

Describing multifaceted writing interventions: From design principles for the focus and mode of instruction to student and teacher activities

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Abstract: To enable a proper evaluation of the results of writing interventions for scientific replication and theory building, it is of vital importance that the design principles underlying an intervention and operationalization thereof are clearly described. A detailed description of a writing intervention is also important from a practical point of view, to foster dissemination and successful implementation of the intervention into practice. In this paper we propose a framework for reporting on the design principles of multifaceted intervention programs in a systematic manner. Unique features of this framework are that we (1) separate the design principles for the focus and mode of instruction, (2) systematically describe how these principles are integrated and operationalized into learning and teaching activities, (3) systematically describe the professional development teachers need to be able to execute the teaching activities. We demonstrate how this framework can be applied, with a worked example of an intervention that we designed, implemented and tested in elementary schools in the Netherlands. The framework provided in this paper makes core features of writing interventions transparent to reviewers, other scholars, and educational practitioners, and warrants that an intervention includes all necessary elements in the most optimal way. Moreover, this type of framework facilitates the comparison of interventions across contexts and countries.

Keywords: Design principles; writing intervention; framework



Koster M., & Boucher, R. (2018). Describing multi-faceted writing interventions: From design principles for the focus and mode of instruction to student and teacher activities. *Journal of Writing Research*, 10(2), 189-224. doi: 10.17239/jowr-2018.10.01.03

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Examining the effects of writing interventions provides insight into what works (and does not work) in teaching writing and contributes to the development of theories on writing instruction and writing development. Various meta-analyses show an accumulating body of writing intervention studies (Graham, McKeown, Kiuahara, & Harris, 2012; Graham, Harris, & Santangelo, 2015; Graham & Perin, 2007; Hillocks, 1986; Koster, Tribushinina, De Jong, & Van den Bergh, 2015). To enable a proper evaluation of the results of these writing interventions for scientific replication, concurrent studies, and theory building, it is of vital importance that the design principles underlying the intervention and operationalization thereof are clearly described (Bouwer & De Smedt, 2018; Rijlaarsdam, Janssen, Rietdijk, & Van Weijen, 2018). However, this is often problematic. In their meta-analysis on writing intervention studies in the upper elementary grades, Koster and colleagues (2015) found large heterogeneity between studies within the same intervention category, possibly caused by differences in operationalization, such as the materials used, the instruction that was given, or the amount of time spent on the intervention. As these aspects were not sufficiently reported, they could not be included as explanatory variables in the analysis, hampering a meaningful comparison between interventions and interpretation of the results. This issue is also raised by Rijlaarsdam and colleagues (2018): “in research papers on single interventions, the intervention itself is rarely laid out fully for the reader who wants to gain insight in its intricacies and thereby find out what its crucial elements could have been” (p. 280).

A detailed description of a writing intervention is also important from a practical point of view, to foster dissemination and successful implementation of the intervention into practice. During implementation, teachers can make adaptations to the original design of the intervention in order to create a better fit to the classroom or school context or to meet specific needs of students. However, when teachers adapt crucial aspects of the design of the program, this might pose a potential threat to the internal validity of the results (cf. Pérez, Van der Stuyft, Zabala, Castro, & Lefèvre, 2016). Previously, researchers have tried to circumvent this issue by executing the intervention themselves, or by using trained research assistants to implement the intervention. A close examination of the 32 writing intervention studies that were included in the meta-analysis of Koster and colleagues (2015) revealed that in nearly half of the studies (49%) teachers were not involved in any stage of the research process (see also Koster, Bouwer, & Van den Bergh, 2017). It is not realistic to expect any long-term effects from an intervention or lasting changes in teacher behavior when teachers are not involved in the research process in a meaningful way (Borko, 2004). Thus, to make a sustainable impact on educational practice, it is essential that teachers participate in the study. An explicit and detailed description of the essential elements of the intervention as well as how they are operationalized in learning and teaching activities supports teachers in the implementation of the crucial aspects of the intervention as intended, thus warranting intervention fidelity. At the same time, such a detailed description enables

researchers to systematically observe and evaluate the balance between fidelity and adaptations to classroom practice.

Hence, for scientific purposes (e.g., validity, reliability, and theory building) as well as for practical purposes (e.g., dissemination and effective implementation in educational practice), it is important to describe writing interventions in detail. In this paper we propose a framework for reporting on the design principles of multifaceted intervention programs that allows for a systematic and analytic description of how each design principle is operationalized into activities for students and teachers as well as the professional development teachers might need to execute these activities. To illustrate how this framework can be applied, we will use a worked example of an intervention that we designed, implemented and tested in elementary schools in the Netherlands.

1. Framework for describing interventions: The building blocks

Starting point for the framework for describing writing interventions is the description of theory-driven underlying design principles. In line with Reigeluth (1999), Merrill (2002) regards these principles as “relationships that are always true under appropriate conditions regardless of program or practice” (p. 43). Reviewing instructional design theories, Merrill (2002) has identified five basic shared prescriptive principles that promote learning: when learners are engaged in whole and authentic tasks, when existing knowledge is activated as a foundation for new knowledge, when new knowledge is demonstrated, when new knowledge is applied by the learner, and when new knowledge is integrated into the learner’s world. However, these principles can only be applied to describe the instructional approach of an intervention, irrespective of the content. A writing intervention, however, is an interplay of what is taught and how this is taught (Fidalgo, Harris, & Braaksma, 2018). In his meta-analysis on effective writing interventions Hillocks (1984) addressed this issue, and he introduced the terms mode of instruction (i.e., the instructional approach, teacher activities and instructional materials) and focus of instruction (the content of the intervention, i.e., the knowledge and skills students have to acquire).

Merrill’s principles (2002) adequately describe the mode of instruction, however, they fall short to describe the focus of an intervention program. Thus, an additional set of design principles are needed: the parameters of the intervention-as-construct (Rijlaarsdam et al., 2018). These design principles should describe which instructions lead to which learning outcome via which learning activity, based on theories and previous research. Together, these design principles form the building blocks of the intervention (Rijlaarsdam et al., 2018). Following Van den Akker (1999), Rijlaarsdam and colleagues (2018) propose to report these design principles as “if-then” statements: “If you want to design intervention X [for purpose/function Y in context Z]; then you are best advised to give that intervention the characteristics C1, C2, ..., Cm [substantive emphasis]; because of theoretical arguments T1, T2, ..., Tp.” (p. 285).

