Nathan L. Mertens
Editor

Writing
Processes, Tools and Techniques

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NATHAN L. MERTENS
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PREFACE

Writing is a complex and cognitively demanding activity. To be successful, writers need an understanding of the components of a quality test as well as knowledge of writing strategies that can be used to shape and organize the writing process. This new book discusses academic writing as a complex task which involves a variety of cognitive and metacognitive activities; a model for teaching writing strategies and the sociocultural processes of written communication; rubric-referenced self-assessment and the quality of elementary and middle-school students' writing and self-efficacy and others.

Chapter 1- In the field of writing studies, the shift between the product-oriented approach to the process-oriented one has resulted not only in conceptual changes in the theories of writing, but also in development of methods and techniques that have enabled us to study the writing process. These real-time or on-line methods track the writing processes while they are operating in order to describe their time course and their functional characteristics. Generally, these methods focus on three features of writing: writing fluency through the analyses of pauses and execution periods, functional characteristics of the writing processes with thinking-aloud techniques, and their demands on working memory with dual-task designs. The most common tools used for that purpose are computers with digitizing tablets and keystroke recording programs. Moreover, recently, a new perspective has been opened by the analysis of the writer's eye movement coupled to the analysis of the on-going text. Some scarce research has also attempted to investigate writing with brain imagery techniques. All these methods are shedding light on the cognitive operations necessary to compose a text. Consequently, the aim of this chapter is to provide readers with an overview of these methods and tools in order to figure out how to conceptualize and design new experiments. In parallel, through the presentation of these methods and of the tools that are required to implement them, this chapter also delineates the issues that are currently addressed in research on writing.

Chapter 2- Academic writing is a complex task that involves a variety of cognitive and metacognitive activities. One approach to assist writers in dealing with the problem of managing their resources during writing is to scaffold writing by computer. Unfortunately, empirical research on computer-based scaffolding (CBS) of writing is quite limited, and the results are mixed. An explanation for these results may be found in the design of the scaffolding. Most CBS support discrete writing activities, independently from the writing process. This chapter seeks to contribute to the question of how to design CBS which supports the academic writing process as a whole. As a basis for the design, the subtask

model of academic writing is presented which explicitly describes the demands of academic writing. This model is derived from theoretical and empirical findings on expert writing. The implementation of CBS for expert writing activities into the writing environment *escribo* is then described. The CBS stepwise supports the application of these expert writing activities. To this end, *escribo* decomposes the writing process in its subtasks and provides specific instruction and tools for the completion of each activity. Furthermore, two evaluation studies on the effects of the writing environment are summarized. The results show that working with *escribo* is superior to a situation without CBS. Implications of these results will be discussed with regard to the benefits and restrictions of fostering expert writing activities through computer-based scaffolding.

Chapter 3- I describe nine popular readability formulae. These are designed to evaluate a piece of English text in terms of the age or grade level of school students at which it should be readable. By example and argument I conclude that these formulae are of only limited use: perhaps as a cheap and easy method for evaluating school textbooks and library holdings. The family of cloze tests is designed to evaluate grammar, vocabulary and reading comprehension by making use of communication theory and the redundancy principle. The most popular are the classical cloze procedure and the C-test. Both are reasonably reliable, but the former is arguably the more valid. Both have been used in many countries and many languages as part of the testing of scholastic ability in the candidates' native languages or in second languages, though using trained assessors remains the yardstick. The Coh-Metrix project examines the coherence of text according to 60 categories, but is still in the course of development and seems not to be flawless. Lexical analysis is a computer-intensive tool for evaluating the active vocabulary used in producing a piece of text. It provides an objective measure of the progress of students who are learning English, especially as a second language. It has also been used to evaluate the quality of English teachers and teaching. But though I am only an outsider looking in, I am forced to conclude that the only truly valid method for evaluating language skills is by trained human assessors.

Chapter 4- This paper proposes a model for teaching writing strategies, tools and techniques within a new aim pursuit. The new objective is the simultaneous development of cognitive and sociocultural processes of written communication for the citizens of the 21st Century. This didactic model is justified by the exigencies of multicultural and technological societies. In order to enter the labour world, to have access to knowledge, information and social relation structures, current societies request two basic competences to their citizens: a) use and command of IT technologies and b) communication in different languages. Written verbal language in a multilingual and multimodal fashion is being given priority in the development of both competences. That is why the didactic model offers strategies with the aim of developing: 1) multimodal writing cognitive processes and operations, using the computer; 2) writing sociocultural processes using different languages, that is to say, in a multilingual way.

To achieve simultaneously the already mentioned aims, the tools and techniques of the didactic model have to be creative. However, these aims, tools and techniques are based on the Metasociocognitive Model which explains written communication as the integration of cognitive and sociocultural processes. The Writing Metasociocultural Model is interactive focused on research and theoretical reflection about writing. It has been functioning since the 70´s.

Also, the Creative, Shared Technological Model (CCT-Model) of Writing-Teaching, is based on the results of an ethnographic research project, concretely, a case study. In this project, writing-teaching is deeply studied applying the content analysis method and validation processes such as triangulation, saturation and crystallization. The new contribution covered in this project is the global approach offered of every possible variable interacting with the writer in a multicultural classroom. The conclusions of the case study allow to design strategies, tools and techniques to enhance the development of all writing processes, from a practical teaching point of view. Finally, sociocultural justification and theoretical research based documentation of the Writing-Teaching Model, support a future multimethod research, which is currently in process. This research project aims to the validation of a Writing-Teaching program (based on the already mentioned models), in multicultural samples of subjects, with control and experimental groups. The objectives of this project are, on the one hand, calculation of the effectiveness of the program and, on the other hand, analysing thoroughly the teaching process when applying writing tools.

Chapter 5- This chapter reviews several recent studies of the relationships between rubric-referenced self-assessment and the quality of elementary and middle school students' writing and self-efficacy for writing. The self-assessment process employed in each study emphasized the articulation of criteria and a carefully scaffolded process of review by students, followed by revision. Taken together, the studies show that rubric-referenced self-assessment is associated with more effective writing, as evidenced by higher total scores for essays written by students in the treatment condition, as well as higher scores for each of the criteria on the scoring rubric. The reviewed research also reveals an association between the treatment and the self-efficacy of girls for writing. The chapter includes a review of relevant literature, a detailed description of the process of self-assessment, a report on the studies, and a discussion of the implications for teaching and research.

Chapter 6- Some of the difficulties busy clinicians face are time constraints and limitations on creativity. It is difficult to have a strong clinical focus and yet find the time and energy to devote toward scholarly productivity. Often, there seems to be insufficient time to "put pen to paper." When time permits, creativity is often lacking because of fatigue or concerns about other issues. As the day-to-day responsibilities take their toll, it can be difficult to express the scholarly interest that serves as the foundation for an academic career. An interesting project or study can become lost in the shuffle of accomplishing more mundane tasks.

This manuscript serves as a template to guide busy clinicians in writing papers of scholarly value. Input from surgeons at various levels of accomplishments and at wide ranging stations in their careers makes this of value to a broad audience. Our focus is on young academicians without notable experience in writing scholarly papers. In the pages that follow we elaborate on the writing of the essential elements of a peer-reviewed manuscript.

Chapter 7- A writing assignment, which develops the skills required of a published author, is hereby described. It has been developed for undergraduate chemistry students with limited research and writing experience. This assignment is part of a writing intensive program developed at Simon Fraser University (SFU), where writing is used as an educational tool. As part of this assignment every student is required to submit a *Chemical Laboratory Information Profile* (CLIP) on one of the chemicals used or produced in a second year chemistry laboratory course. These profiles are used to introduce students to the riggers of publications, the requirements of efficient exchange of ideas and how to research the

hazards related to the chemicals used in the undergraduate laboratory setting. The CLIPs are later used by the students in the laboratory.

Chapter 8- The rules which epitomise good writing may on occasions be broken, deliberately and with good purpose. This can well occur when students or staff set out to engage effectively, and through reflective writing, with their personal and professional development in mind. The rationale for this unusual decision to engage in what is frankly disorderly writing is set out briefly. Its characteristics are summarised, in implicit contrast with more conventional styles of writing. Brief mention is made of claims for the effectiveness of this style when used for developmental purposes; and reference is made to the publications of some of those who have endorsed this approach.

Chapter 9- Since the seminal theoretical models of writing (such as Bereiter & Scardamalia, 1987; or Hayes & Flower, 1980) there has been considerable progress as regards the understanding of the cognitive processes and personal variables involved in writing (Alamargot & Chanquoy, 2001; MacArthur, Graham, & Fitzgerald, 2006). The majority of these models recognize writing as a complex and demanding task which involves a large set of higher and lower order cognitive processes, which must be activated and coordinated recursively throughout the entire writing process. This complexity explains that achieving proficiency in writing requires the deployment of a great load of writer's cognitive resources to cope with managing and monitoring the writing environment, the constraints imposed by the writing topic and task, and the processes and variables involved in composing a text (Graham and Harris, 2000; Kellogg, 1987a; Ransdell and Levy, 1996; Zimmerman and Risemberg, 1997). In fact, coordinating these processes in such a way that yields a text which fulfills the requirements of the writing task requires high levels of self-regulation. Since the greater importance afforded to the self-regulatory processes in writing, in this chapter, firstly, we analyze the specific role of self-regulation in the more recent theoretical models of writing and in the instructional field of writing composition. In the second part of the chapter, we summarize in part our previous intervention study (see García & Fidalgo, 2006), developed with 5th and 6th grade Spanish primary students with Learning Disabilities. The study presents the effectivenes of a self-regulation strategy intervention program based on the Social Cognitive Model of Sequential Skills Acquisition to improve LD student's writing competence, analyzing changes in writing product and process through on-line measures. Finally, proposals for future researches and implications for educative practice are suggested.

Chapter 10- Writing is a complex and cognitively demanding activity. It cannot be performed as a sequence of discrete steps; it requires the simultaneous combination of several strategies and the application of various mental resources. Writing is, therefore, both a recursive and a dynamic process. To be successful, writers need an understanding of the components of a quality text as well as knowledge of writing strategies that can be used to shape and organize the writing process. In particular, writing competence requires appropriate and self-regulated knowledge of strategies for planning what to write, and then revising what has been written.

In this chapter, we first present a review of the recent research on the planning and revision processes in writing in order to show the importance that these have in the development of writing competence. Then, we describe the existing research, evaluating strategy-focused intervention studies, to provide an overview of the nature of the interventions programs and an indication of which have been most successful. In the second part of the chapter, we describe and summarize findings from our own studies (Torrance,

Fidalgo, & García, 2007; and Fidalgo, Torrance, & García, 2008). These studies move beyond existing research by (a) evaluating the effectiveness of this kind of intervention programs for developing self-regulations strategies in writing with normally achieving writers without learning disabilities, b) exploring the effects of strategy focused instruction on students' writing processes as well as on their written products and (b) demonstrating the long-term effects of this kind of intervention. In a final section, we discuss the practical implications of this body of research (both ours and others) and make suggestions for how lessons learned from this research might be applied in the classroom.

Chapter 1

METHODS, TECHNIQUES, AND TOOLS FOR THE ON-LINE STUDY OF THE WRITING PROCESS

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ABSTRACT

In the field of writing studies, the shift between the product-oriented approach to the process-oriented one has resulted not only in conceptual changes in the theories of writing, but also in development of methods and techniques that have enabled us to study the writing process. These real-time or on-line methods track the writing processes while they are operating in order to describe their time course and their functional characteristics. Generally, these methods focus on three features of writing: writing fluency through the analyses of pauses and execution periods, functional characteristics of the writing processes with thinking-aloud techniques, and their demands on working memory with dual-task designs. The most common tools used for that purpose are computers with digitizing tablets and keystroke recording programs. Moreover, recently, a new perspective has been opened by the analysis of the writer's eye movement coupled to the analysis of the on-going text. Some scarce research has also attempted to investigate writing with brain imagery techniques. All these methods are shedding light on the cognitive operations necessary to compose a text. Consequently, the aim of this chapter is to provide readers with an overview of these methods and tools in order to figure out how to conceptualize and design new experiments. In parallel, through the presentation of these methods and of the tools that are required to implement them, this chapter also delineates the issues that are currently addressed in research on writing.

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1. INTRODUCTION

Composing a text engages several major cognitive components that intervene at different levels of representation. At a semantic level, a component, called planning, allows writers to retrieve ideas they want to include in their text from their long-term memory. With that component, writers can also organize these ideas into a textual plan that fits the rhetorical goals of the writing situation. A second component, the translator or formulator, intervenes at a linguistic level of representation to transform the pre-verbal message constructed by planning into written language. For that purpose, the syntactic framework of sentences is first constructed and words are then retrieved from the mental lexicon along with their morphological properties and orthographical form. A third component, which operates at a motor level, is used by writers to transcribe the verbal message in a written form (typing or handwriting). One specific feature of writing is permanency of the written trace, which permits writers to come back to their text and to try to improve it if needed. For that purpose, writers engage a fourth cognitive component that monitors quality and adequacy of their text. With these monitoring processes they can read their on-going text, diagnose problems they have detected, and edit them if it is necessary. In that case, according to the nature of the problem (e.g., conceptual, linguistic or related to handwriting) they call back the planning, translating or execution components. Obviously, such monitoring can also occur mentally, namely before the prepared message is written down, for instance at the exit of the planning and translating components. One goal of on-line studies of writing is thus to track when and how these processes are implemented by writers, but also how they are affected by factors related to the writing situation or by cognitive characteristics of the writers.

One factor that severely affects how writing processes are implemented is working memory. Writing is indeed one of the most effortful activities that humans can implement (Kellogg, 1994, Piolat, Olive & Kellogg, 2005). Since working memory is the cognitive structure in charge of managing cognitive resources and of supervising implementation and coordination of the cognitive processes (e.g., Baddeley, 2000; Cowan, 2005), writing research has focused on the role of working memory in writing (Berninger & Swanson, 1994; Kellogg, 1996; McCutchen, 1996, 2000; Olive, 2004, in press). When managing the flow of written production, writers indeed have to stay within the limited capacity of working memory. For this, they resort to mechanisms that minimize the amount of resources required by writing. A well-known mechanism that reduces the amount of resources devoted to a particular process is automatisation. With practice, operations frequently implemented require fewer resources and become automatized. Moreover, they can be coordinated in parallel with other processes. Strategic activation of the cognitive processes is also important (Brown & Carr, 1989). When the resources necessary to accomplish a task exceed the amount of resources available, the individual is faced with two options. First, it can accommodate this extra cost and start all processes necessary to accomplish the task. However, this type of operation is risky because it usually leads to low performance (Fayol, 1999). For example, in the case of writing, texts can be syntactically or semantically less rich, and the writing process may be longer. Second, the individual can switch from a parallel to a sequential activation of the processes to decrease the general processing demands of the activity. In writing, it is often hypothesized that the use of such strategies is a sign of skilled writing. In that perspective a second goal of on-line studies of writing is to describe and assess the processing demands of the writing processes.

In sum, to better understand the dynamic of the writing process, on-line methods aim at describing the operations carried out by the writing processes by assessing their functional characteristics (processing time, processing demands, mode of coordination). Of course, other types of methods are used in research on writing. For example, with off-line methods, researchers can analyze the written products and the textual operations to infer the underlying writing processes. By contrast, on-line methods track the time course of the writing processes at the time they are conducted. They include the analysis of writing fluency (the study of pauses and of execution periods), the dual-task paradigm, the method of verbal protocols, the analysis of writers' eyes movement, and more recently functional brain imagery.

2. PAUSES AND EXECUTION PERIODS IN WRITING

2.1. Theoretical and Methodological Basis

At a behavioral level, text composition can be characterized by two activities: pausing and executing the text (handwriting or typing). Writers spend roughly half of the composition time pausing or, conversely, handwriting (Alamargot, Dansac, Chesnet & Fayol, 2007; Alves, Castro, Sousa & Strömqvist, 2007; Strömqvist & Ahlsén, 1999). Investigating the temporal dynamic of writing thus requires studying pauses, but also execution periods.

Pauses — Pauses are interruptions of handwriting. However, among all the pauses that can be detected during a writing process, not all pauses are of interest for research on the cognitive processes underlying writing. Indeed, some pauses are only due to mechanical demands of handwriting or of typing. For example, a writer tracing an 'i' or a 't' needs to interrupt handwriting for tracing the dot on the 'i' or the bar of the 't'. Similarly, when typing, moving the fingers between keys create pauses that merely result from key position rather than from occurrence of high-level writing processes. Accordingly, two kinds of pauses have to be distinguished: pauses during which writing processes can occur, and pauses resulting from handwriting or typing mechanical demands. The latter pauses are considered too short to involve high-level writing processes, and so functionally they do not differ from handwriting. Methodologically, it is thus indispensable to distinguish between pauses during which handwriting has stopped long enough so that high-level writing processes do occur, from mechanical pauses. For that purpose, defining a threshold affording such a distinction is necessary. Very different thresholds varying between 130 ms and more than 5 seconds have been used (in handwriting: 130 ms by Alamargot, Dansac, Chesnet, & Fayol, 2007; 200 ms by Passerault, 1991; 250 ms by Olive & Kellogg, 2002; Olive, Alves & Castro, 2009; in typing: 1 second by Alves, Castro & Olive, 2008; 2 seconds by Alves, Castro, Sousa & Strömqvist, 2007; Levy & Ransdell, 1995; Schilperoord, 2002; Wengelin, 2007; 5 seconds by Jansen, van Waes, & van den Berg, 1996). A recent finding suggests that the high-level writing processes can occur during pauses shorter than a quarter of a second (Alamargot, Dansac, Chesnet, & Fayol, 2007). To sum up, pauses that are of interest for the researcher on text production are only those whose length is sufficient to allow the writing processes to occur.

Pauses can occur when writers no longer have information to continue their text, or because of competition between writing processes for limited capacity. Accordingly, pauses would allow preparing the next segment of text. Pauses would also allow examining the text already written to review it. This suggests that planning, translating and revision can all be implemented during pauses (for confirmation, see Alves, Castro & Olive, 2008; Olive, Alves & Castro, 2009).

Actually, two features of pauses are studied: pause duration and pause location. Pause duration is supposed to reflect length of the underlying process(es). Here, researchers are confronted with difficulty to assess whether several processes can be activated during one single pause. Pause duration is also supposed to be a function of complexity of the processes engaged in, and it is thus assumed to reflect processing load of the on-going processes (Foulin, 1995; Schilperoord, 2002): longer pauses reflect cognitive processes that are more effortful compared to load of processes reflected by shorter pauses. It is nevertheless difficult to assume that a 20-second pause reflect a processing load ten times higher than a 2-second pause. Moreover, this raises the question of independence between processing time and processing load.

Pause location is also of great interest as pause duration systematically varies according to structural characteristics of texts (e.g., words, phrases, sentences, paragraphs). For instance, pauses are more frequent or longer at the border of large syntactic or textual unit (sentence, paragraph) compared to low-level units. However, the covariation between pause duration and syntactic location is not systematic. For example, Foulin (1998) attempted to explain length of pauses according to their syntactic location by conducting various regression analyses. He showed, first, that temporal organization of production is only partly predicted by the text's syntactic structure. Secondly, he showed that if clauses can be considered as the planning unit in speech production, in writing, the sentence could be a conceptual and linguistic planning unit. It is also assumed that pause reflects the macro-and micro-structural planning of text. Pauses between paragraphs and between sentences would mainly result from knowledge management, so to conceptual planning (however, in the beginning of sentences, syntactic and lexical processes might intervene jointly with conceptual planning); inter-propositional pauses would indicate mainly formulating processes; breaks intra-propositional pauses would be affected by predictability of lexical items.

The functions of pauses are actually poorly specified in writing research (see Torrance & Galbraith, 2006), and because during pauses all working memory capacity is freed from handwriting demands, pauses have generally been linked with the more effortful processes, namely planning and revising (Foulin, 1995; Schilperoord, 2002). Pauses interpretation remains however difficult given that many factors can affect pause durations and frequencies. The coexistence of physiological factors, cognitive and social factors are all potential determinants of the number, duration and location of pauses. Finally, it must be underlined that pauses can also happen for reasons unrelated to the writing processes. For example, writers can suspend writing because their mobile phone rung. Obviously, such pauses have to be excluded of the analyses, but the difficulty is in identifying them.

