Writing Instruction Matters.

Research on Writing Instruction and Technology-Based Writing Instruction for Students with Writing Difficulties.

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Abstract

This text provides the framework for four studies on writing instruction for struggling writers with and without diagnosed learning disabilities. After students are introduced to the concept of writing texts in elementary school, the influence of students´ ability to *think on paper* gains more and more relevance for success in life. But the writing process is complex and many students with and without disabilities struggle with the task of text composition while many teachers report that they did not receive adequate instruction on how to teach writing. Additionally, most writing outside of school is done digitally, but technology use for writing instruction in classrooms is still relatively rare. The studies presented in this text investigate promising instructional practices that have not received much attention in the scholarly literature on writing instruction for struggling students. They aim to add to the growing body of literature on how to support teachers in delivering effective writing interventions to their students. Furthermore, two of the four studies referred to in this paper contribute to further determine which specific elements of technology-based instruction may impact writing. The studies were conducted in primary and secondary classrooms in Germany with students that struggle with the task of composition writing. Results from the experiments were encouraging and indicate that writing intervention was feasible and successful in supporting these students in their quantitative and qualitative writing. Implications for practice and future research are discussed in detail.

Contents

The Importance of Writing

The influence writing skills have on success in life cannot be understated. Writing is an essential skill whose foundational rules and techniques are taught in elementary school; from then on, writing proficiency is pivotal to understand, demonstrate, and share knowledge, and to communicate and cooperate in academic, occupational, personal, and societal contexts (Graham, 2019). Gillespie et al. (2014) found that 80 percent of teachers across subjects include writing tasks in their lessons to enhance students´ understanding. This clearly demonstrates the importance of writing in school settings and suggests that supporting students´ writing skills can positively impact overall academic success. Outside of school, writing affects an individual's economic chances, with essays being a part of college applications and employers including the writing proficiency of a candidate in their decisions about hiring and promoting their employees (National Commission on Writing, 2004). Furthermore, rapid digitization is changing the way we live, work, learn, and even socialize (Voogt & Roblin, 2012). In this context, under terms such as 21st-century skills or key competencies, skills have been identified that particularly target the changing competency expectations within information society, such as researching, evaluating, and sharing information (van Laar et al., 2017; Voogt & Roblin, 2012). Accordingly, adequate written language skills are crucial for participation and success in the information society. The relevance of digital communication has long since spread to all areas of life and, with predominantly written communication in social media, it even encompasses the realm of private communication (Freedman et al., 2016; Karadag & Kayabasi, 2013). Recognizing the importance of writing makes it clear that individuals who don't reach proficiency in writing are at a disadvantage.

Graham (2019) looked with concern on available statistics from the US reporting that only around one out of three students achieve grade-level appropriate standards (National

Center for Educational Statistics, 2012). For students identified with a disability, the National

Assessment of Educational Progress (U.S. Department of Education, 2011) found that only

5% were able to reach writing proficiency and 60% of the population of students with a

disability did not not meet basic writing achievement levels. And according to Graham and

Harris (2011), 19 out of 20 students with *learning disabilities* (LD) do not acquire adequate

writing skills to succeed in school. National assessments of students´ academic skills in

Germany focus on reading, listening and spelling but do not include writing (see Bos et al.,

2004); concerns about students´ writing development are not limited to the US alone, but are

reported across the globe (see Graham & Rijlaarsdam, 2016). In response, several countries

use curricular standards to describe benchmarks and provide a roadmap for writing skills

that students are expected to reach at a certain grade (CCSS, 2010; Ministerium für Schule

und Bildung [Ministry of School and Education], 2021). Several reasons contribute to

students struggling with the task of writing, including the quality of writing instruction,

biological, genetic, and economic factors (Graham, 2019). On top of that, the writing process

itself consists of a complex set of interrelated skills and is not learnt naturally (egd.).

The Writing Process

To demonstrate the complex tasks involved in writing a text, Hayes and Flower

(1980) developed a model dividing the writing process in the three phases (a) *planning, (b)*

transcribing and (c) reviewing. During planning, a writer activates prior knowledge, sets

writing goals, thinks of, and organizes ideas. During the transcribing part of the writing

process, a writer translates thoughts into words by writing by hand or using a keyboard.

Revising includes reading and correcting one's own text. The three phases of the writing

process are interrelated and performed recursively and nearly simultaneously while a writer

is drafting a text (egd.). In a later adaption, Hayes (1996) emphasized motivation, cognitive

processes, and working memory as prerequisites of an individual for effective text

production.

Students with Writing Difficulties

A majority of the research on writing instruction originates from the US, where learning disabilities are characterized by significant difficulties in one or more academic areas (Gartland & Strosnider, 2018). As one of the identified academic areas, *difficulties with written expression* is considered a type of learning disability (egd.) classified under the **I**ndividuals with **D**isabilities in **E**ducation **A**ct ("IDEA", U.S. Department of Education, 2004). In this paper, the term *writing difficulties* is used in reference to students who underperform in relation to the expected grade-level appropriate writing proficiency despite targeted help (DSM-5, 2013). Many US publications focusing on students who struggle with writing are likely to use the term "Learning Disability". But the criteria and definition for the term *Learning Disability* is discussed controversially around the globe and refers to different groups of students in different parts of the world (see for instance Grünke & Cavendish, 2016; Scanlon, 2013). Federal education laws in Germany require a formal diagnosis attesting *severe, long-lasting and extensive underperformance across academic subjects* for an individual to classify as having special educational needs with focus on learning ("Sonderpädagogischer Schwerpunkt Lernen [Special education focus learning]", KMK, 2019). It is expected that these students demonstrate a below average IQ score in an intellectual assessment, but federal guidelines specify that the diagnostic process evaluates not only IQ scores, but all relevant information and assessments related to the individual to establish a formal special needs diagnosis (egd.).

Barriers for Students with Writing Difficulties

Many students struggle with the task of text production (Graham & Harris, 2000). But in comparison to their typically achieving peers, students with learning disabilities as well as students with or at risk for writing difficulties experience greater barriers that concern most aspects of the writing process (Graham & Hall, 2016; Graham et al., 2017). Difficulties with general cognitive or affective processes will limit a students´ access to general writing and strategy knowledge (Swanson et al., 2013). Additionally, any difficulties that concern foundational text production skills like spelling, handwriting, grammar, typing, and vocabulary

will result in this student having to shift focus towards this task during the transcribing process, leaving little room in working memory for the use of higher-level skills like strategies and knowledge to apply to content, meaning, and coherence (Baker et al., 2003; Gillespie & Graham, 2014; Graham et al., 2017). Typically, students with LD spend less time planning a writing task and generating and organizing their ideas (Gersten & Baker, 2001; Hauth et al., 2013). These struggling writers approach a writing task not so much as a step by step process to create a coherent text, but more as a task to write down their knowledge about a specific context (Graham, 1990). Hence, they write down everything they know about the topic, disregarding the need for structural clarity, purpose, and coherence (egd.). Further, when revising, students with LD typically focus mostly on grammar, spelling, and mechanics (Graham et al., 1995), instead of editing for coherence or formal structure (Graham et al., 2017). Finally, with writing being such a challenging and time-consuming task, researchers report a lack of motivation and negative attitude up to avoidant tendencies towards writing in students with LD (Baker et al., 2003; Gillespie & Graham, 2014; Graham & Harris, 2009).

Writing Instruction

Multiple factors beyond the complexity of the writing process and students' individual abilities contribute to the large number of students struggling with the task of writing. Graham (2019) indicates that writing instruction in many classrooms across countries and grades is not sufficient. Reasons for this unfortunate situation include that practicing teachers as well as teacher candidates report a lack of instruction on how to teach writing, and the limited time teachers typically spend on teaching writing skills or strategies, notably after Grade three (see Graham & Rijlaarsdam, 2016). Luckily, empirical research on writing instruction for students with LD and students with or at risk for writing difficulties identified several effective instructional components and methods teachers can apply to support these students in their efforts.

The first comprehensive meta-analysis to identify writing interventions specifically focused on students with LD was conducted by Gersten and Baker (2001), and found that the included interventions were effective and feasible to support these students. They

identified the following as pivotal: (1) explicit teaching of the steps of the writing process (planning, writing, revising), (2) explicit teaching of text structures, and (3) frequent guided feedback from both teachers and peers on students´ writing (egd.). Graham et al. (2017) recommend that future writing interventions should focus on text production skills for students with LD and students with or at risk for writing difficulties. This includes foundational skills like handwriting, spelling, and typing as well as vocabulary, grammar, and writing knowledge (see also Graham, 2019; Roitsch et al., 2021). Gillespie and Graham (2014) also point to the benefits of supporting text production skills of struggling writers in their meta-analysis and indicate positive effects when dictation substitutes for transcription skills. Ultimately, across several systematic reviews and meta-analyses on writing interventions for students with LD (Gersten & Baker, 2001; Gillespie & Graham, 2014; Graham, 2006; Kang et al., 2016; Rogers & Graham, 2008; Vasquez & Straub, 2016), Roitsch et al. (2021) identified elements connected to strategy instruction as the most effective approach to support these students and generate maintenance effects. In addition, Graham et al. (2012) found that adding self-regulation components to strategy instruction has shown to improve writing quality in typically developing and struggling writers (Graham et al., 2012).

Self-Regulated Strategy Development (SRSD)

An approach that combines strategy instruction and self-regulation is the Self-Regulated Strategy Development Model (SRSD; Harris & Graham, 1992). SRSD is a framework that has been recognized as evidence-based (Baker et al., 2009). Educators can utilize SRSD to teach students the use of writing strategies, knowledge about writing, and self-regulatory processes in six recursive stages: (a) develop and activate background knowledge, (b) discuss the strategy, (c) model and think aloud how to apply the different steps, (d) assist in memorizing each step in order to execute the strategy, (e) scaffold students´ process to apply the strategy independently, and (f) help the students to develop their writing skills (Gillespie Rouse & Graham, 2016). SRSD consistently yielded large effect sizes in supporting typically developing as well as struggling writers with and without

disabilities across grades two through twelve in their writing (see for instance Graham et al., 2012; Graham et al., 2013)

The Stop & List Strategy

One of the limitations of classroom writing practice typically refers to the amount of time teachers dedicate to teaching writing (Graham, 2019). Identifying effective methods that are easy to use in classroom settings can support teachers in their efforts to provide good writing instruction. Of the strategies usually introduced to students through the SRSD framework, the STOP & LIST strategy (Graham & Harris, 2005) has the advantage that it can be implemented very easily into classroom settings, is very intuitive and does not require specific equipment or extensive preparation. The name STOP & LIST is an acronym for four steps structuring the prewriting phase: (a) Stop, (b) Think Of Purpose, (c) List Ideas, and (d) Sequence Them (egd.). STOP and LIST scaffolds the planning process and teaches students to generate and organize ideas prior to writing their story. Even though prior research on STOP & LIST yielded promising results in supporting struggling writers and students with LD (Graham & Harris, 2005; Graham et al., 1998; Grünke & Hatton, 2017; Özbek et al., 2019; Troia & Graham, 2002) the overall body of research on STOP & LIST is still relatively scarce and does only contain pen and paper approaches.

Story Mapping

Another promising approach that focuses on prewriting is story mapping. A story map is a type of graphic organizer and in this case refers to a visual template tool that structures the writing process on the basis of several story cards (When, Where, How, What, Who, Title). While there are several types of graphic organizers (concept maps, cognitive maps, visual displays, semantic maps, story maps, story templates, flowcharts, Venn diagrams; Ciullo & Reutebuch, 2013); they can be broadly summarized as "a graphical representation of concepts and their interrelationships" (Anderson-Inman et al., 1998, p. 1). Dexter and Hughes (2011) found moderate effect sizes (ES = 0.61) for the use of graphic organizers to improve academic performance in students with LD across subjects. Ciullo and Reutebuch (2013) focussed in their meta-analysis on technology-based graphic organizers and found

high effect sizes for content acquisition in social studies and positive results in four out of the

five included experiments for written expression for students with LD (Bahr et al., 1996;

Englert et al., 2005, 2007; Unzueta & Barbetta, 2012). But even though research has found

encouraging results for digital graphic organizers to help students with LD in their writing, the

body of literature on this instructional method is still very limited (see Ciullo & Reutebuch,

2013). Out of the identified experiments Ciullo and Reutebuch (2013) included in their meta-

analysis, only one experiment utilized the graphic organizer in the form of digital story cards.

Unzueta and Barbetta (2012) taught participating students to create digital main idea

clusters with symbols to fill in key concepts and terms during the planning part of the writing

process. Participating students improved in several writing related areas including text

productivity and overall text organization. Another experiment that applied digital story cards

during planning with students with LD was conducted by Gonzalez-Ledo et al. (2015).

Students answered questions (who, when, where, what, why) in response to a writing

prompt and filled in the information prior to the transcribing part of the writing process.

Results showed that participants were able to improve their quantitative writing as well as

the number of included story elements. Overall, despite the promising results, further

research is needed to investigate instructional variations for this strategy (Evmenova et al.,

2016).

Simultaneous Prompting Procedures

Simultaneous prompting is a planned, systematic instruction method, where

individualized, directing prompts (verbal, visual, physical) are presented to the student

immediately before or after instruction to evoke a correct response (Gibson & Schuster,

1992). Gibson and Schuster (1992) installed the simultaneous response procedure, after

their research on response prompting procedures that use a time-delay suggested that

fading a prompt systematically by increasing the time-delay interval between trials was not

necessary; because students often mastered the skill immediately after a 0-s delay trial

(Schuster et al., 1992). Another advantage of simultaneous prompting in comparison to other

prompting procedures is that an immediate delivery of the prompt is easier for the instructor

than to apply a changing delay interval between prompts (Tekin-Iftar et al., 2018).

Simultaneous prompting can be seen as an errorless learning strategy, because the

students respond directly to a correct response instead of giving an independent response

(Tekin-Iftar et al., 2018). Simultaneous prompting procedures have been investigated

extensively over 30 years and have shown to be effective across disabilities, ages, and tasks

(Morse & Schuster, 2004; Tekin-Iftar et al., 2018; Waugh et al., 2011). In their meta-analysis,

Waugh et al. (2011) examined 35 experiments and found an effectiveness rate of 93% for

participants reaching criterion during the procedure. Morse and Schuster (2004) additionally

reported positive effects in maintenance and generalization of skills. However, simultaneous

prompting has received little attention in the scholarly literature on effective writing

interventions so far and has not been investigated as a method to teach writing to students

with LD. The few experiments that utilized the method for writing yielded promising effects

for students with autism and emotional and behavioral disorders (Hudson et al., 2013;

Pennington et al., 2010, 2012, 2014). A chained task simultaneous prompting procedure for

writing typically consists of a systematic step-by-step instruction of a writing task while

controlling for respective correct responses by the student (Birkan, 2005; Hudson et al.,

2013; Rao & Kane, 2009).

Technology-based Writing Instruction

Technology-based instruction refers to methods through which technology is used as

a primary method to deliver instruction, similarly to the definition of *Technology-Aided*

Intervention and Instruction (TAII; see Odom et al., 2015; Wong et al., 2015) and

Computer-Assisted Instruction (CAI; Anohina, 2005). While TAII includes any electronic

device or virtual space (Odom et al., 2015), CAI is limited to the offline use of programs

located on a computer (Root et al., 2018).

While most writing outside of school is done digitally (Freedman et al., 2016)

research suggests that many classrooms still don´t provide technology-based writing

instruction (Applebee & Langer, 2011; Coker et al., 2016). This demonstrates a clear gap

between how writing is taught and how students will be expected to apply writing skills

proficiently to participate successfully in society (e.g. emails, presentations, online communication, multimodal writing). Meta-analysis on technology-based writing instruction found promising results with a weighted average effect size between 0.28 (Little et al., 2018) and 0.41 (Goldberg et al., 2003). Additionally, Little et al. (2018) found greater effects for students with LD than for their typically achieving peers pointing to LD being a moderating variable for technology-based instruction (egd.). Through these findings, it is clear that future research on technology-based instruction for supporting students with LD can add relevant perspectives on how to best support these students in their writing development. Connor et al. (2014) emphasize that technology-based writing instruction provides students with extended opportunities to engage in writing practice outside of the classroom. Furthermore, they point out the benefits of automated scoring to provide immediate and actionable feedback to students as they write and as a reliable tool for teachers for grading purposes, but also as an instrument to utilize assessment information to plan differentiated instruction (egd.). While researchers point out the many chances of technology-based instruction for writing, they also emphasize that it should not be a standalone method but rather be used as a supplemental treatment and be accompanied by instructional activities and guided practice (Ciullo & Reutebuch, 2013; Connor et al., 2014; King-Sears & Evmenova, 2007; Little et al., 2018).

Research Questions Across the Publications on Writing Instruction

With the knowledge that adequate writing skills provide a gateway to success not only in academic but also in personal and economic contexts, teaching writing skills to struggling students is critical; and with many teachers reporting a lack of instruction on how to effectively teach writing (Graham, 2019; Graham & Rijlaarsdam, 2016), research to identify effective writing instruction for these students can provide teachers with the necessary tools to support struggling writers. But while the field of writing instruction has become more prominent, the overall knowledge is still in need of expansion (Grünke & Leonard-Zabel, 2015). This is particularly noticeable in the area of technology-based writing instruction. Meta-analyses in this field consistently point out the gap in scholarly literature

and recommend for future research to investigate the underlying mechanisms on how technology can supplement teachers´ efforts to support struggling writers (see Ciullo & Reutebuch, 2013; Little et al., 2018).

Thus, the purpose for the four experiments this text refers to is to further investigate promising instructional components for struggling writers with and without LD that have not received much attention in the scholarly literature, yet. Furthermore, with regards to technology-based writing instruction, this text aims to further examine which specific elements of technology-based instruction may impact writing.

Experiment No. 1 (Nobel & Grünke, 2017) evaluated the effects of a digital graphic organizer on students´ quantitative and qualitative writing.

Experiment No. 2 (Grünke et al., 2019) evaluated the effects of a prewriting strategy (STOP & LIST) on students´ qualitative and quantitative writing.

Experiment No. 3 (Nobel & Grünke, 2020) applied the same prewriting strategy (STOP & LIST) in a digital format and assessed text productivity.

Experiment No. 4 (Nobel et al., in press) utilized a simultaneous prompting procedure to evaluate the effects on students´ qualitative writing.

Social validity was obtained across the experiments.

Publications

Publication No.1 (Summary)

"The effects of a computer-assisted writing instruction on the length and quality of essays written by fifth graders at risk for school failure"

Nobel, K., & Grünke, M. (2017). Über die Auswirkungen einer PC-gestützten Schreibförderung auf die Länge und Qualität von Aufsätzen von risikobelasteten Fünftklässlerinnen und Fünftklässlern. *Empirische Sonderpädagogik*, *9*(4), 323-340.

Introduction

This article reports on the use of a writing software utilizing story cards as a pre-writing activity and a template-based sequencing approach to guide students through the

steps of the writing process as described by Hayes and Flower (1980). Although prior

research found technology-based graphic organizers foster writing competence in students

with LD (Ciullo & Reutebuch, 2013), the body of literature investigating the use of digital

story cards with struggling writers is still very scarce (egd.).

Methods

Participants for this experiment were selected out of the cohort of all students of

grade five of a secondary school in Northrine-Westfalia based on low text quantity assessed

through a computerized writing sample. A randomized pre-post control group design was

applied (Grünke & Masendorf, 2000) and students were randomly assigned to either the

intervention group (IG) or the control group (CG). While the CG attended regular classes, the

IG received a writing training consisting of twelve 30-minute sessions over the course of four

weeks. Interventionists for this experiment were the first author and three graduate students

of special education. To ensure internal validity, interventionists were instructed by the first

author and received a written manual detailing the steps of the intervention. The IG worked

in two groups to adapt to fixed parameters of students´ weekly academic schedule and to

benefit from working with a smaller group. Writing prompts used for pre- and post-testing as

well as during the intervention were taken from a corpus of simple story starter sentences

(Hirmer & Hirmer, 2007). During pre- and post-testing, students were able to choose out of

three story prompts per measurement and during the intervention, additional story starter

sentences of the same corpus were used. Text quantity was measured using total words

written (TWW; Furey et al., 2016). Text quality was measured through an adapted version of

the "Teacher Evaluation of Story Elements" rubric (TESE; Troia & Graham, 2002). Each

story was evaluated by a group of eight graduate students of special education collectively

until consensus was reached. Additionally, social validity data was retrieved from

participating students of the IG through a questionnaire directly after the last session of the

intervention.

	Level 1 (highest support)	Level 2	Level 3 (least support)
Planning	**visual organizer** (story cards: who, where/when, how, why, what/story line, title)		
Transcribing	**fully sequenced:** 1. title 2. introduction 3. main part 4. ending	**not sequenced** - one section	**not sequenced** - one section
Revising	**fully sequenced:** - step 1 - step 2 - step 3	**fully sequenced:** - step 1 - step 2 - step 3	**not sequenced** - one section
Video example			

Figure 1: Content and levels of support throughout the writing software, video example

Students were instructed to fill out six story cards (title, who, when and where, why, what, how) with keywords as a prewriting activity. Each story card provided additional non-targeted information relating to the writing activity. During transcribing and revising, the software allowed for the students to pull up each story card on a split screen as support (see additional information and visuals in figure 1). During the first three lessons of the intervention, the first author introduced the software and the embedded writing strategy through a direct instruction approach (I do - We do - You do) applying the six steps of the SRSD model. During sessions four - 12, students worked individually with the software and the interventionists scaffolded support through monitoring their progress and assisting only if needed. The software offered three levels of support (see Figure 1) to further apply a scaffolding process with the aim that students gradually apply the learnt strategy more independently. All students started with the version of the software that offered the most support and guidance through the writing process and were introduced to the other versions of the software throughout the intervention individually based on their proficiency in applying

the strategy. Students received detailed feedback on their stories in both verbal and in written form based on predefined categories.

Results

For total words written as the dependent variable the descriptive data shows improvements for nine out of 10 students of the IG in contrast to only two out of 10 students of the CG. Based on the information from the results of the Solomon Plan (one-tailed, Bortz & Lienert, 2008), an effect size of 1.75. d_{Cohen} and 0.435 Eta^2 was calculated, indicating significant improvement for tww between the two conditions for the IG. In contrast, a Mann-Whitney-U-Test (.796) does not show statistically significant effects between the two groups/measurements. When evaluating the effects for text quality as the dependent variable, descriptive data shows that seven out of 10 (IG) in contrast to two out of 10 (CG) students improved their text quality between pre- and post-measurement. Improvement over time was calculated to be 0.50., resulting in no statistically significant effect for text quality for the IG (Mann-Whitney-U-Test: .684; Solomon-Plan, one-tailed: .072). For text quality, the calculated effect size indices indicate a medium effect of 0.70 d_{Cohen} and Eta^2 0.109. Social validity data revealed that students showed a high approval rate for the intervention being delivered digitally. All participants indicated that they prefer to write their stories digitally to a pen and paper version and that it was easy for them to operate the software. Additionally, all participants found that the software´s feedback was helpful. After completion of the intervention, more than half of the participants rated their stories as very good while the other participants rated their texts neutral and no participants indicated that they did not like their stories.