The elegance of if-then statements is that they force researchers to specify interventions in terms of the desired learning outcome, and how to achieve this. However, in this way of reporting, the focus and mode of instruction are highly intertwined. To increase transparency in the choices researchers have made during the design process, it is desirable that the design principles for the focus and mode of instruction (as well as their theoretical underpinnings) are described systematically. Therefore, we propose to adapt the reporting system of Rijlaarsdam and colleagues (2018) in such a way that these design principles are separated. Reporting the design principles for the focus and mode separately allows for a coherent and systematic description of how these two elements are subsequently combined and operationalized in learning and teaching activities. Learning activities are the crucial element of any intervention program: (meta-)cognitive activities with a predetermined purpose that students have to perform to achieve a certain learning outcome (Rijlaarsdam et al., 2018; López, Rijlaarsdam, Torrance, & Fidalgo, 2018). Teaching activities are all activities teachers have to execute to support student learning, such as instructions they have to provide, issues they need to address during classroom instruction, and the prerequisite conditions for task execution (worksheets, writing prompts, etc.). A systematic description of these activities facilitates the replication and implementation of an intervention.

Obviously, the role of the teacher during the intervention is an important one (McKeown, Fitzpatrick, & Sandmel, 2014). Teachers are the link between the student and the program, and an intervention can only be successful when students are provided with the prompts (e.g. instruction, material, writing task) necessary to activate the learning activities. To facilitate that an intervention is implemented as intended, it is crucial that teaching activities are described as detailed as possible. An element that is essential for the implementation of the intervention as intended, but has so far been underexposed in the description of interventions, is the support (e.g., supplementary materials, training or other professional development activities) that teachers need to be able to implement the intervention as intended. For instance, previous research has shown that teachers differ in how effective they are in implementing a writing intervention (Bouwer, Koster, & Van den Bergh, 2018). It is critical to recognize these differences and to understand teachers' attitudes, beliefs, and self-efficacy on the subject of (teaching) writing and whether they already possess the necessary skills and/or knowledge to effectively teach writing (Harris, Lane, Graham, Driscoll, Sandmel, Brindle, & Schatschneider, 2012). To teach effectively, teachers need pedagogical content knowledge, which is a mix of content knowledge and general pedagogical knowledge on the practice of teaching (Ball, Thames, & Phelps, 2008). If teachers lack the required knowledge, some kind of support is needed to empower them. As an intervention often includes elements that are new and innovative, it is important to make an inventory of what support teachers might need for successful implementation (Fidalgo et al., 2018). This kind of inventory helps to design support materials and professional development activities (Ball et al., 2008). Research has shown that

professional development activities aimed to increase teachers' pedagogical content knowledge and skills, lead to change in instruction, which ultimately leads to students' learning (Desimone, 2009; Graham & Harris, 2018). As professional development activities can have a substantial impact on the effectiveness of an intervention, we propose to also include a specific description of the support provided to teachers when describing an intervention.

To summarize, to fully capture the multifaceted character of a comprehensive writing intervention, a framework for reporting on its design should, in our opinion, include the following elements:

- Design principles for the focus of instruction;
- Design principles for the mode of instruction;
- How focus and mode of instruction are integrated and operationalized in learning activities for the students;
- Teaching activities that are required to make learning activities possible;
- Training and support that teachers need to be able to perform these teaching activities.

We developed a general framework in which we accounted for all those elements, see Table 1. In the next section we will provide a worked example of how we used this framework to describe our own writing program Tekster.

Table 1. Framework for describing an intervention study

Design principles		Intervention program		
Focus of instruction	Mode of instruction	Learning activities	Teaching activities	Professional development
What are we going to teach?	How are we going to teach this?	Based on focus and mode, what activities do students have to perform?	What do teachers need to do to support students' learning?	What kind of support do teachers need to be able to perform desired actions?

2. A worked example: Applying the framework to the writing program Tekster

In the Netherlands it has been established that students' writing performance at the end of elementary school does not meet the standards set by the Ministry of Education (Henkens, 2010). As a target goal for the end of elementary school the Ministry

proposes that “students are able to write coherent texts, with a simple linear structure on various familiar topics; the text includes an introduction, body, and ending” (Expert Group Learning Trajectories, 2009, p.15). However, a recent national assessment in the Netherlands revealed that more than 60% of students at the end of elementary school (i.e., grade 6) are not able to write texts that convey a simple message to a reader (Kuhlemeier, Til, Hemker, Klijn, & Feenstra, 2013). Furthermore, this assessment also showed that students’ writing skills improved negligibly from fourth to sixth grade (Kuhlemeier et al., 2013). Moreover, the Dutch Inspectorate of Education determined the quality of writing instruction to be sufficient in only one-third of the nation’s schools (Henkens, 2010). Thus, an improvement in elementary-level writing instruction is required. For this purpose, we developed the writing program Tekster [Texter].

Tekster is a comprehensive strategy-focused writing program for the upper grades of elementary education (grade 4 to 6). The program proved to be effective in improving students’ writing, as was shown in two large-scale studies, in which in total 2785 students and 144 teachers from 52 schools participated (Bouwer et al., 2018; Koster et al., 2017). In the first study the overall effect size was Cohen’s $d = 0.32$ in all relevant writing genres (narrative, descriptive, and persuasive), generalizing over tasks, students, and teachers (Bouwer et al., 2018). This effect size was comparable to students’ average progress of more than half a grade level. In the second study, in which we used the same approach with additional professional development, the effect size was even larger, Cohen’s $d = 0.55$, an average progress of one and a half grade level (Koster et al., 2017). Furthermore, teachers indicated that they were more positive about writing and felt more efficacious about teaching writing after the intervention.

As Tekster is a comprehensive program, containing various components, it is important that all components are explicitly described to enable further in-depth research into the effectiveness of the overall program, as well as of the separate components. We will demonstrate, with Tekster as an example, that the proposed framework, displayed in Table 1, is a useful instrument to achieve this. First, we will discuss the design principles for the focus and mode of instruction (the building blocks of the intervention), subsequently how these are integrated and operationalized into a coherent program of learning and teaching activities, with supplementary professional development for teachers.