Execution periods — Although writing research has traditionally focused on the studies of pauses, in the preceding years research has turn attention to execution periods (or language bursts according to Chenoweth & Hayes, 2001). Execution periods can be defined as the time elapsed between two consecutive pauses during which a writing processes can occur.

The interest of researchers for execution periods came from at least two outcomes. First length of execution periods seems to be related to writing skill. For instance, Kaufer, Hayes, and Flower (1986) observed in their study that the more experienced writers composed their text in longer execution periods (that length be expressed in duration or in number of words produced) than the less experienced writers did (see also Chenoweth & Hayes, 2001). Friedlander (1989) observed a similar finding with second language composition compared to first language text production. Execution periods are longer when texts are composed in first language than in second language.

Second, it has been shown that skilled motor execution (handwriting or typing) frees working memory capacity. Therefore, working memory capacity available during handwriting is allocated to the high-level writing processes that can then be activated concurrently, at least in adults. For example, Bourdin and Fayol (1994, 2002) showed that performance of adults decreased when they had to recall series of digits or to compose sentences using cursive capital letters, a rarely practiced and hence effortful calligraphy. Olive and Kellogg (2002) also observed that children were unable to activate high-level writing processes together with motor execution, and had to suspend handwriting to think over their texts. Conversely, adults were able to activate simultaneously motor execution and high-level writing processes. Chanquoy, Foulin and Fayol (1990) observed increased fluency during the production of the last part of a sentence by contrast with fluency during the first part of the sentence. According to the authors, during the first part of a sentence, adult writers begin to plan or to translate the final part of the sentence, which is then written down without any concurrent process to motor execution. Moreover, as eye movements indicate, adult writers often read the text already produced to either create new content, or to evaluate what has been produced so far (Alamargot, Dansac, Chesnet & Ros, 2006; Alamargot, Dansac, Chesnet & Fayol, 2007). In sum, concurrent activation of high-level writing processes and motor execution is now well documented. This underlined the fact that writing processes are also activated during handwriting, and consequently that the study of execution periods may also provide important information on how these processes are activated.

Some initial studies suggest that formulation processes may account for a large part in variability of length of execution periods. For instance Chenoweth and Hayes (2003) have shown that articulatory suppression, which was assumed by the authors to affect formulation operations, reduces length of execution periods. Moreover, some studies also suggest that handwriting skills are important contributor of length of execution periods. For instance, Alves et al. (2007) observed that low skilled typists produce their text in shorter execution periods than more skilled typists. Finally, Alves, Castro and Olive (2008) and Olive, Alves and Castro (2009) have investigated nature of the writing processes activated during execution periods. They have shown that all writing processes can be activated while handwriting, but that formulation is the process most frequently activated concurrently to handwriting. This findings is in line with the idea that formulation takes less resources from working memory than planning or revision, and thus that it can be activated concurrently to handwriting with more facility than the two other wiring processes. It also explains why Chenoweth and Hayes (2001) have found that formulation seems to be the main determinant of length of execution periods.

By contrast with pauses, only a limited number of study has investigated execution periods. There is consequently not enough substantial data on parameters of execution periods neither published review on the methodological and theoretical status of execution periods.

Nevertheless, execution periods already appear to reveal fruitful information on the temporal dynamic of writing. Future systematic studies investigating how different writer- or situation-specific factors affect length and duration of execution periods are thus needed.

2.2. Tools for Detecting Pauses and Execution Periods

Initially, when research on writing processes began, pauses were detected by filming the handwriting activity of a writer with a camera that included a built-in stopwatch. It was thus possible to analyze the number of pauses and their duration by viewing image-by-image a complete writing session. This method was however time-consuming and, with growing use of personal computers, it was quickly abandoned in favor of digital records with word processors and graphics tablets.

With graphic tablets, writers compose their text on a paper sheet and they use an electronic pen filled with ink. Spatio-temporal data (location on the page of the pen with its time line) are recorded and researchers can then playback the text and display all pauses at their precise location. "Eye and Pen" (Alamargot et al., 2006) is the most widely used program to record and analyses pause data in handwritten text composition because it proposes several options for easily recording and analyzing writing pauses. First, "Eye and Pen" provides a module for recording handwriting in different situations, from the simple copy of words to free text composition. Moreover, researcher can display on the monitor of the computer or even on screen digitizing tablets (such as the Cintiq Digitizing Tablet distributed by Wacom) sources that writers can consult when they wish during writing. For example, series of words to copy, images to denominate, or graphic illustration describe or beginning of texts can be displayed. A second module proposed by Eye and Pen allows researchers analyzing pauses data. Several general measures are proposed without requiring any advanced analysis (for example the total time spent in pause, the number of pauses, the mean time of a pause, etc.). More detailed and precise analyses can of course be carried out, for example by analyzing pauses occurring at specific locations. Finally, Eye and Pen also allows replaying the writing task in real time or by controlling how fast the text is 'rewritten'. More information on Eye and Pen can be found on its website (eyeandpen.net).

A growing number of writers now compose their text with computers by using word processor programs. In that case, pauses can be analyzed through keystrokes recording, which provide a straightforward way for tracking the writers' actions, such as typed characters, pauses, and mouse clicks). Some programs also record position of the mouse in the texts and thus permit to study the textual operations writers have carried in their text, and particularly revision operations.

Several programs are available, which all implement main basic functions for 1) recording the writing activity, 2) analyzing the recorded data, and 3) playing back each writing session. InputLog (Leitjen & van Waes, 2006; www.inputlog.net) records keystrokes and mouse actions independently of the word processor that writers use. InputLog also allows generating text by dictation but also to integrate data from other programs. Moreover, it also proposes basic statistics about pauses and revisions operations. By contrast ScriptLog (Strömqvist & Malmsten, 1998; www.scriptlog.net) is a keystroke-recording tool that integrate a basic word processor and that has a single interface and program for both

recording and analyzing writing. It also proposes options for displaying pictures or graphics that can be used to elicit text composition or that writers can describe. As InputLog, ScriptLog also allows examining revision operations. Finally, Trace-it (Severinson Eklund & Kollberg, 1996; http://www.nada.kth.se/iplab/trace-it/index.html) is specifically designed to support the analysis of revisions. In conjunction with a specific language called S-notation, Trace-it analyses log files from sessions of writing to display the revision episodes. With S-notation, Perrin (2002) has developed a progression analysis for analyzing how a text is rearranged. To conclude on keystroke recording, it is important to notice that other programs may have been developed. The three programs mentioned above are nevertheless the most widely used in writing research and accordingly they provide very convenient facilities and options for researchers to investigate writing.

3. VERBAL PROTOCOLS

3.1. Theoretical and Methodological Basis

The analysis of verbal protocols is a traditional method of psychological research that goes back to the late 19th century: introspection. This method aims at making the mental processes "observable" by asking individuals to think aloud about the activity they are performing. Although verbalization was proscribed during the Behaviorist period (roughly during the first half of the twentieth century) for epistemological motives, next it has been widely used in various fields of cognitive and ergonomic psychology. For example, research on problem solving or on expertise strongly relied on verbal protocols (Ericsson & Simon, 1993). The main assumption that underlies the use of verbal protocols is that individuals can verbalize about some of the mental processes and that individuals have access to some of their mental operations. More precisely, it is assumed that only controlled processes –in other terms the processes operating under the control of working memory– are accessible with thinking aloud protocols. Thus, only processes that are or have been in the focus of working memory can be verbalized. Accordingly, automatic processes are not accessible through verbalization because they do not engage working memory. In writing, this limit is not very problematic since mainly all writing processes are executed in working memory (see next section).

There are different forms of verbal protocols that depend on the moment at which verbalization occurs relatively to the activity under investigation. When participants think aloud about what they are currently doing, verbal protocols are said to be concurrent or simultaneous. By contrast, when verbalization occurs after executing the task, verbal protocols are called delayed or retrospective. Each of these kinds of verbal protocols has methodological limit(s).

As far as simultaneous verbalization is concerned, there is a possibility that verbalization interferes with the task under investigation, for example by slowing it or by reducing its level of performance. This interference could be even stronger when the investigated activity also requires a verbal output, as it is the case with writing. For example, verbal protocols are theoretically expected to interfere less with drawing than with writing because the former activity does not require eliciting verbal processes in working memory, as it is the case in

writing. Interference of verbalization with the investigated task also depends on the kind of verbalization participants are asked to perform. Indeed, participants can first be asked to say aloud all the thoughts they have in mind when executing the task; second they can be asked to categorize their thoughts; third they can try to explain or justify what they are doing. According to Ericsson and Simon (1993), in the first two cases, interference is low and may results only in slowing the primary task. Fore example, writing fluency decreases with free thinking aloud (Ransdell, 1995). In the third case, however, interference is strong and performance at the investigated task is therefore negatively affected. This presumably explains why such kind of verbalization has not been used in writing research.

Although the risk of interference with writing is null with retrospective verbalizations since writing is finished at the moment of the verbalization, another specific problem arises with retrospection. Indeed, when retrospecting, a writer must retrieve information in long-term memory about how she composed her text. In that case, it is probable that the writer forget some of the information about the way she composed her text. So her thinking aloud protocol may lack some important and crucial information for researchers to rebuilt the writing process. Moreover, at the time of verbalization, writers may unintentionally rebuild information. Of course such lapses of memory or reconstructions are more important when time between end of the task and verbalization increases. In that case, information present in the thinking aloud protocol can guide researcher to false or biased understanding of the writing process.

Nevertheless, the analysis of verbal protocols has been used in writing research since the early work of cognitive psychology on written production. For instance, Hayes and Flower's (1980) first description of the cognitive processes engaged in writing (planning, translating and revision) came from the analysis of writers' verbal protocols. With this technique, Flower and Hayes (1980) also shown that the writing processes are not activated linearly but rather recursively, meaning that each writing process can interrupt any other process at any time in the time course of writing. Verbal protocols have also helped researchers to investigate temporal organization of the writing process. For example, Breetvelt, van den Bergh, and Rijlaarsdam (1996) have shown that text quality depends on the moment at which each writing process is activated.

By highlighting how the controlled writing processes are implemented, the analysis of verbal protocols provides an interesting picture of how writers compose their text. It however provides a partial picture of the time course of writing, as it does not provide access to automatic processes such as for example, the syntactic, lexical and spelling processes (excepted when writers make conscious choices between different options). An important limit of the methods is also raised if one considers that writers can activate several writing processes at the same time (see for example, Olive & Kellogg, 2002). In such a case, writers cannot indicate which processes are simultaneously coordinated because such parallelism is a sign of fluent and at some extent of automatized processes.

3.2. Analyzing Verbalization Data

From a practical perspective, the analysis of verbal protocols is very time consuming. Indeed, the analysis of verbalizations requires strong skills of the researcher and it is tedious

and complex, as it requires to playback several times the complete writing sessions. Although recording thinking aloud protocols does not require any particular material (a simple voice recorder is the minimal required material, or a simple camera), some programs however assist researchers in segmenting and categorizing in writing processes the verbal protocols (Levy & Ransdell, 1994). Several timeline-based systems can be used for such analysis. These programs help in categorizing and representing the events that occur in a specific activity along with their time line. For example, with Actogram (Octares Editions; www.actogram.net) it is possible to display sound or video files that the researcher segments and tags with their timeline by pressing keys on a computer keyboard. After having set these keys and the associated events (or processes), researchers simply look at or hear the thinking aloud protocol, and by varying its speed and by stopping playback of the protocol, they press a key when a new event occurs. At the end of the analysis, Actogram proposes options for describing the sessions and the specific events that have been analyzed. As a further step, qualitative analysis program can be used for completing the analysis.

4. DUAL-TASKS

4.1. Theoretical and Methodological Basis

The dual-task method has long been used in cognitive psychology. Requiring individuals to perform two tasks simultaneously (called on the one hand, the primary task, and on the other hand the secondary task), this method is based on the assumption that the cognitive system has limited processing capacities or resources. Accordingly, when performing two tasks simultaneously, individuals have to share their cognitive resources between the primary and secondary tasks. This should result in performance decrement. Such a reduction of performance is generally evidenced by comparing performance at the two tasks performed in dual-task condition with performance at the same tasks performed in single task condition. In writing research, the dual task method is used for different purposes.

First, it helps to determine nature of the mental representations or the writing processes that are engaged during writing. The underlying idea is interference between the primary and secondary tasks indicates that these tasks engage identical or common mental representations (or resources). Generally, such research is grounded in componential theories of working memory and researchers study the relationship between the writing processes and the subsystems of working memory (the phonological loop, the visuospatial sketchpad, and the central executive; Baddeley, 2000). So, the secondary tasks are designed to impose a specific charge to one of these systems by involving stimuli of different natures. For example, interference between a visual task and writing indicates that writing uses visual mental representations, in other words the visuospatial sketchpad of working memory. In that framework, Kellogg, Olive, and Piolat (2007) have tested the hypothesis that planning requires the visuospatial sketchpad when processing figurative elements only. They asked writers to write definitions of abstract or concrete nouns. As secondary task, they were asked to memorize and recall either verbal or visual stimuli. The authors observed a verbal interference with definitions of both concrete and abstract nouns, and a visuospatial

interference only with the concrete nouns, thus supporting their hypothesis (see also Olive, Kellogg, & Piolat, 2008).

A second objective of the dual-task technique is to measure the amount of resources required by the main task. In that case, only performance at the secondary task should be affected (the magnitude of its degradation reflecting the amount of resources required by the main task), as it is to decide on the resources required by the main task when it is executed in standard conditions. In this context, Power (1986) used a continuous tracking task while individuals orally produced two-clause sentences from two words. Power observed more tracking errors during production of the first clause than when producing the second clause. According to the author, this suggests that planning of the second clause may be expected to occur at least partly in parallel with production of the first clause. This study shows that the technique of dual-task allowed inferring how the processes involved in a task are coordinated. In that perspective, Olive and Kellogg (2002) examined how writers coordinate transcription with conceptualization and formulation. For that purpose they resorted to a secondary reaction time task in which writers were asked to respond as quickly as possible to auditory signals (probes) that appeared at irregular intervals during the writing task. To control for interindividual differences in simple RT, a mean RT obtained when individuals perform only the reaction time task was subtracted from each secondary reaction time (RT). The resulting RTs were assumed to reflect the cognitive effort devoted to the primary activity: the longer the RT, the higher the cognitive load. With such secondary RT task, Olive and Kellogg (2002) observed that, in adults, RTs were shorter when they were occurring during pauses than when they were occurring during transcription. In addition, the latter RTs were longer than when the adults transcribed their text during a copying task. These differences can easily be understood if one considers that adult writers, because of their automatized transcription processes, have enough resources available to simultaneously activate other writing processes. Convergent with that interpretation, Olive and Kellogg observed that in 9 years old children for whom handwriting is not automatized, the RTs associated with transcription did not differed between the composition and copying tasks. Moreover, they observed the same result in adults that were asked to use an unfamiliar handwriting (upper case handwriting). For the authors, these findings suggest that low transcription skills (for example in the youngest children, in adults using an unfamiliar handwriting or with low typing skills) are not able to activate high-level writing processes concurrently to handwriting.

4.2. The Triple Task

The triple task is a variant of the dual task technique that combines verbalization with a reaction time task. Initially developed by Kellogg (1987), the triple task allows studying the sequence and the cost of the cognitive processes engaged in writing, but also in other activities (Piolat, Olive, Roussey, Thunin & Ziegler, 1999). In addition to data obtained with verbalizations, each reaction time is associated to the process that appeared at the moment of the auditory signal (also called probe). It is thus possible to associate each RT with a particular writing process. In practice, two variants of the triple task are used. In the first, writers perform a free thinking aloud task (Levy & Ransdell, 1995). The writing processes are identified through a classic analysis of the collected verbal protocols. In the second variant

(Kellogg, 1987), writers directly indicate which writing process the current probe interrupted. Obviously, before being able to perform such a directed verbalization, writers are first trained to identify the writing processes they engage when composing a text.

Data from verbalizations indicate that writers very frequently use the translating processes, and constantly throughout a writing task. In contrast, planning and revising are less frequently used, but roughly in the same proportion. Moreover, activation of planning decreases during the course of writing, while that of the review increases. More specifically, the triple task method was used to study the amount of resources allocated to the writing process. In general, planning and revision have been shown to be the most demanding processes. However, in their review, Piolat and Olive (2000; see also Olive, Kellogg, & Piolat, 2002) have shown that allocation of cognitive resources to the writing processes and temporal organization of these processes vary according to the demands of the writing tasks and writers' knowledge. Amount of resources allocated to the writing processes are mainly affected by writers-specific factors (topic knowledge, working memory capacity). Activation of the writing process, especially of planning and reviewing, is rather mainly influenced by situation-specific factors (composing with or without draft, type of draft, etc).

The triple task technique raises several methodological questions concerning particularly the reactivity and validity of directed verbalizations. Several studies have been conducted to assess its validity (Kellogg, 1987b; Piolat, Kellogg & Farioli, 2001; Piolat, Olive, Roussey, Thunin, & Ziegler, 1999; Piolat, Roussey, Olive, & Farioli, 1996; Ransdell, 1995). These studies indicate that the triple task does not disrupt the writing process. Neither the functional characteristics of writing processes nor quality of the texts that are produced in triple task situation are influenced. Moreover, directed verbalizations provide valid information about the processes underlying the primary task and do not reflect writers' metacognitions about how they compose (Levy & Ransdell, 1995). Of course, directed verbalizations, given their discrete nature, provide only an approximation of the writing processes.

4.3. Tools for Implementing Dual and Triple Tasks

As for verbalization, implementing dual tasks doe not require a specific program. General programs for experimental psychology can be used (E-prime, PsyScope, MEL, SuperLab, etc.). Several of these programs are listed at the Psychology Software List (http://www.psychology.org/links/Resources/Software/). If there is no specific difficulty in using these programs, writing researchers have to take care of how they design secondary task. Two main problems have indeed to be avoided. Firstly, it is important to compare dual task data with single task ones. Accordingly, researchers must not forget to ask writers in their experiment to perform the secondary task, and perhaps even the primary task, in single condition. Secondly and of major importance when the secondary tasks require stimuli of different nature, difficulty of the secondary tasks used in the same experiment have to be of equal difficulty. This point is especially important because when difficulty of different secondary tasks varies, performance at these tasks cannot be compared.

As far as the triple task is concerned, different programs can be used for implementing that method depending on the kind of verbalization writers have to perform. With free verbalization, tools for recording both the writers' thinking aloud protocols and response to

the probes (RTs) are needed. However, with directed verbalization, the ScriptKell program has been designed by Piolat, Olive, Roussey, Thunin, and Ziegler (1999) to allow researchers in experimental and cognitive psychology to measure the time and effort allocated to the various cognitive processes engaged in written composition in a very simple and direct manner. ScriptKell has been designed to easily use and modulate the Triple-task procedure (e.g., the global configuration of the task, the interval between auditory signals, the number and nature of the categories used in the directed retrospection) in order to address a number of theoretical and methodological issues. In sum, ScriptKell facilitates the flexible realization of experiments and the investigation of critical issues concerning cognitive effort and use of the writing processes. More information on the program can be found in the publications already quoted in Section 3.4. A free copy of ScriptKell can be obtained by sending an email to the author of the present chapter.

5. OCULAR MOVEMENT IN WRITING

5.1. Theoretical and Methodological Basis

Despite the analysis of eye movement is an intensive field of research in the scientific study of reading, its use in writing is very recent. This may be due in part by difficulties associated to writing research: the material that writers look at (their evolving text) cannot be manipulated by researchers, and it differs for each writer since each writer compose its own specific text. However, and although these difficulties, the study of writers' eyes movements recently growth and since a few years several research programs on that topic are conducted in different laboratories in the world. The postulate shared by all these research programs is the same than for all real-time studies, namely that the underlying cognitive processes can be inferred through the analysis of time and of location in the text of fixations and of saccades. However, to be fully informative eye movements have to be associated to the writer's activity. Accordingly, eye movement data are analyzed in conjunction with pausing and handwriting (or typing) activities. Different writing processes may indeed be implemented when writers look back at their text when they are pausing or when they are writing down their text, not only because they can read their text for different purposes but also because their available working memory capacity may also differ.