Discussion

The intervention was successful in supporting struggling students in their writing (text quantity/text quality). Additionally, social validity data from the students showed that acceptance of technology-based writing instruction is high, with students preferring a computerized version to a pen and paper approach. However, generalization of these results is limited due to the small group size and homogeneity of participating students as well as

the CG attending regular classes and did not receive an alternative treatment. Additionally, without results from follow up data and a transfer onto other types of texts, generalization or transfer effects can not be established through this experiment. However, results align with other studies that focussed on the effectiveness of digital graphic organizers to foster students´writing development as well as the general value of pre-writing activities (Ciullo & Reutebuch, 2013; Evmenova et al., 2016; Graham & Harris, 2009). The experiment and instruction focussed mainly on the graphic organizer as a prewriting activity, but the intervention included additional methods that could have mediated the improvement of students writing (SRSD, explicit instruction, modeling, sequencing, the use of a computer). While the results evaluate the intervention as a whole without differentiating the effectiveness of each of the contributing factors, Ciullo and Reutebuch (2013) confirmed the need for digital graphic organizers to be applied in conjunction with explicit instruction and guided practice in their meta-analysis. Improvements in text quantity usually go together with improvements in text-quality for developing writers (Grünke et al., 2015). This was accurate for all but 2 students of the EG and for one of the two students of the CG who improved in text quantity. One reason that may have contributed to a larger effect in TWW without an impact on text quality for the two students of the IG is that the software had an embedded word count that provided immediate feedback to the students while they were writing their stories. In comparison, feedback on text quality was not included in the software, but provided in the next session by the interventionists. Ciullo and Reutebuch (2013) found that feedback played a role in advancing learning-outcome in studies with graphic organizers and social validity data from the IG indicated that the feedback was perceived as helpful by the participants. Taking into account that students with LD often exhibit a lack of academic self-confidence (Bryan, 1991), it is very promising to see that participating students in the IG approved of their own texts after the intervention.

Publication No.2 (Summary)

Effects of the STOP and LIST Strategy on the Writing Performance of Struggling Fourth Graders

Grünke, M., Nobel, K., & Bracht, J. (2019). Effects of the STOP and LIST Strategy on the Writing Performance of Struggling Fourth Graders. *Journal of Education and Learning*, *8*(2), 1-13.

Introduction

This study reports on the use of the STOP & LIST strategy as a pre-writing activity to support students who struggle with the task of composition writing. While there is strong evidence to support the effectiveness of both strategy instruction and pre-writing activities (Roitsch et al., 2021), the STOP & LIST strategy has received little attention in scholarly literature thus far.

Methods

Participants were four 9-year-old students attending fourth grade in an inclusive elementary school in Northrine-Westfalia, Germany. The interventionist, a special education graduate student with experience in teaching, was instructed by the authors via video modeling, a detailed script and a self-evaluation checklist to be filled out for every session. The experiment applied a multiple baseline across participants design (AB) with 12 measurements. Dependent variables for this experiment were text length and text quality. Text length was measured through total words written (TWW, Furey et al., 2016) and text quality was scored using an adapted qualitative writing rubric (QWR, Glaser, 2004; Harris & Graham, 1996). Measurement was done after each session through a writing probe using a visual writing prompt. To control for internal validity and autocorrelation in data, baseline conditions were set randomly per participant between a minimum of five and up to seven sessions (Dugard, 2013; Smith, 2012). A draw between all possible options resulted in two participants starting treatment after five baseline probes and the other two participants starting treatment after seven baseline probes. The experiment was conducted over the course of twelve consecutive school days, each lesson lasting 45 minutes per participant in

a 1:1 setting, with 25 minutes reserved for treatment and 20 minutes for measurement.

During baseline, treatment was substituted by a non-writing related activity (coloring book).

During treatment conditions, the STOP & LIST Strategy was introduced according to the

phases of the SRSD model. After modeling the strategy, the interventionist told a story

based on the sequenced notes taken during the session. During lessons one - three, the

interventionist provided a poster displaying the steps of the strategy as a visual cue for the

students. By the end of lesson 3, all students were able to reproduce the steps of the Stop &

List Strategy, produce between four to eight sequenced notes and tell a story based on their

notes. From then on, support was scaffolded to monitor students progress and assist only if

needed.

Results

Data analysis for this experiment was calculated in R using the SCAN package

(Wilbert, 2018) and the SCDA package for R-Commander (MBD and Glass's Δ; Bulté,

2013). Indices calculated included non-overlap effect sizes, Glass's Δ and MBD, as well as

inferential statistics (randomization test and piecewise regression analysis). Overall,

participants yielded higher gains in text quantity than in text quality. Visual inspection for

TWW reveals a steady baseline with a sudden increase at the onset of the intervention.

Regression analysis confirmed no significant trend during baseline for any of the students

and a highly significant level effect for three of the four participants. For text quality, the

visual inspection shows a fairly steady baseline with a sudden increase at the onset of the

intervention for three out of the four participants. Regression analysis showed a level effect

for two of the participants for writing quality. None of the values between phase A and B

overlap for any of the four participants, resulting in the highest score possible for percentage

of non-overlapping data (PND; Scruggs et al., 1987), percentage of all non-overlapping data

(PAND; Parker et al., 2007), improved rate difference (IRD; Parker et al., 2009), non -overlap

of all pairs (NAP; Parker & Vannest, 2009), and Tau-U (Parker et al., 2010). The mean

baseline difference (MBD; Cambell, 2003) yielded a performance increase between 97 and

376 percent across participants. Even with no existing classification for the MBD index a

performance increase in the attested range certainly indicates relevant improvement. Glass's Δ (Glass et al., 1981) calculation yielded high indices between 11.07 and 29.71 for TWW across participants and indices between 3.07 and 6.68 for text quality. The overall effect for all participants was calculated using a randomization test (Edgington & Onghena, 2007; Grünke et al., 2015) and yielded a highly significant effect for text productivity and significant evidence of the effectiveness of the intervention for text quality.

Discussion

The experiment was able to confirm the positive findings on the effectiveness of the Stop & List Strategy on struggling students composition writing (Graham & Harris, 2005; Graham et al., 1998; Grünke & Hatton, 2017; Özbek et al., 2019; Troia & Graham, 2002). Students showed a direct improvement at the onset of the intervention, indicating a level effect. The findings align with the research on the effectiveness of pre-writing activities (see Gersten & Baker, 2001). However, limitations of the experiment refer to the small number and homogeneity of the participants (age, region, educational background). For this study, an AB plan was applied and without any follow up data, no indication about generalization effects can be ascertained. Additionally, the intervention only assessed story writing, so no predictions about possible transfer effects onto other text types can be made.

Publication No. 3 (Summary)

Effects of a Computerized STOP & LIST Intervention to Foster Text Production Skills in Students Who Struggle With Composition Writing

Nobel, K., & Grünke, M. (2020). Effects of a Computerized STOP & LIST Intervention to Foster Text Production Skills in Students Who Struggle With Composition Writing. *Insights into Learning Disabilities*, *17*(1), 73-85.

Introduction

This study follows up on the use of the STOP & LIST strategy to support struggling writers through strategy instruction and prewriting activities. An earlier experiment by the author and colleagues with the Stop & List strategy showed promising results for a pen and

paper version of the strategy (Grünke et al., 2019), but this paper is the first to report on the effects of a digital version of the strategy.

Methods

A randomized pre-posttest control group design was applied to evaluate the effectiveness of the intervention. This design indicates the gold standard to evaluate data of this type according to Mertens and McLaughlin (2003). Teacher referral as well as a writing probe showing a text productivity below the median across four fifth-grade classrooms was used to identify students, who did not meet academic standards in their writing. The participants, 17 male and 13 female fourth-grade students, were randomly assigned to either the treatment or the control group. During the intervention, the control group participated in regular classes, while the treatment group received the writing intervention. Pre- and posttesting through writing probes was done directly before and after the intervention. The quantitative development of student´s texts was assessed through total words written (TWW, Furey et al., 2016), resulting in an interrater reliability of 100%. The intervention was carried out in seven 90-minute sessions over a 2-week period. Interventionists were two graduate students who received a manual on how to conduct each session, including sentence-by-sentence instruction for the software implementation with the students.

get ready	set goals	brainstorm ideas	sequence thoughts	compose text
setting appropriate writing conditions, preparing for writing task	taking time to set writing goals/ think of purpose	*Listing ideas*	*sequencing ideas*	*writing a story*
The program leads through 3 questions consecutively. - is it quiet enough? - am I sitting ok? - am I ready to begin? **Students** pick out a number between 1-10 and receive a writing prompt.	**The program** starts a digital timer is set for 60 seconds **Students** are encouraged to think about the writing task, set writing goals and think of a purpose for their writing.	**The program** provides 12 single text fields on one slide. **Students** have to list at least 3 ideas during this step to be able to continue to the next step.	**The program** allows to sequence each of the 12 text fields via drag and drop. **Students** can pre-structure their ideas through the sequencing task.	**The program** provides two text fields - title and body and a word count provides immediate quantitative feedback. Sequenced ideas are visible at one side of the screen. The story can be saved or converted into pdf. **Students** are encouraged to write and revise.

Figure 2: Guided writing process of the digital stop and list program

The sessions followed the steps of the SRSD Model. The intervention took place in a classroom equipped with computers for each participant. The first lesson was used to familiarize the students with the use of the software. The interventionist modeled each step of the software by projecting their computer screen onto a whiteboard and thinking aloud. After session one, all sessions were structured similarly: (a) students received feedback on their last story if applicable (b) students worked with the software independently but received support if needed, interventionists monitored progress (c) students filled out a feedback questionnaire for the lesson. The software guided the students through the steps of the writing process using the Stop & List strategy (figure 2).

Results

Descriptive data for the dependent variable shows that the intervention group (IG) improved in mean text quantity from 54 words to 130.13 words between measurements. In contrast, the mean scores for TWW for the control group remain relatively stable with only a slight improvement (61.93/65.33). A test for homogeneity of regression showed that the within-group regression coefficients were homogeneous. Additionally, taking the

discrepancies in the pretest scores between the two groups into account (Dugard & Todman, 1995), an analysis of covariance was calculated through ANCOVA with the pretest as the covariate and the posttest as the dependent variable. Results showed a statistically significant effect of $F(1,27) = 20.08$, $p < .001$ for the treatment condition. Calculation of effect size measure was done using a corrected effect size for repeated measures design (Lenhard & Lenhard, 2016) as an adaptation to Cohen´s d, to take pre-existing differences between groups into account. Results yielded an index of $d = 1.77$, surpassing the common convention for large effect sizes ($d = 0.80$, Chen et al., 2010) by far. Social validity data conducted through a questionnaire showed high approval rates for the intervention for all participants with students rating the lessons most favorably in 92% of all cases.

Discussion

After an earlier experiment of the authors (2019) with the STOP & LIST strategy yielded promising results for both text quantity and text quality for four fourth graders who struggled with composition writing, this experiment evaluated a digital version of the strategy with text quantity as the dependent variable. Results show strong improvements (d = 1.77), indicating that the intervention was successful in supporting students to write longer stories. The study is subject to certain limitations. With only four participants of the same age and educational background, the results are not generally transferable to struggling writers. The AB design did not include conducting follow up data, again limiting inferences about long-term effects. However, this experiment consisted of only seven sessions and can be implemented easily in any school setting, as no extensive preparation is needed to apply the strategy and use the software. As with any technology-based treatment, basic IT-facilities of a school are a prerequisite and can also negatively impact accessibility.

Publication No. 4 (Summary)

Using a Simultaneous Prompting Procedure to Improve the Quality of the Writing of Three Students With Learning Disabilities

Introduction

This study reports on the effectiveness of a simultaneous prompting procedure to support students with LD in their composition writing. While simultaneous prompting has been investigated extensively over a period of more than 30 years and has found to be effective to teach various skills to students with disabilities (Tekin-Iftar et al., 2018), the procedure has received very little attention as a method to teach writing to students with LD.

Methods

A multiple baseline across participants design (AB) was used with the simultaneous prompting procedure as the independent variable and the quality of student´s texts as the dependent variable. To control internal validity, the intervention was introduced in a time-lagged manner (Gast & Ledford, 2010) with baseline conditions ranging between three to six sessions and treatment conditions lasting between nine to 12 sessions respectively. Participants were three (initially four students were included with one student dropping out due to missing most sessions) fourth grade students with diagnosed learning disabilities as defined in German federal education standards. The participants were included based on teacher recommendation (regular attendance, motivation, weak writing skills) and the assessment of a writing probe that required 70% of correct spelling and low text quantity. Simple story starters (A trip to the zoo, an adventure by the sea, etcetera) served as writing prompts during treatment and measurement. Students randomly drew one of the story starters each time they were asked to compose a text. Students were asked to compose a story in response to one of the writing prompts without additional support for measurement after each session. The dependent variable was measured using an adapted writing rubric

that applied a 5-point Likert scale to score for five key-elements of a narrative (Martin &

Manno, 1995; Troia & Graham, 2002). Both instructors of the intervention rated the texts

independently after each session, compared results and concluded with a score. After

completion of the experiment, an external paraprofessional was instructed on the rubric and

rated three randomly chosen texts written during baseline conditions and seven randomly

chosen texts written during the treatment phase. Using Spearman's rank correlation,

interrater reliability between total scores across both conditions were 0.93. During baseline

conditions, each session consisted of a card-game, serving as a non-writing related

substitute for the intervention and a measurement, where the students wrote a story in

response to one of the provided writing prompts. During treatment conditions, the

intervention replicated the simultaneous prompting procedure conducted by Hudson et al.

(2013). Each session started with the progress monitoring procedure, followed by the

response prompting procedure and measurement. For progress monitoring, instructors used

the writing rubric to give the students feedback about strengths and weaknesses of their last

story. During the prompting procedure, the interventionists taught the participants five story

writing steps consecutively. Each step was introduced via simultaneous prompting and had

to be replicated successfully by the student before advancing to prompt the next step. *(1)*

create a setting (2) introduce a problem (3) think of a solution (4) describe the consequences

(5) proofreading. The prompting procedure was introduced in session one to the students by

using one of the story starters and providing a verbal prompt and model sentence on "how to

start a story" with a 0-s time delay. Model sentences were accompanied by an explanation

("First of all, you need to provide a general frame for your story") and an additional verbal

prompt containing non-targeted information ("It is important to come up with a creative

setting"). Students were then asked to replicate the task for the same story starter. If

participants started writing within five seconds and finished their sentence within two

minutes, instructors delivered verbal praise. If students did not demonstrate the targeted

behavior, they were corrected and the prompting procedure was repeated until the student

was able to reproduce the targeted task. After a student delivered the correct response, the

instructors delivered the next prompt. The instructors scaffolded their support and after a participant was able to repeat the five steps three times without mistakes, the instructors retreated from prompting to only indicating the steps, monitoring students progress and providing guided feedback, when the students made a mistake.

Results

Data was evaluated using R´s "Scan" package (Wilbert, 2020) for descriptive data, overlap indices and regression analysis. Additionally, the mean baseline difference (MBD) was calculated manually (O'Brien & Repp, 1990). Descriptive data shows a steady increase for text quality in all three participants ranging from 189.81 % (Lene), 138.80% (Yusum) and 188.86% (Lara). Overlap indices show strong, significant effect sizes (p<.01) for non-overlap of all pairs (NAP; Parker et al., 2011) and the percentage of non-overlapping data (PND; Scruggs et al., 1987) across all participants. Tau-U (Parker et al., 2011) was calculated taking an A-trend into account (A vs. B + trendB – trendA) with results showing a large change of 0.74, $p<.001$ for Lene, 0.72, $p<.01$ for Yusum, and 0.75, $p<.001$ for Lara. Additionally, the average text lengths increased in all three participants between baseline and treatment conditions by about 99.83 % (Lara), 115.49% (Yusum) and 122.53% (Lene). These results align with the findings that for writers at that stage, an increase in text quantity usually goes along with an increase in text quality (Grünke et al., 2015). To complete quantitative evaluation of the data, regression analysis shows statistically significant level effects of $p<.05$ for Lene and Yusuf and $p<.01$ for Lara as well as a slope effect ($p<.05$) for Lara. Across all participants, a statistically significant level effect ($p<.001$) and a statistically significant slope effect ($p<.05$), with an average increase of 0.73 scale points per intervention session was calculated.

Discussion

Tekin-Iftar et al. (2018) recommended in their meta-analysis for future research on simultaneous prompting to focus on specific tasks and specific types of disabilities. This experiment contributes to the growing body of research on simultaneous prompting, showing that the procedure was effective at improving the qualitative writing of three students with

learning disabilities. Social validity data for this experiment reveals that the students perceived the intervention as helpful and scored their writing ability higher than before the intervention. Graham, Kiuhara et al. (2017) found that self-efficacy has a positive influence on writing quality, pointing to additional promising developments for academic self-confidence in participating students. However, motivational variables are known to support struggling students in their writing (Graham, Kiuhara et al., 2017) and this experiment did not measure to what extent motivational factors mediated the positive results. To test, if intervening variables like self-efficacy mediate the effects of an intervention, future experiments could utilize multilevel modeling to test a mediator-hypothesis (Kenny et al., 1998; Kenny et al., 2003; Vuorre & Bolger, 2018). Additional limitations of this experiment concern the generality of the results: since the sample consisted of only three students with a similar educational background and age, the text type, and due to the difficult situation in classrooms during the covid pandemic, no followup data was collected to check for maintenance effects. Future experiments should replicate the experiment with a diverse set of participants and text types.

Discussion

Main Findings

Across the four publications included in this paper, the experiments applied technology-based writing instruction as well as pen and paper approaches to support struggling writers. The aim of the four studies was to further examine promising writing interventions that have not been studied extensively with regards to their effectiveness for struggling writers with and without LD. Additionally, this text aimed to identify which specific elements of instruction were supportive for struggling writers within the experiments that evaluated technology-based writing instruction.

Experiment no. 1 (Nobel & Grünke, 2017) evaluated the use of a technology-based graphic organizer as a prewriting activity with 20 students of grade five using a pre-post control group design and was successful in enhancing the text-productivity in nine of the ten participants of the IG and the text quality in seven out of the ten participants of the IG. Only

two of the ten students of the CG in comparison showed improved text quantity and two received higher scores in text quality at post testing. Social validity data revealed that participating students enjoyed the intervention and rated their own texts higher than before the intervention.

Experiment no. 2 (Grünke et al., 2019) evaluated the use of the STOP & LIST strategy as a prewriting activity with four third-grade students using a multiple baseline across participants design (AB) with text productivity and text quality as dependent variables. Participating students were able to enhance both their qualitative and quantitative writing. Data showed a highly significant level effect for three of the four participants for TWW and significant evidence of the effectiveness of the intervention for text quality (p<0.5).

Experiment no. 3 (Nobel & Grünke, 2020) evaluated a technology-based version of the STOP & LIST strategy as a prewriting activity and applied a randomized pre-posttest control group design with 30 fourth grade students with text productivity as a dependent variable. Results show strong improvements (d = 1.77), indicating that the intervention was successful in supporting students to write longer stories.

Experiment no. 4 (Nobel et al., in press) evaluated the use of a simultaneous prompting procedure with three fourth grade students with LD. The experiment was conducted using a multiple baseline across participants (AB) design and text quality as the dependent variable. Results indicate that the procedure was successful in supporting students´ qualitative writing with a steady increase in all three participants ranging between 138.80% and 189.81 %. Regression analysis shows statistically significant level effects of p<.05 for Lene and Yusuf and p<.01 for Lara as well as a slope effect (p<.05) for Lara.

Relevant Instructional Components

All four experiments offered instructional support to the students during the planning phase of the writing process. Other general instructional components within the studies included strategy instruction, systematic instruction and explicit teaching. These methods are continuously described as effective in supporting struggling students and students with LD in

their writing development (eg. Gersten & Baker, 2001; Gillespie & Graham, 2014; Graham & Perin, 2007; Roitsch et al., 2021). The experiments included in this paper were able to confirm the positive findings. Notably, the four publications included several aspects of self-regulation and all but one utilized the SRSD framework to teach and monitor the use of the targeted writing strategy. Graham et al. (2012) report added value for strategy instruction when combined with self-regulation instruction with interventions that utilized SRSD to introduce the strategies yielding higher effects than studies that did not apply the strategy.

Observations from pre-testing and baseline conditions across the experiments were consistent with the findings of MacArthur and Graham (1987), that struggling writers typically invest little time on planning activities. Research suggests that effective planning can predict a positive writing outcome and that a lack of planning can be considered a barrier for struggling writers to produce stories of adequate length and quality (Graham & Harris, 2009). The positive results from the conducted experiments align with all major writing theories that recognize the importance on delivering systematic instruction on how to generate and organize ideas prior to the transcribing part of the writing process (see MacArthur et al., 2006), as well as with the findings from meta-analyses in this field (see Gillespie & Graham, 2014; Gillespie Rouse & Sandoval, 2018; Rogers & Graham, 2008). In addition, all but the analogue STOP & LIST interventions offered step-by-step guidance as well as feedback throughout the writing process. This may be able to support planning as well as generally reduce the cognitive load required to orchestrate the complexity of the writing process. The simultaneous prompting approach has shown positive effects as a writing intervention for students with autism and behavioral disorders in prior experiments (Hudson et al., 2013; Pennington et al., 2010, 2012, 2014), but it had not been evaluated with students with LD. Data from the conducted experiment reveals that simultaneous prompting was successful in improving the qualitative as well as the quantitative writing of three students with LD, pointing to a promising method to take into consideration for future research on writing interventions for students with LD.

Technology-Based Writing Instruction

The two experiments on technology-based writing instruction yielded medium to strong results in supporting students who received the treatment in their writing. Additionally, social validity data shows a preference of participating students to write their stories on a computer. Notably, Little et al. (2018) indicate in their meta-analysis that students with LD may benefit more from technology-based writing instruction than their typically achieving peers and recommend further research to investigate if the discovered effects are robust. Specifically, they advise for future research to identify which specific instructional mechanisms are of importance when using technology-based instruction (Little et al., 2018). First of all, it should be mentioned that *strategy instruction* and *planning* as methods identified by research as effective in supporting struggling writers (see Roitsch et al., 2021), were also successful in supporting struggling writers with LD in the two studies that involved technology. Other instructional components of the two experiments included *scaffolding* processes of the template-based writing software, automated immediate *feedback* on students´ quantitative writing, and *explicit instruction* and *guided practice* as part of the SRSD framework that has been used to teach the strategies. Ciullo and Reutebuch (2013) already identified guided practice and explicit instruction as critical for the use of digital organizers. Little et al. (2018) pointed to feedback and scaffolding as promising instructional elements for technology-based writing interventions for students with LD. While these findings contribute to scholarly understanding of which mechanisms and instructional components technology may impact writing, more research is needed in this field. Finally, both the STOP & LIST strategy as well as the digital story cards were effective in supporting struggling writers both through a pen and paper approach as well as through a digital version of the strategy. This points to the opportunity for future experiments to investigate the effectiveness of other methods and instructional components research identified as effective or promising to teach writing to struggling students when adapted to digital versions.

Limitations and Future Research

While it is encouraging that the above experiments found promising results to support developing writers in their efforts, described limitations in above publications include small sample sizes, homogeneity of the participants, as well as the type of text that was used to measure success. While these limitations can be seen as typical when conducting studies under field conditions in classrooms, they put a constraint on the generality of the results. Further research with larger and more diverse groups would be beneficial for evaluating the promising effects found across the experiments. Another way to establish further reliability of an underlying theory with regards to questions of generality and to evaluate promising research is for future research to conduct replication studies and intentionally change certain aspects of the original study, for instance in relation to participants, dependent variables, measurement, or setting, adding insights to questions of generality in relation to the underlying theory (Hüffmeier et al., 2016; Plucker & Makel, 2021). Plucker and Makel (2021) emphasize that the successful replication of a promising study can enhance trust in educators and policymakers, encouraging them to apply the intervention in their classrooms (egd., 2021). But only 0.13 % of published papers in educational research are labeled as replication studies (Pridemore et al., 2018). If applied to a series of studies investigating the same principle via pen and paper approach as well as a technology-based approach, such as the two studies on the STOP & LIST strategy; utilizing the principles of systematic replication studies would add further reliability to the results.