2.1 Design principles for the focus of instruction

The Tekster intervention was directed at three focal points: the writing process, the writing product, and the writer’s self-regulation. For developing writers, it is quite demanding to perform several resource-demanding cognitive activities simultaneously: activate prior knowledge, generate content, plan, formulate, and revise, while they also have to take into account the communicative goal and the intended audience of the text (Fayol, 1999). This often results in texts that are not sufficiently adapted to the communicative goal and intended audience (Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott, 1992; McCutchen, 1996). Thus, to improve the writing performance

of developing writers, we should look at effective ways to optimize their writing process, to increase their knowledge of written products, and to develop skills to manage the cognitive overload that occurs during writing.

Improving the process: Strategy instruction

In Tekster, strategy instruction was applied to improve the writing process. Strategy instruction involves the explicit teaching of an approach to writing tasks. Roughly two types of strategy instruction can be distinguished: genre-specific strategy-instruction and general strategy instruction. In genre-specific strategy-instruction, students are taught genre- or task-specific strategies, for instance for writing a narrative text (Brunstein & Glaser, 2011) or for writing a persuasive essay (Wong, Hoskyn, Jai, Ellis, & Watson, 2008). For Tekster, we aimed to improve students' overall writing process, instead of writing in a particular genre or task. Therefore, we opted for general writing strategy instruction. In general strategy instruction, students are taught strategies designed to guide general writing processes, such as brainstorming (Troia & Graham, 2002) or revising (Fitzgerald & Markham, 1987). Most general strategies target one or more of the phases of the writing process, as described by model of Flower & Hayes (1981): generate content, organize, formulate, reread, evaluate, revise. This type of strategies reduce the number of cognitive processes that are active at the same time, which helps writers to manage cognitive overload during writing (Kellogg, 1988, 2008). For instance, when students are taught to plan during the prewriting phase, they can focus on other processes while drafting. A substantial body of research has examined the impact of explicitly teaching students to use writing strategies and results are remarkably consistent and positive. Recent meta-analyses reported large average weighted effect sizes (ESs), ranging from 0.82 to 1.15, for explicit strategy instruction (Graham, 2006; Graham et al., 2012; Graham & Perin, 2007; Hillocks, 1984; Koster et al., 2015).

Improving the product: Text structure instruction

To improve the written product, we applied text structure instruction. Text structure instruction is the explicit teaching of criteria for the written product, depending on the communicative goal and intended audience of the writing task. During text structure instruction the elements and organization of different text types are specifically taught. This way, students acquire knowledge about how texts are structured and how different text genres require different structures, which helps them to improve their own writing products. Research examining the impact of explicit text structure instruction for elementary-aged students spans three major genres: narrative (Fitzgerald & Teasley, 1986; Gordon & Braun, 1986), persuasive (Crowhurst, 1990, 1991; Scardamalia & Paris, 1985), and informative (Bean & Steenwyk, 1984; Raphael & Kirschner, 1985). The findings from two recent meta-analyses provide further support for the positive effect of text structure instruction. Graham et al. (2012) and Koster et al. (2015) reported

an average weighted ES for explicit text structure instruction of 0.59 and 0.76, respectively.

Improving writer's self-regulation: goal-setting, peer- and self-assessment

To improve the writer's self-regulation skills, we employed goal-setting, peer- and self-assessment. Self-regulation is defined as "the process whereby individuals activate and sustain behaviors, cognitions, and affect, which are systematically oriented toward the attainment of goals" (Schunk, 2012, p. 123). Tekster's ultimate goal is that students can monitor and regulate their own progress in relation to the communicative goal. To become a proficient writer, it is essential that students possess adequate self-regulatory skills. Previous research has shown that when strategy instruction is combined with teaching self-regulatory skills, the impact on students' writing is greater than for strategy instruction alone (ES = 1.17, Graham et al., 2012).

Goal-setting is a particularly effective self-regulation strategy. Assigning students specific goals for improving the content of their texts and making them aware of the intended audience leads to improvements in planning, drafting, and revising (Ferretti, Lewis, & Andrews-Weckerly, 2009; Ferretti, MacArthur, & Dowdy, 2000; Graham, MacArthur, & Schwartz, 1995; Midgette, Haria, & MacArthur, 2008). Another effective strategy to improve students' self-regulation is peer-assessment. When reading each other's work students become aware of the effect of their text on a reader, which provides them with valuable information on the communicative effectiveness of their texts. Positive effects of peer-assessment have been demonstrated by several studies (cf. Hoogeveen, 2013; Paquette, 2008; Yarrow & Topping, 2001). Ultimately, students should develop adequate self-regulatory skills to evaluate their own writing product in order to determine whether they attained the desired communicative goal. Research has shown that teaching students to apply self-assessment, improves the quality of their writing (Ross, Rolheiser, & Hogaboam-Gray, 1999; Tienken & Achilles, 2003). Table 2 shows the framework for describing the design of an intervention with in the first column the three main design principles for the focus of instruction of Tekster.

2.2 Design principles for the mode of instruction

In writing instruction, learning to write and task execution are often inextricably linked. Usually students have to learn how to write and produce texts simultaneously (Rijlaarsdam & Couzijn, 2000). For developing writers text production is already so cognitively demanding that they have minimal attentional capacity left to learn from their writing experiences (Rijlaarsdam & Couzijn, 2000). The impact of writing instruction on learning might depend on whether instructions are provided before, during or after writing (cf. Hillocks, 1984). It is therefore important to carefully design the format and sequence of instruction. To address this issue, the mode of instruction in Tekster involved three main design principles: (1) observational learning, to separate learning from task performance, (2) explicit instruction, to prepare students for practice

Table 2. The focus of instruction in Tekster

Design principles		Intervention program		
Focus of instruction	Mode of instruction	Learning activities	Teaching activities	Professional development
1. Process related: Strategy instruction	How are we going to teach this?	Based on focus and mode, what activities do students have to perform?	What do teachers need to do to support students' learning?	What kind of support do teachers need to be able to perform desired actions?
2. Product related: Text structure instruction				
3. Writer's self-regulation: goal-setting, peer- and self-assessment				

and (3) deliberate practice with gradual release of responsibility, to guide students towards independent performance.

Separate learning and task performance: Observational learning

One of the main design principles for the mode of instruction in Tekster is observational learning. Observational learning was first described and studied by Bandura (1986) as part of social cognitive learning theory. Learning by observing provides the opportunity to separate task performance from learning (Zimmerman & Risemberg, 1997). Observing someone (teacher or peer) completing an unfamiliar task is less demanding on working memory than having to actually perform the task yourself. This is particularly true when the skill being learned is cognitively complex—such as writing (Rijlaarsdam, 2005).