The study of writers' eye movement especially aims at understanding how, and why, writers consult the text in progress. The text in progress indeed provides a visual external storage for the writer who can consult it text for different purposes. First, writers can read their text for revision purposes. For example, they can read their text to detect errors at different levels (e.g., spelling or grammatical errors, semantic problems…). They can also read their text to find new ideas. In that case, writers do not try to diagnose problems in the text but rather to generate new content. Wengelin, Torrance, Holmqvist, Galbraith, Johansson and Johansson (2009) suggest that:

> " (1) Writers might look at their emerging text to prompt content generation;(2) writers might look at their emerging text to manage reference (presumably, specifically anaphoric reference) and so maintain cohesion; (3) writers might look at their emerging text to detect

and/ or correct errors; (4) writers might look at their emerging text to compare it with an (internal or external) outline of intended content; and (5) writers might look at their emerging text as part of a deliberate and explicit metacognitive decision to revise what they have written".

More globally, two general issues can be addressed by examining writers' eye movements: first studying reading processes in writing and second analyzing how reading is coordinated with the other writing processes (Alamargot, Chesnet, Dansac & Ros, 2006). Before going further, it is necessary to distinguish two kinds of reading in writing. The most obvious function of reading in writing is revising the text (or prompting new ideas). However, before writing, but also during writing, writers might consult external documentation. This issue is particularly important in technical and academic writing where document synthesis, note taking activities and description of figures are very often required.

Regarding how reading is coordinated with the other writing processes, Alamargot et al. (2006) have shown that at least 10% of the reading activity occurs while writers are handwriting their text. More important, they have shown that writers can first read a part of their text while executing it, detect an error and decide to edit it latter. This clearly suggests that revision involve at least two different stages: a detection stage during which writers identify and diagnose errors and an edition stage during which they edit the detected errors.

To conclude on writers' eye movement, a new line of research is opening. As a result, research on writers' eye movement is just emerging and several new questions are rising. One crucial issue that will probably be explored concerns the extent at which reading in writing differs from reading for comprehension. It is clear that different reading activities are carried out when reading a text for comprehending it, but not only the underlying processes differ, the on-line parameters of these processes differs. For instance, as reading for evaluating appears more costly than reading for comprehending (Roussey & Piolat, 2008), fixations and saccades are undoubtedly different in these two kinds of reading. Another crucial aspect relates to revision: studying reading while composing a text will certainly foster our understanding of these complex processes. Finally, eye movement will presumably help to gain insight in how writers create new ideas by reading their text or by checking formulation (Galbraith, 1999).

5.2. Recording and Analyzing Writers' Eye Movement

As for the analysis of pauses, specific programs have been developed for recording and analyzing writers' eye movements according to whether writers compose their text by hand or with a computer keyboard and a word processor. Actually, three programs are available: "Eye and Pen" for the study of eye movements in handwriting, "EyeWrite" (Simpson & Torrance, 2007), and a combination of ScriptLog with an eye tracker (for the study of typed text composition. These tools are described in details in Alamargot, Chesnet, Dansac and Ros (2006) and in Wengelin, Torrance, Holmqvist, Galbraith, Johansson and Johansson (2009) respectively. Accordingly, this section will shortly describe these programs and their main functions.

As already indicated, Eye and Pen analyzes the writers activity by determining when she is writing or pausing. A second module also allows researchers to track eye movements and to

associate them with a precise location in the text and with the activity the writers is conducting, for example during a particular saccade. Eye and Pen is compatible with different eye trackers that can either immobilize writers' head or allow head movements. This program records eye movements, synchronizes them with data from the digitizing tablet; and processes the eye movements to provide global indexes about the temporal parameters of fixations and saccades and location in the text. Eye and Pen also proposes a basic scripting language for supervising experiments (displaying source documents on the computer monitor, displaying stimuli, etc…). As with pauses, it is possible to play again the composed text along with the author eye movements. Thus each eye movement event can be categorized and areas of interest can be defined.

EyeWrite (Simpson & Torrance, 2007) and ScriptLog with an eye tracker integrate keystroke logging with eye movement recordings allowing the study of text production with computer. Both these programs comprise a simple text editor, which does not permit cut and paste operations. The editor program logs both keystrokes and eye movements. EyeWrite analysis program interprets the combined keystroke and eye movement data to generates text-relative fixation location information that can be played back. ScriptLog with an eye tracker needs a supplementary tool –TimeLine– for visualizing keyboard and eye movements. TimeLine propose a specific graphic environment for displaying data which displays represent the writing session by each keystroke and whether the writer's eyes are directed toward the computer monitor or keyboard. TimeLine also indicates whether writers were reading their text for comprehension purpose (for technical details on how this behavior is automatically extracted see Wengelin et al., 2009) but also the x,y coordinates of the gaze. Of course, these programs also generate summary statistics.

6. CONCLUSION

This chapter has reviewed several real-time (or on-line) methods for studying the writing process. Some of the methods that have been described are traditionally used in general psychology (such as verbalizations or dual tasks); other methods and tools have been specifically designed to investigate writing (such as pause analysis or writer's eye movement); some have been used since the beginning of research on the cognitive processes of text production whereas others are still being tested (eye movements). The common postulate under all these research methods is that studying writing while it is performed allows researchers to access, even indirectly, the mental on-going processes. Whatever the method, they help to further understand the writing processes and their functional characteristics.

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Chapter 2

STEPWISE COMPUTER-BASED SCAFFOLDING FOR ACADEMIC WRITING: HOW IT AFFECTS WRITING ACTIVITIES, PERFORMANCE, AND MOTIVATION

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ABSTRACT

Academic writing is a complex task that involves a variety of cognitive and metacognitive activities. One approach to assist writers in dealing with the problem of managing their resources during writing is to scaffold writing by computer. Unfortunately, empirical research on computer-based scaffolding (CBS) of writing is quite limited, and the results are mixed. An explanation for these results may be found in the design of the scaffolding. Most CBS support discrete writing activities, independently from the writing process. This chapter seeks to contribute to the question of how to design CBS which supports the academic writing process as a whole. As a basis for the design, the subtask model of academic writing is presented which explicitly describes the demands of academic writing. This model is derived from theoretical and empirical findings on expert writing. The implementation of CBS for expert writing activities into the writing environment *escribo* is then described. The CBS stepwise supports the application of these expert writing activities. To this end, *escribo* decomposes the writing process in its subtasks and provides specific instruction and tools for the completion of each activity. Furthermore, two evaluation studies on the effects of the writing environment are summarized. The results show that working with *escribo* is superior to a situation without CBS. Implications of these results will be discussed with regard to the benefits and restrictions of fostering expert writing activities through computer-based scaffolding.

INTRODUCTION

Composing scientific texts poses specific challenges for writers. For example, writers must review the literature and develop their own opinion on the topic. Within the essay they must state their opinion clearly and provide evidence for it. To do so, writers need to successfully collect, select, relate, and organize the information into a consistent and coherent text structure. Many researchers agree that an expert writer is a thoughtful planner, a coherent organizer, a careful reviser, as well as an audience-sensitive message sender (Boscolo, 1995; Scardamalia & Bereiter, 1991). Thus, expert writing involves the goal-directed use of a variety of cognitive and metacognitive activities (e.g., Alamargot & Chanquoy, 2001; Kozma, 1991b; Torrance, 1996). However, less skilled writers often struggle with organizing their writing process effectively (McCutchen, 1996, 2000) and may thus produce texts which lack comprehensibility and persuasiveness (Nussbaum & Kardash, 2005).

Indeed, writing expertise is difficult to acquire and only develops as a result of extended experience (Kellogg, 2008). However, it is not solely the amount of relevant experience in a domain, but the amount of deliberate effort that brings performance improvement (Ericsson & Charness, 1994; van Gog, Ericsson, Rikers, & Paas, 2005). In order to engage students in this kind of effortful practice activities, authentic training tasks must be developed (van Gog et al., 2005). These tasks need to externally support those activities that become internal for expert writers, generate feedback, and offer opportunities to practice corrected performance (Ericsson, 2006; Ericsson, Krampe, & Tesch-Römer, 1993). One potential means of externally supporting inexperienced writers is through computer-based scaffolding (Proske, Narciss, & McNamara, in press).

Scaffolding generally can be defined as the provision of external support that helps students carrying out one or more activities involved in writing (Graham & Perin, 2007; Wood, Bruner, & Ross, 1976). In this sense, computer-based scaffolding (CBS) aims at providing the writer with some form of immediate assistance, via interactions with the computer. It typically embeds support within the system and leaves adaptation under the control of the writers who can attempt to follow or work around the computers advice (e.g., Reiser, 2004). The underlying assumption is that students will acquire efficient writing activities as a result of the scaffolding and that they will increasingly apply these activities even when the CBS is no longer available (Graham & Perin, 2007; Sitko, 1998).

CBS can be realized in several ways, including prompts that guide the writing by questions on the screen (e.g., Zellermayer, Salomon, Globerson, & Givon, 1991) and writing tools that assist in the completion of discrete writing activities (e.g., outlining tools, revision tools, see for example Lansman, Smith, & Weber, 1993).

Studies on the effectiveness of CBS show that it can improve writing performance (e.g., Zellermayer et al., 1991) and writers' management of cognitive resources (e.g., Butcher & Kintsch, 2001). However, it has also been found that CBS may lead to the production of less readable texts, less conceptual planning, or lower-level revision processes (e.g., Haas, 1996; Lansman et al., 1993; MacArthur, 2006).

An explanation for these mixed results may be found in the design of the scaffolding. Most CBS support discrete writing activities, independently from the writing process. As such, they cannot guarantee effortful practice with the goal of performance improvement (Proske et al., in press). Given that expert writing activities concern the whole writing

process, CBS should support inexperienced writers throughout the whole writing process as well. The prerequisite for the design of such CBS is a task analysis that identifies those aspects that distinguish expert writers from less skilled writers (van Gog et al., 2005). Only such a task analysis can guarantee that the demands of expert writing will be systematically considered when designing the CBS.

Therefore, the purposes of this chapter are to (a) present an integrative model specifying the demands of academic writing, (b) illustrate how this model serves as basis for the design of a writing environment *escribo* which supports inexperienced writers in academic writing, and (c) summarize the results of two evaluation studies investigating the effectiveness of this writing environment on writing activities, performance, and motivation.

THE SUBTASK MODEL OF ACADEMIC WRITING

Skilled writers purposefully use (a) different sources of knowledge (i.e., topic, linguistic, and genre knowledge), (b) a variety of writing activities (such as prewriting, goal setting), and (c) multiple metacognitive strategies to manage the complexity of the academic writing process (e.g., Alamargot & Chanquoy, 2001; Kozma, 1991b). Figure 1 presents the subtask model of academic writing (Proske, 2007), which was derived from general cognitive writing models (e.g., Bereiter & Scardamalia, 1987; Hayes, 1996; Hayes & Flower, 1980) as well as empirical findings on expert writing strategies (e.g., Kellogg, 1987; Kozma, 1991b; Van Wijk, 1999). The model specifies the demands of academic writing by explicating central aspects of expert writing.

Analogue to the cognitive writing models, the subtask model assumes that an academic writing process takes place in a specific environment (e.g., Hayes & Flower, 1980). The *writing environment* for example is determined by the number of available source texts or the composing time. The central component of the environment is the writing assignment. The writing assignment is composed of a particular task (e.g., to describe) and a specific topic (e.g., an expectancy-value model of motivation) and thus defines which content has to be addressed in the text in which way.

Individual (pre)dispositions mediate between the environment and the writing process (e.g., Hayes, 1996). Skilled writers use their extensive knowledge about topics, text genre, and procedural knowledge as a basis for coordinating their writing activities (e.g., McCutchen, 2000; Torrance, 1996). Furthermore, they rely on motivational beliefs (i.e. intrinsic value of writing and competence beliefs) in order to overcome difficulties and maintain the writing process (Bruning & Horn, 2000; Hidi & Boscolo, 2006). As a result, they are able to fulfill the requirements of the writing assignment and to adapt their text to the reader in terms of adjusting its line of argumentation and its readability (Alamargot & Chanquoy, 2001). Inexperienced writers lack this knowledge and thus are more likely to produce texts of lower quality (Ferrari, Bouffard, & Rainville, 1998; Ferretti, MacArthur, & Dowdy, 2000). This may lead to feelings of incompetence and frustration which in turn will decrease students' writing motivation (e.g., Hidi & Boscolo, 2006).

A final text develops from different intermediate versions of this text (e.g., notes, drafts), with the current text product defining the *actual state* of the developing text. In order to identify the *target state* of the text, the writer has to develop a mental representation about the

writing assignment and the text to be composed by analyzing the writing assignment and activating his/her knowledge on topic and text genre (e.g., Bereiter & Scardamalia, 1987). As writing proceeds, this mental representation needs to be increasingly refined. Each time the current mental representation defines the writers' target state of the text. Actual text and mental representation of the target state interact. The target state guides the composition of the actual text, and the composing of the actual text may lead to new ideas for the target state (e.g., Hayes, 1996; Rijlaarsdam et al., 2008). A permanent *comparison of actual state and target state* allows controlling the text composition. In case of a discrepancy, the writer has to identify reasons for this discrepancy and decide how to overcome it. Expert writers base their actual - target comparison on a more adequate mental representation of the assignment than less skilled writers (Ferrari et al., 1998). As a consequence, less skilled writers are likely to introduce errors into their texts (Ferrari et al., 1998) or to finish the writing process before they have properly explored the topic (Torrance, Fidalgo, & García, 2007).

The *writing process* includes the *subtasks* orientation, collection, planning, translation, and revision under which numerous sub-processes operate (e.g., Bereiter & Scardamalia, 1987; Hayes, 1996; Hayes & Flower, 1980; Kellogg, 1987). Each of these subtasks is related to different activities, results in specific outcomes and thus contributes its particular part to the academic writing process. More specifically, without succeeding in all subtasks the writing process will not be successfully mastered (Proske, 2007).

The goal of *orientation* is to develop a first mental representation of the writing assignment. For this, the scope of the topic has to be estimated and the task demands need to be identified. Inexperienced writers often fail to construct an adequate mental representation of the writing assignment (e.g., Bereiter & Scardamalia, 1987; Kozma, 1991b). Therefore, they may experience problems in carrying out the other subtasks of the writing process goal directed.
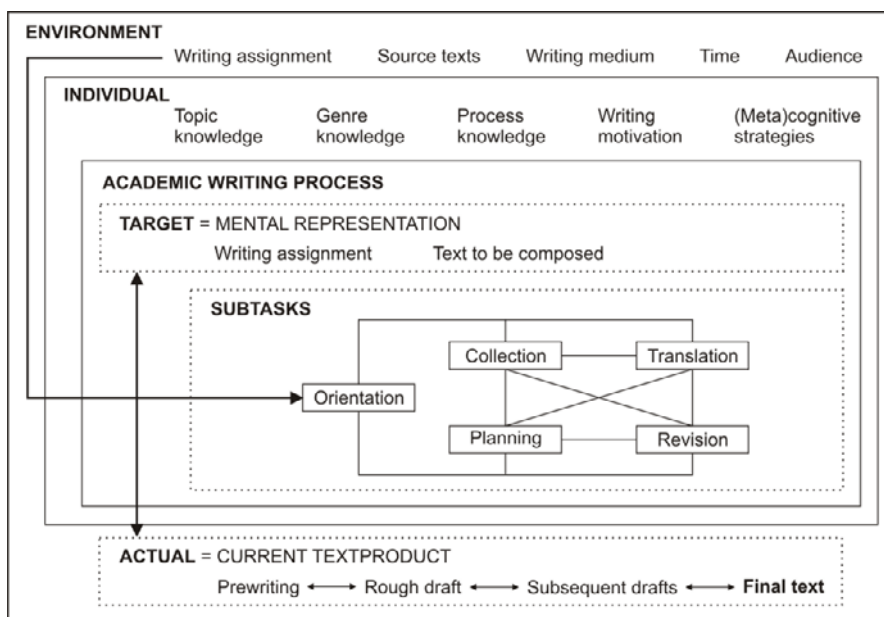

Figure 1. The subtask model of academic writing (Proske, 2007)

The subtask *collection* involves searching for text information. Here, the processing of source texts plays a major role. The writer has to select relevant papers as well as to read and comprehend them. The goal of collection is to find relevant information as well as interrelations and argumentative connections of this information. Expert writers are also competent readers (Hayes, 1996). By contrast, inexperienced writers often oversimplify or misunderstand source texts (e.g., Britt & Aglinskas, 2002) which negatively affects the quality of their own texts that interpret or summarize these source texts (Hayes, 1996).

During *planning* the chosen information will be processed further. Contents for one's own text have to be selected, related to each other, and structured. Thereafter, the text message, line of argumentation, and outline of the text to be composed can be determined. Simultaneously, the target state of the intended text is refined. Expert writers have longer prewriting phases in which they plan more and at a higher, conceptual level than do inexperienced writers (e.g., Bereiter & Scardamalia, 1987; Haas, 1996; Kozma, 1991a, 1991b). Consequently, inexperienced writers develop only vague top level goals for their writing and spend their planning time at lower-level goals which deal with the surface structure of their text (i.e. word choice and sentence structure, Flower & Hayes, 1981).

The subtask *translation* corresponds to language production. Here, the planned contents must be translated into linear text. Later, the writer has to polish words and sentences. Translation demands simultaneous control over four information units (Van Wijk, 1999): (a) the text topic, (b) a local concept (i.e., the current idea that has to be translated into text), (c) the global design of the text structure, and (d) a set of rhetorical considerations. The extent to which writers attend to these four different information units accounts for different levels of competence. Less skilled writers are not able to coordinate all four units at a time (Alamargot & Chanquoy, 2001; Van Wijk, 1999).

During *revision* the writer reworks the text produced so far by considering his/her intended text (i.e., the target state). Expert writers revise frequently and their revision results in changes of both the text's surface (e.g., word and sentence changes) and its meaning (e.g., McCutchen, Francis, & Kerr, 1997). In contrast, inexperienced writers rarely revise, and when they do, their revisions focus primarily on surface features of the text (e.g., spelling, punctuation) rather than on meaning of the text (e.g., Fitzgerald, 1987; Hayes, Flower, Schriver, Stratman, & Carey, 1987). Less-skilled writers have difficulties in detecting problems in their text (Hayes, 2004). Furthermore, they lack knowledge of criteria for good writing that they could use to evaluate and revise their work (Kozma, 1991a).

The subtasks of the academic writing process will typically not be executed in a linear sequence. They, rather, are to be understood as cognitive processes which can occur in the form of complex patterns. Metacognitive control permits expert writers to be aware of their own cognitive activities, to reduce their cognitive load, and to decide when and how to invoke particular writing strategies (e.g., Kellogg, 2006; Scardamalia & Bereiter, 1991).

Clearly, the above presented subtask model of academic writing does not constitute a coherent model of expertise development in writing. Nonetheless, it indicates that the purposeful use of expert writing strategies and knowledge appears to be essential for an efficient management of the writing process as a whole (Alamargot & Chanquoy, 2001). When less experienced writers are not aware of strategies and knowledge to cope with the subtasks of academic writing, they might not be able to use these strategies and knowledge. Therefore, less skilled writers need to be provided with an environment that offers external support to acquire the various activities that characterize expert writers. One possibility of

providing such external support is through computer-based scaffolding. In the following section, the computer-based writing environment *escribo* is described which has been designed based on the subtask model of academic writing.

THE WRITING ENVIRONMENT *ESCRIBO*

The writing environment *escribo* is a web-based application which scaffolds academic writing. It was developed to externally support expert writing by (a) decomposing the writing process into well-designed subtasks, (b) guiding the mastery of the subtasks, (c) providing informative feedback, and (d) giving opportunities for repetition and correction (Ericsson et al., 1993). It stepwise provides information on when and how experts perform specific activities during writing (Ericsson, 2005).