Another limitation concerns the text genre that was assessed. The referenced studies focussed only on narrative writing (story writing). While Graham et al. (2016) found that students´ performance in one text genre was not reliable to also predict their performance in other text genres, the authors add that this observation might not apply to struggling, developing writers with generally little writing knowledge (egd.; Lin et al., 2007; Saddler & Graham, 2007). Taking this into account, future research should include conceptual replication studies with different text genres. This would contribute valuable insights about possible generality of an intervention across text genres for struggling writers. Another

general point of discussion refers to assessing students´ writing. The dependent variables across the referenced publications were text quantity and text quality. Text quantity was measured through Total Words Written, simply referring to the total number of words in a text, hence naturally scoring very high for interrater reliability (TWW, Furey et al., 2016; Hosp et al., 2016). Two of the experiments assessed both text productivity and text quality as dependent variables (see Grünke et al., 2019; Nobel & Grünke, 2017). Generally in both these experiments, the gains in text productivity were higher than the gains for text quality. Additionally, in the technology-based experiment (Nobel & Grünke, 2017) two participating students that were able to improve their text productivity did not simultaneously receive higher scores in text quality. It was discussed that the automated writing evaluation (AWE) for TWW the software provided might have contributed to the higher performance in text quantity without the expected relation to text quality. Prior research on technology-based automated feedback has shown promising results and would point towards including AWE in future experiments (see Palermo & Wilson, 2020; Roscoe & McNamara, 2013; Wilson & Czik, 2016; Wilson & Roscoe, 2020). Text quality was assessed based on qualitative writing rubrics (Glaser, 2004; Harris & Graham, 1996; Martin & Manno, 1995; Troia & Graham, 2002). Rubrics are currently the most common method used to assess the quality of writing probes over time (Grünke et al., 2019), but assessing the quality of a text is prone to more bias than counting the words of a text. As an example, Graham et al. (2011) reported that spelling and handwriting influenced how texts were scored and reacted to by typing students´ texts and correcting any spelling (egd.). While several measures were installed throughout the experiments (see above) to account for a high interrater-reliability, the measures described by Graham et al. (2011) could add additional value for future experiments as could automated essay scoring elements included into writing software.

One more factor that limits the validity of described effects is that both cognitive and motivational variables can support students in their writing progress (Graham, Kiuhara et al., 2017). Measurements regarding mediating factors were not part of the experiments but

could give further insights in future experiments, to what extent a method was responsible

for a resulting outcome and to what extent. Vuorre and Bolger (2018) added the software

package "bmlm" (Bayesian Multi-Level Mediation) for "R" to test the possibility that an

intervening variable like motivation might mediate the effect of the causal variable on the

measured outcome through lower level mediation analysis in single case design studies

(Kenny et al., 1998; Kenny et al., 2003; Vuorre & Bolger, 2018). Applying this tool in future

experiments could result in valuable information about the measured outcome of an

intervention study.

Implications for Practice

      Writing skills are pivotal for successful academic and personal participation, as

literacy skills including writing are becoming even more relevant through the ongoing digital

transformation of society. Luckily, research suggests that several writing interventions,

including the methods evaluated in the four studies this paper refers to, can support

struggling writers in their efforts. The described writing interventions are easy to implement

in educational settings and their handling is intuitive and does not require extensive teacher

training. Digital tools have several benefits, especially in heterogeneous classrooms.

Automated feedback and individualized content can support students in their learning while

providing teachers with extra time to tend to students who need additional support (Nobel &

Grünke, 2017). When a student is motivated to use a computer, this might enhance the time

that this student is willing to spend on-task, making it a powerful method for tasks that rely

on repetition (see Lämsa et al., 2018). However, more research is needed in the field of

technology-based writing instruction. Based on the findings, future experiments in this field

should further investigate the instructional components mentioned above to determine how

technology can best be implemented into classroom instruction for writing.

      One additional implication is in reference to the bridge between research and

practice. As a practitioner with nearly a decade of prior teaching experience mainly in

Germany but also in the US in teaching struggling students with speech and language

impairments, I was able to look at promising methods and experiments from both angles, for

instance in terms of integrating the struggles of balancing a tight curriculum as a teacher and wanting to evaluate and implement promising methods as a researcher. Adding my experience in teaching struggling students in an existing team of versatile researchers enabled us to quickly and effectively identify and set up promising interventions for our students, pointing to several benefits of multiprofessional research teams that include practitioners. Additionally, when conducting the first experiment it was apparent that participating students enjoyed the technology-based writing intervention and preferred this method over a pen and paper approach. But students´ appreciation of the technology-based intervention went far beyond the measured positive effects. By talking to the students I found that, not only did they change their perception of their own writing skills from very negative to positive throughout the short technology-based intervention, they also showed high patience for any technical issues and imperfections of the beta version of the program and were generally eager to work with our software. This observation leads me to believe that including technology-based interventions can be an additional approach to support many struggling students across subjects and that future research should focus on transferring effective methods to technology-based versions.

Writing instruction matters!

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Appendix A: Publication No. 1 (*peer reviewed*)

Über die Auswirkungen einer PC-gestützten Schreibförderung auf die Länge und Qualität von Aufsätzen von risikobelasteten Fünftklässlerinnen und Fünftklässlern

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Zusammenfassung

Die Nutzung grafischer Vorlagen als Ordnungs- und Strukturhilfe im Schreibprozess ist eine erfolgversprechende Unterstützung für Schülerinnen und Schüler mit schwachen Leistungen im kompositorischen Schreiben. In der vorliegenden Studie wurden die Effekte einer computerbasierten Förderung der Schreibkompetenz auf Basis von Geschichtenkarten untersucht. Die Stichprobe bestand aus zwanzig Fünftklässlerinnen und Fünftklässlern, die beim Verfassen von Texten nur sehr wenige Wörter produzierten. Sie wurden in eine Experimental- und eine Kontrollgruppe eingeteilt. Die Experimentalgruppe erhielt über vier Wochen hinweg ein aus zwölf 30-minütigen Sitzungen bestehendes Schreibtraining. Hierbei kam eine eigens entwickelte Lernsoftware zum Einsatz, die sich auf das bekannte Modell von Hayes und Flower (1980) stützt. Der Prozess der Planung wird in dem Programm durch Geschichtenkarten unterstützt, die als grafische Vorlagen dienen. Die Kontrollgruppe besuchte in der Zeit der Förderung den regulären Unterricht. Bewertet wurde die quantitative und qualitative Entwicklung der produzierten Texte. Die Messung der Erfolgskriterien erfolgte direkt vor und direkt im Anschluss an die Intervention. Nach dem Schreibtraining zeigten sich bedeutsame Verbesserungen in der Länge der produzierten Texte und eine mittlere Steigerung der Qualität.

Schlüsselwörter: Textproduktion, Lernschwierigkeiten, Computerunterstützte Förderung, Geschichtenkarten

The effects of computer-assisted writing instruction on the length and quality of essays written by fifth graders at risk for school failure

Abstract

The use of graphic templates as a tool for order and structure in the writing process is a promising support for students with weak performance in compositional writing. The following survey examines the effects of a computer-based support for writing competence on the basis of story-cards. For this, twenty students of grade five were identified, who produce very few words when writing a text. They were divided into an experimental and a control group. The experimental group was provided with twelve 30-minute sessions over four weeks of writing skills training with a self-developed learning software, which supports the process of planning with the aid of story-cards as graphic templates in the process of writing, based on the model of Hayes and Flower (1980). The control group visited the regular lessons in school during that

time. The quantitative and qualitative development of the produced texts was rated. The measurement of the success criteria was done immediately before and immediately after the intervention. After the writing skills training, a high improvement in the length of the produced texts and a medium improvement of the quality of the texts could be seen.

Key words: Text Production, Computer-based Support, Story-cards

Einleitung

Bedeutung der schriftlichen Kommunikation über elektronische Medien

Wissen und Gedanken über ein elektronisches Medium in Schrift umzusetzen, ist gerade im Hightech-Informationszeitalter eine elementare Fähigkeit für schulischen und beruflichen Erfolg (Burnett & Merchant, 2015). Ein großer Teil der Kommunikation in bildungsbezogenen Kontexten erfolgt schriftlich (E-Mails, Präsentationen, Berichte...) und hat bedeutsamen Einfluss darauf, wie kompetent wir als Kommunikationspartnerinnen und -partner wahrgenommen werden. Entsprechend stellen Ausbildungsbetriebe und Hochschulen hohe Anforderungen an die Schreib- und Medienkompetenz der Schulabgängerinnen und Schulabgänger. Die Bildungsstandards der Kultusministerkonferenz (KMK) sehen deshalb bezogen auf den Schreibunterricht ab der Grundschule vor, dass Texte mit und für digitale Medien verfasst werden (Qualitäts- und Unterstützungsagentur, 2017).

Doch auch im privaten Bereich kommt der schriftlichen Kommunikation über PCs, Tablets, Smartphones und Notebooks ein enormer Stellenwert zu. Durch Social Media Kanäle sind ganz neue schriftsprachliche Zusammenhänge aufgetaucht, um mit Peers in Kontakt zu treten und sich darzustellen (Merchant, 2007). Das Lesen und Beantworten von Nachrichten und Posts integriert dabei Lese- und Schreibfähigkeiten als notwendige Kommunikationsmittel (Berninger, Nagy, Tanimoto, Thompson & Abbott, 2015). Schon 97 Prozent der 12-19jährigen besitzen ein eigenes Mobiltelefon; 95 Prozent dieser Geräte sind Smartphones mit Touchscreen und der Möglichkeit, online zu gehen. Zusätzlich haben fast 100 Prozent aller deutschen Haushalte einen Computer oder Laptop mit Internetzugang (Feierabend, Plankenhorn & Rathgeb, 2016). Dadurch ist der Zugriff auf Social Media-Kanäle fast ständig möglich. Es ist davon auszugehen, dass die dazugehörigen Schreibaktivitäten sich zunehmend ausweiten (Becker-Mrotzek, 2014; Becker-Mrotzek & Böttcher, 2012).

Facetten des Schreibprozesses

Dementsprechend ist es wichtig, alle Schülerinnen und Schüler möglichst gut in ihrer Schreibentwicklung zu unterstützen. Didaktisch ist es dazu notwendig, den Ablauf und die relevanten Kompetenzen für den entsprechenden Entwicklungsprozess genau zu kennen. Becker-Mrotzek und Böttcher (2006) beziehen sich in ihrem Schreibkompetenzmodell auf die sprachlichen und kognitiven Teilfähigkeiten, wie grammatische und lexikalische Kenntnisse, Textmusterwissen, Schriftkenntnisse und soziale Kognition. Hayes und Flower (1980) beschreiben in ihrem wegweisenden theoretischen Ansatz den Verlauf der Textproduktion in drei Facetten: Planen, Verschriftlichen und Revidieren. Alle Aktivitäten werden von einem Monitor überwacht. Kompetente Schreiberinnen und Schreiber generieren während der Planung zunächst Ziele, wählen Ideen aus und verbinden bzw. ordnen diese. Beim Verschriftlichen verknüpfen sie die Fähigkeit der Transkription (Übersetzung von Gedanken in Wörter durch Schreiben per Hand oder mittels Tastatur) mit der Kohärenzbildung. Das Revidieren beinhaltet das Lesen und Korrigieren des eigenen Textes. Damit das

Ergebnis der Bemühungen letztendlich ein Schreibprodukt auf akzeptablem Qualitätsniveau darstellen kann, ist es notwendig, dass Schülerinnen und Schüler die nötige Motivation aufbringen, um die drei genannten Teilprozesse mit der gebotenen Gewissenhaftigkeit auszuführen (Hidi & Boscolo, 2007).

Normale und gestörte Entwicklung von Schreibkompetenzen

Wenn man die Entwicklung der Fähigkeit zur Textproduktion betrachtet, nutzen Schreibanfängerinnen und Schreibanfänger zunächst häufig das Muster des „Knowledge Tellings" (Bereiter & Scardamalia, 1987), eine zumeist lineare Wiedergabe des vorhandenen Wissens ohne relevante Bearbeitung. Die vorherrschende Textsorte zu Beginn der Schreibentwicklung ist die Erzählung, die sich zudem stark am mündlichen Sprachhandeln orientiert (Balhorn & Vieluf, 1990). Ab dem Beginn der Sekundarstufe (also im Alter von ca. 10 Jahren) geht es um einen Übergang vom bloßen „Knowledge Telling" hin zum „Knowledge Transforming" (Bereiter & Scardamalia, 1987). Schülerinnen und Schüler können in dieser Phase etwa thematisches Wissen strukturierter einsetzen und Textmuster nutzen. Jedoch ist gerade beim Übergang hin zum „Knowledge Transforming" zu beachten, dass die Schreibentwicklung individuell sehr unterschiedlich verläuft und viele Faktoren darauf Einfluss nehmen können. So spielt beispielsweise die Wahl der Schreibaufgaben und Textsorten im Schulunterricht häufig schon eine wichtige Rolle (Becker-Mrotzek & Böttcher, 2012). Schreibkompetenz entwickelt sich als Prozess sowohl parallel als auch mehrdimensional in allen beteiligten Bereichen. Aus diesem Grund ist der entsprechende Vorgang als komplexe sprachliche Handlung enorm störungsanfällig (ebd.). Gerade bei Schülerinnen und Schülern mit gravierenden Lernschwierigkeiten lassen sich im Bereich der Textproduktion typische Rückstände ausmachen. Häufige Auffälligkeiten

beziehen sich unter anderem auf ein Fehlen von Organisationsstrategien (Englert, Raphael, Fear & Anderson, 1988). Damit verbunden ist zu beobachten, dass diese Kinder und Jugendlichen ohne eine ausreichend lange Planungsphase mit dem Schreiben ihres Textes starten und ihre Ideen nacheinander herunterschreiben (Newcomer & Barenbaum, 1991). Das Ergebnis sind häufig sehr kurze Texte mit wenig kohärentem Inhalt (Re, Pedron & Cornoldi, 2007).

Möglichkeiten der Schreibförderung

Nun stellt sich die Frage, wie man den Schreibprozess effizient fördert und insbesondere risikobelastete Schülerinnen und Schüler davor bewahrt, hinter den Mindeststandards der curricular gesetzten Bezugsnormen zurückzubleiben. Einschlägige Metaanalysen legen nahe, dass sich Fähigkeiten im Bereich der Textproduktion bei Kindern und Jugendlichen mit Lernproblemen auf sehr wirksame Weise aufbauen lassen (Cook & Bennett, 2014; Datchuk & Kubina, 2012; Gillespie & Graham, 2014; Rogers & Graham, 2008). Einen besonderen Stellenwert unter den grundsätzlichen Ansätzen zur Verbesserung der Schreibfähigkeit nimmt hierbei das Self Regulated Strategy Development (SRSD) Modell von Harris und Graham (1996) ein. In ihrer Sekundäranalyse stellen Cook und Bennett (2014) heraus, dass sich knapp die Hälfte aller einschlägigen Wirksamkeitsstudien auf dieses Konzept bezieht. Das SRSD-Modell besteht aus sechs Phasen, die den Verlauf der Instruktion strukturieren:

1) Die Lehrkraft aktiviert bei den Kindern das Wissen über Inhalte, Strukturen und Sprache, das sie zur Bearbeitung der Schreibaufgabe benötigen.
2) Sie vermittelt die Relevanz, welche die zu erwerbende Strategie für die Kinder mit Blick auf die Zielerreichung besitzt.
3) Sie demonstriert das Vorgehen bei der Anwendung der Strategie anhand von Beispielen.

4) Sie leitet Übungen an, die den Zweck verfolgen, bei den Kindern Routine im Einsatz der Strategie zu entwickeln.
5) Sie blendet ihre Anleitungen schrittweise aus und gesteht den Kindern immer mehr Raum zum selbstständigen Arbeiten zu.
6) Sie schafft Möglichkeiten für die Kinder, die Strategie im Alltag anzuwenden.

Die Phasen beruhen auf den Prinzipien des kognitiven Modellierens, des Fadings, des angeleiteten bzw. des selbstständigen Übens sowie der Selbstinstruktion. Was den Nutzen des Ansatzes angeht, stellen Gillespie und Graham (2014) zusammenfassend fest: „... SRSD studies produced greater effects than studies that did not use SRSD. The practical implications of these findings are that teaching students with learning disabilities to plan, write, and revise using strategy instruction is an effective method for improving their writing" (S. 468).

Bedeutung von Geschichtenkarten bei der Schreibförderung

Besonders nutzbringend scheint das SRSD-Modell dann zu sein, wenn man es dazu einsetzt, um Kindern und Jugendlichen mit Lernschwierigkeiten Planungs-, Verschriftlichungs- und Überarbeitungskompetenzen mit Hilfe von grafischen Vorlagen wie etwa Geschichtenkarten (Story Maps) zu vermitteln (z. B. Grünke & Leonard-Zabel, 2015). Eine Geschichtenkarte ist eine visuelle Vorlage, die dabei helfen soll, einen Text zu ordnen und zu strukturieren. Sie besteht aus mehreren Feldern, in die sich die wichtigsten Inhalte aus einer Erzählung oder einem anderen Genre in Stichpunkten eintragen lassen. Im Falle von Geschichten werden die Felder der Vorlage vorab häufig mit den Überschriften „Hauptpersonen", „Zeit", „Ort", „Problem", „Ziel", „Ablauf" und „Ergebnis" versehen und mit Pfeilen verbunden, um zu verdeutlichen, wie sich die Geschehnisse nach und nach entwickeln (Idol, 1987). Die Arbeit mit Geschichtenkarten

dient normalerweise dazu, Schülerinnen und Schülern das sinnverstehende Lesen zu erleichtern. Allerdings lassen sie sich auch für als Hilfsmittel bei der Komposition von Texten einsetzen (Grünke & Leonard-Zabel, 2015).

In einer Studie von Li (2007) mit Viert- und Fünftklässlerinnen bzw. -klässlern konnte gezeigt werden, dass die Verwendung von Geschichtenkarten einen positiven Einfluss auf die Schreibflüssigkeit und die lexikalische Vielfalt ausübt. Die geförderten Kinder in der Untersuchung von Zipprich (1995) waren in der Lage, die per Skalen eingeschätzte Qualität ihrer Texte nach einer Intervention mittels einer besonderen Form der Geschichtenkarte (Structured Story Web) signifikant zu verbessern. Hennes, Büyüknarci, Rietz und Grünke (2015) konnten anhand ihrer Stichprobe demonstrieren, dass eine SRSD-orientierte Förderung mit Hilfe von Geschichtenkarten sowohl die Anzahl der Wörter pro Erzählung erhöht als auch die Qualität der Texte verbessert.

PC-gestützte Schreibförderung unter Einbezug von Geschichtenkarten

Schreibinterventionen unter Einbezug eines PCs führen bei schulschwachen Kindern und Jugendlichen in aller Regel zu beachtlichen Leistungssteigerungen (Grünke, 2006). In ihrer Metaanalyse berichten Gersten und Baker (2001) im Zusammenhang mit der Verbesserung expressiver Schreibkompetenzen von einer mittleren (ungewichteten) Effektstärke von 1.06. Dieser vergleichsweise sehr hohe Wert dürfte nicht nur auf die basalen Prinzipien der Intervention, sondern auch auf das Medium zurückzuführen sein. Wenn Schülerinnen und Schüler mit Lernschwierigkeiten Texte mit Hilfe eines PCs, Laptops oder Tablets verfassen dürfen, dann ist ihre Schreibmotivation deutlich höher, als wenn sie dies mittels Papier und Stift tun müssen (Genlott & Grönlund, 2013; Trageton, 2012). Bildschirmmedien üben auf Kinder und Jugendliche gemeinhin eine große Faszination aus und

animieren meist mehr als „Paper-Pencil-Ansätze" dazu, sich auf das Förderangebot einzulassen. Dies gilt v.a. für solche Mädchen und Jungen, die sich Schreibaufgaben häufig verweigern, weil deren Bearbeitung mit einem relativ hohen kognitiven Aufwand verbunden ist und sie daran in der Vergangenheit oft gescheitert sind. Dürfen sie ihre Schreibprodukte jedoch mit Hilfe eines Bildschirmmediums verfassen, so produzieren sie in aller Regel längere und qualitativ hochwertigere Texte als auf dem Papier (Applebee & Langer, 2009; Collins, Hwang, Zheng, & Warschauer, 2013; Graham & Perin, 2007; Russell & Haney, 1997).

Die Idee, eine Förderung mit Geschichtenkarten computergestützt umzusetzen, wurde von Unzueta und Barnetta (2012) realisiert. Sie versuchten auf diese Weise, die Fähigkeit zum Verfassen von narrativen Texten bei lernbeeinträchtigten Schülerinnen und Schülern zwischen 12 und 13 Jahren bedeutsam zu steigern. Ihre Einzelfallstudie mit vier Kindern ergab, dass die Intervention zu einer merklichen Verbesserung im Bereich der Planungsfertigkeit, der Schreibflüssigkeit und weiterer Zielvariablen führte.

Doch obwohl Geschichtenkarten als Hilfsmittel für eine vielversprechende Intervention nach dem SRSD-Ansatz anzusehen sind und dies auch mit einer effektiven und motivierenden PC-gestützten Förderung umgesetzt werden kann, hat diese Form der Unterstützung für Kinder und Jugendliche mit Lernschwierigkeiten in der Forschung bislang kaum Aufmerksamkeit erfahren. Dabei ist ein solches Vorgehen in Anbetracht der bisherigen Ausführung naheliegend. Denn die Kommunikation über handschriftlich verfasste Texte tritt anteilsmäßig mehr und mehr zugunsten eines immer bedeutsamer werdenden Austauschs mittels elektronischer Medien in den Hintergrund. Die Realisierung einer SRSD-Intervention unter Verwendung von Geschichtenkarten könnte unter Einbezug von PCs, Laptops oder Tablets bei den Schülerinnen und Schülern nicht nur für eine hohe Bereitschaft zur Mitarbeit sorgen, sondern auch dazu führen, dass die Kinder und Jugendlichen ihre Kompetenz im routinemäßigen Umgang mit diesem Medium verbessern.

Fragestellung

Das Anliegen dieser Studie knüpft genau hier an. Ihr Zweck bestand darin, ein eigens konzipiertes Computerprogramm mit Fünftklässlerinnen und Fünftklässlern zu evaluieren, die beim Verfassen von Erzählungen vergleichsweise große Schwierigkeiten aufwiesen. Im Einklang mit den obigen Ausführungen wurden solche Schülerinnen und Schüler in den Fokus genommen, die vom Stand ihrer Entwicklung her das Verfassen von Geschichten aus der Ich- und Fremdperspektive eigentlich gut beherrschen sollten. Die Intervention verfolgte das Ziel, die Schreibleistungen von risikobelasteten Kindern in dieser Phase zu verbessern, um ein Zurückbleiben hinter dem üblichen Niveau zu vermeiden.

Das Lernprogramm lehnt sich vom Ablauf her an das oben beschriebene Modell kompetenten Schreibens von Hayes und Flower (1980) an und führt die Lernenden chronologisch durch den Prozess der Textproduktion. Im Zentrum der Software stehen Geschichtenkarten, deren Zweck darin liegt, den Mädchen und Jungen das Planen ihres Textes zu erleichtern. Wie oben bereits erwähnt, investieren Schülerinnen und Schüler mit Lernschwierigkeiten im Vergleich zu ihren durchschnittlich begabten Altersgenossinnen und -genossen in aller Regel besonders wenig Zeit in das Sammeln und Ordnen von Ideen sowie in das gedankliche Durcharbeiten der Arbeitsschritte (Rodríguez, Grünke, González-Castro, García, & Álvarez-García, 2015). Es wurde erwartet, dass die Kinder durch das Üben am Ende nicht nur längere, sondern auch qualitativ hochwertigere Texte verfassen würden.