In writing instruction, observational learning is frequently implemented by means of modeling. Modeling involves explaining, demonstrating, and verbalizing one's thoughts and actions, with the aim of eliciting behavioral change in an observer (Schunk, 2012). This kind of modeling prepares students for the forthcoming composing task in the initial phase of the writing process. Several studies have demonstrated the effectiveness of teacher modeling as an instructional practice for teaching writing strategies (e.g., Fidalgo, Torrance, Rijlaarsdam, Van den Bergh, & Lourdes Álvarez, 2015; Graham, Harris, & Mason, 2005). Watching someone who is perceived as similar overcome difficulties and/or improve performance over time, i.e., coping modeling, is particularly beneficial for weaker students (Schunk, 1987).

When peers—rather than teachers—act as models, perceived model-observer similarity is high because of the developmental resemblance (Schunk, 1987). Several studies reported positive effects of peer modeling on students' writing performance and

writing processes (Braaksma, 2002; Braaksma, Rijlaarsdam, Van den Bergh, & Van Hout-Wolters, 2010; Couzijn, 1999; Raedts, Rijlaarsdam, Van Waes, & Daems, 2007; Van Steendam, Rijlaarsdam, Van den Bergh, & Sercu, 2014).

Observational learning can also be applied by confronting students with reader reactions to provide them feedback on the communicative effectiveness of their text (cf. Couzijn & Rijlaarsdam, 2004; Holliway & McCutchen, 2004; Moore & MacArthur, 2012). Developing writers often are unaware of communicative deficiencies in their own work. Observing readers and discussing readers' experiences provide students with valuable clues on the readers' needs and whether they succeeded in fulfilling these needs (Couzijn & Rijlaarsdam, 2004; Shriver, 1992). A fair number of studies demonstrated improvements in students' writing after they experienced the effect of their text on a reader (Couzijn, 1995; Couzijn & Rijlaarsdam, 2004; Holliway & McCutchen, 2004; Moore & MacArthur, 2012, Rijlaarsdam, Couzijn, Janssen, Braaksma, & Kieft, 2006).

Prepare for practice: Explicit instruction

Another important design principle for the mode of instruction in Tekster is explicit instruction. Improving students' writing performance cannot be accomplished solely through observational learning; there comes a time when students need to transition from observing writing models to actually composing themselves. Explicit and comprehensive instruction bridges the gap from observational learning to independent practice. For instance, explicit instruction can be used to activate students' background knowledge and to help them understand the purpose and benefits of the strategy being taught (Graham et al., 2005; Graham et al., 1995). Explicit instruction can also promote generalization of strategy use to other tasks and domains (O'Sullivan & Pressley, 1984).

Towards independent performance: Deliberate practice with gradual release of responsibility

The third and last design principle for the mode of instruction in Tekster is deliberate practice with gradual release of responsibility. To successfully complete a writing task, students must eventually progress through all the stages of the writing process. Teacher can support students during this process through the gradual release of responsibility (Pearson & Gallagher, 1983). A similar approach, viz. cognitive apprenticeship, is described by Kellogg (2008). With this approach, cognitive load is gradually shifted from observing models and explicit instruction to deliberate and guided practice and independent performance. This approach builds on Vygotsky's (1980) sociocultural theory and concept of the zone of proximal development. Vygotsky defined the zone of proximal development as the area between a student's level of independent performance and potential development, as determined by assisted performance. Teachers can facilitate progression from assisted to independent performance through scaffolding. That is, they control elements of a task initially beyond a student's capacity

to enable the development of skills within the range of competence (Kellogg, 2008; Wood, Bruner, & Ross, 1976). As a student progresses, teacher assistance is gradually reduced. Writing instruction programs that use gradual release of responsibility and scaffolding techniques have been shown to improve students' written language skills (Graham et al., 2005; Graham et al., 1995).

Table 3 shows the framework for describing the design of an intervention with in the second column the three main design principles for the mode of instruction of Tekster.

Table 3. The focus of instruction in Tekster

Design principles		Intervention program		
Focus of instruction	Mode of instruction	Learning activities	Teaching activities	Professional development
1. Process related: Strategy instruction	1. Observational learning	Based on focus and	What do teachers need to do to support students' learning?	What kind of support do teachers need to be able to perform desired actions?
2. Product related: Text structure instruction	2. Explicit instruction	mode, what activities do students have to perform?		
3. Writer's self-regulation: goal-setting, peer- and self-assessment	3. Deliberate practice with gradual release of responsibility			

2.3 From design principles to learning activities

The next step in the design process is to systematically combine the focus and mode of instruction into learning activities for students, see Table 4 (third column) for a short description of learning activities. As said before, the learning activities are the crucial part of any intervention, as these activities are expected to lead to a certain learning outcome. In Tekster we had three foci of instruction: strategy instruction, text structure instruction and self-regulation strategy instruction. For the mode of instruction, we constructed the following instructional sequence: observational learning to introduce new material/topics/content, followed by explicit instruction and deliberate practice with gradual release of responsibility. We applied this instructional sequence systematically to each focal point of instruction, to ensure that the focus and mode received equal attention. In Table 4 can be seen that, although we applied the same instructional sequence to each focal point of instruction, the actual learning activities differed as a consequence of the different nature of the focal points. In the next section of this paragraph which we will provide a more detailed overview of the learning activities for each focal point.

Learning activities for strategy instruction

The central strategy in Tekster is a general strategy for the approach of writing tasks, based on the steps of the writing process (Flower & Hayes, 1981). To support students in applying the strategy, the writing process is represented by acronyms: VOS (fox) for grade 4, DODO (dodo) for grade 5, and EKSTER (magpie) for grade 6. The letters of the acronyms represent the steps of the writing process as follows: VOS (fox) for Verzinnen (generate content), Ordenen (organize), Schrijven (write); DODO (dodo) for Denken (think), Ordenen (organize), Doen (do), Overlezen (read); Ekster (magpie) for Eerst nadenken (think first), Kiezen & ordenen (choose & organize), Schrijven (write), Teruglezen (reread), Evalueren (evaluate), Reviseren (revise).