The writing environment *escribo* is depicted in Figure 2. It consists of *file cards* that decompose the writing process into the five subtasks for successful academic writing: orientation, information collection, planning, writing, and revising the text. The aim of this decomposition is to break up and organize the writing process as well as to draw the writer's attention to each relevant activity (e.g., Pea, 2004; Salomon, Perkins, & Globerson, 1991). When clicking on a file card, sub-file cards are activated which represent the different writing activities of the particular subtask.
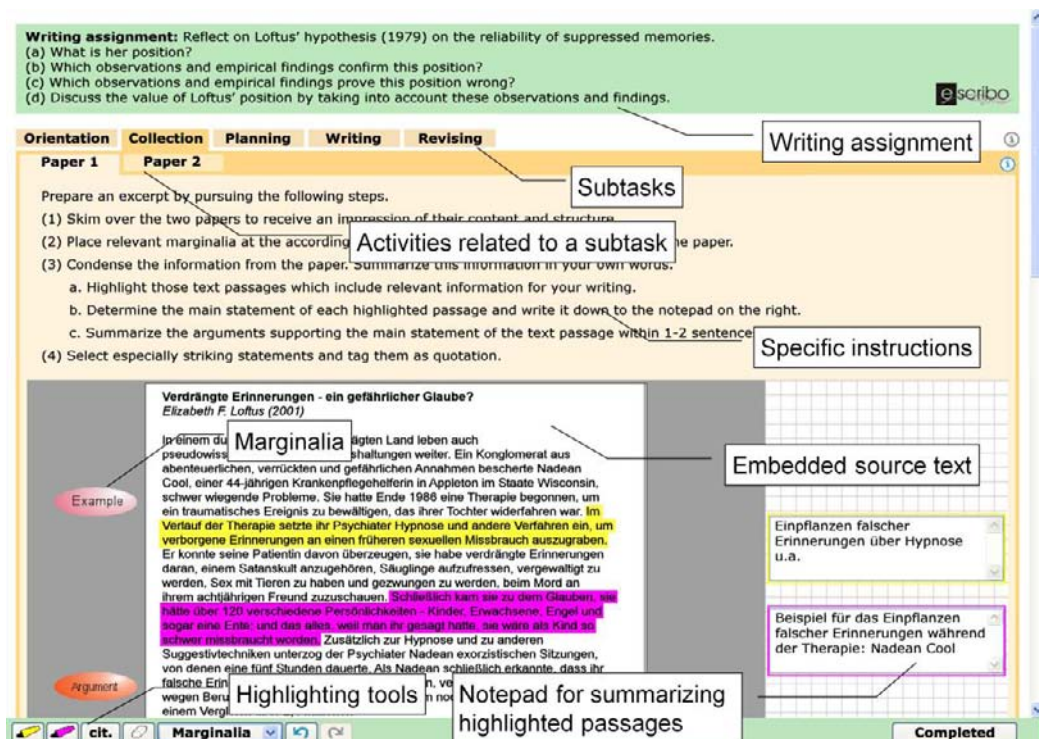

Figure 2. The writing environment escribo – File card Collection, sub-file card Paper 1

Table 1. The Writing Process in the Writing Environment escribo

Sub-task	Sub-file card	Requested writing activities
Orientation	Orientation	Analyzing writing assignment
		Activating prior knowledge
		↓
Collection	Paper 1 (pro)	Highlighting relevant passages
		Summarizing relevant passages with own words
	Paper 2 (con)	Highlighting relevant passages
		Summarizing relevant passages with own words
		↓
Planning	Analyzing	Structuring information from the textbook articles
		Developing own position
		Clarifying and defining terms
		↓
	Argumentation	Formulating main thesis for the text
		Determining line of argumentation
		↓
	Outline	Formulating headings
		Matching arguments
		↓
Writing	Transforming	Producing a first rough draft
		↓
Revising	Revision 1	Capturing the reader's perspective
		Reading own text
		Revising for structure and line of argumentation
		↓
	Revision 2	Reading own text
		Revising for text comprehensibility
		↓
	Revision 3	Reading own text
		Editing text
		↓
		Final version of the text

The writing assignment is continuously present at the top of the screen. If a writer finishes an activity by clicking on the button *completed*, the writer is automatically forwarded to the next file card. Results from the previous file cards are available and can be processed further. It is impossible to skip a card at the first attempt, but writers may at any time return to a file card that they already had worked on, as well as modify or correct the entries on the particular card.

On each sub-file card, specific instructions and tools assist students in the completion of the particular activity. In this way, expert guidance is embedded by making effective writing strategies visible to the writers (Quintana et al., 2004). Furthermore, *escribo* automatically delivers time-prompts which ensure an optimal allocation of writing time (Breetvelt, van den Bergh, & Rijlaarsdam, 1994). Thus, writers are supported in interpreting and clarifying task demands and in setting goals and sub-goals. Table 1 provides an overview about the writing activities which scaffolds *escribo* on each sub-file card.

Figure 3. The writing environment escribo – File card Planning, sub-file card Outline

On the file card *orientation* students are encouraged to analyze the writing assignment, as well as to activate their prior knowledge on the text genre and topic. In order to prevent writers from ignoring this writing subtask, the button *completed* is inactive for about a minute. Therefore, students can only proceed to the next subtask after the button is activated.

The *collection* file card requires students to summarize and structure relevant information from two textbook articles (sub-file cards *paper 1* and *paper 2*, respectively). The textbook articles are implemented within the writing environment. Using strategies for summarizing reading material improve writers' ability to concisely and accurately present relevant information in writing (e.g., Britt & Aglinskas, 2002; Britt, Wiemer-Hastings, Larson, & Perfetti, 2004). Therefore, *escribo* first requests the writer to get an overview about content and formal structure of the particular textbook article. To this end, *escribo* provides marginalia which exemplify particular functions of a text passage (e.g., pro-argument, counter-argument, or definition). In order to qualify the formal structure of the particular textbook article, students can place these marginalia near a respective text passage (see Figure 2). In a next step, information which is relevant for the own text can be highlighted and summarized. As soon as the writer highlights a text passage, a notepad is automatically opened on the right side. This notepad requires the writer to shortly summarize the highlighted passage. In this way a superficial copying of information from the textbook article can be prevented (Britt & Aglinskas, 2002).

During *planning*, the collected information needs to be processed further and related to each other on the sub-file card *analyzing*. Furthermore, the analyzing sub-file card requests students to determine and define key points and concepts for their text by using the collected information. As clear and specific goals for the writing product improve writing performance

(e.g., Graham & Perin, 2007), the *argumentation* sub-file card asks students to write down their text goal, i.e. the main message of their text to be produced. Furthermore, writers are required to select a line of argumentation out of three typical argumentation structures *chain*, *rhombus* and *balance* (Bünting, Bitterlich, & Pospiech, 2000). The *outline* sub-file card helps writers gather and organize ideas for their composition (Kozma, 1991b). As strategies for topical organization and structure seem to be superior to other prewriting strategies such as listing or clustering (Englert, Yong, Dunsmore, Collings, & Wolbers, 2007; Kellogg, 1988, 1990), the outline file card requests students to formulate headings according to their line of argumentation selected on the argumentation sub-file card. This line of argumentation is automatically visualized on the outline sub-file card. Key points and concepts from the sub-file card *analyzing*, as well as the text goal formulated on the argumentation sub-file card are available and can be assigned to the particular heading (see Figure 3).

The *writing* file card provides students a text editor with fundamental editor functions (e.g., copy and paste, formatting and listing options) for translating their planned ideas into a rough draft of their text (e.g., Kellogg, 1990). Access to previously developed content and text structure allows students to engage in and better monitor higher-level writing processes (Sturm & Rankin-Erickson, 2002). Therefore, headings and pertinent structured text fragments from the outline sub-file card are available on the left side. The headings as well as the text goal from the argumentation sub-file card are transferred automatically to the text editor.

In order to prevent writers from revisions that focus primarily on surface features of the text (e.g., Fitzgerald, 1987; Hayes et al., 1987), *escribo* supports three *revision* steps. On the sub-file card *revision 1* students are requested to capture the readers' perspective (Fitzgerald, 1987). To this end, *escribo* provides an audio-file that contains students' rough draft. By listening to this audio-file students are requested to control their line of argumentation. In a next step, they have to highlight the presented position, pro- and counter-arguments, as well as their own opinion within their text with different colors. Based on these markings, *escribo* makes suggestions in which sequence position, evidence in favor and against this position, as well as their own opinion should be included into the essay. The sub-file card *revision 2* asks writers to revise their texts with respect to readability and style. As less-skilled writers have difficulties in detecting text problems (Hayes, 2004), students have the possibility to use the following tools: (a) a tool indicating long sentences, (b) a tool indicating a lack of coherence between two sentences, and (c) a tool indicating nominal style. Furthermore, writers are prompted to revise sentences and to reconsider their word choice by eliminating redundancies, or cutting empty and inflated phrases. Finally, the sub-file card *revision 3* requests writers to revise for grammar, spelling, and punctuation. An automatic spelling control supports this revision step by highlighting misspelled words.

EVALUATION OF THE WRITING ENVIRONMENT *ESCRIBO*

In order to evaluate the effectiveness of the computer-based scaffolding provided by *escribo* two evaluation studies were conducted which will be summarized in the following sections.

Evaluation Study 1: Short-Term Effects of Working with Escribo on Writing Product, Achievement, and Motivation

The first evaluation study did not only seek to investigate the effects of the CBS on writing product and achievement, but also on motivation (Proske, 2007).

Design. The study employed a quasi-experimental design with two consecutive measures. Forty one university students (33 women, 8 men, *M* age = 21.6 years, *SD* = 3.1) participated in the study. One half of the participants worked with *escribo* in the first session and in the second session in a control situation (treatment - no treatment group = TNT group). The other half of the participants wrote their texts without CBS in the first session, but used the writing environment in the second session (no treatment - treatment group = NTT group, see Table 2).

At every session each participant worked on a different writing assignment. Assignments were identical regarding surface features, but differed in their content. The writing assignment *Whorf* concerned Whorf's position on the relation of speech and thinking (Whorf, 1956), whereas the assignment *Loftus* was about Loftus' position on the reliability of suppressed memories (Loftus, 1979). The sequence of the writing assignments was counterbalanced between the groups. Students in each writing assignment were asked to present (a) the particular academic position, (b) evidence in favor of this position, (c) evidence against this position, and (d) their own opinion. In order to complete the assignments, students were asked to integrate information from two German textbook articles. One of the textbook articles supported the academic position, the other argued against that position. Both textbook articles were included into the writing environment *escribo* on the sub-file cards paper 1 and paper 2, respectively.

Measures. All students' activities were recorded in log-files. To asses *writing product* variables, *total working time* and *number of words included into the final essay* were automatically summarized from these log-files. The measure of total working time represents the sum of time on all writing activities that had been done.

Table 2 Design of Evaluation Study 1 (see also Proske, 2007)

	Test Time 1			*Test Time 2*	
Condition	Pre-test	t1	Dependent measures	t2	Dependent measures
TNT group (treatment - no treatment)	Control variables Motivation	*escribo*	Writing product Performance Motivation	Control	Writing product Performance Motivation
NTT group (no treatment - treatment)		Control		*escribo*	

Accuracy and coverage of content was rated using a coding scheme. It consisted of anchor examples illustrating poor to very good answers to the four parts of the writing assignment (presentation of the academic position, evidence pro position, evidence contra

position, and presentation of own opinion). Construction of anchor examples was based on the textbook articles. For each part, accuracy and coverage of information from the textbook articles was evaluated on a scale from 1 (very good quality) to 5 (poor quality).

Interrater agreement was calculated by using the Intraclass Correlation Coefficient (*ICC*, Rae, 1988; Shrout & Fleiss, 1979). The correlational coefficients for interrater agreement were between *ICC* = .49, $p < .05$ and *ICC* = .91, $p < .01$ for readability and *ICC* = .62, $p < .01$ and *ICC* = .99, $p < .01$ for accuracy and coverage of content. Averaged ratings were used for statistical analyses of data (for detailed information see Proske, 2007).

Motivation was assessed by a questionnaire addressing perceived intrinsic value, competence beliefs and easiness of academic writing (Proske, 2007). The questionnaire was developed on the basis of an integrative expectation - value model of learners' motivation (Narciss, 2006).

Table 3. Means and Standard Deviations of Writing Behavior, Performance, and Motivation Measures during Test Time 1 and Test Time 2

	Treatment - no treatment group (*n* = 19)			No treatment - treatment group (*n* = 21)	
Variable	*M*	*SD*		*M*	*SD*
	Test time 1				
Performance					
Readability	2.39	0.53		2.86	0.72
Accuracy and coverage of content	3.20	0.84		2.96	1.11
Number of words in final essay	715.00	222.02		1006.86	299.10
Total working time (minutes)	184.55	35.50		185.86	38.90
Motivation					
Intrinsic value	2.89	1.10		3.62	1.09
Competence beliefs	2.49	0.86		3.08	1.05
Easiness of writing	2.95	1.00		3.38	0.99
	Test time 2				
Performance					
Readability	2.51	0.70		2.62	0.54
Accuracy and coverage of content	2.74	1.02		3.25	0.96
Number of words in final essay	872.89	341.16		776.62	245.24
Total working time (minutes)	160.64	39.00		189.02	38.76
Motivation					
Intrinsic value	3.54	1.19		2.88	1.22
Competence beliefs	3.46	1.13		2.55	0.88
Easiness of writing	3.74	1.27		2.74	1.25

Statistical analyses. For both test times, separate multivariate analyses of variance (MANOVA) were conducted. For each MANOVA condition (TNT vs. NTT) served as

independent variable; dependent variables were the writing product and performance measures, as well as an integrated motivation measure that summarized the three scales of the questionnaire (intrinsic value, competence beliefs, and easiness). Separate analyses were conducted for each test time rather than a MANOVA with repeated measures because the conditions of testing (treatment - no treatment, TNT vs. no treatment - treatment, NTT) rendered the two test times incomparable for the groups.

Results. Table 3 presents the descriptive statistics for both groups on writing behavior, performance, and motivation variables at both test times. The MANOVA for test time 1 revealed a statistically significant difference between the two conditions ($F(5, 32) = 4.21$, $p < .01$). In univariate follow-up-analyses this main effect could be attributed to readability ($F(1, 36) = 3.99$, $p < .05$), number of words ($F(1, 36) = 12.97$, $p < .01$), and motivation ($F(1,36) = 5.07$, $p < .05$). The TNT group which received CBS by *escribo* at this test time achieved a better readability, but included fewer words into their final essay. Furthermore, they reported to be less motivated than the NTT group who was not supported by CBS at this time.

At test time 2, the MANOVA also revealed a main effect for condition ($F(5, 27) = 2.92$, $p < .05$). This main effect could not be attributed to performance; writers in both conditions achieved the same results on both dimensions of performance. However, univariate tests showed that the main effect was significant for total working time ($F(1,31) = 10.16$, $p < .01$) and motivation ($F(1,31) = 5.53$, $p < .05$). Students who had worked with *escribo* at test time 1 (TNT group) were about 30 minutes faster than the group who did not receive CBS in the session before (NTT group). At test time 2 the writing performance in both groups was equal, but the TNT group completed their text faster. This may be interpreted as more efficient writing. Furthermore, at this test time the TNT group assessed their motivation higher than the NTT group (see Table 3).

At each test time students considered their motivation lower when they were supported by *escribo*. To understand this pattern of results, students' answers on the single scales of the motivational questionnaire were analyzed in more detail. A MANOVA with repeated measures yielded a statistically significant main effect for test time ($F(6, 33) = 7.21$, $p < .01$). Contrasts revealed that intrinsic value and easiness of writing were perceived higher when students were not supported by CBS (intrinsic value: $F(1, 38) = 8.11$, $p < .01$, easiness: $F(1, 38) = 18.88$, $p < .01$). Conversely, self-reports of competence beliefs were significantly lower after working with CBS than at the pre-test ($F(1, 38) = 26.83$, $p < .01$, see Figure 4).

Discussion. The results of the first evaluation study provide evidence that working with *escribo* is superior to a control situation without CBS. Students who were supported by CBS wrote more readable tests at test time 1. Moreover, at the second test time without CBS these students completed their tests faster compared to students who received the CBS for the first time. Additionally, students reported a fairly high acceptance of such a writing environment (see Proske, 2007). These findings indicate that stepwise supporting expert activities by CBS can improve the academic writing of inexperienced writers.

The results of this study also show that working with *escribo* has an impact on motivational variables. Whereas students' beliefs in their competence significantly decreased when they were supported by CBS, beliefs did not change when they worked within the control condition. It might be that the CBS not only facilitates the application of expert writing activities, but also points to the complexity of academic writing. By using CBS,

students simultaneously figured out what academic writing involves, what they have to do, what they have to keep in mind, etc. A situation without scaffolding does not deliver such information. This hypothesis is corroborated by the finding that perceived intrinsic value and easiness of writing did not significantly change when students were supported by *escribo*. Unfortunately, a detailed investigation of these motivational aspects was not possible due to the study design.

In summarizing, the first evaluation study showed that stepwise scaffolding expert writing activities is an appropriate mean of supporting inexperienced writers in expert writing activities (see also Proske, 2007). However, there are many open questions left. One of them concerns the question how long the effects of *escribo* will last even if the CBS is no longer available.
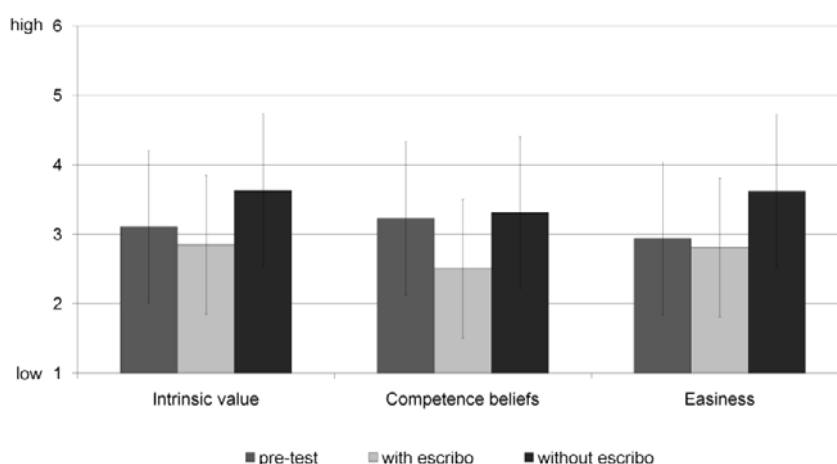
Figure 4. Perceived intrinsic value, competence beliefs, and easiness after writing with and without escribo

Evaluation Study 2: Longer-Lasting Effects of Practicing Writing with Escribo on Writing Activities and Achievement

In order to investigate long-term effects of *escribo*, a second evaluation study was conducted in which effects of practicing academic writing with and without *escribo* on a posttest were compared (Proske et al., in press).

Design. Forty two university student (36 women and 6 men, *M* age = 21.5 years, *SD* = 2.8) participated in the study. There were two writing sessions separated by one week. The first session consisted of practice in which students wrote an essay either with or without computer-based scaffolding. Participants were randomly assigned to the conditions. Students of the *escribo* group wrote the essay within the writing environment, whereas students in the practice-only group wrote the essay with a web-based editor. At posttest one week later, students of both groups used the editor to write another essay. The same writing assignments (Loftus, Whorf) as in the first evaluation study were used; assignments were counterbalanced

across test times. The design was a treatment-posttest randomized comparison group design. The presence or absence of practice by *escribo* during the first session served as the independent variable: *escribo* group vs. practice-only group.

Measures. Dependent variables were measures of *writing activities* and *performance*. Similar to the first evaluation study, *number of words included into the final essay* was assessed as a characteristic of writing activities. Furthermore, prewriting time and writing time were measured. The measure of *prewriting time* corresponds to the time between activation of the writing assignment and the student's start of writing the essays. *Writing time* represents the time spent typing and revising the final essay.

Following the first evaluation study, writing performance was assessed at the two dimensions *readability* and *accuracy and coverage of content* (see Proske et al., in press, for detailed information).

Statistical analyses. Both groups wrote an essay at two times: (a) at the practice session and (b) at the posttest. The research question addresses possible transfer effects of practice with *escribo* on writing activities and performance at the posttest in which students were no longer provided with CBS support. Differences between the groups will indicate those expert writing activities that students could transfer from the practice session by CBS to the posttest without computer support. Thus, for the posttest a multivariate analysis of variance (MANOVA) was conducted. The measures of writing activities (word number, prewriting time, writing time) and writing performance (ratings of readability, accuracy and coverage of content) served as dependent variables and condition (*escribo* vs. practice-only) as the between-subject-factor.