Methode

Stichprobe und Untersuchungsplan

An der Studie nahmen 6 Schülerinnen und 14 Schüler der Jahrgangsstufe 5 einer Gesamtschule in einer mittelgroßen rheinischen Kreisstadt teil. Um geeignete Kinder für die Untersuchung zu identifizieren, schrieben alle Mädchen und Jungen der vier 5. Klassen jeweils eine Geschichte auf einem Laptop. Den Schülerinnen und Schüler wurden individuell drei per Zufall ausgewählte Überschriften aus dem Aufsatzband von Hirmer und Hirmer (2007) auf Papierstreifen vorgelegt. Sie konnten sich dann für eines der Themen entscheiden. Es gab keine Zeitvorgaben oder Hilfestellungen. Die Stichprobe umfasste letztendlich die 20 Kinder, welche beim Verfassen ihrer Erzählungen am wenigsten Wörter produzierten. Laut Grünke, Büyüknarci, Wilbert und Breuer (2015) stellt die Textlänge während der Entwicklungsphase, in der sich die in dieser Studie untersuchten Mädchen und Jungen befanden, das wichtigste Kriterium bei der Beurteilung von Geschichten dar. Legt man Expertinnen und Experten Erzählungen entsprechender Kinder vor und lässt sie diese relativ informell bewerten, so schneiden diejenigen Schreibprodukte in aller Regel verhältnismäßig gut ab, die vergleichsweise lang sind. Im weiteren Verlauf der Entwicklung reduziert sich der Stellen-

Tabelle 1: Angaben zu den Schülerinnen und Schülern

Vpn.	Gruppe	Alter	Geschlecht	Migrations- hintergrund	Verkehrs- sprache	IQ
1	EG	10;1	männlich	nein	d	108
2	EG	11;4	männlich	nein	d	95
3	EG	11;5	weiblich	ja	d/t	115
4	EG	10;9	männlich	ja	d	99
5	EG	11;0	männlich	nein	d	95
6	EG	10;8	weiblich	ja	d	87
7	EG	12;3	weiblich	nein	d	82
8	EG	10;6	männlich	nein	d	103
9	EG	11;7	männlich	ja	d	121
10	EG	11;1	männlich	ja	d/k	98
11	KG	11;0	männlich	ja	d	92
12	KG	12;2	männlich	nein	d	110
13	KG	10;8	männlich	nein	d	97
14	KG	11;1	männlich	ja	d/t	91
15	KG	11;6	weiblich	nein	d	100
16	KG	10;1	weiblich	ja	d/a	89
17	KG	12;5	weiblich	k.A.	k.A.	79
18	KG	11;2	männlich	ja	d/i	97
19	KG	11;6	männlich	nein	d	109
20	KG	10;7	männlich	nein	d	103

Anmerkung: Vpn. = Versuchsperson, k.A. = keine Angaben, Verkehrssprache = vorzugsweise zu Hause gesprochene Sprache, a = amharisch, d = deutsch, i = italienisch, k = kurdisch, t = türkisch, IQ = Intelligenzquotient.

wert dieses Kriteriums allerdings zusehends (MacArthur, Graham & Fitzgerald, 2006).

Die Klassenlehrkräfte lieferten alle notwendigen Informationen darüber, welche Erstsprachen und welche weiteren Sprachen in den Elternhäusern der Kinder gesprochen wurden. Als Informationsquelle im Hinblick auf die intellektuelle Leistungsfähigkeit der Mädchen und Jungen diente der Zahlenverbindungstest (ZVT) von Oswald (2016). Es handelt sich hierbei um einen sprachfreien Intelligenztest, mit dessen Hilfe sich die kognitive Bearbeitungsgeschwindigkeit bzw. die Fähigkeit zur Lösung neuartiger Probleme erfassen lässt.

Als Versuchsplan wurde ein randomisiertes Kontrollgruppendesign mit Prä- und Postmessung ausgewählt (vgl. Grünke & Masendorf, 2000). Zehn zufällig ausgewählte Kinder nahmen an der Förderung teil, während die verbleibenden zehn Schülerinnen und Schüler weiterhin den regulären Unterricht besuchten. Die Erfassung der Erfolgskriterien fand unmittelbar vor der ersten und unmittelbar nach der letzten Interventionseinheit statt.

Tabelle 1 liefert einen Überblick über die wichtigsten Angaben zur Experimental- (EG) und Kontrollgruppe (KG).

Im Hinblick auf die in Tabelle 1 präsentierten Angaben unterschieden sich die beiden Gruppen nicht in signifikanter Weise.
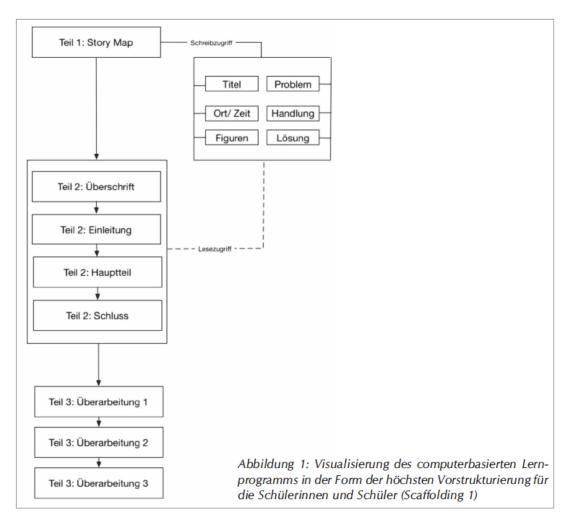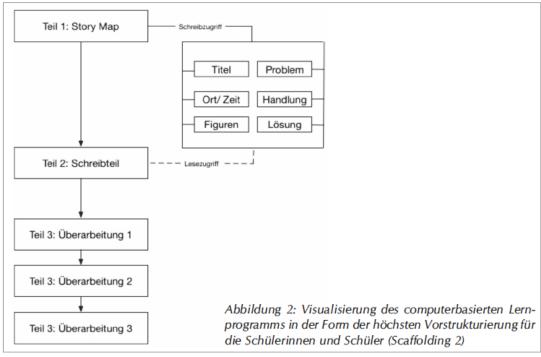
Intervention

Die Software ist, angelehnt an die von Hayes und Flower (1980) identifizierten Merkmale des Schreibprozesses, in drei Teile aufgeteilt. Für die Phase der Planung (1) wurde auf das Konzept der Geschichtenkarten als Visual Organizer zurückgegriffen. Während der Übersetzung (2) unterstützt die Software den Prozess des Schreibens, indem sie die Schülerinnen und Schüler im Sinne des so genannten Sequenzing (siehe z. B. Yakubova, Hughes & Shinaberry, 2016) nacheinander durch die Teile einer Erzählung führt. Dabei kann jederzeit auf die Informationen aus der Geschichtenkarte

als Hilfestellung für den Schreibprozess zurückgegriffen werden. Im dritten Teil geht es darum, den eigenen Text kritisch und auf bestimmte Überarbeitungsfragen hin zu lesen und gegebenenfalls zu verändern. Um einen Transfer zum Schreiben ohne die Software anzubahnen, wurde angelehnt an Phase fünf des SRSD-Modells der Anteil an Strukturhilfen in der Software im Sinne eines Fadings (siehe z. B. Rivera, Koorland & Fueyo, 2002). sukzessive verringert. Die Abbildungen 1 bis 3 visualisieren den Aufbau der Software und die drei Versionen Scaffolding 1 bis 3 mit einem geringer werdenden Anteil an Strukturhilfen. Der Begriff „Scaffolding" bezeichnet hierbei ein Prinzip, bei dem Lernende durch eine vorgegebene Struktur und gezielte Hinweise durch den Prozess des Wissens- oder Kompetenzerwerbs geleitet werden (vgl. Dubs, 1995).

Abbildung 4 zeigt das Menü der Geschichtenkarten in der Lernsoftware. Die Kinder wählen durch Klicken aus, welche Geschichtenkarte sie bearbeiten möchten und werden auf das verknüpfte Formular weitergeleitet. Um von den positiven Effekten auf die Schreibleistung durch computerbasiertes Feedback zu profitieren (Kellog &Whiteford, 2009), arbeitet das Programm mit zwei verschiedenen Formen des Feedbacks. Die Länge der Schülertexte wurde durch einen Wörterzähler unter dem Textfeld unmittelbar während des Schreibens rückgemeldet. Das Programm offerierte nach jedem der drei Arbeitsteile ein schriftliches Feedback zur Struktur und zum Fortschritt.

Der Umfang der hier zum Einsatz gekommenen Intervention bestand aus insgesamt 12 Trainingseinheiten á 30 Minuten (drei Sitzungen pro Woche bei insgesamt vier Wochen). Den Beginn markierte eine initiale Einführung in das Programm (drei Sitzungen) durch die Erstautorin. Das Vorgehen orientierte sich an dem Konzept der direkten Instruktion entsprechend der Methode „I do, we do, you do" (vgl. Archer & Hughes, 2011). Die Erstautorin erklärte den Kindern der EG zunächst den Umgang mit

Abbildung 1: Visualisierung des computerbasierten Lernprogramms in der Form der höchsten Vorstrukturierung für die Schülerinnen und Schüler (Scaffolding 1)

Abbildung 2: Visualisierung des computerbasierten Lernprogramms in der Form der höchsten Vorstrukturierung für die Schülerinnen und Schüler (Scaffolding 2)
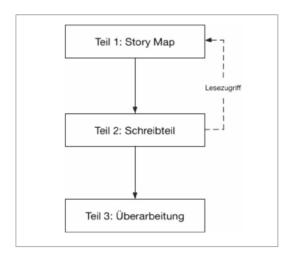
Abbildung 3: Visualisierung des computerbasierten Lernprogramms. Vorstrukturiert ist nur noch die Reihenfolge im Ablauf des Gesamtprozesses (Scaffolding 3)

der Software und die Arbeitsweise mit den digitalen Geschichtenkarten. Danach beschäftigten sich jeweils sechs Schülerinnen und Schüler in einem Arbeitsraum an Laptops unter Aufsicht der Erstautorin oder einer Studentin im Masterstudiengang „Lehramt für sonderpädagogische Förderung" der Universität zu Köln selbstständig damit,

Aufsätze zu verfassen. Als Impuls dienten erneut die Themen für Erlebniserzählungen von Hirmer und Hirmer (2007). Alle Schülerinnen und Schüler arbeiteten zunächst mit der Version der Lernsoftware mit der höchsten Strukturierung (Abbildung 1). Während der Arbeit an ihren Aufsätzen erhielten sie bei Bedarf technische und inhaltliche Hilfestellung und nach der Fertigstellung eine mündliche und schriftliche Rückmeldung.

Im Einklang mit diesem Feedback entschieden die Erstautorin und die Studentin gemeinsam, ob eine Verringerung der Unterstützung für die nächste Geschichte angemessen erschien (Fading). Falls dies positiv beurteilt wurde, erhielt die entsprechende Schülerin bzw. der entsprechende Schüler eine neuerliche Einweisung in die nun leicht angepasste Software. Alle Kinder durchliefen im Laufe der Förderung alle drei Scaffolding-Stufen. In keinem Fall erschien es angemessen, nach der Entscheidung, eine anspruchsvollere Version zu wählen, einen Schritt zu revidieren und zu der jeweils vorherigen Version der Software zurückzukehren.

Abbildung 4. Gestaltung der Übersicht zur Auswahl der zu bearbeitenden Geschichtenkarten in der Lernsoftware

Messinstrumente

Bevor und nachdem die Kinder der Experimentalgruppe die Förderung erhielten, sollten alle 20 Mädchen und Jungen jeweils eine weitere Geschichte auf einem Laptop verfassen. Ihnen standen neben einem transportablen PC auch Notizzettel und Stifte zur Verfügung. Wie bei der Stichprobenauswahl wurden den Kindern jeweils drei zufällig ausgewählte Aufsatzthemen aus dem Buch von Hirmer und Hirmer (2007) präsentiert. Für die Aufgabe gab es keine Zeitbegrenzung. Es wurde darauf geachtet, dass kein Kind die gleiche Überschrift zweimal zur Auswahl erhielt.

Als Maß für die Quantität diente die Anzahl der geschriebenen Wörter. Dieses häufig als „Total Words Written" (TWW) bezeichnete Maß stellt das verbreitetste Kriterium zur curriculumbasierten Fortschrittsmessung im Bereich des Schreibens dar (Hosp, Hosp & Howell, 2016). TWW sind definiert als die Anzahl der Wörter ohne Berücksichtigung der Satzzeichen. Da die Kinder ihre Geschichten mit dem Programm Microsoft® Word verfassten, ließ sich das Auszählen der Wörter automatisch vornehmen. Menschliche Fehler beim Ermitteln der TWW waren somit quasi auszuschließen.

Für die Einschätzung der Textqualität wurde die Skala „Teacher Evaluation of Story Elements" (TESE) von Troia und Graham (2002) ausgewählt und für unsere Zwecke adaptiert. Zusätzlich zu den fünf vorgegebenen Kategorien (Setting, Problem, Actions, Consequences of the Actions, Character Emotions) fügten wir eine sechste Beurteilungskategorie hinzu (Structure). Durch diese Ergänzung sollte eruiert werden, wie gut die Schülerinnen und Schüler alle formal zugehörigen Teile einer Geschichte (Einleitung, Hauptteil, Schluss) abgebildet hatten. Die Auswertung des TESE erfolgt auf Basis von Punkten. Für jede Kategorie lassen sich für die Qualität der Beschreibung bis zu fünf Punkte vergeben (wobei 1 die geringste Punktzahl darstellt). Falls ein Kriterium in der Geschichte gänzlich unberücksichtigt bleibt, sind hierfür null Punkte zu notieren.

Die Bewertung der Texte mit Hilfe des TESE geschah durch acht Studentinnen des Masterstudiengangs „Lehramt für sonderpädagogische Förderung" der Universität zu Köln im Verlauf zweier Doppelstunden. Alle Urteilerinnen besuchten eine spezielle Lehrveranstaltung zur Förderung von Schülerinnen und Schülern mit Schreibschwierigkeiten und verfügten über fundierte Erfahrungen im Hinblick auf die Einschätzung der Qualität von Texten. Die Studentinnen bewerteten die ausgedruckten Geschichten gemeinsam, ohne zu wissen, welchem Kind die Erzählungen zuzuordnen sind. Im Zuge des Prozesses wurden die Texte mehrfach miteinander verglichen. Hierbei kam es immer wieder zu leichten Anpassungen der Bewertungen. Waren sich die Studentinnen im Hinblick auf eine Beurteilung uneinig, wurde bis zu einem Konsens diskutiert.

Ergebnisse

Die Anzahl der geschriebenen Wörter im Vor- und Nachtest, die Differenzen zwischen den Messungen sowie Informationen über etwaige Verbesserungen in der Experimental- (EG) und in der Kontrollgruppe (KG) im Verlauf der Förderung finden sich in Tabelle 2.

Der Median von d_{TWW} über beide Gruppen hinweg liegt bei 15.50. Differenzen, die sich über diesem Wert befinden, werden als Verbesserungen deklariert (siehe Klauer, 2002). Vergleicht man die beiden Bedingungen bezüglich TWW 1 mit Hilfe eines Mann-Whitney-U-Tests (zweiseitig), so ergeben sich keine signifikanten Diskrepanzen (U = 54.00, z = 0.30, p = .796). Nimmt man diese Gegenüberstellung jedoch mit Hilfe eines Solomon-Plans (siehe Bortz & Lienert, 2008) für d_{TWW} vor, so offenbaren sich statistisch bedeutsame Unterschiede (einseitig) zwischen den Gruppen (U = 11.00, z = -2.95, p = .001). Eine Abschätzung der üblichen Effektstärkemaße

Tabelle 2: Angaben zu den Veränderungen im Bereich der Textlänge

Vpn.	Gruppe	TWW 1	TWW 2	d_{TWW}	Verbesserung
1	EG	68	108	40	ja
2	EG	67	152	85	ja
3	EG	71	237	166	ja
4	EG	85	333	248	ja
5	EG	174	195	21	ja
6	EG	95	134	39	ja
7	EG	120	161	41	ja
8	EG	101	539	438	ja
9	EG	76	115	39	ja
10	EG	202	183	-19	nein
11	KG	86	96	10	nein
12	KG	60	43	-17	nein
13	KG	62	51	-11	nein
14	KG	179	41	-138	nein
15	KG	107	38	-69	nein
16	KG	39	39	0	nein
17	KG	109	155	46	ja
18	KG	129	123	-6	nein
19	KG	126	41	-85	nein
20	KG	213	135	-78	nein

Anmerkung: Vpn. = Versuchsperson, TWW 1 = TWW im Vortest, TWW 2 = TWW im Nachtest, d_{TWW} = TWW 2 - TWW 1.

anhand der Angaben aus den Ergebnissen des Solomon-Plans mit Hilfe des entsprechenden Online-Rechners auf www.psychometrica.de/effektstaerke.html ergibt ein Eta² von 0.435 und ein d_{Cohen} von 1.75. Nach den Konventionen von Cohen (1988) handelt es sich hierbei jeweils um Indices, die einen großen Leistungsanstieg zum Ausdruck bringen.

Tabelle 3 enthält die Informationen über die Verteilung in beiden Gruppen der mittels Mediansplit vorgenommenen Kategorisierung in Schülerinnen und Schüler mit und ohne Verbesserung (siehe Klauer, 2002). Demnach haben neun von zehn geförderten Schülerinnen und Schülern von der Intervention profitiert. In der Kontrollgruppe war dies nur bei einem Kind der

Tabelle 3: Angaben zur Anzahl der Kinder pro Gruppe mit Zuwächsen im Bereich der Textlänge oberhalb (Verbesserung) und unterhalb des Medians (keine Verbesserung)

	EG	KG	N
Verbesserung	9	1	10
keine Verbesserung	1	9	10
N	10	10	20

Fall. Die Unterschiede zwischen den beiden Versuchsbedingungen sind als signifikant zu bezeichnen (Chi-Quadrat nach Pearson = 12.80, df = 1, p = .001).

Angaben zu den Qualitätseinschätzungen der von den Schülerinnen und Schülern verfassten Texte vor und nach der Förderung werden in Tabelle 4 präsentiert.

Der Median der Unterschiede zwischen den Einschätzungen aus der Erhebung vor und nach der Intervention beträgt -0.50. Es zeigten sich insgesamt also keine Zugewinne über die Zeit. Das Niveau ist im Schnitt quasi gleich geblieben. Differenzen, die sich oberhalb von -0.50 befinden, werden ungeachtet dessen als Verbesserungen interpretiert. Stellt man die TESE 1-Werte der zwei Gruppen gegenüber, so zeigen sich

bei zweiseitiger Testung keine statistisch bedeutsamen Ergebnisse (U = 44.50, z = -0.42, p = .684). Allerdings legt auch ein Solomon-Plan (einseitig) über d_{TESE} keine signifikanten Unterschiede offen (U = 30.50, z = -1.48, p = .072). Demnach ist bei den geförderten Kindern unter Berücksichtigung der Veränderungen bei den ungeförderten kein nennenswerter Anstieg im Hinblick auf die Güte der Texte auszumachen. Eine Abschätzung der Effektstärkemaße resultiert hingegen immerhin in einem Eta^2 von 0.109 und einem d_{Cohen} von 0.70. Beide Maße stehen für eine Verbesserung im mittleren Bereich.

Tabelle 5 enthält die Angaben über die Verteilung in beiden Gruppen der mittels Mediansplit vorgenommenen Kategorisie-

Tabelle 4: Angaben zu den Veränderungen im Bereich der Textqualität

Vpn.	Gruppe	TESE 1	TESE 2	d_{TESE}	Verbesserung
1	EG	2	9	7	ja
2	EG	6	19	13	ja
3	EG	12	23	11	ja
4	EG	13	6	-7	nein
5	EG	19	15	-4	nein
6	EG	12	13	1	ja
7	EG	11	18	7	ja
8	EG	10	15	5	ja
9	EG	14	15	1	ja
10	EG	19	10	-9	nein
11	KG	3	5	2	ja
12	KG	13	10	-3	nein
13	KG	14	5	-9	nein
14	KG	23	5	-18	nein
15	KG	7	7	0	ja
16	KG	5	4	-1	nein
17	KG	14	9	-5	nein
18	KG	11	23	12	ja
19	KG	9	6	-3	nein
20	KG	11	5	-6	nein

Anmerkung: Vpn. = Versuchsperson, TESE 1 = TESE im Vortest, TESE 2 = TESE im Nachtest, d_{TESE} = TESE 2 - TESE 1.

Tabelle 5: Angaben zur Anzahl der Kinder pro Gruppe mit Zuwächsen im Bereich der Textqualität oberhalb (Verbesserung) und unterhalb des Medians (keine Verbesserung)

	EG	KG	N
Verbesserung	7	3	10
keine Verbesserung	3	7	10
N	10	10	20

rung in Schülerinnen und Schüler mit und ohne Verbesserung. Die Differenzen sind nicht statistisch bedeutsam (Chi-Quadrat nach Pearson = 3.20, df = 1, p = .089). Beim Blick auf Tabelle 4 lässt sich feststellen, dass sieben der zehn geförderten Mädchen und Jungen von der Intervention profitiert haben. In der Kontrollgruppe traf dies hingegen nur auf drei Kinder zu.

Es ist an dieser Stelle jedoch darauf hinzuweisen, dass die Signifikanzgrenze im Kontext der Beurteilung der Textgüte nur knapp verfehlt wurde. Hätte man ein weniger konservatives Vorgehen gewählt und die Daten parametrisch ausgewertet, so wäre nach Dimitrov und Rumrill (2003) die Kovarianzanalyse mit den Prätestergebnissen als Kovariate der Königsweg gewesen. Bei einem solchen Vorgehen würde man in der Lage sein, nach der Förderung einen bedeutsamen Effekt des Gruppenfaktors auf die Leistung nachzuweisen ($F_{1,19}$ = 6.68, p = .019) (bei einseitiger Testung).

Die Überprüfung des Verhältnisses zwischen beiden Maßen vor dem Beginn der Förderung (TWW 1 und TESE 1) mittels Rangkorrelation nach Spearman legt im Übrigen lediglich einen niedrigen Zusammenhang offen (r = .343; p = .070). Quantität und Qualität stehen somit zweifelsohne miteinander in Beziehung. Allerdings können hierdurch nur 11.76% der gemeinsamen Varianz aufgeklärt werden.

Diskussion

Beantwortung der Fragestellung

Der Zweck der vorliegenden Studie bestand darin, die Wirksamkeit eines eigens entwickelten computergestützten Lernprogramms zur Verbesserung von Textproduktionskompetenzen bei schreibschwachen Fünftklässlerinnen und Fünftklässlern zu überprüfen. Mit Hilfe der Software sollten die Fähigkeiten zur Durchführung der einzelnen Teilhandlungen im Rahmen eines Schreibprozesses nach Hayes und Flower (1980) (Planen, Verschriftlichen und Revidieren) verbessert werden. Der Weg zum angestrebten Ziel verlief über ein am SRSD-Modell orientiertes Vorgehen, bei dem die Schülerinnen und Schüler fortwährend auf Geschichtenkarten zurückgriffen. Eine Realisierung der Förderung mittels eines Visual Organizing Tools auf der Arbeitsfläche eines digitalen Lernprogramms sollte zudem dazu führen, die Lernmotivation bei den beteiligten Mädchen und Jungen zu erhöhen (Genlott & Grönlund, 2013, Trageton, 2012).

Im Ergebnis zeigte sich, dass die risikobelasteten Fünftklässlerinnen und Fünftklässler, die über einen Zeitraum von vier Wochen 12 Übungseinheiten á 30 Minuten mit dem Programm absolvierten, nach dem Abschluss der Maßnahme in aller Regel merklich längere Geschichten verfassten als ihre Klassenkameradinnen und -kameraden, die zeitgleich am regulären Unterricht teilnahmen. Die Zuwächse lagen bei neun von zehn Kindern über dem Median der Gesamt-Prä-Post-Differenzen. Das quantitative Ausmaß der Verbesserungen (ausgedrückt in Effektstärken) kann als imposant bezeichnet werden. Auch im Hinblick auf die Qualität zeigten sich Steigerungen, auch wenn diese mit dem hier verwendeten relativ konservativen Testverfahren keine statistische Signifikanz erreichten. Dennoch lagen die Effektstärken zumindest im mittleren Bereich.

