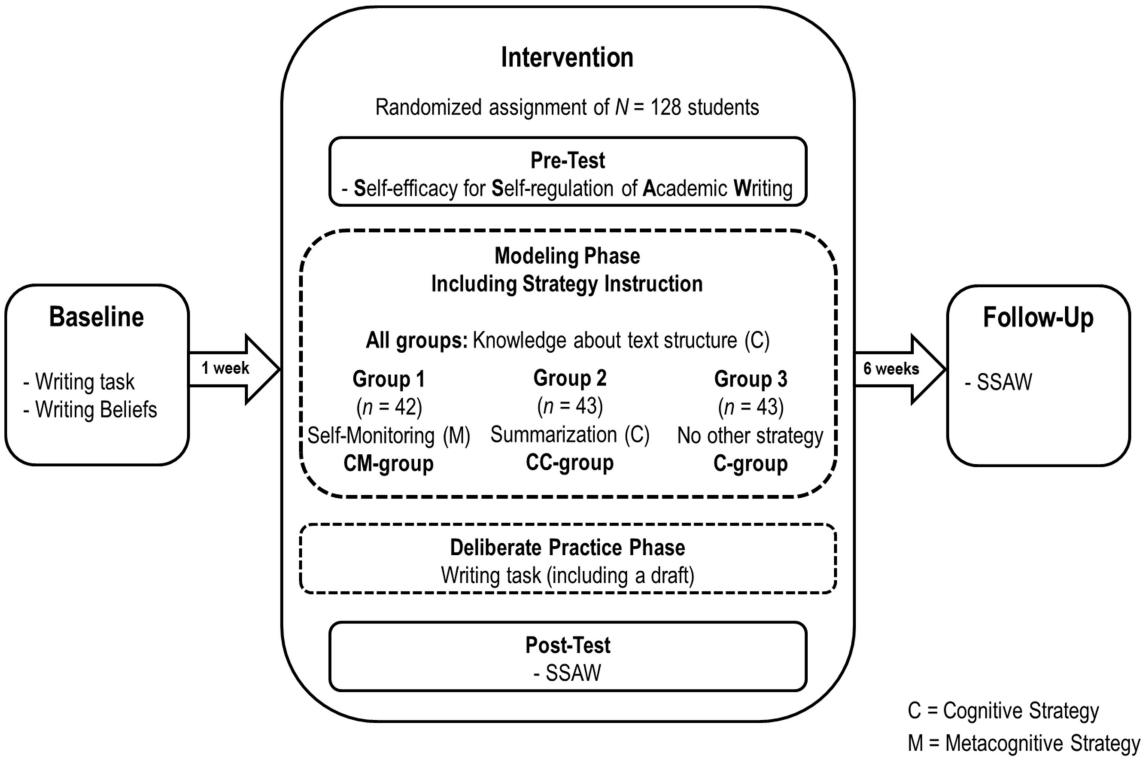

Figure 1. Experimental design, intervention groups, and instruments used at the different points of measurement.

Instruments

Text Quality

We measured text quality for baseline, draft, and final text by rating the overall quality for the written texts on a seven-point scale that ranged from 1 (*disastrous*) to 7 (*excellent*) (Cho, Schunn, & Charney, 2006). Three independent raters rated the texts of the total sample without awareness of the treatment condition or the participants' identity. We examined inter-rater reliability by calculating intraclass correlations (ICC) for each point of measurement of text quality. According to Cicchetti (1994, p. 286), inter-rater reliability can be evaluated as good for the baseline ratings (ICC 3, 2 = .70) and as excellent for the ratings of the drafts (ICC 3, 1 = .96) and final texts (ICC 3, 1 = .97).