Results. The MANOVA revealed a significant main effect of the practice condition on the posttest. The results of univariate follow-up analyses show that the main effect was significant for the time measures and one measure of performance: prewriting time, writing time, and readability. These results indicate that students in the *escribo* group at the posttest spent more time on planning and generating ideas, as well as formulating and revising their essays than did the practice-only group. In addition, the readability of the essays for the students in the *escribo* group was significantly better compared to the practice-only group.

Discussion. Although there was no CBS at the posttest, students in the *escribo* group planned longer and wrote essays with a better readability than the practice-only group. Longer prewriting is distinctive of expert writers (e.g., Bereiter & Scardamalia, 1987; Haas, 1996; Kozma, 1991a, 1991b). Therefore, previously practicing writing by *escribo* appears to facilitate the acquisition of expert writing activities such as paying more attention to the prewriting phase.

Furthermore, during the posttest students of the *escribo* group invested more time typing and revising their essays than did the practice-only group. Students were allowed to work on their essay as long as they wanted during the posttest. Thus, taking into account prewriting time as well, the *escribo* group invested more time writing their posttest essays. Given that expert writers also spend more time on their text (e.g., Alamargot & Chanquoy, 2001; Scardamalia & Bereiter, 1991), this result can be considered as a further indicator of acquiring expert writing activities which are increasingly applied even when the CBS is no

longer available (e.g., Graham & Perin, 2007; Sitko, 1998). This result seems to be in contrast to the results of evaluation study 1 in which students previously supported by *escribo* at test time 2 completed their texts faster than the comparison group (Proske, 2007). Yet, students of the *escribo* groups in study 2 spent roughly the same total working time for finishing their posttest essays than students of the TNT group in study 1 at test time 2. However, students of the practice-only group in study 2 invested still less time for finishing their posttest essay. As they achieved a lower readability than the *escribo* group this fast text completion indicates a superficial and rather careless text preparation.

The results of evaluation study 2 also indicate that practicing writing by *escribo* does not affect accuracy and coverage of content of the final essay. The development of expert writing activities not only involves acquiring strategies such as prewriting, but also acquiring knowledge related to text content and text structure which can be used to evaluate and revise the text produced so far (Scardamalia & Bereiter, 1991; Torrance, 1996, 2007). Research shows that inexperienced writers in particular lack this knowledge (Kozma, 1991a). Consequently, inexperienced writers might overestimate the quality of their text. Although *escribo* offered much information on academic writing, as well as feedback and opportunities for repetition and correction, it is possible that this overestimation led students to omit the provided information which in turn may have overlaid possible benefits of practicing with *escribo* (Proske et al., in press). The development and investigation of CBS for writing that ensures the optimal use of the offered information is thus an open question for further research.

Limitations of the Evaluation Studies

Four limitations of the evaluation studies should be pointed out. First, due to the huge time effort for the participants and the effort of analyzing the data (e.g., log-file analysis, text ratings), sample sizes were relatively small. Furthermore, intervention periods were relatively short. Yet, the studies indicate that CBS designed to stepwise support the writing process as a whole could be an effective means to facilitate the acquisition of expert writing activities. Future research should thus conduct studies with larger sample sizes and longer intervention periods to systematically explore the conditions under which stepwise scaffolding is superior to CBS of discrete writing activities.

Second, because of the long duration of each test time (for example in study 2 every session lasted about 3 hours), both designs included no pretest of writing activities and writing performance. However, all participants were at the beginning of their university studies and reported not to have much experience in academic writing in terms of already completed university writing assignments. Moreover, participants were randomly assigned to the conditions, and did not differ in any of the demographic or control variables. Nevertheless, a pretest would be desirable for future studies in order to control for possible differences between the participants.

Third, the evaluation studies included primarily time measures in order to characterize writing. These measures are quantitative and do not qualitatively characterize the different writing activities performed by the students. Therefore, it is possible that students were not only engaged in typing and revising their essays during their writing time, but also in

generating ideas and planning text content. Future studies thus also should consider qualitative measures of writing activities, such as thinking-aloud protocols (e.g., Breetvelt et al., 1994) or keystroke logging (e.g., Sullivan & Lindgren, 2006).

Finally, evaluation study 1 indicated that working with *escribo* influences writing motivation. It has been shown that students' beliefs in their competence decreased after they were supported by CBS, whereas intrinsic value and easiness did not change. Due to the study design it was not possible to systematically investigate the impact of stepwise CBS on motivation. It might be that the stepwise scaffolding called students' attention to writing activities that they would not had performed spontaneously through their writing. As a result, their beliefs about their ability to manage the writing process and to produce good texts might have been decreased. In order to invest engagement, writers need positive beliefs in their competence as a writer (Bruning & Horn, 2000). Therefore, further research should figure out the impact of CBS on motivational variables more detailed.

CONCLUSION

This chapter highlighted some important aspects related to the design of computer-based scaffolding (CBS) for the acquisition of expert writing activities in academic writing. It was argued that CBS should support inexperienced writers throughout the whole writing process rather than only supporting discrete writing activities (Proske et al., in press). As a basis for the design of such a CBS the subtask model of academic writing (Proske, 2007) was presented which identifies those aspects that distinguish expert writers from less skilled writers (van Gog et al., 2005). Then, a writing environment *escribo* was described which decomposes the complex writing process into its subtasks orientation, collection, planning, translating, and revising. Furthermore, it was demonstrated how the writing environment facilitates the application of expert writing activities by specific instructions and tools.

The results of two evaluation studies illustrate that dividing the writing process in subtasks and stepwise guiding the application of expert writing activities may positively impact writing activities and writing performance of both situations where students are supported in their practice (evaluation study 1) and situations where students are no longer provided with support (evaluation study 2). Furthermore, evaluation study 1 shows that working with *escribo* has an impact on writing motivation. As such, stepwise CBS appear to be a valuable instructional tool and a promising means in facilitating students' development of expert writing activities.

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Chapter 3

READABILITY FORMULAE, CLOZE TESTS, AND COMPUTERIZED TEXTUAL ANALYSIS FOR TESTING LANGUAGE SKILLS: ARE THEY USEFUL?

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ABSTRACT

I describe nine popular readability formulae. These are designed to evaluate a piece of English text in terms of the age or grade level of school students at which it should be readable. By example and argument I conclude that these formulae are of only limited use: perhaps as a cheap and easy method for evaluating school textbooks and library holdings. The family of cloze tests is designed to evaluate grammar, vocabulary and reading comprehension by making use of communication theory and the redundancy principle. The most popular are the classical cloze procedure and the C-test. Both are reasonably reliable, but the former is arguably the more valid. Both have been used in many countries and many languages as part of the testing of scholastic ability in the candidates' native languages or in second languages, though using trained assessors remains the yardstick. The Coh-Metrix project examines the coherence of text according to 60 categories, but is still in the course of development and seems not to be flawless. Lexical analysis is a computer-intensive tool for evaluating the active vocabulary used in producing a piece of text. It provides an objective measure of the progress of students who are learning English, especially as a second language. It has also been used to evaluate the quality of English teachers and teaching. But though I am only an outsider looking in, I am forced to conclude that the only truly valid method for evaluating language skills is by trained human assessors.

KeyWords: Cloze; Coh-Metrix; C-test; Dale-Chall; Flesch; Fry; Gunning's FOG; Hayes; Nation; Power-Sumner-Kearl; reliability; SMOG; Spache; validity.

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INTRODUCTION

I have had a long-standing interest in English words, grammar and usage, and have a large collection of books on and around these subjects. However, these have not helped me write good English prose. I was drawn to the topic announced in the title of this article through an active interest in promoting better writing in the biomedical sciences [Ludbrook, 2007]. In the course of this pursuit I came across reports of using readability formulae and lexical analysis to evaluate the quality of English expression in scientific articles. This stimulated me to try to gain an understanding of the virtues and limitations of formulaic techniques for evaluating language skills, and to perform some simple experiments with measures of readability, cloze tests, and computerized textual analysis.

VALIDITY AND RELIABILITY IN LANGUAGE TESTING

Two important concepts in language testing are those of validity and reliability. A test is regarded as *valid* if it really measures the property of language for which it is designed. 'Face-validity' refers to an otherwise unsupported opinion that a test is valid. True validity is very difficult to prove, for how can it be tested except by way of a formal language test? In other words, the argument is a circular one.

Reliability is a necessary, but not a sufficient, prerequisite for validity. It refers to the ability of a test to produce the same results if it is administered repeatedly to the same individuals (test-retest), or if the odd and even items in a test instrument result in near-identical scores.

READABILITY FORMULAE

These are claimed by their inventors to provide numerical measures of the 'readability' of English prose. Since the 1920s more than 200 have been described [DuBay, 2004], but only those dating from the late 1940s are in use today. The most popular of these are listed in Table 1, and the way they work is summarised in Tables 2 and 3. The best-known are: the Flesch Reading Ease Score [Flesch, 1948, 1951]; the Flesch-Kincaid Grade Level [Flesch, 1951]; Gunning's FOG Index [1952], where the acronym FOG stands for frequency of gobbledygook; and the SMOG Index [McLaughlin, 1969], where SMOG stands for simplified measure of gobbledygook). The first two formulae depend on the average sentence length (ASL) and the average number of words per sentence (AWS), with strict rules about what constitutes a sentence. The last two depend on ASL and the absolute number or percentage of polysyllabic ('hard') words. The Flesch Score has a range from 0 (unreadable) to 100 (easily read). The other three formulae result in a US school Grade (equivalent to Years in the Australian school system) at which the text should be readable. Detailed and accurate definitions of these formulae can be found in the online encyclopedia Wikipedia [2009]. These formulae can be applied by hand, or the Flesch Score and Flesch-Kincaid Grade can be calculated by means of the Tools/Spelling and Grammar function of *Microsoft*

Word (Microsoft Corporation, Seattle WA). There were some serious flaws in the way *Microsoft Word* applied the formulae, but these have now been corrected and *Microsoft*'s scores correspond closely to those that I calculated manually (Tables 4 & 5). However. computerized evaluation of readability appears to be highly unreliable [Mailloux, Johnson, Fisher, & Pettibone, 1995]. Moreover, there is little evidence that measures of readability of a piece of prose indicate how intelligible it is to readers [Klare, 1976].

Table 1. Some popular readability formulae

Name of formula	Formula
Flesch Reading Ease Score [Flesch, 1948]	Score = 206.835 – 1.015(ASL) – 84.6(ASW)
Flesch-Kincaid Grade Level [Flesch, 1951]	US Grade = 0.39(ASL) + 11.8(ASW) – 15.59
Gunning FOG Index [Gunning, 1952]	US Grade = 0.4(ASL + %HW)
SMOG Grade Level [McLaughlin, 1969]	US Grade = $\sqrt{\text{No. of HW}} + 3$ In 30 sentences from the beginning, middle and end of the text. For shorter pieces of text, use the formula: US Grade = $\sqrt{(\text{No. of HW}/\text{No. of sentences})(30)} + 3$
Fry Readability Graph [Fry, 1951, 1977; Schrock, 2006]	US Grade = (Number of sentences*) versus (Number of syllables) per 100 words of text, entered into a Fry Graph
'Old' Dale-Chall Reading Level [Dale & Chall, 1948]	Level = 0.1579 (%HW) + 0.0496(ASL) + 3.6365 Where HW are those absent from the Dale list of 3000 common words, and the US Grade is obtained from a Table
'New' Dale-Chall Reading Level [Chall & Dale, 1995a, b]	Level depends on the number of HW and sentences per 100 words, where HW are those absent from the Chall-Dale list of 3000 common words. A table is consulted to give the Reading Level, and another table to convert this into a US Grade.
Powers-Sumner-Kearl [Powers et al., 1958]	US Grade = 0.0778(ASL) + 0.0455(NS) – 2.2029 For Primary School grades only
Spache Readability Index [Spache, 1953, 1974a]	US Grade = 0.141(ASL) +0.086(%HW) + 0.839 Where HW are those absent from the Spache (1974a) list of 769 common words. For Primary School grades only

- NB: Unless otherwise indicated, formulae are based on at least 200 words.
- A US Grade is equivalent to the Australian school Year (1 to 12+). ASL, average sentence length (number of words/sentence). ASW, average number of syllables/word. HW, hard words (words with >2 syllables). NS, number of syllables per 100 words.
- * To the nearest 1/10.

Table 2. A classification of readability formulae

1. Depend only on average sentence length (ASL) and average syllables/word (ASW)
• Flesch Reading Ease Score (Score of 0-100)
• Flesch-Kincaid Grade Level (US School Grade)
2. Depends on plot of number of syllables versus number of sentences per 100 words
• Fry Readability Graph (US School Grade, especially Primary School Grade)
3. Depends on average sentence length (ASL) and number of syllables per 100 words
• Powers-Sumner-Kearl test (US Primary School Grade)
4. Depend heavily on the frequency of 'hard' words
(a) 'Hard' words are those with >2 syllables
• Gunning FOG Index (US School Grade)
• SMOG Grade Level (US School Grade)
(b) 'Hard' words are those not included in a word list
• Dale-Chall Reading Level (Convertible into US School Grade)
• Spache Readability Index (US Primary School Grade)

At the same time as what might be called the 'Flesch' school was flourishing, rival schools were evolving. One was based on the work of Dale, Chall and others [Dale, 1931, Dale & Chall, 1948; Chall & Dale, 1995a, b]. The 'Old' Dale-Chall readability formula [Dale & Chall, 1948], like the Flesch-Kincaid, FOG and SMOG formulae, results in a US school Grade level, and incorporates average sentence length. Like the FOG and SMOG formulae, it also incorporates a term for the frequency of occurrence of difficult words. But, unlike FOG and SMOG, a difficult word is defined as being absent from a 3000-word list of simple words which 80% of US 4th graders should understand [Dale-Chall List, 2009]. The original Dale-Chall formula [Dale & Chall, 1948] has been succeeded by the 'New' Dale Chall Formula [Chall & Dale, 1995a, b]. In both of these, the number of uncommon words and number of sentences are entered into a table to obtain the Reading Level, then another table consulted to give the US School Grade. Given the 3000 word list [Dale-Chall List, 2009], the Dale-Chall grade can be calculated manually. Then there are two formulae that are designed for children at Primary School. These are the Powers-Sumner-Kearl Grade Level [Powers, Sumner & Kearl, 1958], and the Spache Readability Index [Spache, 1953, 1974a, b]. Another contender in the readability stakes is the Fry readability graph [Fry 1963, 1968, 1977a & b; Schrock 2009]. This, too, is designed chiefly for use with Primary School students. The results of applying the readability formulae referred to above to pieces of text are in Tables 4 and 5. One difficulty in implementing the above measures of readability is that the definitions of what constitutes a sentence, syllable or 'hard' word vary from formula to formula; and each of the various word-lists is used in a different way (see Table 3). It is essential to go back to the original sources to be sure of executing and interpreting the formulae correctly. There is an expensive piece of commercial software that promises to calculates scores according to the above formulae, though I did not purchase it and so cannot vouch for its accuracy [Readability plus, 2009].

Table 3. Definitions of sentences, syllables and 'hard' words

Formula	End of Sentence	Syllable	'Hard' words (usually >2 syllables)
Flesch Reading Ease Score [Flesch 1948]	. : ;	?As written	Not applicable
Flesch-Kincaid Grade Level [Flesch 1951]	. : ;	?As written	Not applicable
Gunning FOG Index [Gunning 1952]	. : ;	?As spoken	Exclude proper nouns, compound words (bookkeeper), words ending in –er, -es, -ing
SMOG Grade Level [McLaughlin 1969]	. ! ?	As spoken, incl. abbreviations eg. U-NES-CO, M-r	Include proper nouns
Fry Readability Graph [Fry 1951, 1977a, b]	Unclear	As spoken	Not applicable
'Old' Dale-Chall Reading Level [Dale & Chall, 1948]	. ! ?	Not applicable	Words not on Dale List
'New' Dale-Chall Reading Level [Chall & Dale 1995a, b]	. ! ?	Not applicable	Words not on Chall-Dale list Treat proper nouns such as Los Angeles, UNESCO etc. as 1 word
Powers-Sumner-Kearl [Powers et al. 1958]	. : ;	?As written	Include proper nouns
Spache Readability Index [Spache 1953, 1974a]	Unclear	Not applicable	Words not on Spache list

I have tested some 30 pieces of prose, ranging from scientific articles, through novels, to nursery rhymes and other verses, by means of readability formulae. The highest Flesch Score (92/100) pertained to a passage from the writing of the Australian novelist, Steven Carroll [2001] (Table 4). Other measures of readability indicated that the passage was readable by 8-10 year-olds. In Table 5, I present the outcomes of applying readability formulae to a passage from Vladimir Nabokov's *Lolita* [Nabokov, 1959]. Its Flesch Score was 69/100. What consensus there is suggests that the text should be readable by 14-16 year-olds – but I wonder if they would understand it? A telling criticism of all the formulae is that random re-arrangement of the words within sentences, or the sentences within the piece of text, has no effect on the indices of readability. Readers can demonstrate this for themselves. It also concerns me that, leaving aside the formulae designed for Primary School students (Table 1), for many passages the school Grades given by the various formulae differ considerably (see Tables 4 & 5). I could find no simple explanation for this phenomenon, but it casts doubt on the reliability of readability formulae.

Table 4. Readability and lexical analysis of a passage from Steven Carroll's *The art of the engine driver* [2001]*

I had been sitting in that little <u>lounge</u> room, waiting for him all night with his mother and *aunt*. *Vic* and I were getting <u>engaged</u> and I had come to have *tea* and talk about it all. But after an hour he still had not come. After two his mother looked down at the <u>cakes</u> and <u>tea</u> and asked me over and over again if I wanted another *cup*. <u>Vic's</u> aunt was just looking on and saying nothing. But she had the look of someone who knew what was happening.
Eventually, she said it was pay day. Pay day? What does that mean I asked her, and his mother said it did not mean anything. But she added that <u>Vic</u> could be late, so why did I not go home and everyone could have *tea* another time. But I wanted to stay. I was *worried*.
That was when we heard this sound at the door. A sort of *clawing* like a dog or an animal of some kind asking to be let in. The next thing I was standing on the <u>footpath</u> in the *rain* and he was lying in the <u>gutter</u> with his pay *floating* all around him.
Dressed in black, in a dark *hat* and long *coat*, his *aunt* waved an *umbrella* at me. Do not marry him, she called out through the *rain*. Mark my words, she called as she disappeared up the street, you will <u>rue</u> the day. And then she was gone around the *curve* at the top of the road and somehow I had moved and I was helping his mother walk <u>Vic</u> into the house.

* Elisions such as 'I'd', 'hadn't', and 'didn't' have been expanded.

Note that readability analysis suggests that this piece of text is suitable for students aged 9-14 (Table 4)

- **Lexical Analysis by *the Compleat Lexical Tutor* (Cobb, 2006)**
- K1 List words (plain text): 90.0%. *K2 List words* (italics): 5.9%. **Academic Word List** (boldface): 0.4%. <u>Off-List words</u> (underlined): 3.7%.

- **Manually-Applied Reading Formula Analysis (See Table 1)**
- Flesch Reading Ease Score: 91.8. Flesch-Kincaid Grade Level: 4.0. Gunning FOG Index: 8.7. SMOG Index: 6.6. 'Old' Dale-Chall Grade: 4.0. 'New' Dale-Chall Grade: <4.0. Fry Readability Graph Grade: 4.8. Powers-Sumner-Kearl Primary School Grade: 4.3. Spache Primary School Grade: 3-4.

- *Microsoft Word* **reading formula analysis**
Flesch Reading Ease Score: 90.2. Flesch-Kincaid Grade Level: 4.2.

Is the purpose of using readability formulae to evaluate the ability of students to comprehend what they read? It seems to me that none achieves this goal. Is the purpose to evaluate the skills of school students in writing plain English prose? Maybe the formulae can serve as a guide. But this dodges the question "For whom is a piece of text intended?" It is obvious that text designed to be read by school students (for example, textbooks or literature), or the general public (as in newspapers or magazines), will differ greatly from a piece of text designed to be read by experts in their fields – for instance, doctors, lawyers, scientists and other professionals. In this context, some of these formulae have been applied to medical and scientific prose, to provide an 'objective' measure of the quality of the prose and to compare the standard of writing in different journals [Ludbrook, 2007]. The formulae have also been recommended to the authors of manuscripts of articles or theses as a means by which they can improve the readability of their manuscripts [Hall, 2006], though I regard this strategy as of doubtful value [Ludbrook, 2006]. It seems to me that no formula can be as useful as having

trained assessors evaluate the readability of text at the required level. And abuses of grammar, usage and style are best detected and corrected by persons who are trained editors.