Methodenkritische Reflexion

Ungeachtet der insgesamt vielversprechenden Ergebnisse unterliegt die Studie verschiedenen Einschränkungen. Zunächst einmal ist an dieser Stelle zu konstatieren, dass die Stichprobe relativ klein (N = 20) war. Außerdem bestand sie lediglich aus Fünftklässlerinnen und Fünftklässlern aus einer ganz bestimmten Schule. Hierdurch sind die Möglichkeiten der Generalisierbarkeit der Ergebnisse recht limitiert. Einschränkungen ergeben sich auch im Hinblick auf die Wirkungen des Programms auf die Fähigkeit zum Verfassen von anderen Textarten außer einfachen Geschichten. Es bietet sich an, die vorliegende Untersuchung mit einer größeren Stichprobe zu replizieren, das Programm auch mit Schülerinnen und Schülern aus verschiedenen Altersgruppen bzw. aus anderen geographischen Regionen durchzuführen sowie die Wirkungen der Intervention auf andere Genres zu überprüfen.

Eine weitere Limitation betrifft den Umstand, dass die Kontrollgruppe kein alternatives Training erhielt. Es wurde lediglich untersucht, ob sich bei gleicher zeitlicher Entwicklung unter normalen schulischen Bedingungen ein ähnlicher Effekt herausbildet, wie durch die hier eingesetzte Intervention. Somit lassen sich in den Ergebnissen unspezifische Zuwendungseffekte nicht von den spezifischen Wirkungen der Förderung trennen. Gleiches trifft auf den Umstand zu, dass die SRSD-orientierte Intervention in Form einer Lernsoftware angeboten wurde. Es lässt sich nicht differenzieren, in welchem Ausmaß das motivierende Medium Laptop und der Aufbau bzw. der Inhalt der Förderung zum Erfolg der Bemühungen beitrugen. In zukünftigen Studien könnten verschiedene Variablen (wie das Ausmaß der Zuwendung in der Kontrollgruppe und das Medium der Vermittlung) variiert werden, um Aufschluss darüber zu erhalten, welche Facetten eines Schreibtrainings für welche Zugewinne verantwortlich sind.

Als weitere Einschränkungen sind der relativ kurze Zeitraum der Intervention von nur vier Wochen und der Umstand zu nennen, dass außerhalb der Postmessung keine weiteren Nacherhebungen stattfanden. Für weitere Untersuchungen könnte eine längere Förderung mit einer regelmäßig durchgeführten Prozessdiagnostik differenziertere Antworten auf die eingangs formulierte Fragestellung liefern. Auch eine mehrmalige Erfassung der abhängigen Variablen nach Abschluss der Maßnahme würde hilfreiche Hinweise bezüglich der Nachhaltigkeit der Effekte liefern.

Für die Studie wurden die Erfolgskriterien Quantität und Qualität als relevant bestimmt. Die gewählten Messinstrumente TWW und TESE konnten in der gewählten Form und Ausführung eine relativ hohe Objektivität der Bewertung gewährleisten. Jedoch sind sie nicht die einzige Alternative für die Analyse von Texten. Gerade in Messungen zur Qualität kann eine unterschiedliche Einschätzung durch beteiligte Gutachter und Gutachterinnen nicht ausgeschlossen werden. In weiteren Untersuchungen könnten beispielsweise T-Units (Hunt, 1965) Aufschluss über Textkomplexität und Satzstruktur liefern.

Die Verbesserungen hinsichtlich der Qualität der Geschichten waren bei den geförderten Kindern weniger markant als die Zugewinne bezüglich der Textlänge. Ein Grund dafür könnte sein, dass das computerbasierte Feedback im Bereich Wörterzählen automatisiert war. Für jedes geschriebene Wort gab es eine unmittelbare, sichtbare Veränderung im Zähler unten auf der Seite. Sofortiges Feedback, wie es in einem behavioristisch orientierten Lernprogramm verwendet wird, könnte auch für die Qualität der Texte erfolgversprechende Funktionen erfüllen. Kellog und Whiteford (2009) schreiben computerbasierten Rückmeldungen gerade bei Schreibanfängerinnen und Schreibanfängern gute Effekte zu. In nachfolgenden Untersuchungen sollte auch das Feedback über die Güte der Texte daher möglichst unmittelbar erfolgen. Roscoe und McNamara (2013) haben beispielsweise mit „Writing Pal" eine Software vorgestellt, die

mit einem intelligenten tutoriellen System arbeitet und dadurch die Schülerinnen und Schüler unmittelbar darin unterstützt, ihre Texte auch qualitativ zu verbessern. Sie konnten in einer Studie über sechs Monate positive Effekte für die Arbeit mit „Writing Pal" nachweisen (ebd.).

Schließlich wäre es angemessen, die Intervention in zukünftigen Forschungsarbeiten durch Lehrkräfte durchführen zu lassen. Hierdurch können Einflüsse durch die besondere Situation der Studie verringert werden. Gleichzeitig ließe sich sicherstellen, dass die Software auch ohne das Eingreifen von Expertinnen btw. Experten in den Schulalltag integrierbar ist.

Praktische Implikationen und Ausblick

Obwohl die von uns ausgewählten Kinder laut Auskunft ihrer Lehrkräfte vor der Intervention allesamt eine äußerst negative Einstellung gegenüber Schreibaufgaben an den Tag legten, erwies sich die Arbeit am Laptop bei der Experimentalgruppe ganz offenkundig als durchweg unproblematisch. Die Mädchen und Jungen zeigten keinerlei Ängste, ablehnende Haltungen oder negative Erwartungen in Anbetracht der Aussicht, Geschichten verfassen zu müssen. Vielmehr waren sie aufmerksam und stellten Rückfragen zu Benutzungsmöglichkeiten und um sicherzustellen, dass sie bei den nächsten Schreibterminen wieder mit dem Laptop arbeiten dürfen. Es war offensichtlich, dass der motivationale Faktor des elektronischen Bildschirmmediums für „Digital Natives" hoch genug ist, um eine grundsätzlich negativ belastete Anforderung attraktiv erscheinen zu lassen.

Gerade da der Einsatz des Computers im Unterricht die Möglichkeit bietet, viele Schülerinnen und Schüler gleichzeitig zu fördern, sollte in Betracht gezogen werden, Gesamtklassen in weitere Untersuchungen mit einzubeziehen. So lässt sich durch den Vergleich von Ergebnissen und Lernprofilen untersuchen, ob zusätzlich zu risikobelaste-

ten Mädchen und Jungen auch weitere eingrenzbare Gruppen von einer kombinierten Förderung von Schreibstrategien am Computer profitieren.

Die Arbeit am PC kann denUnterricht in heterogenen Lernformen unterstützen, wenn Schülerinnen und Schüler in der Lage sind, selbstständig damit zu arbeiten. Dies ermöglicht es den Lehrkräften. die gewonnene Zeit zu nutzen, um individuelle Unterstützung zu leisten. In dieser Form bietet die Arbeit mit Computern besondere Vorteile für den Einsatz in der Inklusion. Eine Untersuchung der Effektivität dieser Methode im Hinblick auf Gruppenarbeit wäre also eine denkbare Erweiterung der Forschungsergebnisse auf diesem Gebiet. Weiteres Potenzial für den Unterricht in heterogenen Gruppen bietet das Programm durch die Möglichkeit einer inneren Differenzierung. Neben dem Anteil an Strukturhilfen können auch inhaltlich Veränderungen herbeigeführt werden, indem durch die Lehrkraft beispielsweise im Überarbeitungsteil die Aufgabenstellungen zur Revision des Kindertextes an die Leistungsmöglichkeiten der Schülerinnen und Schüler angepasst werden.

Durch den einfachen Aufbau der Lernsoftware ist es möglich, weitere Textsorten zu berücksichtigen. Es wäre problemlos möglich, weiteres Einsatzpotenzial für den Unterricht zu erschließen. Durch den schon bekannten Aufbau des Lernprogramms können die Schülerinnen und Schüler sich voll auf die Aufgabe der Textproduktion konzentrieren.

Digitale Medien sind für Kinder und Jugendliche meist ein Faktor starker intrinsischer Motivation und daher ein gutes Instrument für Förderung. Trotz der Einschränkungen der hier abgebildeten Untersuchung und einer sich dadurch ergebenden Notwendigkeit weiterer Studien zu dieser Thematik zeigt sich, dass PC-gestützte Schreibförderung positive Effekte auf die Länge und Qualität von Aufsätzen risikobelasteter Fünftklässlerinnen und Fünftklässler haben kann.

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Appendix B: Publication No. 2 (*peer reviewed*)

Effects of the STOP and LIST Strategy on the Writing Performance of Struggling Fourth Graders

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Abstract

This study tested the effectiveness of a writing planning strategy (STOP & LIST) with four struggling students from fourth grade. A multiple-baseline design (AB) was used with baselines consisting of between five and seven daily probes. The duration of the intervention was between five and seven 25-minute sessions. A randomization procedure was implemented within the constraint that the baseline had to comprise at least five measurements and the treatment had to comprise at least three. The data were analyzed using visual inspection, different effect sizes, randomization tests, and piecewise regression analyses. Results revealed distinct improvements in both the length and quality of stories that the participants produced from baseline to the end of the training. This indicates that the ability of young struggling writers to plan narratives can be fostered considerably through rather simple means. Implications for practice and future research are discussed.

Keywords: writing problems, strategy instruction, single-case research, STOP and LIST

1. Introduction

"If speaking makes us human, writing makes us civilized" (Algeo, 2010, p. 6). The ability to create text using one's intellectual and linguistic resources is the primary foundation upon which record keeping, history, and art are grounded. It is a major means of expression, both for personal cognitive purposes and for communicating meaning with others. Without it, our society could not function (Fayol, Alamargot, & Berninger, 2012). Teaching children how to put their thoughts onto paper is indispensable for helping them to develop clarity of thought, to construct meaning, and to acquire reasoning skills (Graham, MacArthur, & Fitzgerald, 2013). In school, writing is the main instrument used to determine how much a student has learned and to assess his or her academic performance. This is true not only for language arts but for any subject that requires linguistic exposition (Mercer, Mercer, & Pullen, 2011; Saddler & Asaro-Saddler, 2010).

Even though the ability to transfer ideas into written form is crucial for the success of an individual in and out of school, as well as for the continuance of our society, according to Troia (2009), it is the most neglected of the basic skills taught during elementary or secondary education. Many teachers tend to stress reading, spelling, and arithmetic over text production. One reason is that they feel overwhelmed by the task of having to motivate their students to tackle such an extremely demanding activity and to instruct them on how to execute it (Gündoğmuş, 2018). Regrettably, a significant share of children and adolescents are unable to acquire ample writing skills without well-structured and frequent support (Graham & Harris, 2018).

Thus, it is no wonder that the prevalence rates of students not meeting basic standards in text production and qualifying for a so-called written language disability (WLD) are quite high. Children and adolescents with a WLD demonstrate significantly lower writing abilities than expected based on their chronological age, their measured intelligence, and the education that they have received so far (Nielsen et al., 2018). The incident rate of a WLD in students up to age 19 varies between 6.9% and 14.7% (Katusic, Colligan, Weaver, & Barbaresi, 2009).

To effectively aid children and adolescents to overcome their difficulties or to prevent them from significantly falling behind in their performance, it is essential to be aware of expedient starting points for an intervention. The most influential theories on writing (e.g., Bereiter & Scardamalia, 1987; Hayes, 1996; Hayes & Flower, 1980; Rijlaarsdam & van den Bergh, 1996) help to make the writing process transparent and palpable. In simple words, they subdivide the corresponding activities into three recursive phases: (a) planning (setting goals,

retrieving relevant information from long-term memory, generating ideas, and organizing ideas), (b) translating (putting ideas into visible language), and (c) revising (reading and editing what has been written so far). All of these models acknowledge that individuals plan, translate, and revise repeatedly. Thus, a writing activity is generally not a process in which an individual undergoes the various stages consecutively.

However, it is safe to say that generating, choosing, and structuring ideas occurs more often at the beginning of the endeavor than during the rest of the time. Research has shown that struggling writers tend to neglect planning activities in particular (e.g., Rodríguez, Grünke, González-Castro, García, & Álvarez-García, 2015). In fact, MacArthur and Graham (1987) found that they generally invest less than one minute in such prewriting efforts. Because those students do not take the time to brainstorm and organize their ideas, they basically jot down whatever comes to mind. As a result, they usually submit relatively short, incomplete, and incoherent texts (Englert & Raphael, 1988; MacArthur & Graham, 1987).

Due to how important writing is for students' overall success and the high number of them who struggle with composition writing, research on how to effectively support their endeavors is highly relevant. Fortunately, the basis of studies on the benefits of respective treatments is relatively strong by now. This is true not only for approaches aimed at facilitating translating and revising skills but also for treatments geared toward supporting the planning process. There are several meta-analyses on the effects of various writing interventions for struggling students (Cook & Bennett, 2014; Datchuk & Kubina, 2012; Gillespie & Graham, 2014; Gillespie Rouse & Sandoval, 2018; Rogers & Graham, 2008). Most of the studies included in these synopses were single-case analyses involving K−12 students with documented learning disabilities (LDs). The great majority of research papers utilized the well-known Self-Regulated Strategy Development (SRSD) model by Graham and Harris (1995), a six-stage approach of instruction: (a) activate background knowledge, (b) discuss the strategy, (c) model the strategy, (d) enable memorization of the strategy, (e) support the strategy, and (f) provide opportunities for independent strategy use. Based on explicit strategy instruction (see Reid, Linemann, & Hagaman, 2013), the SRSD model offers a framework for teachers to plan and deliver effective writing lessons. Overall, the findings on ways to assist with generating ideas and organizing them through the use of the SRSD model appear promising. The respective effect sizes focusing on the length and/or quality of narratives always ranged between medium and high (Grünke & Leonard Zabel, 2015; Sperling & Grünke, 2017).

Based on the findings of these meta-analyses, the so-called STOP and LIST strategy can be considered auspicious. However, it has received little attention in the scholarly literature so far. STOP and LIST is an acronym that stands for the following four stages: (a) Stop, (b) Think of Purpose, (c) List Ideas, and (d) Sequence Them (Graham & Harris, 2005). Based on the problem-solving theory by D'Zurillas and Goldfried (1971), STOP and LIST scaffolds the process of planning a writing product and teaches students how to generate and organize their ideas. The four stages are communicated by way of the SRSD model. STOP and LIST focuses on planning stories as the most basic text genre.

An extensive computer-supported search in the databases Educational Abstracts, ERIC, PsycINFO, Scopus, TOC Premier, and Web of Science yielded only three published studies about the effectiveness of STOP and LIST on the performance of students with writing problems: Graham, Harris, and Troia (1998); Grünke and Hatton (2017); and Troia and Graham (2002). In all these cases, the intervention was very beneficial in helping the participants to better plan and draft narratives and evoked sudden increases in achievement. The experiment by Graham et al. (1998) involved three fifth graders with LDs, the one by Grünke and Hatton (2017) included one boy with a specific WLD in sixth grade, and the one by Troia and Graham (2002) involved 20 fourth- and fifth-grade students. Supplying struggling learners with a road map of how to plan their texts is a provision that should not be held back for longer than necessary. As soon as children have acquired ample accuracy and fluency in basic transcription skills (spelling, handwriting, grammatical knowledge, etc.), they are equipped to learn how to produce simple stories from a first-person perspective. This usually happens during the late stages of their elementary school career (Berninger, Fuller, & Whitaker, 1996; Hacker, 2018; Kim & Schatschneider, 2017).

The purpose of the present study was to add to the scarce body of research on the effectiveness of the STOP and LIST strategy with struggling students in fourth grade. We deliberately chose at-risk children in an early phase of their writing development to precociously counteract severe problems that were likely to emerge if they were left to their own resources. It was expected that the participants would produce not only longer but also qualitatively better stories over the course of the intervention. In line with previous studies, we anticipated a sudden rather than a gradual increase in achievement.

2. Method

2.1 Participants and Setting

The participants were four 9-year-old fourth graders from a public inclusive elementary school in a major city in Northrhine-Westfalia: Adal, Berta, Channa, and Daniel (names changed for anonymity). A female graduate student of special education, who served as interventionist for this study, selected the children for participation based on recommendations from their main teacher. She had extensive experience working with children through various internships lasting several weeks in different schools. To be included in the experiment, the participants had to show severe deficits in writing composition. However, they had to be capable of composing at least simple sentences. In addition, they needed to demonstrate adequate handwriting and spelling skills. By resorting to the school records, the main teacher recommended the aforementioned children for participation.

To back up the proposals, the graduate student conducted the General German Language Test (Steinert, 2011), in which participants had to write a story in response to a prompt that consisted of a picture showing a man climbing up a ladder to a balcony and a woman watching him from a window in a neighboring house. There was no time limit for finishing the task. Results revealed that Adal, Berta, Channa, and Daniel were among the five students in the class who produced the shortest stories. Even though they had never been diagnosed with a disability and did not receive specialized instruction at the time of the study, they could clearly be considered to be at risk for academic failure in the area of written expression.

Adal is the son of Turkish migrant workers. Channa's parents were both born in Poland and migrated to Germany when she was a toddler. Berta and Daniel did not have immigrant backgrounds. Results from informal observations by the graduate student during two school visits in preparation for this research indicated that all four participants were easy to distract and difficult to motivate.

2.2 Design and Measures

We applied a single-case multiple baseline across participants design (AB) to investigate treatment effects before and during instruction (Kazdin, 2010). The whole experiment lasted only 12 consecutive school days. During this time, we collected 12 measurements from each participant. To increase the internal validity of the study (see Dugard, 2013), the start and close of the intervention were determined randomly for each case within the constraint that phase A had to consist of at least five and phase B of at least three probes. To detect autocorrelation in the data, it is often suggested to set the minimum number of baseline probes at five (e.g., Smith, 2012). Previous research gives rise to the hope that instruction in the STOP and LIST strategy does not have to take long to elicit notable improvements (Grünke & Hatton, 2017). Considering the aforementioned confinements, the treatment could have started any time between the sixth and tenth probe. A random drawing of all five possible options resulted in an arrangement whereby the training started on the day of the sixth measurement for Adal and Channa and on the day of the eighth measurement for Berta and Daniel.

Two dependent variables were applied to evaluate treatment effects: total words written (TWW) and a qualitative writing rubric (QWR). For baseline and intervention writing probes, participants were asked to produce a story in response to a randomly chosen picture from a pool of 20 DIN A4-size photographs. These depicted social scenes such as parties, conversations between people, or sports events (the pictures are available upon request). The students had as much lined DIN A4 notepaper at their disposal as they wanted. There were no time limits given to complete the assignment.

TWW was defined as the number of words written in a story (see Furey, Marcotte, Hintze, & Shackett, 2016). Titles were not included. However, incorrectly spelled, nonsense, or illegible words all counted toward TWW. To ensure accuracy, TWW was counted twice on two consecutive days by a female student assistant who was blind to the study. If the two counts differed (which happened in less than 5% of the runs), she counted a third time. A fourth count was never necessary.

The QWR was adapted by Glaser (2004) and constitutes a German variation of the Scale for Scoring the Inclusion and Quality of the Parts of a Story by Harris and Graham (1996). The assessment form comprised eight categories, each measurable from 0 to a maximum of 3 points. The first category was the protagonist of the composed text. Zero points were given if the student did not mention a main character at all. Up to 3 points were distributed if the student provided at least one detail of the protagonist in at least two following sentences. The next category was the setting of the text and ranged from not mentioning the setting to mentioning the setting with at least one detail in two following sentences. The same distribution of points was adapted to the aspect of time in which the text is set. The next category referred to the intention of the text's protagonist. Zero points were given if no intention was obvious, and up to 3 points were distributed if the student provided the reader

with a highly detailed and complex description of the protagonist's intention. The distribution of points for the plot were based on if the plot did not follow any logical order up to the plot following a logical order with at least five sentences written. The penultimate category was the ending of the text. Zero points were given if no ending was mentioned, which means no conflict resolution or dénouement was provided. Up to 3 points were distributed if a plot-orientated ending was described using direct speech, thoughts, or feelings of the protagonist. The last category involved the coherence of the written text. Zero points were given if there was no context and/or an incomplete structure so that parts of the plot were missing. Up to 3 points were distributed if the student provided the reader with a completely coherent text.

The range of total points that could be earned for a narrative ranged between 0 and 24. After receiving ample instructions on how to use the instrument from the first author, a female graduate student conducted the scorings. An experienced student assistant appraised a random selection of 20% of the texts independently. We calculated the interrater agreement for each of these writing products by dividing the smaller number of points by the larger one and multiplying by 100. Average interrater reliability reached a remarkably high level of 94.95%. This degree of agreement gave us the confidence to go by the graduate students' appraisals and view them as dependable.

2.3 Procedures

At the beginning of the second, third, fourth, and fifth period of each day of the experiment (each lasting 45 minutes), the previously mentioned interventionist took one of the four participants into a resource room of the school, while the rest of the children remained in class with their main teacher. Even though our four subjects were not the only students present, it was always possible to find a quiet place away from children not receiving treatment. The order in which Adal, Berta, Channa, and Daniel were asked to go with the interventionist varied daily. During baseline conditions, the students were given coloring books to keep them occupied for 20 minutes. In the remaining 25 minutes, the children were asked to produce a story based on a randomly chosen picture, as outlined in the section on design and measures.

During intervention, the participants still had to write a text at the end of a given period. However, prior to this, instead of coloring books, they were instructed in the use of the STOP and LIST strategy. Neither in phase A nor in phase B did Adal, Berta, Channa, or Daniel need more than 15 minutes to finish their stories. Whenever they indicated that they were done, the interventionist took them back to their classroom. Contrary to producing texts during baseline, all participants started taking notes in accordance with the STOP and LIST strategy before writing a narrative as soon as the treatment had commenced.

In accordance with the SRSD model, Lesson 1 started with guiding the children to recall their basic knowledge of strategies and aspects of focus when composing a text. This led to an initial reflection of the students' writing process and enabled them to recall certain rules they had learned so far (e.g., "Be organized," "Take good notes", "Ask for help if you get stuck"). Secondly, the interventionist promised that the participants would be able to write better stories if they assiduously applied the planning strategy she was about to introduce. Subsequently, she modelled the process of working through the four steps of STOP and LIST, using a writing prompt in the form a DIN A4-size printed picture taken from https://www.teachstarter.com/widget/visual-writing-prompts/. While going through the various phases, the interventionist continuously referred to a DIN A3 poster that she placed on the table and that contained the instructions of the strategy (Stop, Think of Purpose, List Ideas, Sequence Them). In each incidence, the interventionist produced six ideas on what could have happened in a story related to the photograph, jotted them down, and organized them in a chronological sequence. The students were asked to be aware that they now had a useful outline for producing a more or less detailed and captivating narrative. In closing, the interventionist told a story based on her notes while trying to develop a comprehensible plot with a clear beginning, middle, and end. She advised the children that they should always make a draft of what they want to write about before actually putting down a text. At the end of this and all lessons in which the poster was used, it was taken away before performance was measured.

Lesson 2 started with the interventionist recapitulating the strategy steps while pointing to the poster that was again placed on the table. Afterward, the interventionist turned the poster over and asked the participants to recall the four stages by heart. If a child got stuck, the interventionist offered assistance. As soon as a student managed to repeat the steps without a mistake, another writing prompt in the form of a photograph was chosen to create another story outline. This time, the interventionist provided guided practice while she and the students went through the process together. As soon as they finished, they repeated the procedure with yet another writing prompt.

In Lesson 3, the participants were asked to produce a story outline by themselves. The interventionist placed the

poster on the edge of the table to serve as a memory aid. Insofar as the participants were capable of applying the strategy independently, the interventionist withheld her help. As soon as a child did not know what to do next, she intervened. By the end of Lesson 3, all students were able to apply the strategy steps, end up with four to eight sequenced notes, and tell a story based on their memos.

During the remaining lessons, the participants kept practicing STOP and LIST with the interventionist supporting them as far as it seemed expedient. The poster was not used from this time onward. However, the interventionist reminded the children of the four strategy steps any time they did not seem to know what to do next.