Self-Efficacy for Self-Regulation of Academic Writing

Participants rated their ability to self-regulate academic writing activities with the Self-efficacy for Self-regulation of Academic Writing scale (SSAW scale; Golombek et al., 2018; Cronbach's $\alpha = .96$). The SSAW scale features 22 items and a response scale including 11 categories. These categories ranged from 0 (*no chance*) to 100 (*completely certain*). The SSAW scale comprises items representing each phase of the cyclical model of self-regulation in writers (Zimmerman & Kitsantas, 2007). Consequently, cognitive (e.g., 'I can organize my ideas even when I work on a complex topic'), metacognitive (e.g., 'I can monitor my progress in writing'), and motivational (e.g., 'I can motivate myself to start writing') items are represented. The instructions asked students to indicate how confident they are to perform specific writing-related activities. The scale yields satisfying psychometric properties and has been validated in several studies (Golombek et al., 2018).

Writing Beliefs

We assessed writing beliefs during the baseline with two subscales of the Beliefs About Writing Survey (BWS; Sanders-Reio et al., 2014). These two subscales were recursive process (5 items, a = .84; e.g., 'The key to good writing is revising') and audience orientation (14 items, a = .87; e.g., 'Good writers support their points effectively'). The scale features a response format of a 5-point Likert-type scale (1 = *does not apply to me at all true* and 5 = *does exactly apply to me*).

Data Analyses

To examine the development of SSAW, we used latent neighbor change models including multiple group comparisons. Latent neighbor change (LNC) models analyze the changes between consecutive points of measurement by estimating latent difference variables (Geiser, 2011, 2013). Those variables are adjusted for measurement errors and are assumed to measure true change (Geiser, 2011, p. 151). Also, effects of additional variables that are suitable to explain differences in the development over time can be investigated.

We built an LNC model that represented the total SSAW scale. The model comprised three state variables (representing pre, post, and follow-up measurement) and two latent difference variables that represented the change between the pre and post measurement (diff2_1) and between the post and follow-up measurement (diff3_2). Regarding the latent states, items of the SSAW scale were parcelled respectively to the point of measurement. We used a balancing approach to build the parcels (Little, Rhemtulla, Gibson, & Schoemann, 2013).

For comparing latent means and applying multiple group comparisons, scalar measurement invariance is required (Christ & Schlüter, 2012; Geiser, 2011). We tested measurement invariance for the measurement model of the SSAW scale for each point of

measurement. Finally, the LNC model was used to analyze the development of SSAW over time as well as between groups using the multiple group comparisons. In a further step of the analyses, we included writing beliefs as possible explanatory variables in the LNC model. Figure 2 displays an exemplary LNC model including one of the two covariates.