**Table 5. Readability and lexical analysis of a passage
from Vladimir Nabokov's *Lolita* [1959]**

The road now *stretched* across open country, and it occurred to me – not by way of protest, not as a symbol, or anything like that, but merely as a novel experience – that since I had disregarded all laws of humanity, I might as well disregard the rules of traffic. So I crossed to the left side of the highway and *checked* the feeling, and the feeling was good. It was a pleasant diaphragmal *melting*, with elements of diffused tactility, all this enhanced by the thought that nothing could be nearer to the elimination of basic physical laws than deliberately driving on the wrong side of the road. In a way, it was a very spiritual itch. Gently, dreamily, not exceeding twenty miles an hour, I drove on the queer mirror side. Traffic was light. Cars that now and then passed me on the side I had abandoned to them, honked at me brutally. Cars coming towards me wobbled, swerved, and cried out in fear. Presently I found myself approaching populated places. Passing through a red light was like a sip of *forbidden* Burgundy when I was a child. *Meanwhile complications* were arising. I was being followed and escorted. Then in front of me I saw two cars placing themselves in such a manner as to completely *block* my way. With a *graceful* movement I turned off the road, and after two or three big bounces, rode up a *grassy slope*, among surprised *cows*, and there I came to a gentle rocking stop. A kind of thoughtful Hegelian synthesis linking up two dead women.

- **Lexical Analysis by *the Compleat Lexical Tutor* (Cobb, 2006):**
  K1 List words (plain text): 83.2%. *K2 List words* (italics): 4.2%. **Academic Word List** (boldface): 3.8%. Off-List words (underlined): 8.8%.
- **Manually-Applied Reading Formula Analysis (See Table 1):**
  Flesch Reading Ease Score: 69.1. Flesch-Kincaid Grade Level: 8.0. Gunning FOG Index: 10.4.
  SMOG Grade Level: 9.2. 'Old' Dale-Chall Grade: 9-10. 'New' Dale-Chall Grade: 9-10. Fry Readability Graph Grade: 8.2. Powers-Sumner-Kearl Primary School Grade: 5.6+. Spache Primary School Grade: 5.3+.
- *Microsoft Word* **reading formula analysis**
  Flesch Reading Ease Score: 68.0. Flesch-Kincaid Grade Level: 8.1.

THE FAMILY OF CLOZE TESTS

Cloze tests supposedly evaluate the ability of an individual to comprehend a piece of text. Taylor developed the classical cloze test in 1953, and elaborated it in 1957. In this test, every n^{th} word (for instance, 5th, 10th or 11th) is deleted from a piece of text, and the candidate is required to fill in the gaps, within a prescribed time limit (see Table 6a). The trained tester awards a score to the candidate on the basis of the proportion of correct answers. Taylor [1953, 1957] conducted several experiments to determine the optimal deletion-rate of words, and to compare the cloze score with the Flesch Reading Ease Score and Dale-Chall Reading Level. He found that deleting every 10th word was as good as making random deletions, and that awarding synonyms a part-score was no better than insisting on correct answers. However, Taylor's recommendations have been disputed [see Oller 1983]. Is Taylor's fixed deletion scheme as

good as random deletion or rational deletion? Should not synonyms of correct entries be given some credit? And should not the complexity of the text be tailored to the linguistic skills of those taking the test? Taylor found that the correlation of cloze score with formulaic measures of readability was good for some texts, bad for others. For instance, James Joyce's *Finnegan's Wake* scored near-zero with cloze (unintelligible), but had a Flesch Score of 79 (easily readable). The negative correlation of cloze scores with Dale-Chall Reading Levels was rather stronger, presumably because the latter takes into account unusual words.

Out of curiosity, I conducted a very small study of the classical cloze test on two passages taken from novels. The candidates were 12 friends and friends-of-friends, male and female. All were university graduates in the humanities or sciences. I used the tests set out in Tables 4 and 5. The detailed results are given in the Appendix. In short, the average score for the more easily readable text was 77%, for the more difficult 42%. Importantly, the candidates' sex, their reading habits, and whether they were humanities or science graduates had no differential effects on these scores. Though my experiment was only a very small one, the results did make me wonder whether the classical cloze test is truly valid. Surely a voracious reader of fiction should score better than an occasional reader?

The classical cloze test requires the use of active vocabulary as well as comprehension. The texts must be selected so as to reflect the age and prior knowledge of candidates. The test has been used to evaluate reading ability and comprehension as part of scholarly aptitude testing in school and tertiary students, in many countries and many languages. Several manuals that include cloze tests are recommended by the Australian Council for Educational Research [TORCH, 2003; Young, 1992]. *The Compleat Lexical Tutor* has a routine for setting up a cloze test, in English or French, according to user-defined criteria [Cobb, 2009].

I cannot leave the classical cloze procedure without referring to Coleman's formula [Coleman, 1965], which is described by DuBay [2009]. Coleman developed, by way of multiple linear regression analysis, a complex formula which he claimed would predict the cloze score (% correct insertions). The independent variables in the formula were frequencies of occurrence of parts of speech per 100 words of text. The numbers of monosyllabic words, sentences and pronouns were positive predictors of the cloze score. The number of prepositions was a negative predictor. I have serious reservations about the formula. It is hard to believe that parts of speech can predict comprehension, unless it be by default: that is, the greater the proportion of monosyllabic words and pronouns, the lower the frequency of more challenging words. When I applied the formula to the pieces of prose in Tables 4 and 5, a cloze score of 68% was predicted for Steven Carroll's prose, a score of 53% for Vladimir Nabokov's. My 12 adult readers scored an average of 77% for the former, 42% for the latter (see Appendix). The Coleman estimate is too low for Carroll, but within the 95% confidence limits for Nabokov – but is there any point in using it?

The C-test was invented as a modification of the cloze procedure [Klein-Braley & Raatz, 1982]. It, too, is based on communication theory and the concept of redundancy in language. In a piece of text, the second half of every second word is deleted. The first and last sentences are left intact. Single-letter words and proper nouns are ignored. An example is in Table 6b, though it is usual to present several shorter pieces of text so as to factor out the effect of topic. Usually, there is a total of about 100 gaps. In calculating the total score, only correct (and correctly spelled) answers are counted. Coleman and his colleagues have edited a book in which the merits of the C-test are extolled, especially in the context of the European

Language Proficiency Survey and of tertiary students learning a second language [Coleman et al., 2002].

Table 6. An example of the cloze procedure and C-test on a passage from Carroll [2001]

A. CLOZE PROCEDURE

(1) _____ had been sitting in that little lounge room, waiting (2) _____ him all night with his mother and aunt. Vic (3) _____ I were getting engaged and I had come to (4) _____ tea and talk about it all. But after an (5) _____ he still had not come. After two his mother (6) _____ down at the cakes and tea and asked me (7) _____ and over again if I wanted another cup. Vic's (8) _____ was just looking on and saying nothing. But she (9) _____ the look of someone who knew what was happening.

(10) _____, she said it was pay day. Pay day? What (11) _____ that mean I asked her, and his mother said (12) _____ did not mean anything. But she added that Vic (13) _____ be late, so why did I not go home (14) _____ everyone could have tea another time. But I wanted (15) _____ stay. I was worried.

That was when we heard (16) _____ sound at the door. A sort of clawing like (17) _____ dog or an animal of some kind asking to (18) _____ let in. The next thing I was standing on (19) _____ footpath in the rain and he was lying in (20) _____ gutter with his pay floating all around him.

Dressed (21) _____ black, in a dark hat and long coat, his (22) _____ waved an umbrella at me. Do not marry him, (23) _____ called out through the rain. Mark my words, she (24) _____ as she disappeared up the street, you will rue (25) _____ day. And then she was gone around the curve (26) _____ the top of the road

B. C-TEST

I had been sitting in that little lounge room, waiting for him all night with his mother and aunt. Vic a__ I we__ getting eng____ and I h__ come t_ have t__ and ta__ about i_ all. B__ after a_ hour h_ still h__ not co__. After t__ his mot___ looked do__ at t__ ca___ and t__ and as___ me ov__ and ov__ again i_ I wan___ another c__. Vic's au__ was ju__ looking o_ and say____ nothing. B__ she h__ the lo__ of som____ who kn__ what w__ happening.

Event_____, she sa__ it was p__ day. P__ day? Wh__ does th__ mean I as___ her, a__ his mot___ said i_ did n__ mean any____. But s__ added th__ Vic co___ be la__, so w__ did I n__ go ho__ and ever____ could ha__ tea ano____ time. B__ I wan___ to st__. I w__ worried. Th__ was wh__ we hea__ this sou__ at t__ door. A so__ of claw___ like a do_ or a_ animal o_ some ki__ asking t_ be l__ in. T__ next thi__ I w__ standing o_ the foot____ in t__ rain a__ he w__ lying i_ the gut___ with h__ pay floa____ all aro___ him.

Dres___ in bla__, in a da__ hat a__ long co__, his au__ waved a_ umbrella a_ me. D_ not mar__ him, s__ called o__ through t__ rain. Ma__ my wo___, she cal___ as s__ disappeared u_ the str___, you wi__ rue t__ day. A__ then s__ was go__ around t__ curve a_ the t__ of t__ road a__ somehow I h__ moved a__ I w__ helping h__ mother wa__ Vic in__ the ho___.

What of the reliability of the C-test, and of the C-test versus the word-deletion cloze test? Chapelle and Abraham [1990] concluded that both are very reliable. The Kuder-Richardson 20 coefficients for fixed cloze, rational cloze, multiple choice close and the C-test were very similar and acceptably large (0.76-0.80). Bachman [1985] reported identical reliability coefficients (0.86) from a split-half study for fixed and rational cloze tests. However, using a similar technique, Greene [1965] found the rational cloze test to be more reliable (0.76) than the fixed test (0.52). Jafarpur [1995] tested 202 native and 325 non-native English speakers who were undergraduate or graduate university students. He concluded that the C-test was easy to construct and score, and was acceptably reliable.

Are the members of the cloze family of tests valid? This is a contentious issue. Bachman [1985] compared fixed and rational cloze tests with six other, independent, language tests. The ranges of correlation coefficients were 0.68-0.81 and 0.62-0.82 respectively. Katona and Dörnyei [1993] found correlations of 0.53 and 0.58 between a multi-factor test of general language proficiency on the one hand, and cloze and C-tests on the other – not very convincing. Jafarpur [1995] reported an elaborate and extensive study of 527 university students of English as a first or second language. Each student took a word-deletion cloze test and one of 20 versions of the C-test. Jafarpur found that the C-test was not valid *vis à vis* the cloze test; that it does not possess face-validity; and reported that the adults who took it described it as "good for children".

In summary (Table 7), it seems to me that the classical, word-deletion, cloze procedure is the best of this family of tests for measuring the ability to comprehend English prose. But it is worrying that trained assessors, rather than cloze tests, were used in two very large studies of literacy in OECD countries [Literacy in the Information Age, 2000; International Adult Literacy Survey, 2009]. And cloze tests are not mentioned in the guidelines for evaluating second-language proficiency in European countries [see The Common European Framework, 2009].

I cannot resist interpolating a comment about the studies in this field carried out by educationalists, from the point of view of someone who is a biomedical scientist and applied statistician. Language researchers make much use of correlation to test for reliability and validity – but correlation is generally regarded by biostatisticians as unsuitable for this purpose, and it is potentially misleading in that it may conceal bias [see Ludbrook, 2002]. And language researchers often test multiple hypotheses without any correction for the greatly increased risk of false-positive inferences which is incurred by making multiple comparisons [see Ludbrook, 1998].

Table 7. Summary of tests and suggested language skills they test

Test	Procedure	Skill tested
Readability formulae	Combinations of words/sentence, syllables/word, % difficult words etc.	Predicts ease of reading of text, given the educational level of candidate.
Fixed ratio cloze	Every nth word deleted (eg. 5, 10, 11). Candidate must produce the words.	Comprehension, active vocabulary.
Random cloze	Words deleted at random.	Comprehension, Active vocabulary.
Rational cloze	Selected words deleted. Candidate must produce the words.	Active vocabulary, comprehension.
Multiple choice cloze	Candidate selects word from short list.	Passive vocabulary.
C-test	Second half of alternate words deleted. Candidate completes words.	Passive vocabulary, grammar.
Lexical analysis	In text written by candidate, words are classified as: K1, K2, AWL, Off-List.	Active vocabulary used in writing.

- Active vocabulary = productive vocabulary. Passive vocabulary = receptive vocabulary. See text for details.

THE COH-METRIX PROJECT

This is the brainchild of Danielle McNamara and her colleagues from the Institute of Education at the University of Memphis, USA [McNamara, Kintsch, Songer, & Kintsch, 1996; McNamara, Louwerse & Graesser, 2002; Graesser, McNamara, Louwerse, & Cai, 2004]. The project is a remarkably ambitious one. It is described as a "comprehensive tool that produces indices of the linguistic and discourse representations of a text" [Coh Metrix, 2009]. An example of Coh-Metrix analysis of a piece of tertiary-level science text can be found on the Coh Metrix website [2009]. It scores the text on 60 criteria. However, I was less than impressed that two of the criteria were a Flesch Reading Ease Score of 61 and a Flesch-Kincaid Grade Level of 8.8. I couldn't believe that this very difficult piece of text would be readable by a 14-year-old, so I did my own readability tests. The Flesch Score was 39, the Flesch-Kincaid Grade 12+, the SMOG Grade 13.8. Lexical analysis (see below) found that 24% of the words were Off-List. I am not yet persuaded that the Coh-Metrix approach will be useful in practice.

LEXICAL ANALYSIS

This tests an altogether different property of English text from that which is evaluated by readability formulae. Lexical analysis provides a measure of the vocabulary that individuals employ in their writing: that is, their active vocabularies. Its advocates argue that the most important element in learning a language, whether it be one's native language or a second language, is the acquisition of vocabulary [Nation, 2001]. This is consistent with Noam Chomsky's notion of universal grammar [Chomsky, 2002]. That is, the inborn grammatical faculty needs a vocabulary of words to work with before language can be acquired. Paul Nation and his colleagues from the Victoria University of Wellington, New Zealand [Nation, 1990, 2001; Laufer & Nation, 1995; Nation & Waring, 1997], and Donald Hayes, of Cornell University, USA [Hayes, 1988, 1992], have been greatly influential in developing the tool of lexical analysis. In lexical analysis, words used in a piece of text are compared with a lexicon (vocabulary) in which words are categorised according to the frequency with which they are used in the written language.

The lexical tool which is based on the work of Paul Nation and his colleagues has a lexicon of some 54 000 word families, where a member of a family consists of the base word plus all its recognisable affixes (prefixes and suffixes) [Bauer & Nation, 1993]. Thus, for instance, from the base word *walk* can be derived *walks*, *walked*, *walking* (but not *walker*). If an individual knows the base word and the available affixes, it is supposed that he or she can recognise members of the *walk* family and, with somewhat less certainty, can use these in writing. The tokens (words) in a piece of text are divided into four categories. K1 words are the 1000 most commonly used words, K2 the next 1000 most commonly used. Academic words are those on an academic word list (AWL) of 570 word families. The AWL is perhaps the most important indicator of lexical richness. Its families are derived from four disciplines: Arts, Law, Commerce and Science, but only word-families that occur in more than one of these disciplines are included. All other words are relegated to the Off-List word list, which includes proper nouns (names, places) and uncommon technical words or neologisms. Tom

Cobb [2009] has developed an advanced online program, *The Compleat Lexical Tutor*, with which individuals can perform lexical analysis on a piece of text. It also allows them to test their vocabularies in either English or French. As an illustration, in a passage from *TheArt of the Engine Driver* fewer than 4% of the words used by Steven Carroll [2001] are Off-List (Table 4). By contrast, in a passage from Vladimir Nabokov's *Lolita* [1959] nearly 9% of the words are Off-List (Table 5). Incidentally, I have established by experiment that *The Complete Lexical Tutor* recognises both Anglo-Australian and US spelling.

Lexical analysis is currently used as a research tool by many applied linguists, especially to measure the growth in richness of the vocabulary used by students of English as a second language during their courses [see, for instance, Laufer & Nation, 1995]. Good progress is indicated by the use of an increasing proportion of words drawn from the K2 and AWL lists. Less securely, it has been used to quantify the increasingly complex vocabulary used in articles in the high-impact science journals *Nature* and *Science* over the periods 1930-1990 [Hayes, 1992] and 1900-2000 [Knight, 2003]. Regrettably (and surprisingly for articles published in such a prestigious science journal as *Nature*), the details of the method of lexical analysis used were not given, though it appears to be based on Hayes' work [Hayes, 1988] and a list of 10 000 words [Carroll, Davis, & Richman, 1971]. In any case, because the vocabulary of science has become more complex and specialized *pari passu* with the increasing specialization of science itself, the findings are scarcely surprising.

Lexical analysis is an excellent method for evaluating the active vocabulary used by an individual in writing English prose. It does not, however, measure the intelligibility of prose. If the words in a piece of prose are deliberately jumbled so that the piece in unintelligible, the outcome of lexical analysis is unaffected. Neither does lexical analysis take into account the cognitive abilities, vocabulary and determination of the readers for whom the message is intended.

CONCLUSION

What are these various 'objective' measures designed to do? I have attempted to summarise this in Table 7. In brief:

- Readability formulae (Tables 1, 4, & 5) are concerned with evaluating the suitability of prose for those who may *read* it.
- The classical cloze procedure evaluates *readers*: how well they comprehend what they are reading and their active vocabulary (Table 7).
- The C-test also evaluates *readers*: but in terms of vocabulary and grammar rather than comprehension (Table 7)
- Lexical analysis is concerned with the richness of the active vocabulary used by *writers* (Tables 4 & 5).

Language researchers claim that all the above procedures are reliable, though I have already expressed some reservations about readability formulae. But are the procedures also valid? I suggest that if they are, it is only in the narrow sense of face-validity in measuring the properties listed in the preceding paragraph.

Readability formulae appear to be of some value in longitudinal or comparative studies of the ability of school students to write English prose, and for monitoring the suitability of school texts and library collections for specific age-groups. I favour the SMOG Index, because it samples long passages, it involves hard (polysyllabic) words, and it is easy to execute. But one is left with the distinct impression that using readability formulae for the above purposes is a cheap and easy substitute for the evaluation of reading material and writing ability by trained assessors. In this context, it is noteworthy that in two very large national and international studies of literacy among school students, trained assessors, not readability formulae, were used [Forster & Masters, 1997; Cresswell, Greenwood & Lokan, 2001]. Tim McNamara [2000], of the University of Melbourne, is strongly of the view that the most valid way of testing second language skills is by using trained assessors. But this dodges the question of what constitutes adequate training, and how trainees are chosen. My own attempts to re-train assessors of diagnostic clinical skills were a dismal failure [Ludbrook & Marshall, 1971; Marshall & Ludbrook, 1972].

In contrast, the classical cloze procedure requires candidates to make active use of their stored vocabulary, even if over only a limited range; and at the same time it requires them to have some comprehension of the text. Its widespread use in many countries and many languages as part of the evaluation of scholastic ability establishes it as a reliable instrument. The C-test is, if anything, even more popular than the cloze procedure because of its simplicity; but it appears childish to adults, and may measure passive vocabulary and grammar rather than comprehension. It is not at all certain that cloze procedures and the C-test are better at measuring reading comprehension than, for instance, the semi-quantitative Nelson-Denny reading test that was invented in 1929 [Brown, Fishco & Hanna, 1993].

The Coh-Metrix project does set out to test the understanding of more complex properties of English text, but is still in the process of being developed.