2.4 Treatment Fidelity

The first author extensively instructed the interventionist during three 1-hour lessons prior to the beginning of the treatment using exemplary video images depicting the first author applying the strategy with different students. In addition, the graduate student was given a detailed script to follow and a checklist that contained every important step of the procedures (both can be obtained from the authors upon request). She was asked to record her actions using this list to ensure that lessons were delivered in accordance with the plan. During the intervention, she stayed in daily contact with the first author via e-mail or phone to discuss the progress of the treatment and to make sure that it was implemented as intended.

3. Results

Descriptive data for the TWW and QRW results are displayed in Tables 1 and 2. Both measures are highly correlated across cases ($r_{Spearman's\ Rank} = .87$; $p < .001$; one-tailed).

Table 1. Total words written for each participant

		Baseline	Intervention
Adal	N (Probes)	5	7
	Raw Scores	56; 46; 43; 44; 50	79; 124; 121; 129; 136; 189; 144
	M	47.80	131.71
	SD	5.31	32.69
	Range	43–56	79–189
Berta	N (Probes)	7	5
	Raw Scores	41; 40; 30; 41; 36; 39; 31	149; 189; 184; 166; 190
	M	36.86	175.60
	SD	4.67	17.73
	Range	30–41	149–190
Channa	N (Probes)	5	7
	Raw Scores	40; 45; 46; 34; 39	82; 92; 98; 107; 110; 104; 112
	M	40.80	100.71
	SD	4.87	10.78
	Range	34–46	82–112
Daniel	N (Probes)	7	5
	Raw Scores	32; 36; 39; 33; 27; 28; 40	95; 90; 81; 86; 96
	M	33.57	89.60
	SD	5.06	6.27
	Range	27–40	81–96

Table 2. Qualitative writing rubric for each participant

		Baseline	Intervention
Adal	N (Probes)	5	7
	Raw Scores	8; 6; 6; 5; 8	9; 14; 9; 13; 19; 15; 12
	M	6.60	13.00
	SD	1.34	3.51
	Range	5–8	9–19
Berta	N (Probes)	7	5
	Raw Scores	5; 3; 5; 4; 7; 7; 4	15; 14; 14; 18; 15
	M	5.00	15.20
	SD	1.53	1.64
	Range	3–7	14–18
Channa	N (Probes)	5	7
	Raw Scores	5; 8; 6; 2; 4	9; 13; 14; 9; 9; 16; 13
	M	5.00	11.85
	SD	2.24	2.85
	Range	2–8	9–16

Daniel	N (Probes)	7	5
	Raw Scores	6; 4; 7; 3; 6; 5; 8	12; 13; 14; 12; 14
	M	5.57	13.00
	SD	1.72	1.00
	Range	3–8	12–14

A visual display of the data is provided in Figures 1 and 2. All graphs were produced using the SCAN package for R by Wilbert (2018). A visual inspection of the data reveals fairly stable baselines for all four participants and both dependent measures. It also suggests a sudden increase in performance upon the onset of the intervention.
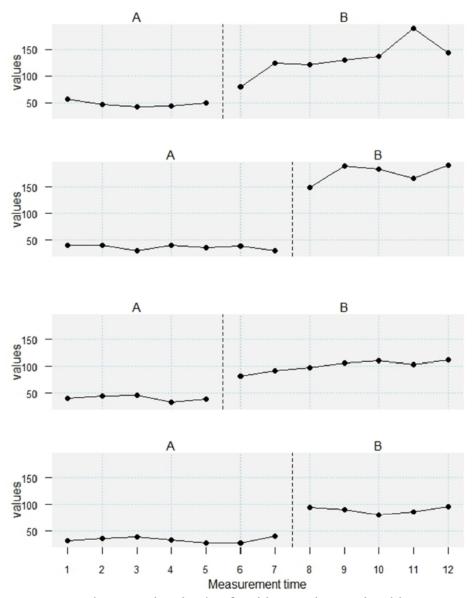

Figure 1. Total words written for Adal, Berta, Channa, and Daniel
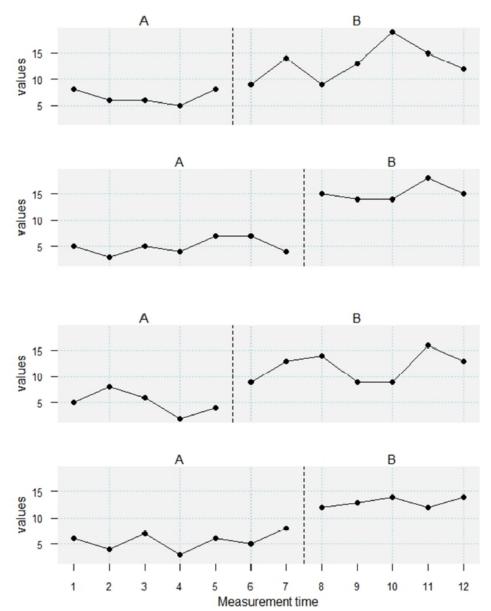
Figure 2. Qualitative writing rubric for Adal, Berta, Channa, and Daniel

Table 3 presents the results for some of the most common effect size measures used in single-case research: percentage of non-overlapping data (PND; Scruggs, Mastropieri, & Casto, 1987), percentage of all non-overlapping data (PAND; Parker, Hagan-Burke, & Vannest, 2007), improved rate difference (IRD; Parker, Vannest & Brown, 2009), mean baseline difference (MBD; Cambell, 2003), Glass's Δ (Glass, McGaw & Smith, 1981), non-overlap of all pairs (NAP; Parker & Vannest, 2009), and Tau-U (Parker, Vannest, Davis, & Sauber, 2010). The indices were calculated using the SCDA package, a plug-in for R-Commander, developed by Bulté (2013; for MBD and Glass's Δ), and the SCAN package by Wilbert (2018; for all non-overlap effect sizes).

Because there was no overlap between the values in phases A and B for any of the four subjects, the indices for PND, PAND, IRD, NAP, and Tau-U each reached the highest score possible. For NAP and Tau-U, the SCAN

package provides p-values and confidence intervals. As indicated in Table 3, all respective data analyses yielded statistically highly significant differences between phases A and B. The two effect size measures not quantifying overlap (MBD and Glass's Δ) offer a more differentiated picture. MBD is generated by subtracting the mean of the baseline points from the mean of the treatment points, then dividing by the mean of the baseline points and multiplying by 100. There is no commonly accepted convention for classifying different MBD values as small, moderate, or high. However, considering that an MBD index represents the percentage of performance increase, data between 97 and 376 can certainly be viewed as remarkable. Aside from the statement that all children showed notable increases, it can be asserted that Berta profited the most. In all cases, the improvements in TWW were greater than in the qualitative appraisals.

Table 3. Effect sizes for total words written (TWW) and qualitative writing rubric (QWR)

	PND	PAND	IRD	MBD	Glass's Δ	NAP	Tau-U
TWW							
Adal	100	100	1.00	176	15.80	1.00***	1.00***
Berta	100	100	1.00	376	29.71	1.00***	1.00***
Channa	100	100	1.00	147	12.31	1.00***	1.00***
Daniel	100	100	1.00	167	11.07	1.00***	1.00***
QWR							
Adal	100	100	1.00	97	4.77	1.00***	1.00***
Berta	100	100	1.00	204	6.68	1.00***	1.00***
Channa	100	100	1.00	137	3.07	1.00***	1.00***
Daniel	100	100	1.00	133	4.32	1.00***	1.00***

Note. PND=percentage of non-overlapping data; PAND=percentage of all non-overlapping data; IRD=improved rate difference; MBD=mean baseline difference; NAP=non-overlap of all pairs.

Glass's Δ is considered an appropriate effect size measurement if baseline data are not excessively variable and do not present trends. It expresses the difference between intervention and baseline means in units of the standard deviation of the baseline scores. The convention for categorizing Cohen's d (1988) indices into small (0.20), medium (0.5), and large (0.80) does not apply to Glass's Δ. However, scores between 11.07 and 29.71 for quantitative measures (TWW) can be considered tremendously high. Indices between 3.07 and 6.68 for the qualitative appraisals (writing rubric score) are not enormous, but still remarkable. According to the Glass's Δ scores for TWW, Berta benefitted the most (29.71) and Daniel the least (11.07). Based on the assessments done with the writing rubric, Berta profited the most from the training (6.68), whereas Channa (3.07) showed the smallest gains.

Furthermore, we applied a randomization test suitable for multiple-baseline designs (AB; Edgington & Onghena, 2007), again using the SCAN package for R by Wilbert (2018). Randomization tests are not yet widely spread among researchers engaged in single-case research. They are model-free, computationally intensive methods for hypothesis testing that generate many replicates of an actual dataset—typically called pseudo-samples—and use the pseudo-samples to estimate a score distribution (Grünke, Boon, & Burke, 2015; La Fond & Neville, 2010). Randomization tests offer the great advantage of enabling analysis of an overall effect for all participants and providing exact p-values for generalizing the results (Dugard, 2013). For TWW, data analysis yielded a highly significant effect ($\Delta M_{AB}=123.04-39.00=84.04$; $p<.01$); for QWR, it generated at least respectively significant evidence ($\Delta M_{AB}=13.13-5.50=7.63$; $p<.05$).

Finally, we conducted piecewise regression analyses to explore the relevance of different effects (trend, level, and slope) for the results (Moeyaert, Ugille, Ferron, Beretvas, & Van Den Noortgate, 2014). Again, we utilized the SCAN package by Wilbert (2018) to execute the calculations. The outcomes of the analyses are provided in Tables 4 and 5.

Table 4. Piecewise regression model for total words written

	B	SE	t	p	R²
Adal					
Intercept	52.00	18.08	2.88	.02*	
Trend	-1.40	5.45	-0.26	.80	.00
Level	38.14	19.76	1.93	.09	.05
Slope	13.54	6.35	2.13	.07	.05
Berta					
Intercept	40.57	9.52	4.26	.00***	
Trend	-0.93	2.13	-0.43	.67	.00
Level	123.83	14.09	8.79	.00**	.17
Slope	6.83	4.15	1.65	.14	.01
Channa					
Intercept	44.70	5.35	8.35	.00***	
Trend	-1.30	1.61	-0.81	.44	.00
Level	44.51	5.85	7.61	.00**	.13
Slope	5.80	1.88	3.09	.02*	.02
Daniel					
Intercept	34.14	5.26	6.49	.00***	
Trend	-0.14	1.18	-0.12	.91	.00
Level	57.06	7.79	7.33	.00***	.22
Slope	-0.06	2.29	-0.03	.98	.00

Note. * significant at the .05 level. ** significant at the .01 level. *** significant at the .001 level.

Table 5. Piecewise regression model for qualitative writing rubric

	B	SE	t	p	R²
Adal					
Intercept	6.90	3.00	2.30	.05*	
Trend	-0.10	0.90	-0.11	.92	.00
Level	3.60	3.28	1.10	.30	.05
Slope	0.85	1.05	0.81	.44	.03
Berta					
Intercept	4.00	1.38	2.89	.02*	
Trend	0.25	0.31	0.81	.44	.01
Level	8.25	2.05	4.03	.00***	.13
Slope	0.15	0.60	0.25	.81	.00
Channa					
Intercept	7.40	2.79	2.66	.03*	
Trend	-0.80	0.84	-0.95	.37	.03
Level	6.60	3.05	2.17	.06	.16
Slope	1.26	0.98	1.29	.02*	.06
Daniel					
Intercept	4.57	1.31	3.50	.01**	
Trend	0.25	0.29	0.86	.42	.01
Level	5.78	1.93	2.99	.02*	.12
Slope	0.05	0.57	0.09	.93	.00

Note. * significant at the .05 level. ** significant at the .01 level. *** significant at the .001 level.

First, our initial impression of a stable baseline was confirmed—there was no significant trend for any of the students in phase A. Moreover, as shown in Table 4, for all but one participant, there was a highly significant level effect relating to phase differences in TWW, with R^2 between 13 and 22%. In addition, Channa showed a noteworthy slope effect. However, no significant results were identified for Adal. With regard to improvements in writing quality (see Table 5), only Berta and Daniel demonstrated a meaningful increase in level.

Even though the piecewise regression analyses did not support all hypotheses proposed in this study (the level effect was only significant in five out of eight cases), the results need to be seen as a whole. And taking all modes of data analysis into account (visual inspection, effect size estimates, randomization tests, and piecewise regression modelling), the picture becomes relatively clear: The intervention certainly had a distinct impact on the scores of the participants.

4. Discussion

4.1 Basic Findings

This study aimed at shedding lighter on the effectiveness of a promising strategy to help struggling writers plan better stories (STOP & LIST). The results of our single-case analysis appear very encouraging. Visual inspection indicates a remarkable quantitative and qualitative improvement from baseline to intervention. In addition, all effect size measures point to notably higher achievements as soon as the participants were taught the strategy. Finally, inferential statistics (randomization test and piecewise regression analyses) substantiate these appraisals of the treatment benefits. The level effects in particular were striking.

Thus, our findings tie in with the ones produced by other studies focusing on STOP and LIST (Graham, Harris, & Troia 1998; Grünke & Hatton, 2017; Troia & Graham, 2002). The results of this experiment fortify the assumption that the lack of planning is a crucial barrier for struggling writers as they try to produce stories of an acceptable length and of sufficient quality. As soon as they receive some substantiated instruction on how to generate and organize ideas, their performance increases considerably. The insights from this research agree with all major writing theories that recognize planning as an essential part of the process (see MacArthur, Graham, & Fitzgerald, 2006), as well as with the findings from existing meta-analyses on the subject (Cook & Bennett, 2014; Datchuk & Kubina, 2012; Gillespie & Graham, 2014; Gillespie Rouse & Sandoval, 2018; Rogers & Graham, 2008).

4.2 Limitations

Like all empirical research, this study is subject to certain limitations. First, the results of an intervention with only four students do not allow for far-reaching conclusions about how to successfully support every struggling writer. Additionally, our participants were all the same age and had a similar educational background. Thus, our findings can only refer to students of this particular sub-segment. It has to be taken into account that children struggling with text composition are a heterogeneous group. Not every one of them necessarily benefits from one certain intervention. It is yet to be determined whether STOP and LIST has the potential to help a wider variety of learners than just students of a specific age group with moderate deficits. None of the participants of this study was ever diagnosed with a WLD. In fact, the purpose of the treatment applied was to prevent the problems from expanding and intensifying. Even though previous studies have focused on students with LDs or WLDs (Graham et al., 1998; Grünke & Hatton, 2017), the research base is anything but broad enough to call STOP and LIST evidence-based for a variety of subgroups of students with writing problems. It would be beneficial to apply this technique to a larger group of children and adolescents with different characteristics to identify responders and nonresponders.

Another limitation concerns the design of our study. We applied a multiple-baseline plan (AB) without collecting any follow-up data. Therefore, it is not possible to draw any inferences about the long-term effects of the intervention on the writing performance of the participants. However, considering that teaching our students how to plan their stories had an immediate impact on their performance gives rise to the hope that teaching a learner how to use the tool will help him or her not only during a treatment phase but even beyond.

A final limitation pertains to the way we captured writing performance. Assessing this skill is generally more complicated than detecting reading fluency or spelling. This is especially true when trying to measure the quality of a text, which always results in relatively subjectively colored data. Using writing rubrics is the most conventional mode to monitor the degree of excellence in a text over time. However, the sheer quantity of these scoring guides is dizzying. Almost every single-subject experiment in the previously cited meta-analyses used its own self-constructed tool for determining writing quality. Thus, there is obviously no silver bullet among the rubrics. Even though this was dissatisfactory, we had to choose one particular instrument from among a variety of alternatives to measure writing quality, knowing full well that any decision in this respect would make us prone to criticism.

4.3 Implications for Practice

Writing skills have great relevance for the school careers of children and adolescents as well as for their social participation. Luckily, research suggests that students struggling with this skill can be supported effectively. This study confirms that STOP and LIST is a very promising tool to improve their writing. It is easy to implement in educational settings because using STOP and LIST is highly intuitive, and teaching it requires no special equipment. Even peer-tutoring concepts, that compensate for a possible lack of ideas in students who struggle with composition writing, can disburden the teacher and leave capacity for support where needed elsewhere. In this way, STOP and LIST can be applied in very heterogeneous classrooms. Because the main part of the STOP

and LIST strategy is to find and sequence ideas for the subsequent writing task, one option could be to divide the class into cooperative learning settings, such as groups or partners, to enhance the quantity and quality of ideas the students generate. To meet the increasing influences of technology-enhanced learning, the authors are in the middle of developing a digital version of the STOP and LIST strategy.

4.4 Conclusion

Further research on this promising strategy could enhance the insights into the improvement of writing competence. Future studies should focus on replicating this experiment while addressing the limitations discussed above. The findings strongly support the hypothesis that STOP and LIST has positive effects on the quantitative and qualitative writing performance of struggling students.

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Appendix C: Publication No. 3 (*peer reviewed*)

Effects of a Computerized STOP & LIST Intervention to Foster Text Production Skills in Students Who Struggle With Composition Writing

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Most students who struggle with writing have particular trouble with planning a text. They do not find themselves sufficiently able to generate content and organize the ideas they wish to address into a coherent order. STOP & LIST is a well-proven strategy that has the potential to help students mold an internal representation of the text in their minds before composing it. However, teaching such a technique in diverse classroom environments is challenging. We thus developed a computerized version of a STOP & LIST intervention geared toward providing each student with sufficient practice opportunities and individualized feedback to acquire ample text-planning skills. In our randomized experiment, we involved 30 fourth graders with severe difficulties in expressive writing. We provided 15 students with seven 90-minute training sessions using our software, and the other 15 continued to participate in regular classroom activities. Our results speak to the high effectiveness of the intervention. The children obviously benefitted greatly from the treatment. Our program produced an effect size of about one and three quarters standard deviations. We end the paper with a critical discussion of the results and some practical implications of the findings.

Keywords: **Writing Instruction, Learning Disabilities in Written Expression, Strategy Instruction, STOP & LIST**

INTRODUCTION

Being able to form words and sentences to produce texts that are comprehensible to their readers is indispensable in today's society. As MacArthur et al. (2006) put it, "writing is one of humankind's most powerful tools" (p. 1). It is often viewed as equivalent to thinking (Foerster et al., 2000) and a key way in which people reveal their skill levels and their knowledge (Day, 2018).

The significance that text production holds for daily functioning in educational, work-related, and personal life contexts makes it problematic if learners fail to reach at least a minimum competency level in writing. Unfortunately, difficulties in this area are one of the most common obstacles for elemen-

tary and secondary students on their way to reaching their full potential. In fact, only a little over 40% of all high school graduates in the United States meet the basic requirements for most career fields in this respect (College Board, 2014). Because written language disorders are among the most prevalent learning disabilities (LDs) worldwide (Grünke & Leonard Zabel, 2015), it is assumed that problems in producing texts of sufficient quality are widespread all around the globe (not just in America).

In their influential theory, Hayes and Flower (1980) described the composition process as an activity that consists of three recursive stages: planning, translating, and revising. Skilled writers often spend more than a third of the time of the whole procedure thinking of ideas and organizing information (Gillespie-Rouse & Graham, 2016). In contrast, students who are academically challenged in literary language, such as those with specific LDs in writing, often invest less than one minute in planning (MacArthur & Graham, 1987).

Luckily, there are several meta-analyses that give evidence about different ways to support children and youth who struggle with text composition (e.g., Cook & Bennett, 2014; Datchuk & Kubina, 2012; Gillespie & Graham, 2014; Gillespie et al., 2018; Rogers & Graham, 2008). The underlying thrust of these systematic aggregations of available effectiveness studies indicates that strategy instruction, goal setting, word processing, summarization, positive reinforcement, and sentence construction are very useful in helping children and adolescents improve their text production skills.

An especially promising approach in assisting students with severe problems in planning is called STOP & LIST (Graham & Harris, 2005). The name stands as acronym for the four steps that should be taken during the prewriting phase: (a) *S*top, (b) *T*hink *O*f *P*urpose, (c) *L*ist *I*deas, and (d) *S*equence *T*hem (Graham & Harris, 2005). Like many other efficient learning techniques, STOP & LIST usually gets taught by way of the self-regulated strategy development (SRSD) model by Graham and Harris (1995). SRSD is an empirically validated framework for explicitly guiding struggling writers through the different activities that need to be undertaken before arriving at an admissible text product. The What Works Clearinghouse recognizes it as an evidence-based practice that involves six stages: (a) develop and activate background knowledge in the students, (b) discuss the strategy with them, (c) model the way to apply the different steps involved while thinking aloud, (d) assist the students to memorize the steps necessary to successfully execute the strategy, (e) scaffold the process as they try to use it on their own, and (f) help the students to master the transition from "overt" to "covert" writing (Gillespie Rouse & Graham, 2016).

Up to now, five published studies have evaluated the effects of STOP & LIST in struggling writers (including those with specific LDs; Graham et al., 1998; Grünke & Hatton, 2017; Grünke et al., 2019; Özbek et al., 2019; Troia

& Graham, 2002). In all experiments, the students were able to improve their performance in a meaningful way by applying the strategy. After they had been taught STOP & LIST, they unanimously wrote more extensive and more elaborate texts than before the treatment.

Despite these promising findings, offering struggling children and youth interventions such as the one just described remains difficult in a classroom setting with a large group of students who all need different amounts of support. It is virtually impossible for teachers to sufficiently attend to the individual needs of academically challenged learners while providing them with enough opportunities to practice various skills until they reach a mastery level. Thus, educational strategies are warranted that carry the potential of being responsive to the specific strengths and weaknesses of every student, especially to those of weak performers.

Computer-assisted instruction (CAI) is a method of programmed learning that seems to meet these requirements. It is a teaching process in which a PC, a laptop, or a tablet is used to enhance the acquisition of different skills. There is a broad research base on the effects of CAI, supporting the notion that this model is especially beneficial for struggling children and adolescents. In their meta-analysis, Gersten and Baker (2001) stated that using CAI in story writing instruction yields high effect sizes of $d > 1.00$ for students with LDs. Kellog and Whiteford (2009) added that automated feedback can boost such positive outcomes.

The purpose of this study was to evaluate the effects of a computerized STOP & LIST intervention on the story writing performance of struggling fourth graders. We chose this particular target group because children that age should have already mastered the skill of producing simple narratives (Decker et al., 2016; Kellog, 2008). The first author designed the software and aimed at scaffolding the crucial planning process of the participants while applying STOP & LIST. We expected that in comparison to students who would not receive the intervention, children who took part in the training would demonstrate a significantly greater increase in text length from pre- to post-testing.

METHOD

Participants and Settings

The participants were 17 male and 13 female fourth graders between the ages of 8 and 9 years. We chose them through a screening process across four classrooms in two elementary schools in North Rhine Westphalia (Germany). All students were asked to compose a narrative on a computer in response to a simple writing prompt (no time limits were given). They were able to pick one of three options ("It is all your fault," "A bicycle accident," or "Lost keys") about which to write their text. A median split was performed based on the length of

the stories. Students whose narratives contained fewer words than the median were considered potential candidates for our study. In addition to having been able to only produce a rather small number of words, they had to meet the following criteria:

1. Their teachers deemed them skillful in using a computer keyboard (based on the experiences they had instructing them in the school's computer lab).
2. Their teachers considered them comparatively weak writers.
3. The students did not have any kind of intellectual disability (IQ not lower than 85).
4. The students did not score in the last quarter of a standardized spelling test.

By considering these prerequisites, we tried to make sure that the participants possessed all the necessary requirements to benefit from our intervention. It would not have been reasonable to choose children who were not even able to engage in the writing intervention because they lacked the necessary keyboard skills, intellectual capabilities, or orthographic competence.

To capture intelligence and spelling, we applied the Number Combination Test by Oswald (2016) and the Hamburg Writing Samples by May (2018). The eventual group of 17 boys and 13 girls demonstrated an IQ between 85 and 112 ($M = 96.07$; $SD = 8.21$). According to their teachers, about half of them did not grow up with German as their first language. However, all of them spoke and wrote the language fluently.