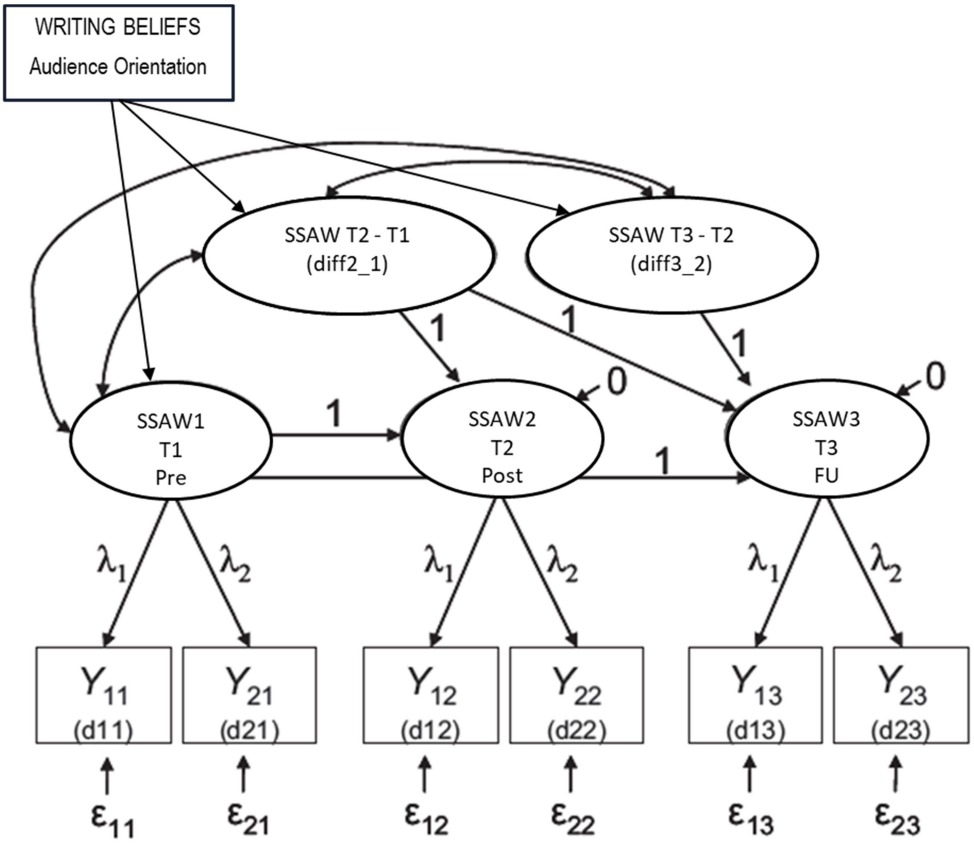

Figure 2. Exemplary LNC model for SSAW including the WBS subscale audience orientation as a covariate.

Results

Text Quality

Mean scores in the total sample for the baseline ratings of text quality (M = 3.10, SD = 1.30, min = 1, max = 5) indicated a rather poor to mediocre text quality. There was no significant difference between the three groups regarding text quality (F[2, 123] = .96, p <

.39) at the first point of measurement. Table 1 displays the mean scores of text quality at the first point of measurement for each group.

Mean scores for the draft (M = 3.30, SD = .97, min = 1, max = 5) and the final text (M = 3.95, SD = 1.13, min = 1, max = 7) indicated gains between the two points of measurement. We used repeated measures analysis of variance (rmANOVA) with planned contrasts to analyze changes in text quality and to examine H 1 and H 2. In addition, we calculated the effect size partial Eta-square (η^2) for all rmANOVAs and planned contrasts. According to Cohen (1988), partial η^2 was evaluated as follows: .01 as a small effect, 0.06 as a medium effect and 0.14 as a strong effect.

Analyses yielded significant differences, showing that text quality increased over time in all three groups, $F(1.62, 259.08) = 24.23$, $p < .01$, partial $\eta^2 = .17$. Partial η^2 indicated a strong effect. Planned contrasts confirmed H 1 in that they showed significant differences regarding the comparison of T1 with T3 ($\eta^2 = .22$, $p < .01$) and of T2 with T3 ($\eta^2 = .31$, $p < .01$). Effect sizes for planned contrasts indicated strong effects. We did not find a statistically significant interaction of time and treatment, $F(3.23, 193.93) = .52$, $p < .69$. Thus, results did not support H 2.

Table 1

Descriptive Statistics for the SSAW Scale, Text Quality, and Writing Beliefs at First Point of Measurement

		CM-Group		CC-Group		C-Group	
		M	*SD*	*M*	*SD*	*M*	*SD*
SSAW Scale		7.74	1.32	7.84	1.79	7.77	1.39
Text Quality		3.07	1.35	3.32	1.29	2.93	1.24
Writing Beliefs							
	Recursive Process	3.77	.83	3.79	.80	3.87	.72
	Audience Orientation	3.94	.48	3.92	.59	3.91	.53

Note. *M* = means; *SD* = standard deviation.

Development of Self-Efficacy for Self-Regulation of Academic Writing

Students in the total sample reported feeling fairly self-efficacious concerning regulating their writing activities in the various phases of academic writing at the first point of measurement. Mean scores in the total sample ranged between 7.50 (*SD* = 1.56) and 7.99 (*SD* = 1.46). On the 11-point response format of the SSAW scale, scores corresponded to a self-efficacy with an intensity of 60–70%. There was no significant difference between the three groups regarding students' SSAW ($F[2, 125] = .05$, $p < .95$) at the first point of measurement. Table 1 shows the mean scores of SSAW at the first point of measurement for each group.