Regarding observational learning and strategy instruction, as previous research reported positive effects of teacher modeling (cf. Fidalgo et al., 2015; Graham, Harris, & Mason, 2005) as well as peer modeling (cf. Braaksma, 2002; Braaksma et al., 2010; Schunk, 1987), we decided to implement both in Tekster. During the first lessons students observe, with the teacher as a (mastery) model, how to apply the steps of the strategy on different types of writing tasks (e.g., a story, a recipe, an invitation), and how to proceed from one step to the next. Further, in a number of lessons (5 out of 16) students observe peer models in video clips. These video clips are examples of coping modeling, showing students generating content for their texts-to-be-written, discussing the content and structure of texts written by peers, and writing a text together. After observing and comparing the peer models, students engage in plenary discussion activities, accompanied with guiding questions in their workbooks to facilitate these discussions.

Table 4. Translation of design principles for Tekster's focus and mode of instruction into learning and teaching activities.

Design principles		Teaching program		Professional development
Focus of instruction	Mode of instruction	Learning activities	Teaching activities	Training & support for teachers
1. Process related: Strategy instruction General approach for writing tasks, based on phases of the writing process: generate content, organize, formulate, reread, evaluate, revise	a. Observational learning	Observe/discuss/compare model(s), (teacher or peer) applying the writing strategy in different stages of the writing process	Modeling strategy use (thinking aloud while performing (part of) the writing task)	DVD with exemplary videos for modeling in the teacher manual, practicing modeling during first training session, instructions for the use of modeling in lesson plans in teacher manual
	b. Explicit instruction	Listen actively, retrieve relevant background knowledge from memory, take notes	Explain the components of the strategy, make students aware of the purpose and benefits of using writing strategy, activate student's background knowledge	Explanation of strategy and components in first training session and in general introduction of teacher manual, specific instructions for each lesson in lesson plans
	c. Deliberate practice with gradual release of responsibility	Apply the steps of the strategy to writing tasks: authentic tasks with clear communicative goal and intended audience in various genres	Provide help when needed through scaffolding and process feedback	Explanation of importance of feedback and practice with giving feedback in second training session, information on feedback in general introduction teacher manual, specific instruction for each lesson in lesson plans

Design principles	Teaching program	Professional development	Design principles	Teaching program
Focus of instruction	Mode of instruction	Learning activities	Focus of instruction	Mode of instruction
2. Product related: Text structure instruction Criteria for written product, depending on communicative goal and intended audience	a. Observational learning	Before writing: Observe/discuss/compare model(s), (teacher or peer) talking about criteria for and conventions of various text types, compare and discuss model texts of the same text type to derive criteria and conventions for a good text After writing: Evaluate peer/own text on the basis of the previously discussed criteria and give feedback (reader reaction), observe reader reaction, observe model revising on the basis of feedback	Before writing: Model the relevant aspects of the text type, provide model texts or show video clips of peer modeling After writing: Evaluate students' texts on the basis of previously discussed criteria, give feedback (reader reaction), model how feedback can be used in revision to improve the text	DVD with exemplary videos for modeling in the teacher manual, practicing modeling during first training session, instructions for the use of modeling in lesson plans in teacher manual, model texts are provided in workbooks, specific instruction for each lesson in lesson plans DVD with exemplary videos for modeling in the teacher manual, practicing modeling during first training session, instructions for the use of modeling in lesson plans in teacher manual, Explanation of importance of feedback and practice with giving feedback in second training session, information on feedback in general introduction teacher manual, specific instruction for each lesson in lesson plans

Design principles	Teaching program	Professional development	Design principles	Teaching program
Focus of instruction	Mode of instruction	Learning activities	Focus of instruction	Mode of instruction
	b. Explicit instruction	Listen actively, take notes	Explain why and how the criteria and conventions should be used, discuss important criteria and conventions on the basis of model texts	Specific instruction for each lesson in lesson plans in teacher manual
	c. Deliberate practice with gradual release of responsibility	Apply the discussed criteria to writing tasks: authentic tasks with clear communicative goal and intended audience After writing: Give feedback /assess own text according previously discussed criteria	Provide help when needed through scaffolding and product feedback	Explanation of and practice with how to assess text quality of and provide feedback on students' texts in second training session, information on feedback in general introduction teacher manual, specific instructions and suggestions for each lesson in lesson plans, rating scales with benchmark texts for three genres (narrative/descriptive/argumentative)

Design principles	Teaching program	Professional development	Design principles	Teaching program
Focus of instruction	Mode of instruction	Learning activities	Focus of instruction	Mode of instruction
3. Writer's self-regulation: Writer's monitoring and regulating of own progress in relation to communicative goals	a. Observational learning	Observe/discuss/compare model(s), (teacher or peer) setting goals and monitoring progress in relation to goals during the writing process, observe/discuss/compare effect of self-regulation on the written product.	Model self-regulation during writing, by thinking aloud during performing writing task	DVD with exemplary videos for modeling in the teacher manual, practicing modeling during first training session, suggestions for the use of modeling in teacher manual
	b. Explicit instruction	Listen actively, take notes	Explain why it is important to set communicative goals for writing in advance, explain the differences between various communicative goals, when and how during the writing process progress towards the communicative goal can best be monitored	General information on goal-setting and communicative goals in first training session and in introduction teacher manual. Specific information (i.e. communicative goal of the lesson) in lesson plans

Design principles	Teaching program	Professional development	Design principles	Teaching program
Focus of instruction	Mode of instruction	Learning activities	Focus of instruction	Mode of instruction
	c. Deliberate practice with release of responsibility	Set communicative goal before writing, monitor progress towards this goal during writing, regulate own writing process and adapt if necessary, evaluate written product in relation to communicative goal, revise if necessary.	Provide help when needed through scaffolding, and self-regulation feedback	Explanation of and practice with how to provide feedback in second training session, information on feedback in general introduction teacher manual, specific instructions and suggestions for each lesson in lesson plans

Explicit strategy instruction is provided in every lesson of the workbook. Students discuss this information plenary to make sure that they know what is expected of them. Students listen actively and take notes, if necessary. After each writing assignment (an authentic writing task with a clear communicative goal and intended audience) students find a “how-to” prompt with an icon of the acronym-animal and the steps of the strategy. These steps also serve as scaffolds during deliberate practice. During this phase students work in their workbook on a writing assignment. Each step of the strategy is a subassignment with accompanying written instructions on how to complete the task.

Learning activities for text structure instruction

In text structure instruction observational learning is applied through the use of model texts. With this type of modeling students receive two or three texts that differ in quality, which they have to compare and discuss in order to derive criteria and conventions for a good text. After writing, students evaluate each other’s texts and their own texts on the basis of these criteria and conventions. Students observe reactions of readers reading their text, which provides immediate feedback on the communicative effectiveness of their text and gives directions for revising the text. Subsequently they observe (with the teacher as a model) how to revise their texts on the basis of feedback.