Despite their sufficient intellectual and spelling abilities, their composition skills were below expectations (according to our screening and their teachers' estimations). An LD is characterized by low achievement in one or more academic areas (reading, mathematics, and/or written language; Fletcher, Llyon et al., 2018). Even though there is no standardized test in German aimed at capturing compositions skills, all of our participants did obviously demonstrate insufficient performance in this academic area and thus conformed with the general description of what constitutes an LD.

Design and Measures

We employed a pre-posttest control group design, which is the strongest type of plan for the collection and analysis of data and should be used whenever possible (Mertens & McLaughlin, 2003). Participants were randomly assigned to either the treatment or the control group. Fifteen children received the intervention, and the other 15 continued to take part in regular classroom activities. We conducted the measurements one day before the first intervention session and the day after the last one.

The pretest and the posttest each consisted of another writing task. Students were asked to produce a story in response to a prompt similar to the

one we used during the screening assessment. From those writing examples, the number of total words written (TWW) was determined by two graduate university students (interrater reliability equaled 100%). According to Grünke et al. (2015), at the age of our participants and in the phase of the writing development in which they were operating, the number of TWW is the most common way of capturing productivity and text quality. If experts evaluate writing examples from children on that level, longer texts usually get better ratings. When students acquire more experience in writing, the correlation is lower (MacArthur et al., 2006).

Intervention

Our computerized version of the STOP & LIST intervention was designed as a method that guides learners through the planning and transcribing part of the writing process in five steps:

1. Get ready for the task: Students are led through three questions that revolve around setting appropriate writing conditions and preparing emotionally for the assignment ("Is it quiet enough to start working?" "Am I sitting comfortably?" "Am I ready to begin?"). Subsequently, the software lets the students select a writing prompt. The aim is to apply rituals for structured work that the learners can transfer into their self-regulated workflow.

2. Set goals and focus on purpose: With their writing prompt in mind, a digital clock set to one minute helps students to focus on setting appropriate writing goals and thinking about the purpose of the writing task.

3. Brainstorm ideas: During the next step, students have to list at least three thoughts in the form of keywords on what they want to include in their story.

4. Sequence thoughts: After jotting down some notes, the aim of the next step is to sequence the listed ideas. The interface lets students pull every keyword up and down until they build an order that should help them write down their story during the last step of the strategy.

5. Compose the text: The software provides a blank form for students to write down their story. The sequenced keywords are displayed on the right side of the screen to aid during the transcribing and reviewing part of the writing process.

After all steps are completed, the story can be printed or saved as a pdf document. To benefit from the positive effects of automated feedback on writing (Kellog & Whiteford, 2009), a word-counting tool was included. Thus, the participants always received instant feedback on the length of their texts.

The intervention consisted of seven 90-minute sessions spread over 2 weeks. Two graduate college students of special education conducted the treatment. They were both experienced in working with children, due to several internships they had completed in different elementary schools during the course of their university training. To enhance the internal validity and guide the interventionists through the process, we prepared a written manual (available upon request). It contained information about technical and formal questions regarding the procedures. In addition, it provided a guideline on how to conduct each lesson during the intervention. It entailed sentence-by-sentence instruction for the implementation of the software.

For the sessions, the children met up with the interventionists in two empty classrooms that were equipped with computers for each child. The first lesson focused on familiarizing the students with the software and on demonstrating its use. After recalling basic knowledge about the writing process (Step 1 of SRSD), the interventionists explained that learning about and applying the STOP & LIST strategy would help them to write better stories (Step 2 of SRSD). They modeled the use of the software by displaying a computer screen on a whiteboard and demonstrating how to use it while commenting on each activity. The interventionists started by going through the three questions aimed at preparing learners for the writing process ("Is it quiet enough to start working?" "Am I sitting comfortably?" "Am I ready to begin?") and by clicking "yes" on the dialogue window on the screen. Subsequently, a selection of different writing prompts appeared.

After choosing one, the interventionists typed in 10 ideas that came to their mind while contemplating the chosen topic. Next, they sequenced their thoughts in order to reflect the course of action in the story to be created. As a last step, they transcribed a short story of about 60 words while referring to the sequenced list of ideas (Step 3 of SRSD).

During the whole time, the university graduate students thought aloud and commented on their actions. Furthermore, they involved the children in the process by asking them guided questions about the purpose of each activity they were demonstrating. Next, they asked participants to go through the process and use the software themselves, while the interventionists provided help and corrective feedback (Step 4 of SRSD).

All remaining sessions were structured in the same way: (a) The interventionists praised the children for their previous achievements, based on positive aspects about the stories they had written in the last lesson (because every text was saved on the hard drive of the computers, the university students were always able to analyze and evaluate each story after a session); (b) the children worked independently with the software, while the interventionists monitored the process and provided help whenever it was needed; and (c) the participants

filled out a three-category questionnaire about how they liked the day's session (Step 5 of SRSD). Over time, the university students gradually faded out their support and put the children in the place of applying the software bit by bit more independently (Step 6 of SRSD).

RESULTS

Figure 1 presents the results for the number of TWW in both groups in the form of a boxplot. As can be easily recognized, the treatment group improved remarkably, whereas the control group did not show any noteworthy enhancements.
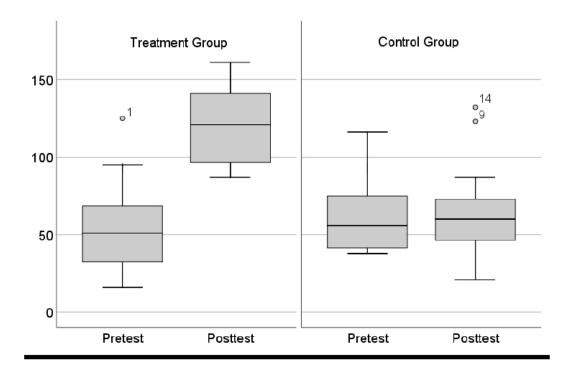

Figure 1. **Boxplots for the number of total words written in both groups.**

Descriptive data concerning the number of TWW of the students who received the intervention and of those who did not are presented in Table 1.

Table 1. *Means of Performance on Pretest and Posttest Measures for Both Groups*

	Pretest		Posttest	
Group	Mean	*SD*	Mean	*SD*
Treatment Group ($N = 15$)	54.33	29.66	130.13	55.58
Control Group ($N = 15$)	61.93	26.89	65.33	30.54

The pretest scores did not significantly differ between both conditions, $t(28) = -.73$, $p = .468$ (two-tailed). However, the average number of TWW of the students in the control group exceeded that of the students in the treatment group by 13.99%. Taking this nonsignificant yet notable difference into account, we conducted an analysis of covariance (ANCOVA) with the pretest as the covariate and the posttest as the dependent variable. This approach is often recommended in the literature for the analysis of data from pre-post control group designs when there are at least marginal discrepancies in pretest scores between conditions (see Dugard & Todman, 1995). Before running the AN-COVA, we performed a test for homogeneity of regression to determine whether the within-group regression coefficients were equivalent. The results indicated that the regression coefficients were essentially homogeneous. As can be seen in Table 2, the main effect of the treatment condition proved to be statistically significant, $F(1,27) = 20.08$, $p < .001$.

Table 2. *The Results of the ANCOVA*

Source	*df*	Mean Square	*F*	Sig.	eta^2
Pretest	2	8528.75	4.82	.037	.15
Group	1	20825.32	20.08	<.001	.43
Error	27	1769.57			
Total	30				

That means that group membership did have a significant effect on the posttest scores when controlling for pretest differences. To quantify the magnitude of change, we used a corrected effect size for repeated measures designs (see Lenhard & Lenhard, 2016), which is an adaption of Cohen's *d* (Cohen, 1988).

The formula accounts for any differences between groups that might have existed before a treatment was implemented. Our calculation yielded a remarkably high index of $d = 1.77$. According to common conventions for small ($d = 0.20$), medium ($d = 0.50$), and large effects ($d = 0.80$; Chen et al., 2010), our results can be considered very positive.

The data from the aforementioned questionnaire about how the students liked the day's lesson revealed that the acceptance rate of the intervention was very high. All 15 participants in the experimental group indicated at least four out of five times that they enjoyed the particular session very much. None of them ever expressed disapproval. In 92.00% of all cases, the students rated the lesson most favorably on our three-category questionnaire.

DISCUSSION

Basic Findings

The aim of this randomized control trial was to evaluate whether a computerized STOP & LIST intervention would improve the writing performance of struggling fourth graders. Our training consisted of just seven 90-minute sessions. The results indicated that students who received the treatment produced significantly longer texts upon termination of the instruction than those who continued to participate in regular classroom activities. In fact, the improvements were so strong that they yielded an unusually high corrected effect size of $d = 1.77$. Thus, our approach can be seen as very helpful and beneficial.

These findings correspond with the results of previous studies on the potency of STOP & LIST interventions as described above. What is novel about our approach is the implementation of this very effective planning strategy within a CAI framework. Hence, we were able to demonstrate that helping struggling writers to improve their ability to generate content and to organize ideas does not have to be done by teachers to be effective. It seems that our software can also facilitate the process of acquiring application knowledge in using the STOP & LIST strategy in a very feasible way. Furthermore, the participants seemed to like the intervention very much and gave markedly positive feedback.

Limitations

Notwithstanding the positive results, our study is subject to several caveats. First and most obvious, it was conducted with only 30 children. Furthermore, all of them were of a similar age and educational background. This makes generalizations to the population from which we selected our sample difficult, let alone to groups of students that differ in relevant attributes from our participants. The study needs be replicated with more and more diverse learners to be able to draw broader conclusions about the effects of our STOP & LIST intervention. Due to the fact that there are no standardized writing tests in German (like the Test of Written Language by Hammill and Larsen [2009] in English),

the objectivity in defining and selecting our sample was certainly not beyond reproach. The choice of our participants rested, among other factors, on the appraisals of the teachers concerning students' writing performance and ability to use a computer keyboard. Subjective evaluations such as these lack the precision that would be necessary to properly replicate our experiment. Furthermore, classifying our participants as having an LD in written expression remains questionable. However, given the lack of a suitable instrument to capture writing performance objectively, this shortcoming could not be avoided.

Another limitation pertains to the question of which factors were responsible for the outcomes and to what extent. Research shows that both the use of a computer (e.g., Peterson-Karlan, 2011) and of strategy instruction (Graham et al., 2018) usually leads to significantly better writing performance in students with LDs. However, it is impossible to determine based on our findings whether the positive outcomes can be explained by the fact that we used a computerized version of STOP & LIST instead of any other approach to enhance planning skills. Prospective studies should investigate the effects of different techniques in this respect and should alternate between CAI and non-CAI.

We used no other measure of writing performance besides the number of TWW, and we did not include a follow-up test. This limits the validity of the claim that the intervention had a deep and lasting impact. As mentioned above, text length correlates very highly with text quality when appraising stories written by elementary school children (Grünke et al., 2015). However, both aspects are not synonymous. It would have been helpful to include some expert judgements on how well the narratives were written. In addition, integrating follow-up measures into our study design would have enabled us to make statements about whether the effects were still traceable after certain periods of time. Unfortunately, restricted resources prevented us from conducting a study that would have been more elaborate, rich, and complex.

Finally, the software that the interventionists worked with was a beta version with some features not yet finished, such as the option to reassess and finish a story. The university students had to work around some bugs that might have had a negative influence on the writing outcomes and motivation. In future studies on our computerized STOP & LIST intervention, these shortcomings will have certainly been eliminated.

Implications for Practice and Outlook

In almost every part of the world, classrooms are becoming more and more diversified as students who were once pulled out for special programs are now included within regular instruction (Rapp & Arndt, 2012). This places increasingly high demands on teachers to transform their approaches to instruction to meet the needs of very heterogeneous groups of children and youth. Incorporating CAI into the curriculum can be a crucial step in making learning

more tailored for individual students. By applying such interactive instructional techniques, everyone can work on a skill that matches their needs. Even though a computer cannot replace a human when it comes to the "I do it!" part of the common sequence of the three steps in explicit teaching ("I do it!" "We do it!" "You do it!"; Goeke, 2008), it can certainly help with prompted and unprompted practice. Software like the one we used in this study is definitely suitable for intense drills while providing immediate feedback. In addition, the observation that students are generally very motivated to engage in CAI has been repeatedly documented for several decades now (e.g., Kulik et al., 1983; Lepper, 1985; Seymour et al., 1987). Hence, an intervention such as ours meets several requirements that are essential for providing individuals with learning problems a custom-fit range of academic activities from which they can actually benefit (Mitchell, 2014).

The beta version of the software certainly had some flaws and caused extra work on the side of the interventionists and students because they were not able to use all features. Without a doubt, our intervention needs some optimizing and fine-tuning. We have to make sure that it functions well and is user-friendly with low maintenance. However, regardless of any possible shortcomings in conjunction with the software, we were definitely able to demonstrate that delivering the well-proven STOP & LIST strategy through a CAI model can help struggling students to write longer stories while enjoying the activity. When dealing with such an aversive and arduous task as text production, such a finding cannot be valued enough. Engaging young learners at risk for failure in activities that help them improve their composition performance is extraordinarily valuable. We hope that instructional approaches such as ours will receive wide attention in research as well as in practice to enhance the often dire situation of children and youth in school systems that all too often fail to meet the needs of their struggling students.

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Appendix D: Publication No. 4 (*peer reviewed*)

Using a Simultaneous Prompting Procedure to Improve the Quality of the Writing of Three Students with Learning Disabilities

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Abstract

The purpose of this experiment was to determine the effects of a simultaneous prompting procedure on the writing performance of three upper-elementary-level students diagnosed with learning disabilities (LD). Interventionists gave task directions followed by model prompts with a 0-s time delay to teach students composition. Non-targeted information related to the writing process was embedded in the form of progress monitoring. A multiple-baseline design across participants (AB) was used to assess the effectiveness of the intervention. Results indicate that the simultaneous prompting procedure positively affected the overall quality of writing of students with LD. Implications for practice and future research are discussed.

Keywords: Writing, Learning Disabilities, Simultaneous Prompting

1.   Introduction

When considering the importance of being able to compose texts, one might be inclined to think that this skill is most relevant for people who are pursuing a career in a literary field, such as academia or journalism. However, the significance of being able to put one's thoughts on paper goes far beyond that. For example, writing assignments, written test answers, essays, and reports are typical ways of assessing students' academic success in school (Graham, 2006). In addition, writing is used not only to evaluate learning, but also to facilitate it (Gillespie et al., 2014; Graham & Hall, 2016). Therefore, the ability to compose texts is a crucial skill for success in school, and students who struggle to think on paper are at a clear disadvantage (Gillespie & Graham, 2014; Graham et al., 2017). Writing remains relevant when entering higher education or the job market (Graham & Harris, 2011). Moreover, it is also important in everyday social contexts. The information society has

greatly increased the amount of information available online and has made literacy a pivotal skill for finding, analyzing, and interpreting these resources (Grönlund & Genlott, 2013). Hence, proficiency in writing-related activities has become critical for active participation in society.

The writing process integrates many complex tasks, including planning, transcribing, and reviewing (Hayes & Flower, 1980). These activities need to be performed recursively, and nearly simultaneously, while a writer is composing. Besides, all of these tasks are interrelated, meaning that weakness in one area can impact the others. In a later adaption of his original model, Hayes (1996) emphasized the role of individual, pointing to high motivation, well-coordinated cognitive processes, and fully developed working memory as prerequisites for effective text production.

Despite the influence writing has on success in life and the complexity of the writing process, writing instruction typically does not receive much attention in schools, as reported in multiple studies from around the world (e.g., Håland et al., 2019; Hsiang et al., 2018; Rietdijk et al., 2018). Reasons for this unfortunate situation include a lack of teacher training in writing instruction and the limited time teachers typically spend on teaching writing skills or strategies, notably after Grade 3 (Applebee & Langer, 2011; Gilbert & Graham, 2010; Kiuhara et al., 2009; Rietdijk et al., 2018; Wijekumar et al., 2019). As a result, it is not surprising that many students have difficulty navigating and succeeding at the task of text production.

1.1 Students With Learning Disabilities

One group of students who are at particular risk for not meeting basic writing achievement levels are students with learning disabilities (LD) (Graham et al., 2017). According to Graham and Harris (2011), 19 out of 20 students with LD do not acquire adequate writing skills to succeed in school. These children and youth demonstrate difficulties across all parts of the writing process. Specifically, during planning, students with LD spend less time than their typically achieving peers on prewriting activities and generating ideas (Gillespie & Graham, 2014), and in terms of transcribing, they experience problems with spelling, handwriting, and typing, leaving little room in working memory to apply to content, meaning, and coherence (Baker et al., 2003; Gillespie & Graham, 2014). Further, when revising, young people with LD typically focus only on grammar, spelling, and mechanics (Graham et al., 1995), leading to texts that often lack coherence, clarity, and purpose (Graham et al., 2017). Finally, given how challenging, cognitively overwhelming, and time-consuming the task of writing is for this group of students, it is perhaps not surprising that researchers report a lack of motivation and negative attitude towards writing in students with LD (Gillespie & Graham, 2014; Graham & Harris, 2009).

Considering the lifelong importance of being able to write effectively, it is critical to provide teachers with effective and evidence-based interventions to support students' writing. Several meta-analyses provide an overview of interventions for students with disabilities who struggle with text composition (Cook & Bennett, 2014; Gillespie & Graham, 2014; Gillespie Rouse & Sandoval., 2018; Kaldenberg et al., 2016). Most of the studies reviewed were single-case research designs, and a majority of the approaches with positive effects were related to implementation of the Self-Regulated Strategy Development (SRSD) framework by Harris and Graham (1996), a thoroughly validated model whereby teachers systematically teach strategies for the writing process. Treatments that focus on the *planning* or *revising* part of the writing process were identified as effective, as long as they are instructive in nature. Sentence combining has also proven to be an effective intervention in improving text quality (Saddler et al., 2018). Other interventions identified in the meta-analyses as being effective in supporting struggling students' writing include *goal setting*, *prewriting activities,* and *strategy instruction*.

1.2 The Simultaneous Prompting Procedure

One promising strategy for systematic writing instruction for students with LD is simultaneous prompting, defined as a planned, systematic instruction method, where individualized, controlling prompts are presented to the student immediately before or after instruction to evoke a correct response (Gibson & Schuster, 1992). Prompts may be verbal, visual, or physical. By allowing the student to respond to the prompt rather than having the opportunity to give an independent response, it serves as an errorless learning strategy (Tekin-Iftar et al., 2018). Educational approaches that minimize opportunities to make mistakes provide more opportunities for positive reinforcement (Gibson & Schuster, 1992). Adding non-targeted information to a simultaneous prompting intervention, as in Hudson (2013), can improve learning outcomes (Albarran & Sandbank, 2018; Smith et al., 2011). Non-targeted information provides the opportunity to increase students' exposure to information without also increasing instructional time (Smith et al., 2011). It can be placed before, during, or following a prompting procedure and can be related or unrelated to the intended learning outcome.

One way of implementing non-targeted information as part of simultaneous prompting procedures is the use of progress monitoring, which involves frequent assessment of a student's performance in specific skill areas (Shapiro et al., 2011). This process can have a very motivating effect on struggling writers (Hisgen et al., 2020). Graham et al. (2017) suggest that enhancing motivation and confidence to write is important for students with LD to become skilled writers and can enhance writing performance (Graham, 2006). Additionally, the non-targeted information can be acquired in the form of incidental learning (Werts et al., 1995) without additional demands to the learner. Simultaneous prompting

procedures can be used for both discrete tasks (single unit tasks like naming vocabulary) and chained tasks (tasks that consist of multiple steps). A chained task simultaneous prompting procedure for writing would include systematic instruction in a sequence of responses to facilitate a step-by-step writing intervention (Birkan, 2005; Hudson et al., 2013; Rao & Cane, 2009).

Simultaneous prompting has been shown to be an effective teaching method for students with and without disabilities between the ages of preschool and adulthood (Morse & Schuster, 2004; Tekin-Iftar et al., 2018; Waugh et al., 2011). For example, a literature review by Waugh et al. (2011) suggests an effectiveness rate of 93% within the 35 peer-reviewed studies examined with 126 out of 136 participants reaching criterion during the simultaneous prompting intervention. In addition, Morse and Schuster (2004) reported positive effects on maintenance and generalization of skills.

The procedure has also been found effective for children with disabilities. For example, Tekin-Iftar et al. (2018) concluded that there is substantial evidence that the simultaneous prompting procedure is effective across participants with a variety of disabilities, across ages and target skills. Further, there is also some support for the use of simultaneous prompting in writing instruction with students with disabilities. For example, Hudson et al. (2013) used this approach, including non-targeted information, to teach paragraph composition to students with emotional and behavioral disorders, resulting in positive effects and generalization effects to other writing tasks. Non-targeted information was also acquired. Other studies found positive impacts for simultaneous prompting in combination with computer-assisted instruction on the writing of students with autism (Pennington et al., 2010, 2012, 2014).

The purpose of this study was to extend the existing research on the effectiveness of simultaneous prompting and to further specify the effectiveness of the types of tasks and the type of disability. Specifically, we examined the effectiveness of a simultaneous prompting procedure including instructional feedback as non-targeted information in the specific academic field of text composition, focusing on fourth-grade students with LD. The hypothesis was that the intervention would increase the quality of students' stories.

2. Methods

2.1 Participants

2.1.1. Students

Initially, four students participated in the study. Parental permission was obtained prior to the experiment and subjects' names were changed to maintain confidentiality. The students attended fourth grade in a special educational school. In Germany, the diagnosis of LD is determined contingent on repeated serious school failure accompanied by an IQ score of 70-85. Students are tested by a professional as part of the regulations and enrollment

process of the German special educational school system. According to intellectual assessment based on the German version of the Wechsler Intelligence Scale for Children (Petermann, 2017), all students fell into that category. In addition, the special education teacher recommended these students for the intervention based on their weak writing skills, their regular attendance over the previous three months, and their estimated motivation to take part in the intervention. As a final step in selecting the participants for this experiment, students were asked to produce a writing sample of 20–40 words as a free writing task with no support. The writing probes were scored for quantity and spelling with a minimum requirement of at least 70% of correct letter sequences. During the experiment, one student (Sophie) was dismissed due to excessive absences as she missed a third of the probes. The following information was taken from the school records of the remaining three students. The first participant was 10-year-old Lene. She was born to parents with German citizenship. Due to severe abuse and neglect, she was placed in a group home a year prior to the intervention. Her IQ was 83. The second student was 10-year-old Yusem. He and his parents fled Syria during the refugee crisis in 2015. Yusem lived at home. His IQ was 68. However, it can be assumed that his score would have been somewhat higher if it was not for the slight language barrier he experienced (thus, he was considered LD even though his IQ fell two points short of reaching criterion). The third participant was 11-year-old Lara. She was born to German parents. Lara was at increased risk for attention problems since she was a premature infant who experienced birth complications. Her IQ was measured at 70, but inattention may have contributed to her difficulty completing the assessment; therefore, this score may not accurately represent her intellectual abilities.

2.2 Instructors

Two 25-year-old female graduate university students of special education served as instructors. They had recently completed two courses on writing interventions for students with learning problems, including several practice sessions on response prompting. Moreover, they had teaching experience gained through several internships in different special educational schools.

2.3 Setting

The study took place in a resource classroom in a suburban special educational school located on the metropolitan fringes of a large city in Northrhine-Westfalia (Germany). The school enrolled about 200 students in grades 1 to 10. The socioeconomic status of the school, as estimated by the mean occupational status of the families of the students attending, was considered low. A little over 60% of the school population had a migration background with Arabic, Russian, and Turkish being the most common primary languages spoken at home. At the time of the study, everyday life in school was considerably affected

by COVID-19 precautions. This included wearing masks, frequent ventilation, and partially remote teaching (with only half of the students in class at a time).