Measurement Invariance Testing

To test measurement invariance for the measurement model of the total SSAW scale, we used a step-up approach (cf. Christ & Schlüter, 2012). We started with evaluating a baseline measurement model and stepwise tested the assumptions of configural, metric, and scalar measurement invariance by adding the respective constraint in the model. We evaluated each model with a combination of fit indices including chi-square, degrees of freedom, comparative fit index (CFI), and Tucker-Lewis-Index (TLI). Furthermore, nested models of the consecutive levels of invariance were tested against another by using chi-square difference tests comprising a scaling correction (Satorra & Bentler, 2010). We repeated those steps in order to confirm for measurement invariance for the total LNC model as well.

Regarding the SSAW scale's measurement model, the comparison of the baseline model with the model establishing metric invariance yielded a significant difference in the scaled chi-square test of model fit. We removed one constraint in the model so one of six loadings was freely estimated. Comparison of the revised model with the consecutive one did

not show any significant difference and indicated partial metric invariance. The comparison with the consecutive nested model for establishing scalar measurement invariance yielded no significant difference. For the LNC model of SSAW, comparisons of the models on each level did not yield significant differences. All in all, the assumption of scalar measurement invariance was given. This allowed comparing the latent means for the SSAW scale. Table 2 contains the fit indices for each level of invariance and the corresponding results of the chi-square difference tests.

Table 2

Indices for Testing Measurement Invariance for the SSAW Scale

	Level of M. I.	χ^2 (df)	*p*	CFI	TLI	Satorra-Bentler Scaled χ^2 (df)	*p*	Model comparison
Measurement model								
M 1	configural	50.583 (18)	.000	.966	.916			
M 2	metric	81.458 (30)	.000	.947	.921	30.467 (12)	.002	M 1 vs. M 2
M 3	partial metric	69.976 (28)	.000	.957	.931	18.056 (10)	.054	M 1 vs. M 3
M 4	scalar	74.750 (34)	.000	.958	.945	3.889 (6)	.692	M 3 vs. M 4
LNC model								
M 1	configural	27.514 (6)	.000	.966	.914			
M 2	metric	32.248 (8)	.000	.961	.927	3.850 (2)	.146	M 1 vs. M2
M 3	scalar	34.369 (10)	.000	.961	.942	.501 (2)	.778	M 2 vs. M 3

Note. M = model; M. I. = measurement invariance; χ^2 = chi square; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis-Index.

Latent Neighbor Change Analyses

The LNC model for the SSAW scale yielded a good fit (χ^2 [df] = 34.369 [10], p = .00, CFI = .961, TLI = .942). In the CM-group, latent means for the first point of measurement yielded M = 7.748 (p < .01). The latent difference variable diff2_1 indicated a significant gain in SSAW (M = .424, p < .01) whereas the latent difference variable diff3_2 showed a decline that was not significant (M = -.046, p < .72). The CC-group showed a latent mean of M = 7.888 (p < .01) in SSAW at the first point of measurement and the latent difference variable diff2_1 indicated a significant gain (M = .202, p < .05). In contrast to the CM-group, scores significantly decline in the follow-up measurement ($M_{\text{diff3\_2}}$ = -.313, p < .05). In case of the C-group, the latent mean for the first measurement yielded M = 7.805 (p < .01) in SSAW. Means of the two latent difference variables indicated no significant changes between the other points of measurement.