Lexical analysis seems to have its greatest application in providing an objective measure of progress among those learning to write and, by extension to speak, English. An equally important application is in gauging the progress of those learning English as a second language. In either case, it can be used to measure the effectiveness of teaching programmes. I have not referred to another use of lexical analysis. This is to quantify literary style in order to attribute newly-discovered pieces of text to one or another established author, especially by way of discriminant analysis of 'function words' such as conjunctions, prepositions and pronouns [Holmes, 1985; Peng & Hengartner, 2002].

However, neither readability formulae nor lexical analysis are of much use in teaching students of any age how to write intelligible English prose. Intelligibility depends on many more factors than those measured by formulaic or lexical techniques. An adequate understanding of grammar and sentence and paragraph construction, and an adequate vocabulary, are surely only the most basic skills necessary for writing clear prose. Proficiency can be attained only by the constant practice of writing, and having it read and commented on by qualified critics.

ACKNOWLEDGMENTS

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APPENDIX

Twelve university graduates, aged 38-69 years, were recruited into the study. They completed two classical cloze tests, constructed from the texts by Carroll [2001] and Nabokov [1959] in Tables 4 and 5, within a time limit of 20 minutes each. They were given a summary of the narrative preceding the piece of text. Every 10th word of the text was deleted. The exact word (not a synonym) was required. Of the 12 candidates, 6 were male, 6 female. Six were graduates in the Humanities, 6 in the Sciences. Six described themselves as voracious readers of fiction, 6 as occasional readers. The results were analysed by three-way analysis of variance, with extraction of the 3 main effects, the 3 two-way interactions and the single three-way interaction.

The overall mean scores (with 95% confidence intervals) for correct answers were 77.2% (73.2-81.2) for Carroll, 42.3% (34.6-50.0) for Nabokov ($P < 0.0001$ for difference). There were no significant differential effects of sex, university degree, or reading habits on the scores (P always >0.28).

Chapter 4

STRATEGIES, TOOLS AND TECHNIQUES FOR THE DEVELOPMENT OF WRITTEN COMMUNICATION METASOCIOCOGNITIVE PROCESSES

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ABSTRACT

This paper proposes a model for teaching writing strategies, tools and techniques within a new aim pursuit. The new objective is the simultaneous development of cognitive and sociocultural processes of written communication for the citizens of the 21st Century. This didactic model is justified by the exigencies of multicultural and technological societies. In order to enter the labour world, to have access to knowledge, information and social relation structures, current societies request two basic competences to their citizens: a) use and command of IT technologies and b) communication in different languages. Written verbal language in a multilingual and multimodal fashion is being given priority in the development of both competences. That is why the didactic model offers strategies with the aim of developing: 1) multimodal writing cognitive processes and operations, using the computer; 2) writing sociocultural processes using different languages, that is to say, in a multilingual way.

To achieve simultaneously the already mentioned aims, the tools and techniques of the didactic model have to be creative. However, these aims, tools and techniques are based on the Metasociocognitive Model which explains written communication as the integration of cognitive and sociocultural processes. The Writing Metasociocultural Model is interactive focused on research and theoretical reflection about writing. It has been functioning since the 70´s.

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Also, the Creative, Shared Technological Model (CCT-Model) of Writing-Teaching, is based on the results of an ethnographic research project, concretely, a case study. In this project, writing-teaching is deeply studied applying the content analysis method and validation processes such as triangulation, saturation and crystallization. The new contribution covered in this project is the global approach offered of every possible variable interacting with the writer in a multicultural classroom. The conclusions of the case study allow to design strategies, tools and techniques to enhance the development of all writing processes, from a practical teaching point of view. Finally, sociocultural justification and theoretical research based documentation of the Writing-Teaching Model, support a future multimethod research, which is currently in process. This research project aims to the validation of a Writing-Teaching program (based on the already mentioned models), in multicultural samples of subjects, with control and experimental groups. The objectives of this project are, on the one hand, calculation of the effectiveness of the program and, on the other hand, analysing thoroughly the teaching process when applying writing tools.

INTRODUCTION

This paper seeks, in a first place, to identify the cultural necessities of the Knowledge Societies, which justify the design of tools and techniques to develop cognitive and sociocultural writing processes. The sociocultural necessities, gathered from the worldwide education policies documentation, are the ones which support the development of theoretical models and the research on writing. In this way, the Metasociocognitive Model of Writing Composition Development is introduced here. The Model integrates contributions of linguistic, cognitive and sociocultural models of written communication and provides a global comprehension of the writing process.

In the second place, an ethnographic research project on Teaching-Writing in a particular education environment is described, inspired by the Metasociocognitive Writing Model. Also the Creative, Shared Technological Model (here-on referred to as CCT-Model) of Writing-Teaching is introduced. This Model seeks the development of cognitive and sociocultural processes in multilingual and multimodal writing, in line with: a) the Metasociocognitive Model of Writing Development; b) the research project results and c) the necessities of the Western Society of the 21st Century. Finally, future lines of research on Teaching Writing are described developing the proposed models. Also, the didactic scope of this research line is described at national and international levels, as well as its links.

1. CULTURAL FEATURES OF THE WESTERN SOCIETY OF THE 21ST CENTURY

The theoretical line in which this paper is placed has a pedagogic approach (Arroyo, 2008), and is focused on: the integral development of the human being towards the society change in favour of the shared progress. Unquestionably, in the Western Society of the 21st Century, there is no possible participation in politics and production means if the citizens do not command writing communication skills. Written language, is also a tool to access information and knowledge and has a fundamental role in the cognitive development of the

person. As a last point, links between oral languages and reading can not be forgotten, being all of them basic cultural competences for the affective, social and ethical development of every human being.

The kind of society interesting for this pedagogic model is the Multicultural and Technological Society of Knowledge.

One of the defining features of the Western Societies of the 21st Century is cultural diversity, which is even enhanced by the European and international political and educational institutions. In the same way, the use and command of new Technologies of Information and Communication is also enhanced (see, as an example, UNESCO Universal Declaration on Cultural Diversity, adopted in the 31 Session of the General Assembly, 2nd November 2001 and the European Parliament Decision 1720/2006/CE adopted by the Counsel on the 15th November 2006, by which an action program is established in the long-life-learning field).

Citizens of the Western Multicultural Society claim the equality of the human essence regarding rights and obligations, individual as well as in the community; instead of taking exclusive relativist points of view, they look for the value of diversity. The diversity value is linked with: a) equal access to social, economic and cultural opportunities for all individuals and human groups, and the preservation of a self cultural identity. In this context, "culture is understood as a concept which explains the way in which groups organize their individual differences, achieving a particular type of shared sense and a flexible unit, which permits the exchange with other cultures". That is why, in Western Societies, the person is understood as a multicultural reality, which means that:

1. Each citizen shares cultural competences with his/her group of origin.
2. Each citizen freely acquires competences of other cultures.
3. Every citizen can achieve common competences to enable the shared progress of the Society.

As already mentioned, one of the basic competences demanded by the Western Society to all its citizens is the knowledge of different written languages (multilinguisim) and a privileged use of the Technologies of Information and Communication.

As a conclusion, written language is now, more than in any other historical moment in the Western World, a fundamental cultural tool for the social, political and economic participation of its citizens. The pedagogic approach meets the multilingual and technological communication needs of the 21st Century citizens. In order to meet these needs, the pedagogic approach offers theoretical models of written development and didactic models to teach writing. These models have been validated by educational research and have opened new research paths.

2. THEORETICAL MODELS AND WRITING RESEARCH. THE METASOCIOCOGNITIVE MODEL OF WRITTEN COMPOSITION DEVELOPMENT

The current situation of research on written expression is the result of an historic process, in which different conceptual approaches (theoretical models) have coincided during at least

the three past decades, and from which empirical research has emerged, giving sound knowledge in several fields and educational practices.

The most perdurable and influential model which explains the development of written composition is the one created by Flowers and Hayes (1981, 1984). This model considers writing as a process dealing with a set of other processes. These processes are panning (generation of ideas, establishing aims, organizing the text), transcription (transforming the planned into written language) and revision (assessment and correction). Then, these models recognize that writing is not a simple phenomena, but a set of organized cognitive processes very different among them (strategic, linguistic, conceptual…). Definitely, writing is created basically by the intercommunion of three processes, which are interrelated with another process: metacognition in writing.

The writing metacognitive process has been subsequently developed, and only in the most recent revisions (Hayes, 1996; Bruning and Horn, 2000; Arroyo, 2005c; Salvador, 2008) are metacognitive processes considered. These models widen the purely cognitivist writing perspective. In them, written composition is explained as a complex process in which other contextual, affective and cognitive variables intervene. In this way, it highlights: a) a social context (audience and collaborators), b) a physical context (the text, the environment), c) memory (long-term and short-term memory) and d) processes of written composition (interpretation, reflection and production); all of them monitored by the metacognitive processes (knowledge and self-regulated processes execution).

Written Composition Metacognition is a process which implies, firstly a:) knowing what is a text, b) knowing why the text is created, c) knowing the aim of the creation of the text, d) knowing what is to create a text, e) knowing how to create a text; and f) performing it according to the goals (self-regulation). Secondly, Metacognition includes every adequate affective and social variable, in a self-regulated way.

From a sociocultural perspective, within the spaces and times, social, physical and virtual in which metacognitive processes of written composition take place, other processes are identified, called "sociocultural" which are conditioning writing tasks and textual products (Schultz and Fecho, 2000; Sperling and Freedman, 2001; Arroyo, 2007). The sociocultural perspective suggests that other processes not purely metacognitive affect written composition. These processes are:

- The social process in which the development of the written composition takes place,
- The local socio-affective process which surrounds the writer,
- The didactic process, followed by written composition learning,
- The social relation process among subjects,
- The cultural identity building process of each writer,
- The reconceptualization of written composition process as an interaction of diverse complex processes.

All these processes point out that writing, in every Western Society, is a powerful instrument which can be used to serve fanatism, racism, nationalism, mercantilism and many more –isms (remainders of the Modernism and Postmodernism), if it has not a reflexive and shared development, if it is not intercultural. That is how the Metasociocognitive Model for

the Development of Written Composition emerges (Arroyo, Beard, Olivetti, Balpinar and Silva, 2009; Arroyo, 2009:78). In this model not only metacognitive processes are included, but also sociocultural ones, assuming in this model new operations such as:

- Self-regulation of sociocultural writing processes,
- Interaction between sociocultural processes and the text,
- Interaction between metacognitive and sociocultural processes, and interactions between them and the text.

That means that the understanding of the development of written composition emerges from a diversity of processes, metacognitive as well as sociocultural ones, and that between them there are connecting links as well as with the text.

Intercultural development of written composition is linked with the Metasociocognitive Model of Written Composition and, also, is a requirement (together with new technologies and multilinguism) of multicultural societies to train their citizens. This model understands written composition as a means of reflection and communication and to make possible the same politic and economic opportunities to every person, from its different positions. In this sense, the enhancement of cultural and linguistic diversity through written composition is to promote equal rights and freedom to choose a way of life, participating in the society politically and economically and rejection of all personal and collective differences (provided they improve the person physically, psychologically and socially).

The development of Metasociocognitive Written Composition will be achieved, combining metacognitive development strategies with intellectual and multilingual ones, based on empirical research.

3. TEACHING WRITING FROM A METASOCIOCOGNITIVE PERSPECTIVE. PROCESS AND CONCLUSIONS OF AN ETHNOGRAPHICAL EDUCATIONAL RESEARCH PROJECT

The objective of this project was to discover and describe the teaching process of written composition in a particular educational context, one of English as a *lingua franca,* and very interesting because of the multiculturalism of the society.

Two main questions were the origin of this research project:

- Which didactic model is applied in practice for teaching basic processes of written composition?
- To which extent is the environment multiculturalism taken into account?

From these two basic questions arose different objectives:

1. Identifying objects and contents which are made explicit when teaching written expression in a classroom,
2. Highlighting basic cognitive processes of written composition which are promoted by activities within the classroom,

3. Describing teachers' acts when following the student's development in the classroom to resolve possible learning difficulties of the processes implied in written expression,

4. Identifying social and multicultural elements in the learning environment of the classroom,

5. Suggesting an intercultural didactic model for written composition, inspired on the contributions and limits of the real case studied.

The methodological approach "case study" was applied (Stake, 2000; Rose and Grosvenor, 2001; Corbet, 2001). The analysed case was the teaching processes of written composition in a Primary School classroom, with students of seven and eight years of age (third year of Primary School), coordinated by a tutor teacher and in collaboration with assistant teacher and a ratio of 25 students per classroom.

The aim when using the research method was, mainly, to obtain a representative quantity of different evidence, extracted from the space in which the case was taking place, in order to be able to abstract and integrate possible conclusions related to the objectives set ahead. On the one hand, in this "case study" the following were used:

1. Different techniques and tools to note data such as: "*qualitative observation*" (Wragg, 2001:99) using the notebook; semi-structured interview in a questionnaire form (Goetz and LeComte, 1988) and digital photographs,

2. The "Content analysis" method (Bardin 1986; Krippendorf 1997; Gubrium and Holstein, 2000; Arroyo, 2000) to minimize and interpret data,

3. Validity and reliability processes such as: triangulation (Gillham, 2000), experts' judgements, saturation and crystallization (Richardson, 1997; Dezin, 1998; Hodder, 2000).

The teaching process of written composition was described from an analytical point of view in the case presented. The individual treatment received by each of the components of the teaching process previously described in the aims section was highlighted. The exhibition of these interpretations was illustrated with data from a note book, the corresponding numbered photographs and the answers to the questionnaires.

As a conclusion, this research project shows that a teaching method focused on the following motto: "writing, at its most simplest level, demands reflection and restructuring of ideas in an abstract way, and when learning writers need help to be able to carry out the process". This didactic approach, at the time, enables students to concentrate on certain aspects of the writing process, simultaneously working on the rest of them, and leading, in an effective way, towards independent writing.

The didactic method, which coming from the introduced research, reveals the complexity of writing processes to all students and highlights the potential value of the teacher, as a model to teach writing processes, canalizing students' suggestions. This project shows that the potentialities of the method have their origins in the following principles:

• Every student and professor is aware of the extension and complexity of the global writing process,

• The leading path towards written composition is built by the teacher,

- Every student practice, collectively, in groups and individually in writing operations gives knowledge on writing,
- Every student learns how to write in a particular atmosphere with support, but at the same time, gets the benefit of the efforts necessary to develop writing skills,
- Every student uses tools and techniques which helps when learning writing till they reach more complex projects.

Writing, in the studied case, is characterized by the following elements and features:

1. Objects and contents related to written expression are made explicit during the whole writing-teaching process and are connected to knowledge and individual, group or collective products.
2. Writing skills can be classified in the following activities:
   Activities to plan a text, being frequent content creation activities and text restructuring,
   Transcription activities with frequent lexical and orthographic activities,
   Revision activities, insisting on self- revision,
   Metacognition activities directed to the identification and construction of a good text.
3. Writing operations learning assessment is shared and reflects, its being the responsibility of support teachers and the tutor teacher, applying assessment instruments such as : control list and students notebooks.
4. From the assessment activities decisions can be made to reinforce students' writing achievements.
5. The learning environment is characterized by:
   Attracting students' attention towards written tasks and creating a flexible order in the use of spaces and resources in the classroom and the centre.
   Combining different groups, resources and support in written tasks.
   Including the multicultural dimension of the environment in decorative aspects in the classroom and printed resources.
   Using specific contents for teaching-writing exclusively represented in a Western Anglo-Saxon culture.

Finally, some basic approaches of interaction in cognitive and sociocultural processes in this didactic model are highlighted:

1. Exclusive development of a single language: English,
2. Contents and procedures if as single culture: Anglo-Saxon,
3. Focus on grammatical and cognitive objective procedures,
4. Learning experiences centred on the classrooms,
5. Incorrect use of no IT resources.

From the Metasociocognitive Model of Development of Written Composition, the final aim of the model is suggested to be reform. A didactic model coherent with the Metasociocognitive Model has a double-aim: a) transmit and reproduce the writing skills needed by a society to keep using all technologies offered by the society; b) change prejudice, stereotypes, classism and racism of a society, to enable every citizen to participate in the same equal conditions. According to these objectives, written expression from being an end becomes a tool which promotes social change.

That is why, a didactic model for the Metasociocognitive development of written composition will prepare all students to: a) actively and creatively participate in the labour world, b) worry about other people (near or far away); c) create a fairer justice. Apart from these, written composition teaching will prepare every individual to freely choose his or her cultural background (different languages learning and command of Technologies of Information and Communication) and to autonomously and creatively develop their own writing.

Definitely, according to Metasociocognitive perspective of teaching written language, criteria coming from the principles of the didactic model described before could be applied, and at the same time thinking processes allow to enable the student: a) to learn writing processes; b) to achieve deep and shared knowledge of different written languages; c) to become aware of conceptual and real gaps associated by the society to each culture; d) to integrate in an adequate way the use and command of Technologies of Information and Communication.

In the following section a didactic model to teach written composition which pools together all empirical research contributions and suggestions of the Metasociocognitive Model of Development of Written Composition is introduced.

4. THE CREATIVE, SHARED TECHNOLOGICAL MODEL OF WRITTEN COMPOSITION TEACHING. CCT- MODEL

This section takes a step forward towards the design of a pedagogic model which contemplates every dimension of writing related to the exigencies and problems of the current Societies of Knowledge. This model is called the Creative, Shared, Technological Model of Written Composition Teaching (*Modelo Creativo, Compartido y Tecnológico* CCT-Model) (Arroyo, 2009:213).

4.1. Pedagogic Basis of the CCT-Model

The CCT- Model is primarily focused on writing-teaching, because this topic is a widely interesting one of Pedagogy. Currently, Pedagogy is an area of Knowledge which seeks the following objectives:

- Objective 1: Adapting human beings to the necessities and exigencies of the society.
- Objective 2: Creative participation in the sustained development of society.
- Objective 3: Personal or social problem and conflict solving, reaching integrative, enriching and inclusive solutions.
- Objective 4: Balanced personal development, that is to say, with a shared sense of unit and personal identity.

Specifically, objective 4 can not be achieved if the pedagogic model offered is not global, which means that it should cover in a cohesive way every possible approach or dimension of the development of the person. Unquestionably, in this global model communicative and

knowledge-construction dimensions can not be forgotten, because written language is a basic tool of those. But also, in Western societies, written language is a privileged instrument of social participation in a creative way (Objective 2). And as a consequence of this, a social necessity and exigency is covered (Objective 1).

The foundations of the CCT- Model are:

- The global and interconnected perspective of every training dimension of the human being (communication, assessment and behaviour). In concrete, this model seeks the development of written language as a means of communication and knowledge-construction, to achieve intercultural values when interacting with new Technologies of Information and Communication.
- The features describing Western Knowledge societies are multilinguism, technologies and intercultural conflicts. That is the reason why this pedagogic model seeks the promotion of multimodal written communication to solve conflicts of intercultural solutions in different languages.

4.2. Description of the CCT- Model

The CCT-Model is based on and promotes communicative and knowledge construction functions of written language. According to this principle, the functional communication must be used in didactic situations in order to enhance integration of every writing process taking into account the linguistic and cultural backgrounds of the subjects as well as the theoretical and multilingual exigencies of the society.

The CCT- Model is supported by five basic pedagogic principles:

1. Significant teaching of written composition, linked with the writing experiences and knowledge of the students,
2. Functional writing teaching, seeking the student to be ready to participate in technologic and multilingual societies and to solve multicultural problems using written communication,
3. Collaborative teaching of written composition, where the subject develops Metasociocognitive processes of written composition actively participating in the communication networks of different groups,
4. Reflexive teaching of written composition, which enhances the subject autonomy and independence to lead self-learning towards own aims,
5. Teaching values of written language, which favours increasement and expression of values in the writing process.

Within the CCT-Model three fundamental methodological stages can be identified, integrating reading and writing as well as oral language:

1. Written language composition as a formal system of meaning transmission and new meanings construction. This consists of making the subject aware of the resources possessed to compose written discourses. This process requires a meta-language, to reflect on the written language cognitive processes, on interactions which are put at

risk when building a text and about the social and cultural content which determines the text.

2. The oral expression of the intentions of the text, the social conventions, prejudices and unbalances reproduced and the values suggested, in the linguistic forms as well as in the message transmitted.

3. Written discourses production, using technological resources in different languages. This productions will lead to the end of unbalanced relations, suggesting new values and alternative expressive resources.