Explicit text structure instruction concerns the explanation of the application of specific criteria and conventions for different genres. These are discussed plenary, students listen actively and take notes, if necessary. During deliberate practice students write various types of texts for which authentic writing tasks with various communicative goals and audiences are used. Specifically, in each grade they learn to write descriptive texts (e.g., a self-portrait or personal ad), narrative texts (e.g., a story or newspaper article), persuasive texts (e.g., a nomination email for a television program or a flyer for recruiting new members for a club), instructive texts (e.g., a recipe, rules for a game) and personal communication (e.g., a holiday postcard or invitation). The writing tasks comply with the goals set for the end of elementary school by the Dutch Ministry of Education. The level of difficulty ascended through the grades as follows: in grade 4, predominantly writing tasks were used in which the intended audience was in close proximity of the student, such as classmates, friends, or (grand-)parents. In grade 5, this was expanded to people with whom students have a more distal relationship, but are still familiar to them, such as their teacher, relatives, or neighbors. In grade 6, students also have to write texts that are intended for unfamiliar people, such as the editor of a newspaper, or the managing director of a company.

After having written their text, students assess (through peer-assessment or self-assessment), whether their texts meet the previously set criteria, scaffolded by guiding questions in the workbook.

Learning activities for self-regulation strategy instruction

During self-regulation strategy instruction, students observe (with their teacher as a model) how to set goals before writing, how to monitor progress towards these goals and make adaptations when needed. For this, a combination of mastery and coping modeling is used. Coping modeling is especially important in this respect, as students have to become aware of the difficulties they might come across during writing and how they can overcome them. Further, students also observe examples of how to apply strategies for peer- and self-assessment, with their teacher as model.

Explicit self-regulation strategy instruction concerns plenary discussion of the importance of goal-setting and the difference between various communicative goals, as well as when and how during the writing process progress can be evaluated. These are discussed plenary, students listen actively and take notes, if necessary. In the deliberate practice phase students practice with preset goals, and they are guided through the writing process by questions in their workbooks, during writing and after writing. They practice assessing the quality of texts (each other's or their own), giving peer feedback and using peer feedback to revise their texts.

2.4 From learning activities to teaching activities

Subsequently, we determined for each learning activity what activity is needed from the teacher to optimally support students' learning, see the fourth column in Table 4. During the learning activities that involve observational learning, the main teaching activity is modeling: thinking aloud while performing a writing task or a part thereof.

During explicit instruction the teacher explains plenary important aspects of, respectively, the writing process, the writing product and the writer's self-regulation. In particular, in strategy instruction the teacher explains the components of the strategy, and benefits of strategy use. In text structure instruction the teacher explains the criteria and conventions of different text types. Finally, in self-regulation instruction, the teacher explains the importance of goal-setting, various communicative goals, and how to monitor progress towards these goals by evaluating your own work or the work of others.

During deliberate practice teachers offer tailored scaffolding to individual students, provide help where needed, and give feedback on the writing process, writing product and the writer's self-regulation. In this phase of the lesson the teacher is supposed to move around the classroom, monitoring the students' progress and intervene if necessary. The teacher can provide individual scaffolding by modeling, asking questions, making suggestions, providing hints, providing individualized feedback or by linking students to a peer with whom they can collaborate.

2.5 Professional development activities for teachers

Lastly, we analyzed for each teaching activity what kind of training and support teachers would need to implement the intervention as intended (see Table 4, fifth column). Teachers are often ill-prepared to teach writing (Henkens, 2010; Pullens,

2012; Van der Leeuw, 2006), and some of the aspects of the Tekster intervention were quite innovative and could not be considered common knowledge. Professional development activities were therefore needed to enable teachers to successfully implement the intervention. According to Desimone (2009), there are five core features that determine effective teachers' professional development. These are (a) focus on the content and how students learn that content, (b) opportunities to engage in active learning, (c) coherence between the learning goals and teachers' knowledge and beliefs and state standards or policies, (d) sufficient duration of learning experiences, with activities that are spread over a larger span of time, and (e) collective participation in which teachers interact and learn from each other. In a conceptual framework she further elaborated how these core features of professional development improve student achievement. That is, teachers' experiences of features of effective professional development will bring about changes in teachers' knowledge and skills and/or in their attitudes and beliefs, which subsequently lead to improvements in their classroom practice, and ultimately also in their students' learning.

Using these core principles for effective professional development, we identified for each teaching activity what kind of support teachers might need and how we could provide this in the most optimal way. The intervention framework enables us to report on all the means of teacher support in a very systematic manner, see Table 4. As the intervention contained several aspects of which we suspected that they were new for teachers, we decided to address these topics in a training program. To allow for a sufficient duration of the learning process, we decided to spread these professional development activities over two training sessions of four hours each. The first training session was provided before the start of the intervention, and the second session was scheduled after six lessons (i.e., almost two months after the start of the program). The content of the training was focused on improving teachers' knowledge of important aspects of the writing process, the writing product, and of writers themselves (e.g., self-regulation, attitudes, motivation), as well as of knowledge of how to teach this content to students in grade 4 to 6 (i.e., pedagogical content knowledge; Ball et al., 2008). In addition, we aimed to improve teachers' specific skills in modeling the writing process and self-regulation strategies, evaluating text quality and providing effective feedback. To do so, we organized small-group assignments and discussions in order to promote active and collaborative learning. We enlarged teachers' tacit knowledge on writing quality and effective feedback by providing them with ample student texts of varying quality and with various examples of written feedback. We showed how Tekster was designed to facilitate the teaching and learning of writing, and teachers experienced themselves how the teaching materials could be used to guide students' writing process through modeling, evaluation and providing feedback.

As professional development is an ongoing and continuous process that should be embedded in teachers' daily lives (Desimone, 2009), we also supported teachers in their daily implementation of the intervention in the classroom. We provided a teacher manual with background information and specific lesson plans, as well as a DVD with

examples of modeling. We also provided benchmark rating scales for supporting teachers in the formative and summative assessment of students' writing in each of the three central writing genres in *Tekster*: narrative, descriptive and argumentative writing. These benchmark rating scales provide clear examples of the range in text quality for students in grade 4 to 6, ranging from very poor to very high quality. It is explicated why each of the benchmarks is representing a specific quality level with respect to the most important aspects of writing, that is, communicative effectiveness, content, structure, language use, grammar, spelling, and punctuation of the text. The descriptions that accompany each of the benchmarks are aimed at supporting teachers to provide feedback with which students can improve their writing performance. Additionally, we also encouraged teachers to observe lessons of colleagues, to share their experiences and provide each other feedback. This allows for collaborative learning experiences, which can foster an enduring professional learning community (Borko, 2004; Guskey, 1994; Harris et al., 2012).