For the multiple group comparisons, the CC-group served as reference group. Changes over time in the latent means of the CM- and C-group were compared whether they differed significantly from those of the reference group respectively. Comparisons showed no significant difference between the two cognitive groups. In contrast to the CC-group, the positive mean of the latent difference variable diff2_1 (M = .426, p < .01) in the CM-group showed a significant higher score. This indicated a significant higher gain in SSAW for the CM-group. Results of the multi group comparison in the LNC analysis fully confirmed H 3 in that we found a significant higher gain in SSAW for the intervention group that received a strategy training including a combination of a cognitive and a metacognitive strategy than for the other two groups. Furthermore, LNC analyses showed no significant declines between post and follow-up measurement in the scores of the CM-group. In contrast, scores of the CC-group significantly declined. Results of the LNC analyses are summarized in Table 3.

Table 3

Results of Latent Neighbor Change Analyses (LNC) and LNC with Multi Group Comparison for the SSAW Scale

		CM-Group		CC-Group		C-Group	
		M	*p*	*M*	*p*	*M*	*p*
LNC Analysis							
	T1	7.748	.000	7.888	.000	7.805	.000
	diff2_1	.424	.006	.202	.015	.037	.697
	diff3_2	-.046	.718	-.131	.017	-.066	.641
LNC Multi Group Comparison							
	T1	7.741	.000	.000	.000	7.851	.000
	diff2_1	.426	.005	.000	.000	.006	.944
	diff3_2	-.054	.666	.000	.000	-.086	.537

Note. M = latent means.

Effects of Writing Beliefs on the Development of SSAW

With a mean score of 3.93 (*SD* = .53) on the subscale audience orientation and a mean of 3.81 (*SD* = .78) on the subscale recursive process of the BWS (Sanders-Reio et al., 2014), participants indicated to have rather sophisticated beliefs about writing. Scores for audience orientation ($F[2, 123] = .04$, $p < .96$) and recursive process ($F[2, 123] = .18$, $p < .84$) did not significantly differ between the groups. Means scores at first point of measurement for each group are presented in Table 1.

Latent Neighbor Change Analyses With Writing Beliefs as Covariates

The two subscales recursive process and audience orientation of the BWS that were assessed prior to the intervention were entered separately as covariates in a further step of the LNC analyses. Regarding the recursive process subscale, we did not find a significant change in the regression coefficients of the model. Regression coefficients for audience orientation are significantly positive for the first point of measurement in the LNC model for SSAW ($\gamma = .592$, $p < 0.01$; $\gamma_{standardized} = .213$, $p < 0.01$). Coefficients indicated that participants with higher scores for audience orientation also reported higher SSAW-scores.

Discussion

The present study examined the development of self-efficacy for self-regulation in academic writing (SSAW) when writing strategies are trained. We assumed that a strategy training including a combination of cognitive and metacognitive strategies is more conducive to the development of SSAW than trainings solely focusing on cognitive strategies. To check the responsiveness to treatment in our study, we first analyzed text quality prior and after the intervention. For all groups text quality increased over time indicating that participants

benefited from the trainings and demonstrated better writing performance. We did not find that the group receiving combination of a cognitive and a metacognitive strategy (CM-group) outperformed the other two groups that received either a single cognitive (C-group) or a double cognitive strategy (CC-group) instruction regarding text quality. Latent neighbor change analyses including multiple group comparisons showed positive developments in SSAW for the CM-group and the CC-group from pre to post measurement. Furthermore, they revealed that gains in the CM-group were significantly higher compared to the CC-group. The analyses also offered insights regarding the long-term effects. Declines in scores after the post measurement were only significant in the CC-group indicating that the intervention only had a short-term effect in this group whereas effects in the CM-group seemed to be more stable. In addition, we aimed at accounting for influence of factors that are strongly associated with writing performance on the development of SSAW. We found participants' beliefs about audience orientation to be associated with SSAW prior to the intervention in that participants with higher scores for audience orientation also perceived higher abilities for regulating their academic writing activities in general. However, beliefs did not affect the changes in SSAW over time.