2.4 Measurement

A list of 50 simple story starters served as writing prompts (e.g., "A trip to the zoo," "A spooky Halloween party," "An adventure by the sea"). Each prompt was printed on a slip of paper and put into a little box. During measurements, each participant drew one of the writing prompts and was provided with pens and paper. The same pool of prompts was used during the intervention, but no story starter was presented more than once to a student.

A writing rubric that addressed all key elements of a narrative according to Martin and Manno (1995) and Troia and Graham (2002) was used to rate the quality of the stories composed by the participants. Both instructors rated the writing probes independently on a 5-point Likert scale according to how well the participants depicted a certain aspect (ranging from "1 = very poor" to "5 = very good"). If a particular element was not mentioned, no points were awarded. The items were as follows: (1) "Quality of the description of the setting," (2) "Quality of the description of the problem," (3) "Quality of the description of the solution," (4) "Quality of the description of the consequences," and (5) "Quality of the description of emotions."

Both instructors independently assessed the skill level demonstrated in the narratives the same day they were written and subsequently compared their ratings. Any disagreements were discussed and resolved. Because the outcome of the evaluations had to be reported back to the students the following day, it was not possible to involve an independent rater at this point. However, reliability of the assessment was estimated after the training had ended (see below).

2.5 Experimental Design

A multiple-baseline-across-participants design (AB) was used to examine the effects of the intervention. This approach demonstrates experimental control by systematically introducing the treatment in a time-lagged manner (Gast & Ledford, 2010). We staggered the baseline measurements across participants with 3, 4, 5, and 6 sessions, for Lene, Yusem, Sophie, and Lara, respectively. The independent variable was the response prompting procedure, whereas the dependent variable was the quality of the texts written by the students. Baseline consisted of between three and six daily probes. Duration of the intervention ranged between 9 and 12 days.

2.6 Procedures

2.6.1. Instructor training

The third author provided procedural training to the instructors during three 30-minute sessions via video conference. It included an overview of the simultaneous prompting intervention and a demonstration of the different steps of the training. To help instructors

implement the procedures with as much fidelity as possible, he also provided a standard 4-page script in which the treatment was outlined in a step-by-step manner. In addition, the third author taught the instructors to score writing probes using anchor essays written by different students during previous studies. That is, he presented the instructors with essays that he considered very well written for fourth graders with LD and went through the different categories of the rubric, explaining why he would award a high number of points for a particular feature in a given story. Subsequently, he repeated the procedure with text products that he deemed of mediocre and low quality. Following, the instructors independently rated six different texts of varying skill levels and lengths. The third author discussed the results with them and gave them feedback on how appropriate he thought their appraisals were.

2.6.2. Baseline

During baseline, each student met alternately with one of the instructors for 30 minutes every day in a resource room of the school, which was equipped with guided reading and math toolkits for lower-level students. The time of the day each child met with which instructor was determined by chance. To control for possible attention effects and to replace instruction during baseline with a non-writing-related activity, the first 20 minutes of each session were spent playing a card game. Data were collected at the end of each lesson, when the students were asked to write a story in response to a randomly drawn prompt (see above). There were no time limits for composing a text. However, the students finished their stories in less than 5 minutes.

2.6.3. Intervention

Treatment conditions resembled those during baseline with two exceptions: (a) Each session started with a 3- to 5-minute evaluation of the story that the students had composed the day before. With the help of the rating scale, the interventionists went through the different parts of each narrative and gave feedback on the strengths and weaknesses of the writing product. (b) Instead of playing a card game, the instructors involved the participants in a response prompting procedure that was in large part analogous to the one utilized in the Hudson et al. (2013) experiment. Thus, each session began with an evaluation of the previous writing product, continued with about 20 minutes of training, and finished with approximately 5 minutes of measuring performance, paralleling baseline.

In the first lesson, the instructors set the goal for the intervention by announcing "Today, you will learn how to start a story." They then presented a randomly drawn writing prompt from the pool of story starters to the students and continued the treatment by saying: "I will show you the first step in writing a story." Immediately after that (0-s delay), the instructors provided a model sentence (like the one in Table 1) that they wrote on a blank piece of paper, accompanied by the explanation: "First of all, you need to provide a general frame for

your story (who, where, and when). I am going to show you a topic sentence." A verbal prompt followed that included non-targeted information (e.g., "It is important to come up with a creative setting"). Next, the instructors asked the participants to write an opening sentence about the same writing prompt. If the participants started writing within 5 s and finished the sentence within 2 min, they were praised for their accomplishments. It did not matter whether they just copied the words or came up with a different solution. If they did not demonstrate the targeted behavior, they were corrected ("No, this is not a proper starting sentence") and the procedure (explanation plus modeling) was repeated before the children were asked again to compose a starting sentence. Once the participants delivered the desired response, the instructors went on to the next step (see Table 1) in a similar matter until the time was up.

Table 1

Task Analysis of Story Writing With Non-Targeted Information

Steps	Prompts	Training directions	Non-targeted information
Create a setting (when, where, who)	"Show me the first step in writing a story."	"First of all, you need to provide a general frame for your story (who, where, and when). I am going to show you a starting sentence (e.g., Not too long ago, there was an old woman who lived with her cat in a tiny house)."	"It is important to come up with a creative setting."
Introduce a problem	"Show what comes next in writing a story."	"Next, you need to explain something that happened in your story. I am going to show you a sentence that includes a problem (e.g., Because the woman fed the cat so much, it grew too big to sleep besides her in her bed)."	"Remember to begin your sentence with a capital letter."

Think of a solution	"Show what comes next in writing a story."	"Next, you need to relate how what happened ended up happening. I am going to show you a sentence that provides a solution (e.g., "The woman decided to sleep on the floor and let the cat sleep in her bed)."	"Remember to place the correct punctuation mark at the end of the sentence."
Describe the consequences	"Show what comes next in writing a story."	"Next, you need to wrap up your plot and conclude it. I am going to show you a sentence that finishes a storyline (e.g., The cat was happy, but the woman thought that she should not have fed the cat so much)."	"Describing how people feel makes your story more interesting."
Proofreading	"Show me the last step in writing a story."	"This is how you proofread your story. I am going to read my text aloud and check for mistakes."	"Reading your story aloud is a good way to proofread."

The second lesson started with the steps that were not covered in Session 1. Once a story was finished, the instructors guided the students through finding and correcting mistakes in the text. They stated: "I will show you how to proofread a story." Immediately afterwards (0-s delay), they read their model text aloud, checked for errors in spelling and grammar, and explained: "Reading your story aloud is a good way to proofread." Subsequently, the instructors prompted the students by saying: "Show me the last step in writing a story." If the students began proofreading within 5 s and finished within 2 min, the instructors gave positive feedback. If the targeted task was not performed by the students, the prompting procedure was repeated.

During the third and all following sessions, the instructors practiced composing stories with the students, each time using different randomly drawn writing prompts. After participants were able to complete the routine three times in a row without making a mistake and within

the given time frame, the instructors limited themselves to only indicating the prompts in Table 1 ("Show me the first step in writing a story," "Show me what comes next in writing a story," "Show me the last step in writing a story"). Whenever a student got stuck or made a mistake, the instructors provided guided feedback. Towards the end of the intervention, the instructors encouraged the participants to embellish their narratives by writing more sentences and including more adjectives. While doing that, they gradually faded their support.

2.7. Reliability

A female special educator with over 10 years' teaching experience was present for 18 (50%) of the 36 training sessions (12 for Lene, 11 for Yusem, and 9 for Lara) to assess procedural reliability. During each observation, she marked a checklist that was based on the manual to which the two graduate university students adhered as they worked with the students. The procedural reliability was rated at 100%.

After every story was graded by the two instructors, a male paraprofessional rated three randomly selected texts (23.08%) composed during baseline conditions and seven randomly selected texts (21.88%) composed during treatment conditions. This rater had no previous knowledge about the study but had been briefed by the third author on the use of the rubric during a one-hour training session. For the interrater reliability, Spearman's rank correlation for total scores across both conditions was 0.93.

2.8. Social Validity

Upon conclusion of the study, the two instructors met with each student individually to solicit their perspectives on the intervention. They thanked the children for their participation and asked them to fill out a social validity scale consisting of seven items ("Did you enjoy writing the stories?," "Did the instruction help you write better stories?," "Do you think you can write better stories now than before the training?," "Do you enjoy writing stories now more than before the training?," "How did you like the feedback at the beginning of each session?," "Would you recommend the training to your friends?"). For each question, the participants had the option of choosing between a happy, neutral, and sad smiley image.

3.   Results

The "Scan" package by Wilbert (2020) for the statistics program "R" was used to evaluate the descriptive data as well as the overlap indices and regression analyses. Additionally, the mean baseline difference (MBD) was calculated manually (O'Brien & Repp, 1990).

First, the three students wrote considerably longer stories during the intervention than during baseline. On average, Lene produced 30.67 (SD = 6.11), Yusem produced 23.75 (SD = 5.85), and Lara produced 57.83 (SD = 16.20) words before the treatment started. By comparison, while the treatment was implemented, Lene wrote a mean number of 68.25 (SD = 29.88), Yusem wrote 51.18 (SD = 17.26), and Lara wrote 115.56 (SD = 32.01) words. That

is, the text length from baseline to intervention increased by 122.53%,115.49%, and 99.83% for Lene, Yusem, and Lara, respectively.

As illustrated in Figure 1, Lene showed a negative trend in the baseline but a direct increase in performance upon the onset of the intervention. After the initial increase, a downward trend can be observed again, before data eventually increased rapidly and steeply. Yusem initially showed a drop in data in Phase A, before the values stabilized with a slight positive trend. Here, again, a level effect is visible as the intervention set in, and overall a gradual increase with a smaller drop in data at the end. Finally, up to the first measurement point Lara showed a very stable baseline with a level effect from Phase A to Phase B. In Phase B the data increased steadily. Only at measurement times 11 and 12 a drop in the data is visible before it rises again. All in all, there was a steady increase in data in Phase B for all three participants.
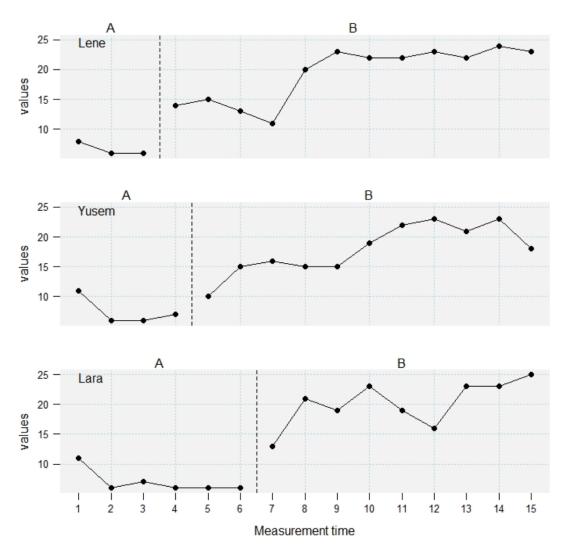

Figure 1

Data for the Writing Scores in Phase A and B for All Participants

The descriptive data (Table 2) show an increase of 189.81% from Phase A to Phase B for Lene and a maximum achieved value of 24.00 in the intervention phase. Yusem displayed an increase of 138.80% and a maximum value of 23.00 in Phase B, while Lara had a maximum value of 25.00 and an increase of 188.86%.

Table 2

Descriptive Data for the Dependent Variable Across All Participants

	N (A)	N (B)	M (A) (*SD*)	M (B) (*SD*)	Max (B)	MBD
Lene	3	12	6.67(1.15)	19.33(4.68)	24.00	189.81%
Yusem	4	11	7.50(2.38)	17.91(4.13)	23.00	138.80%
Lara	6	9	7.00(2.00)	20.22(3.87)	25.00	188.86%

Note. N = number of measurement times; A = baseline; B = intervention; M = mean; SD = standard deviation; Max = maximum value in Phase B; MBD = mean baseline difference.

Additionally, overlap indices (Table 3) were calculated to obtain further information about the effectiveness beyond the descriptive analysis. For this purpose, the non-overlap of all pairs (NAP; Parker et al., 2011), the percentage of non-overlapping data (PND; Scruggs et al., 1987), and Tau-U (Parker et al., 2011) were used. The *p*-value for the PND was calculated according to Tarlow and Penland (2016). For Tau-U, we applied the calculation formula that takes an A Phase trend into account (A vs. B + trendB – trendA). For the NAP, strong and significant effect sizes were identified (*p*<.01) across all students. The same goes for the PND. Regarding Tau-U, all students displayed a large change: Lene (0.74, *p*<.001), Yusem (0.72, *p*<.01), and Lara (0.75, *p*<.001).

Table 3

Overlap Indices for the Dependent Variable Across All Participants

Name	NAP	*p*	PND	*p*	Tau-U	*p*
Lene	100.00	<.01	100.00	<.01	0.74	<.001
Yusem	98.00	<.01	90.91	<.01	0.72	<.01
Lara	100.00	<.01	100.00	<.01	0.75	<.001

Note. NAP = non-overlap of all pairs; PND = percentage of non-overlapping data.

To complete the visual and quantitative analysis, a regression model (Table 4) was calculated per child and across all participants (Level 1 and Level 2 analysis). Lene and Yusem show statistically significant level effects ($p<.05$) with beta coefficients of 6.67 (Lene) and 6.207 (Yusem). Lara's data revealed a significant level ($p<.01$) and slope effect ($p<.05$) from Phase A to Phase B. Her performance increased by 1.66 scale points per intervention session. Level 2 analysis indicates no overall trend in Phase A. There was a statistically significant level effect ($p<.001$) and a statistically significant slope effect ($p<.05$), with an average increase of 0.73 scale points per intervention session.

Table 4

Regression Model for Dependent Variable Across All Participants (Level 1 and Level 2 Analysis)

	B	SE	*t*	*p*
		Lene		
Intercept	8.67	4.00	2.17	.05
Trend	-1.00	1.85	-0.50	.60
Level	6.67	2.88	2.31	<.05
Slope	2.08	1.87	1.11	.29
		Yusem		
Intercept	10.50	3.11	3.38	<.01
Trend	-1.20	1.13	-1.06	.31
Level	6.21	2.68	2.32	<.05
Slope	2.20	1.16	1.90	.08
		Lara		
Intercept	9.60	2.50	3.84	<01

Trend	-0.74	0.64	-1.16	.27
Level	10.50	2.76	3.81	<.01
Slope	1.66	0.73	2.27	<.05
Overall				
Intercept	6.373	1.165	5.469	<.001
Trend	0.246	0.314	0.784	.44
Level	5.939	1.369	4.338	<.001
Slope	0.728	0.328	2.219	<.05

Finally, all three students completed a social validity questionnaire. Responses showed that they enjoyed writing the stories, found the instruction helpful, viewed their writing skills as being better than before the intervention, and would recommend the training to their friends. Lene gave a neutral response to the question of whether she liked the feedback at the beginning of each session. However, the two other children found it helpful to receive a response to their texts.

4.   Discussion

4.1. Main Findings and Implications

Results from data collected during the intervention show that the simultaneous prompting procedure with non-targeted information was effective in teaching composition to all three students. The visual analysis revealed a direct increase at the onset of the intervention for all participants. Interesting, the visual analysis also indicates phases during the intervention where the data show a decline that is followed by an increase in writing quality. This may be linked to external reasons like the writing prompt, low motivation, the time of day when the intervention took place, or other factors related to the setting.

In summary, all participants showed a steady increase in the quality of their writing throughout the intervention phase, with mean gains ranging from 99.83 % to 122.53% between Phase A and Phase B. Overlap indices (NAP, PND, Tau-U) further demonstrate that the intervention was highly effective with statistically significant results for all students.

The results of this single-case analysis add to the growing body of research on strategies that can help students with LD to improve their writing (Cook & Bennett, 2014; Gillespie Rouse & Sandoval., 2018; Kaldenberg et al., 2016). The findings are also consistent with those of other research linked to teaching chained academic tasks to students with

disabilities using the simultaneous prompting procedure (Hudson et al., 2013; Pennington et al., 2014; Tekin-Iftar et al., 2018). As such, they add to the limited body of research on the effectiveness of a simultaneous prompting procedure on the academic task of composition writing for students with LD. However, more research is needed with regard to specific types of tasks and specific disabilities to further validate its general effectiveness (Tekin-Iftar et al., 2018).

Observations in this study were consistent with the findings of MacArthur and Graham (1987), that struggling writers generally invest little time on planning activities. As a consequence, their stories tend to be short, incoherent, and often incomplete (Englert & Raphael, 1988; MacArthur & Graham, 1987). Furthermore, weak text production skills exert an additional strain on students' limited working memory and can negatively impact how well and how much they write (Graham et al., 2017). Hence, the step-by-step guidance and feedback provided by the simultaneous prompting procedure throughout the writing process may be able to support planning as well as generally reduce the cognitive load required to orchestrate the complexity of the writing process. Once teachers and students are trained in using this procedure, it can be applied to a variety of tasks, making it a particularly interesting and versatile tool for teachers. Additionally, students indicated that they enjoyed the intervention and found it useful in improving their writing. Thus, there is social validity to using this intervention with students with LD, at least for the participants in this study. This is a crucial factor, as strategies to increase engagement and motivation for writing can lead to improved writing productivity (e.g., Grünke, 2019).

4.2. Limitation and Future Research

The study is subject to certain limitations. First of all, it included data from only three participants. The study was conducted at one school, the participants were of similar age and educational background, and all of them attended the fourth grade. Therefore, it is not possible to generalize the findings to the cohort of all struggling writers or all students with LD. Further research with larger and more diverse groups would be beneficial for evaluating the promising effects of simultaneous prompting as a chained task intervention in the academic field of writing. Another limiting effect concerns the research design. Due to time constraints and difficulty conducting in-class interventions during the Covid pandemic, we did not collect any followup data. As a consequence, maintenance effects on writing outcomes were not observed. However, in other experiments, simultaneous prompting procedures were found to generate maintenance effects for writing-related tasks (Hudson et al., 2013; Pennington et al., 2010, 2012, 2014) as well as for both discrete and chained non-writing -elated tasks (Tekin-Iftar, 2018). In future studies, a collection of writing samples across participants prior to and following the intervention could be assessed to generate insights into possible generalization effects (Hudson et al., 2013).

Another factor limiting the results of this study is the complexity of assessing the quality of a text. Rubrics are currently the most common method used to assess the quality of writing probes over time (Grünke et al., 2019), but the risk of subjectivity can still limit the inference with a higher probability of low inter-rater reliability scores between assessors. For this reason, in the present study, two assessors scored the writing probes independently using an adapted writing rubric; in addition, a paraprofessional unfamiliar with the study rated three randomly selected texts produced during baseline and seven randomly selected writing probes produced during intervention, resulting in a percentage of agreement of 0.93 between assessors. An additional limiting factor with regard to the validity of the intervention is that both cognitive and motivational variables can support students in their writing progress (Graham et al., 2017). The study did not measure which method was responsible for the positive outcome and to what extent.

Finally, Pennington et al. (2014) used simultaneous prompting in combination with computer-assisted instruction (CAI) and found positive effects for story composition. It would be beneficial to conduct more research on how CAI or technology-aided instruction and intervention (TAII) and simultaneous prompting procedures can be combined as a way to maximize both the positive effects computers can add to an intervention (Grünke, 2006) and the systematic instruction of a simultaneous prompting procedure.

4.3. Conclusions

Despite the above limitations, the simultaneous prompting procedure with non-targeted information was found to be effective for improving the quality of stories of three students with LD in the academic field of writing instruction. Thus, the results of this study offer insight into a previously unexplored area of writing with students with LD. The findings strongly point to simultaneous prompting with non-targeted information being a successful method of improving the quality of stories written by students with LD. More research is needed to further strengthen the evidence found in this experiment, taking into consideration the limitations mentioned above when replicating the study.

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Appendix E: "Erklärung zur Eigenleistung" [Declaration of own performance]

Publication No. 1	
Nobel, K. & Grünke, M. (2017). Über die Auswirkungen einer PC-gestützten Schreibförderung auf die Länge und Qualität von Aufsätzen von risikobelasteten Fünftklässlerinnen und Fünftklässlern. *Empirische Sonderpädagogik, 9*(4), 323-340. [The effects of a computer-assisted writing instruction on the length and quality of essays written by fifth graders at risk for school failure]	
Research idea	Overall control
Current state of research	Overall control
Design/ Measurement	With Co-Author
Study	Overall control
Data analysis	With Co-Author
Publication	With Co-Author

Publication No. 2	
Grünke, M., Nobel, K.& Bracht, J. (2019). Effects of the STOP and LIST Strategy on the Writing Performance of Struggling Fourth Graders. *Journal of Education and Learning, 8*(2),1-13.	
Research idea	Overall control
Current state of research	Overall control
Design/ Measurement	With Co-Authors
Study	Overall control
Data analysis	With Co-Authors
Publication	With Co-Authors

Publication No. 3	
Nobel, K. & Grünke, M. (2020). Effects of a Computerized STOP & LIST Intervention to Foster Text Production Skills in Students Who Struggle With Composition Writing. *Insights into Learning Disabilities 17*(1), 73-85	
Research idea	Overall control
Current state of research	Overall control
Design/ Measurement	Overall control
Study	With Co-Authors
Data analysis	With Co-Authors
Publication	With Co-Authors

Publication No. 4	
Nobel, K., Barwasser, A., Grünke, M., Asaro-Saddler, K., & Saddler, B. (2021). Using a simultaneous prompting procedure to improve the qualitative writing of three students with learning disabilities. *International Education Studies, 14*(11), 81-93.	
Research idea	Overall control
Current state of research	Overall control
Design/ Measurement	With Co-Authors
Study	With Co-Authors
Data analysis	Overall control
Publication	Overall control

Appendix F: "Erklärung zur Selbstständigkeit" [Declaration of independence]

Eidesstattliche Erklärung nach § 11 (1) 8 PromO

Ich versichere eidesstattlich, dass ich die von mir vorgelegte Dissertation selbständig und ohne unzulässige Hilfe angefertigt, die benutzten Quellen und Hilfsmittel vollständig angegeben und die Stellen der Arbeit einschließlich Tabellen, Karten und Abbildungen, die anderen Werken im Wortlaut oder dem Sinn nach entnommen sind, in jedem Einzelfall als Entlehnung kenntlich gemacht habe sowie dass diese Dissertation noch keinem anderen Fachbereich zur Prüfung vorgelegen hat.

Die Promotionsordnung ist mir bekannt.

Die von mir vorgelegte Dissertation ist von Prof. Matthias Grünke betreut worden.

[I affirm in lieu of an oath that I have prepared the dissertation submitted by me independently and without unauthorized assistance, that I have fully indicated the sources and aids used, and that I have identified in each individual case as borrowed those passages of the dissertation, including tables, maps, and illustrations, which are taken from other works in terms of wording or meaning, and that this dissertation has not yet been submitted to any other department for examination.

I am familiar with the doctoral regulations.

The dissertation submitted by me was supervised by Prof. Matthias Grünke.]

Appendix G: Publications

Grünke, M., Nobel, K. & Bracht, J. (2019). Effects of the STOP and LIST strategy on the writing performance of struggling fourth graders. *Journal of Education and Learning, 8*(2), 1-13.

Nobel, K., Barwasser, A., Grünke, M., Asaro-Saddler, K., & Saddler, B. (2021). Using a simultaneous prompting procedure to improve the qualitative writing of three students with learning disabilities. *International Education Studies, 14*(11), 81-93.

Nobel, K. & Grünke, M. (2017). Über die Auswirkungen einer PC-gestützten Schreibförderung auf die Länge und Qualität von Aufsätzen von risikobelasteten Fünftklässlerinnen und Fünftklässlern. *Empirische Sonderpädagogik, 9*(4), 323-340.

Nobel, K. & Grünke, M. (2020). Effects of a computerized STOP & LIST intervention to foster text production skills in students who struggle with composition writing. *Insights into Learning Disabilities, 17*(1), 73-85