3. Designing the lessons

Although the framework provides a compendious overview of the design principles, learning activities, teaching activities, and training and support for teachers, it provides no insight in the specific content and structure of the lessons, as it is still not fully clear when and how all elements are included and combined in the program. Especially for a comprehensive program it is important not only to report on the design principles, learning activities, and teaching activities, but also provide a more specific lesson format which describes how the activities are organized in the lessons. To ensure that all activities described in Table 4 were covered in the intervention program, all *Tekster*-lessons were designed using a general (more or less fixed) lesson format (see Table 5), a sample lesson is included in Appendix A.

In the first lesson of the program the acronym-animal (VOS/DODO/EKSTER) is introduced in a story in which students also practice the steps of the strategy for the first time. In the following lessons these animals are the common theme, with small icons of the animals serving as a visual support. Each lesson starts with a plenary introduction in which the goal of the lesson is explicitly stated (lesson phase 1, see Table 5). During a short plenary introduction specific characteristics of the text type at hand are addressed through modeling (teacher modeling, or peer modeling using videoclips), comparing model texts, or explicit instruction (lesson phase 2, see Table 5). Next, the authentic writing assignment is introduced, with an explanation of the communicative goal and intended audience (lesson phase 3, see Table 5), and the acronym for the strategy is explicitly named (lesson phase 4, see Table 5). Subsequently, students start with the first step of the strategy, which is generating content in keywords (lesson phase 5, see Table 5).

Table 5. Tekster's general lesson format

Lesson phase	Learning and teaching activities
1	Goal of the lesson is explicitly stated (3b)
2	Plenary introduction in which specific characteristics of text type are addressed through modeling (2a), comparing model texts (2a), or explicit teacher instruction (2b)
3	Introduction of authentic writing assignment in which communicative goal and intended audience are explicated (3b)
4	Acronym for the strategy is explicitly named (1b)
5	Content is generated in keywords (first step of the strategy; gradual release of responsibility from 1a to 1c, 3a to 3c)
6	Generated content is organized (second step of the strategy; gradual release of responsibility from 1a to 1c, 3a to 3c)
7	Text is written using organized content (third step of the strategy; 1c, 2c, 3c)
8 ^a	Students' texts are read (fourth step of the strategy; 2a)
9 ^a	Students' texts are evaluated by answering evaluative questions and/or giving feedback (fifth step of the strategy; 2a)
10 ^b	Students' texts are revised on the basis of the received feedback (sixth step of the strategy; 3c)

Note. Bold numbers refer to focus (1 = strategy instruction, 2 = text structure instruction, 3 = self-regulation strategy instruction) and mode of instruction (a = modeling, b = explicit instruction, c = deliberate practice with gradual release of responsibility) as shown in Table 4. ^aOnly for grades 5 and 6. ^bOnly for grade 6.

This is followed by the second step of the strategy, which is organizing the generated content, supported by the teacher through scaffolding with gradual release of responsibility (lesson phase 6, see Table 5). During the third step of the strategy students start writing their text using the organized content, while the teacher provides support when necessary (lesson phase 7, see Table 5). During the following step of the strategy (grade 5 and 6 only) students read each other's texts or their own text (lesson phase 8, see Table 5). In the fifth step of the strategy (grade 6 only) students evaluate the quality of their written text by answering evaluative questions and/or giving

feedback (lesson phase 9, see Table 5). During the sixth step of the strategy (grade 6 only), students revise (parts of) their text on the basis of the feedback they received (lesson phase 10, see Table 5).

The intervention program consists of three lesson series of 16 lessons, one for each grade level, compiled in a workbook for students, accompanied by a teacher manual. The duration of the average Tekster-lesson is between 45 and 60 minutes. Teachers provide one lesson a week, duration of the intervention was 16 weeks in total.

4. Discussion

This paper presents a framework for describing an intervention in a structured and systematic way. We propose that, in order to fully capture the multifaceted character of a comprehensive writing intervention, a framework for reporting on its design should include the following elements:

- Design principles for the focus of instruction
- Design principles for the mode of instruction
- How design principles for the focus and mode of instruction are integrated and operationalized in learning activities for students
- Teaching activities that are required to make learning activities possible
- Training and support that teachers need to be able to perform these teaching activities.

We developed a framework in which we accounted for all these elements. The main feature of this framework is that we separated the design principles for the focus of instruction from the mode of instruction, as both deserve equal attention in the description of an intervention (cf. Hillocks, 1984). Through this schematic approach, the framework provides insight in how the design principles for the focus and mode of instruction are integrated and operationalized into specific learning and teaching activities. Additionally, the framework describes in a systematic way what means of support (e.g., supplementary materials, professional development activities) are included for teachers. We used Tekster as an example to show how this framework is especially helpful in reporting on a multi-faceted writing intervention that includes multiple design principles. Together with a general lesson format, which describes how the activities are organized in the actual lessons, the framework can be used for replication purposes as well as for the implementation of the intervention in educational practice. The proposed framework does not only warrant a more transparent description of an intervention study, it can also help in designing an intervention as it forces educational designers to think systematically about the goals of the intervention and the path one needs to follow to reach those goals.

Another important feature of the framework is that it facilitates the comparison of interventions across contexts and countries. As stated in the introduction, comparative

research, such as meta-analyses, is hampered by incomplete information on certain aspects of interventions. If interventions, and especially multi-faceted ones, are reported systematically, using the same reporting framework, it will be easier to pinpoint similarities and differences between interventions (see also the comparative descriptions by De Smedt & Van Keer, 2018 and López et al., 2018 in this special issue). In this respect it would be interesting to fit our framework to the SRSD approach (Graham & Harris, 2018; Harris and Graham, 1996), as this is a multi-faceted approach that much resembles the approach we applied in designing Tekster. For instance, SRSD and Tekster share many of their basic principles for the focus as well for the mode of instruction (strategy instruction, self-regulation instruction, observational learning, explicit instruction, gradual release of responsibility), but the actual lessons of the interventions look rather different, due to differences in the operationalization of the underlying principles. Zooming in on these differences could provide more insight in what works (and what not) under what circumstances in teaching writing, which could provide useful information for theory building and further optimization of interventions.