The fact that the CM-group did not outperform the other two groups regarding writing performance does not replicate the findings of Wischgoll, 2016. It might be discussed with regard to the fit between the students' expertise and the treatment. Previous studies on strategy instruction in academic writing have shown positive effects regarding writing performance in samples of beginning academic writers (MacArthur et al., 2015; Wischgoll, 2016). For those writers, highly structured guidance in combination with metacognitive strategies might be more beneficial than for more advanced writers that have already gathered some writing experience and presumably knowledge about writing strategies. In the present study, participants were already enrolled in their master's program and—even though they

expressed having difficulties in handling and comprehending the genre throughout the semester—they might be more heterogeneous in their learner characteristics, such as prior writing experience or genre-specific knowledge. Consequently, the highly structured instructional design might not have suited each participant. However, we did not assess variables that enabled us to control for those kinds of aptitude-treatment interactions (cf. Snow, 1989, 1991) in this study. We recommend incorporating this perspective in future studies examining the effects of different strategies and instructions for academic writing. Contrary to previous research that pointed out strong associations between self-efficacy, self-regulation, and writing beliefs, we did not find that these factors affected the changes in SSAW. On the one hand, this might indicate that effects of interventions are not affected by students' beliefs about the nature of writing. On the other hand, these factors could be affected and changed by the intervention. This assumption is in line with previous research showing that writing beliefs even changed due to writing interventions (Jöhren et al., 2025). Another explanation for the result that beliefs about recursive processes in writing do not impact SSAW might be the short time frame participants had been working on the writing assignment. Sanders-Reio and colleagues (2014) argue that recursive process beliefs depend on the context of the assignment. If assignments cover more time (e.g., when writing a thesis) or aim to meet high standards (e.g., research articles written for publication), those beliefs would be more adaptive (Sanders-Reio et al., 2014, p. 9).

Our findings are somewhat limited by several constraints. First, we did not assess learner characteristics that could have influenced our results, such as participants' prior knowledge about writing or their writing experience. Thus, we did not account for heterogeneity in those characteristics and were not able to examine possible aptitude-treatment interactions (cf. Snow, 1989, 1991). All participants were enrolled in a master's program for prospective teachers and effects of the intervention cannot be generalized to

other programs. Second, our design focused on the development of SSAW due to a short term intervention and writing performance was solely assessed as a pre- and post-measure to examine the intervention's effects. Writing performance was not assessed in the six-week follow-up. The rationale for doing so was twofold: a) in this initial study, we had limited our perspective to the development of SSAW; and b) as participation was voluntary and there were no incentives offered to the participants, we expected huge dropouts due to the participants' expanse. Third, in line with previous research indicating writing beliefs to be rather stable over time, we decided to include writing beliefs only as pre-intervention measure. However, we did not draw on the possibility to check whether those findings also apply to our study (e.g., by including multiple assessments of beliefs).

The present study emphasized the beneficial impact of metacognition and outlines possibilities for future research. Including metacognitive strategies in writing interventions is conducive for an important predictor of writing competence and is associated with stable effects. Results also stress the need for further research on strategy instruction in academic writing with respect to various aspects. First, learner characteristics and aptitude-treatment interactions should be investigated. Second, effects and interplays of other strategy combinations incorporating both cognitive and metacognitive strategies should be examined with respect to short- as well as long-term effects regarding the development of SSAW as well as of writing performance. By including an assessment of writing performance in the follow-up, it would be possible to check if the effects of instruction had any permanency and also to examine if and to which extent writing practice and SSAW influence one another over time. Third, as the intervention and the constructs we assessed to evaluate the interventions' effects might be highly intertwined and influencing one another, more sophisticated research designs are needed to carefully examine those effects. For instance, in line with the multiple assessment of students' self-efficacy for self-regulation, writing beliefs could be assessed

multiple times, as well. This would allow examining to which extent the change in one variable predicts the change in another one. In sum, far more insight into the complex interplay of writing instruction and the development of writing predictors as well as writing performance is needed. Based on further studies taking the abovementioned aspects into account, effective strategies and strategy combinations could be selected for writing interventions leading to evidence-based writing interventions in academic writing.

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