Further, for scientific purposes, such a standardized schematic overview of interventions offers support in evaluating the quality of the implementation of an intervention in practice. For instance, it can be used by researchers as a basis to observe in practice whether the teaching and learning activities in the classroom actually include the essential elements of the intervention, and hence, to establish whether the intervention is implemented as intended. Gathering this kind of data is important when the intervention is executed by teachers instead of researchers, especially when they are allowed to adapt aspects of the intervention to meet the needs of their students (see also Koster et al., 2017). Detailed information on how teachers implemented the intervention in practice is critical to determine if improvements in writing can be attributed to the writing intervention (Graham & Harris, 2014).

When evaluating the implementation of an intervention it is not only important to evaluate what teachers did, but also how they did it (i.e., the quality of their instruction) (Graham & Harris, 2014). By explicating separate design principles for the focus and mode of instruction, the proposed framework can be used as a comprehensive scheme for observing the content as well as the quality of teachers' instructions. The systematic description of teaching and learning activities in the proposed framework also allows for a systematic inventory of the support teachers might need to be able to perform the teaching activities in the most effective way. Teachers are the crucial factor in bridging the gap between research and the classroom (Desimone, 2009). To ensure that an intervention is implemented as intended, it is essential to provide optimal support for teachers, especially when an intervention contains innovative or complex elements. Professional development activities empower teachers, which increases the likelihood that teachers will continue using essential features of the program after the intervention.

To study the sustainability of an intervention, it is also important to understand how teachers and students experienced the different components of an intervention, for example through questionnaires, interviews or observations. This refers to the social

validity of an intervention, which is typically assessed by the acceptability of and satisfaction with the intervention program according to the individuals who receive and implement it (Luiselli & Reed, 2011). Validating the social acceptability of an intervention program is needed to understand the long-term effects in educational practice. Interventions (or aspects of an intervention) that are not judged positively by the relevant stakeholders are not likely to be adopted, even when they have proven to positively impact students' performance. Social validity of an intervention can be low when students are not convinced of the appropriateness of the intervention for improving their writing, or when teachers indicate that the intervention is too complex, requiring too much time for implementation, or when they are not satisfied with the outcomes (Luiselli & Reed, 2011). The proposed framework can be used to systematically evaluate the social acceptability of the crucial elements of an intervention, and hence, to draw conclusions on the expected maintenance effects of the intervention.

Further, the proposed framework provides the information that is needed for replication studies. Educational practitioners and/or researchers can use the framework to develop and test their own writing lessons based on the same theoretical principles and activities for learning and teaching. A detailed description of the critical features of an effective writing intervention also provides insight in what works and why. The writing intervention Tekster, which is described in this paper, was tested as a whole. It is therefore not possible to draw conclusions on the effectiveness of separate components. However, the structured and systematic approach makes it possible to manipulate the components, for instance by deleting elements, or manipulate the order of the components (cf. Fidalgo et al., 2015). Furthermore, a structured and systematic framework for describing the underlying design principles for both the instructional focus and mode of interventions allows for a comparison of the effectiveness of similar interventions across contexts and countries.

To conclude, the framework proposed in this paper makes core features of writing interventions transparent to reviewers, other scholars, and educational practitioners, and can be used to design, describe and implement multifaceted, comprehensive interventions. By systematically translating and integrating design principles into learning and teaching activities and additional professional development activities for teachers, it is warranted that an intervention includes all necessary elements in the most optimal way. Subsequently, this framework can be used as a foundation for the design of the actual writing lessons. If we, as writing researchers, want to get a grip on what works (or not) in teaching writing, we have to build towards a common standard for reporting on interventions in great detail. We hope that this framework facilitates researchers in reaching that goal.

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Appendix A: Sample lesson, translated from Dutch

SILENT BALL

Goal of the lesson: writing game rules

INTRODUCTION:

In the previous lesson you have learned how to write a recipe. A text like this, that teaches you how to do something we call an **instructive text**. An **instruction** describes the steps you have to take to make, cook or assemble something.

Game rules also are instructive texts. If you are used to playing games, you know that rules are very important.

✎ In the video you are going to watch, two students discuss the content of game rules. They mention important aspects that have to be included.

Write down the 5 most important aspects:

- 1.....
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- 2.....
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- 3.....
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- 4.....
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- 5.....
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✎ Now you are going to play an exciting game. This game is called 'Silent Ball'. You first will get a short explanation, and then you are going to play it.
Have fun!

Assignment

Silent Ball is a fun game, which you probably want to play again. But in a while you have probably forgotten the rules of the game. That is why it is handy to write down the rules, then you can consult them if you do not remember them. Try to write it down in such a way that someone who does not know the game can play the game without any problems..



HOW ARE YOU GOING TO DO IT?

To write the game rules you use the steps of EKSTER (MAGPIE):

1. **E**erst nadenken (think first)
2. **K**iezen en ordenen (choose and organize)
3. **S**chrijven (write)
4. **T**eruglezen (reread)
5. **E**valueren (evaluate)
6. **R**eviseren (revise)

STEP 1: E VAN EERST NADENKEN (THINK FIRST)



You are collaborating with a partner. First read the assignment again and remember the game you just played. What really has to be included in the game rules? Write all your ideas down in keywords.

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STEP 2: K VAN KIEZEN EN ORDENEN (CHOOSE AND ORGANIZE)

▼ Fill in the scheme below together with your partner. Use keywords.

Preparation
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Course of the game
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Ending of the game
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STEP 3: S VAN SCHRIJVEN (WRITE)

 You have thought about the rules of the game and the order of the rules. Now, write your rules down. Note that they must be clear for someone who is going to read them.

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STEP 4: T VAN TERUGLEZEN (REREAD)

✎ Read your game rules one more time. In the introduction you have written down five important aspects that have to be included in game rules. Did you include them in yours?

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.....

STEP 5: E VAN EVALUEREN (EVALUATE)

✎ Exchange your game rules with another duo and read the tekst they have written.

Can you play the game with their rules?

yes

no

Write down tips to improve the game rules.

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STEP 6: R VAN REVISEREN (REVISE)

✎ Read the tips you have been given and revise your game rules. Write your revised version below.

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