These are the characteristics of the CCT- Model:

1. The seeking of psychomotor, cognitive, linguistic, affective, emotional, sociocultural and ethical development, in a global manner, establishing written language in different languages as the fundamental axis,

2. The promotion of a reflexive use of writing to create a Metasociocognitive knowledge of it and to solve multicultural problems or conflicts,

3. The selection of intercultural contents to shape different cultural identities,

4. The development of individual and collective strategies, tools and techniques promoting declarative, procedural and conditional knowledge on writing processes in different languages (task and text theory creation),

5. The creation of a support theory to reinforce writing capacities acquired by students, ensuring the command of Technologies of Communication and Information,

6. The expression of a commitment for social change and intercultural values through written productions,

7. The integration of different writing experiences of students in their different context and their strategic writing knowledge,

8. The organization of a network of social relations which promotes self-emotional control and affective predisposition in writing tasks,

9. The organization of spaces and resources to improve imagination and self-initiative in writing tasks,

10. The assessment of writing socio-cognitive processes, motivation towards them, socio-cultural values and technological skills shown.

4.3. Strategies of the CCT-Model: Tools and Techniques of Metasociocognitive Writing

The CCT- Model suggests a writing teaching process providing students with the tools to participate actively in thinking processes (or collective reflection) and enabling them to experiment interculturality: a sound and shared knowledge of different cultures, in equal conditions.

This Model also takes into account that writing is a personal creativity development process, conditioned by the subject's writing experiences. The CCT- Model guides each student into the elaboration of their own writing tasks and text theory in which their cultural background and experience can be included.

As an example, some estrategies, techniques and didactic tools are introduced, applied to the CCT-Model in order to achieve the objectives and contents of the Metasociocognitive written development.

4.3.1. How to raise awareness of one's own writing process

Aims

1. Increasing awareness of the cognitive effort necessary to build a text,
2. Self-reflecting on self-competences activated when creating a text,
3. Expressing self cultural values in written texts,
4. Making personal introspection tasks in text building processes from a global approach.

Contents

a) Strategies, techniques and tools applied by students in their writing composition processes.

Strategies: tools and techniques

- Individually writing a text on an agreed topic, using software in two different languages known by the students.
- Individually answer a cognitive simplified interview on written composition operations applied in IT format (Grahan and Harris, 2005a:143). The questionnaire has been answered in the two used languages used to write the text.
- Individually answer to an estimation scales created to measure the affective predisposition towards writing in IT format (Salvador and García, 2005:67). The estimation scales must be answered in the two languages in which the text is written.
- Collectively reflect on strategies used by each student to build the text. Which strategies have been used when writing in one language and which are applied when writing in the other.
- Collectively reflect on the values and attitudes shown by various texts produced by the students. Different texts are shown to prove cultural diversity in the classroom.

4.3.2 How to write multimodal and multilingual poetic texts expressing cultural identity?

Aims
1. Using different resources for text multimodal and multilingual production (images, photos, music, verbal written language in different languages),

2. Detecting and correcting words and phrases with no grammatical, logical, ethic or aesthetic sense, using functions of text processors,
3. Detecting and correct links which do not establish a logic, aesthetic nor ethic relationship between the parts of the texts, using functions of text processors,
4. Applying self-instructions for self-control, self-regulation, self evaluation and self-reinforce behaviour when constructing own texts,
5. Selecting the most adequate for the future text,
6. Building a defined cultural identity, using mother tongue and the own cultural background in text construction,
7. Choosing the content, style, structure, finality and language of the text, according to personal and sociocultural interests,
8. Designing and applying collaborative strategies for the shared written development.

Contents

a) Vocabulary wideness, lexical selection according to the audience, the literary genre or type of text and the language in which it is written,
b) Assessment of words, phrases, paragraphs by its adaptation to the aims, audience, structure, texts contents and the way in which it is written,
c) Own experiences, feelings and emotions expressed on the written composition,
d) Generated ideas from own cultural experience,
e) Self-created instructions to build the text,
f) The competence level in IT and command of expression modalities,
g) Literature and oral tradition of the cultures of the local societies and communities,
h) Different languages used in the society and modalities of expression (music, images...),
i) Collaborative strategies in text construction.

Strategies: tools and techniques

- Collectively choosing and reading a poetic text (poem, song…) which self-define a human group.
- Reflecting and applying the following 3 Wh Questions strategy to the read poem
What is telling us? (Example: state feelings or an idea, enunciates an action, describes…)
How many parts has it got?
Which ideas express each part?
How many stanzas (paragraphs) are there in the poem and how many verses (lines) are there in each stanza?
- Projecting the poem and collectively applying the following analysis techniques:
Reading each verse clapping the syllable and counting the syllable of each line (metric).
Underlining tonic syllable and checking the position they occupy (accentuation).
Reading the verse marking the rhythm (clapping stronger in tonic syllable).
Drawing a red circle round words with a similar sounds.
Checking the consonants and vowels of the last word of each verse (rhyme)
nderlining funny, original, rare, nice and suggestive words or expressions.

- Collectively reflect on cultural features in the classroom group and describing the ideas defining the group
- Explaining, for the teacher's part, the strategy: Plan, Organize, Express, Meliorate and Straighten (POEMS) to write a poem expressing the group identity:

1. Plan and note**:**
   - Plan:
   -

     Intentions: Why am I writing this poem?
     People: Who am I writing it for?
     Purpose: What am I writing it for?
     Parts: How many ideas are to be expressed by the poem?
     Words: How many words will each verse have?

   - Note:

     - Note on the computer all your ideas about the topic, the ones you have found and the ones you have been told.
     - Note on the computer the ideas which represent what you want to tell, choosing them from the previous ones.
     - Note on the computer the previous ideas in order: Which ideas will go first? Which ideas will be in the middle? Which ideas will be at the end?

2. Organize:
   - How many stanzas will your poem have and how many verses in each stanza?
   - Make a list with the verses which came into your mind, the original and different ones.
   - Look in the synonyms' dictionary for the words used in the verses with similar meaning and the nice, strange, surprising ones…

3. Express- Write the poem on the computer:
   - Write the first line with a sentence
   - Clap the syllable marking the tonic ones
   - Write another sentence with words which sound similar at the end of the sentence and maintain the rhythm of the first sentence.
   - End the stanza with a sentence which maintains the rhythm and sound of the rest

4. Meliorate the poem. Read the poem paying attention to the following points and create a document with the answers:
   - Are there very common or colloquial expressions or words? Which ones will you change?
   - The sentences when read maintain a good rhythm. Which words will you change?

- Is the idea of each verse understood? Can it be improved?

5. Straighten the poem: write the new poem with the suggestions noted in the previous document.

- The POEMS strategy is applied in a collective way following steps from 1 to 5.
- The poem is translated into different languages.
- By groups a multilingual and multimodal montage which includes music , photos and group videos.
- The montage will be up loaded on the Blog group.
- The POEMS strategy will be applied to the composition of a poem to express self-identity following these instructions:

Behaviour self-control: (for example: "What should I do? First I need?... In which way should I write the poem to be understood by the readers, even the younger ones? How should I link this idea with the following one?").

Behaviour self-assessment: (for example: "Have I really said what I wanted to say? Is this a good idea or is it unclear? Is it aesthetically expressed? Does it sound right?").

Behaviour self-reinforcement: (for example: "Fine, this sentence is right", "fabulous, this is a good job").

Conduct self-control: (for example: Am I concentrating on the task? Am I motivated to write that? Should I rest before carrying on?..).

Individually a multilingual and multimodal montage will be performed with the created poetic composition.

Collectively reflect if different identities are an influence on the group identity.

5. FUTURE RESEARCH LINES IN WRITING TEACHING AND ITS DIDACTIC APPROACH

Currently, the future research lines are marked by the activities led by the ED.INVEST Research Group of the University of Granada (Arroyo and Salvador, 2009), the main ones are:

1. An innovation Teaching Project aiming to the development of the multilingual scientific writing in university students, financed by the University of Granada.
2. Coordination of the International Master Multilingual Writing: Cognitive, Intercultural and Technological Processes in the Written Communication (www.multilingualwriting.com), with the collaboration of the following universities: a) University of Granada (Spain); b) Universitá Degli Studi di Roma "La Sapienza" (Italy); c) Anadolu University (Turkey) d) and the University of Coimbra (Portugal)
3. Management of the "The European Network For Excellence In Research of Citizenship Education" (http://www.enerce.org/).

These activities seek to be a platform to the design of National and International Research Projects in order to prove the efficiency of global strategies in the written development

training of the Citizenship of the 21st Century. In this sense, several International Research Projects are being developed.

The objective of the Project is to apply teaching programs of a written *lingua franca* in different multicultural contexts, using cognitive, multilingual, intercultural and technological strategies, tools and techniques to check its advantages regarding the citizen's metacognitive and sociocultural development.

The design of the Project is performed by randomized groups with Pretest and Postest (improving the model of Campbell and Stanley, 1982) combined with the study of a concrete teaching process followed by the experimental group. In the project a multimode methodology will be applied combining:

- Qualitative and quantitative data pool techniques such as: Writing Metasociocognitive questionnaire, Self-Perception Scale of Writing Efficiency and student produced texts plus digital video.
- Analysis, reduction and data interpretation methods: the Content Analysis, Descriptive Statistics, Size of the effect of the adjusted measures (ANCOVA) and Inferential Statistics: ANOVA and MANCOVA.

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Chapter 5

SELF-ASSESSMENT AND LEARNING TO WRITE

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ABSTRACT

This chapter reviews several recent studies of the relationships between rubric-referenced self-assessment and the quality of elementary and middle school students' writing and self-efficacy for writing. The self-assessment process employed in each study emphasized the articulation of criteria and a carefully scaffolded process of review by students, followed by revision. Taken together, the studies show that rubric-referenced self-assessment is associated with more effective writing, as evidenced by higher total scores for essays written by students in the treatment condition, as well as higher scores for each of the criteria on the scoring rubric. The reviewed research also reveals an association between the treatment and the self-efficacy of girls for writing. The chapter includes a review of relevant literature, a detailed description of the process of self-assessment, a report on the studies, and a discussion of the implications for teaching and research.

INTRODUCTION

Self-assessment is a process during which students reflect on the quality of their work, compare it to explicitly stated criteria, judge how well their work reflects the criteria, and make appropriate revisions (Andrade, 2010). Rather than being used to determine a grade, as in self-evaluation, self-assessment is a formative process during which students recognize the strengths and weaknesses in their work and take steps to improve upon it (Andrade & Valtcheva, 2009). This chapter will introduce a theoretical framework for self-assessment, including its formative nature, its relationship to self-regulated learning and self-efficacy, and its application to the writing process. Three studies of rubric-referenced self-assessment recently conducted by the first author will be reviewed, followed by a discussion of the results and implications for practice and research.

THEORETICAL FRAMEWORK

Black and his colleagues (Black, Harrison, Lee, Marshall, & Wiliam, 2004) have pointed out that "students can achieve a learning goal only if they understand that goal and can assess what they need to do to reach it. So self-assessment is essential to learning" (p. 14). A body of research covering a wide range of content areas, including social studies, science, math, and writing provides support for the claim that there is an important relationship between student self-assessment and improved student learning and performance, assuming a formative approach (Andrade, 2010).

Self-Assessment as Formative Assessment

One common misconception about self-assessment is that students will inflate their assessments to obtain a better grade. If students are permitted to self-evaluate their work and if their evaluations count toward final grades, they will, in fact, tend to overestimate their grades (Boud & Falchikov, 1989). Therefore, it is important to emphasize the formative nature of self-assessment as a process of reflection and revision, not a matter of summative assessment in which students determine their own final grades. Like any type of formative assessment, true self-assessment is not used to determine a grade but rather is an ongoing process that informs teachers and students about how to adjust their performance to meet an established target (Popham, 2009).

This formative conception of self-assessment honors the critical role of feedback in learning (Andrade & Valtcheva, 2009). Research has clearly shown that feedback promotes learning and achievement (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Brinko, 1993; Butler & Winne, 1995; Crooks, 1988). A model of feedback proposed by Hattie and Timperley (2007) involves providing feedback to students and teachers about the targets for learning, where students are in relation to those targets, and what can be done to fill in the gaps. According to Hattie and Timperley, in order for feedback to help close the gap between current states and target states, learners must ask themselves "Where am I going?", "How am I going (or doing)?", and "What's next?" These three questions feature in the approach to self-assessment discussed in this chapter.

Although few teachers have the privilege of responding to all of their students' work on a regular, individual basis, research has shown that students themselves can be a valuable source of feedback via self-assessment (Andrade & Boulay, 2003; Andrade, Du, & Mycek, in press; Andrade, Du, & Wang, 2008; Ross, Rolheiser, & Hogaboam-Gray, 1999). There is also some research that suggests that, with training and practice, students will embrace self-assessment as a formative process of checking their work, revising, and reflecting (Andrade & Du, 2007), especially when the expectations for performance are clear.

Under supportive conditions, self-assessment can promote learning by helping students become more accurate judges of the quality of their work (Schunk, 2003). According to Goodrich (1996) the conditions that must be in place in order for students to receive the full benefits of self-assessment include:

1. An understanding of the value of self-assessment,
2. Access to explicit criteria on which to base the assessment,
3. A particular task or performance to assess,
4. Models of good self-assessment,
5. Direct instruction in and assistance with self-assessment,
6. Cues for appropriate times to self-assess,
7. Opportunities to revise and improve the task or performance, and
8. Practice

Several of the key conditions for effective self-assessment are commonly used classroom practices including the use of models, direct instruction, cueing, and practice. Introducing a rubric can give students access to the second condition—the need for explicit criteria.

A rubric is usually a one- or two-page document that lists criteria and gradations of quality, from excellent to poor, for a particular assignment (Andrade, 2000). Rubrics are often used by teachers to determine final grades, but they can serve the dual purposes of evaluation *and* instruction (Andrade & Du, 2005; Arter & McTighe, 2001; Stiggins, 2001). Teachers and their students can work together to co-generate criteria for a particular assignment and then shape the criteria into a rubric. A useful rubric will describe what makes good work shine as well as identify common mistakes students tend to make, taking the guess work out of understanding their learning targets. Rubrics can promote learning when used to scaffold self-assessment by enabling the students to share a concept of quality that is similar to the teacher's, continuously monitor the quality of work they produce, and have access to strategies for improvement any time, anywhere (Andrade & Valtcheva, 2009; Sadler, 1989).

To engage students in effective self-assessment, Andrade and Valtcheva (2009) recommend three steps: the articulation of expectations, self-assessment, and revision.

1. *Articulate expectations.* An important first step is to clearly articulate the expectations for the task or performance. The expectations can be determined by the teacher, the students, or, preferably, the teacher and students together. This can be done by co-creating part or all of a rubric in class, often through critiquing models of strong and perhaps weak student work.

2. *Self-assessment.* Students create a rough draft of their assignment. They monitor their progress by comparing their work-in-progress to the articulated expectations. For example, if the students are writing, they can use colored pencils to circle a key phrase in the rubric and, using the same color, circle in their drafts evidence of having met the standards articulated in the key phrase. If students have found they have not met a specific criterion in their draft, they give themselves feedback by writing a reminder to make improvements in their final drafts. This process can be completed for each criterion on the rubric, with various colored pencils, and can be completed in one or two class periods (Andrade, Du, & Wang, 2008).

3. *Revision.* Students use their self-generated feedback from their self-assessments to guide revision. This step is crucial: Self-assessment without an opportunity to revise and improve one's work is a largely pointless exercise, and students know it.

Although the process described above may be supplemented with teacher and peer assessment, these three steps have been associated with significant improvements in the effectiveness of students' writing (Andrade, Du, & Mycek, in press; Andrade, Du, & Wang, 2008).

Self-Assessment and Self-Regulated Learning

Self-regulated learning is the process by which learners set goals and attempt to monitor, regulate, and control their cognition, motivation, and behavior in the service of reaching those goals (Pintrich, 2000). Self-regulated learning and self-assessment share the central purpose of providing learners with self-generated feedback about their learning and their approaches to it in order to deepen their understandings and improve their performances (Andrade, 2010).

A clear illustration of the commonalities between self-regulation and self-assessment can be seen by comparing Zimmerman's (2000) commonly cited model of self-regulated learning to the process of self-assessment described by Andrade and Valtcheva (2009). In Zimmerman's model of self-regulated learning, three main phases function cyclically: 1) *forethought* is when learners set goals and make plans to reach them; 2) *performance* or *volitional control* occurs during learning and involves the use of learning strategies and self-monitoring; and 3) *self-reflection* is when learners evaluate and reflect on their work. These phases have considerable overlap with the three steps of self-assessment described above: (1) articulating expectations or targets, which is an example of self-regulated *forethought*, (2) self-assessment of one's work in relation to those expectations or targets, which involves self-monitoring of *performance* as well as *reflection*, and (3) revision in order to fill in any gaps between the work and the expectations, which is a form of *reflection*.

In many ways, theories of self-regulated learning and formative self-assessment use different terms to talk about the same processes and skills. One notable difference between the two areas of inquiry is the focus of the feedback: Simply stated, self-regulated learning tends to involve the management of the learning *process* while self-assessment is more focused on the *products* of learning (Andrade, 2010). Nonetheless, the shared goal of providing feedback that promotes learning suggests that research and practice in each field can inform the other. For example, it is conceivable that regular self-assessment could lead to improved self-regulated learning. This claim is largely untested but rapidly gaining in popularity (Wiliam, 2010).

Self-Assessment and Self-Efficacy

Self-efficacy is commonly considered a component of self-regulated learning (Pintrich, 2000). Self-efficacy is one's belief in one's capability to achieve a specific goal (Bandura, 2003). Noting that "it's not just a matter of how capable you are, it's also a matter of how capable you think you are" (Pajares, 2000, p. 13), Pajares cites extensive research that has shown that students' self-efficacy exerts a powerful influence on their academic achievement, including in writing (Pajares, 2003; Pajares & Johnson, 1996; Pajares & Valiante, 1997), and at the elementary and middle school levels (Pajares, Miller, & Johnson, 1999; Pajares &

Valiante, 1999). Highly efficacious students tend to see difficult tasks as challenges to be met. Their efficacious outlook fosters intrinsic interest in activities and prompts them to work harder, persist longer, adopt what they believe are better strategies, and/or seek help from teachers and peers. Students with low self-efficacy, in contrast, tend to avoid challenging tasks and give up quickly (Bandura, 2003; Schunk, 2003).

There is limited evidence that self-assessment or self-evaluation can promote self-efficacy. For example, Paris and Paris (2001) reviewed research that suggests that self-assessment is likely to promote monitoring of progress, stimulate revision strategies, and promote feelings of self-efficacy. In a linear structural model, Wagner (1991, cited in Ross, Rolheiser, & Hogaboam-Gray, 1999) found positive path coefficients from self-evaluation to self-efficacy. Schunk and Ertmer (1999) have shown that "the opportunity for self-evaluation promoted self-efficacy" (p. 257). Schunk (2003) recommends giving students practice with criterion-referenced self-evaluation in order to develop and sustain self-efficacy for learning. Results from Kitsantas, Reiser, and Doster's (2004) study of ninth and tenth grade students learning to use presentation software showed that, "among students who received organizational signals, those in the self-evaluation condition reported significantly higher levels of self-efficacy than did those in the no self-evaluation condition" (p. 284). Finally, a qualitative study of undergraduates (Andrade & Du, 2005) suggested that criteria-referenced self-assessment made them feel more motivated and confident about their work.

In summary, there is compelling but limited evidence that student self-assessment—and even self-evaluation—is associated with self-regulated learning, self-efficacy, and more effective writing. The following section of this chapter introduces three studies recently conducted by the first author in order to test the latter two claims: that self-assessment is related to increases in elementary and middle school students' self-efficacy and in the quality of their writing.

THREE STUDIES OF RUBRIC-REFERENCED SELF-ASSESSMENT OF WRITING

This section of the chapter will summarize and discuss three studies of rubric-referenced self-assessment conducted by the first author and her colleagues. In two studies we examined the effects of rubric-referenced self-assessment on the quality of students' writing in grades three through seven (Andrade, Du, & Wang, 2008; Andrade, Du, & Mycek, in press). In a third, we studied the relationship between self-assessment and students' self-efficacy for writing (Andrade, Wang, Du & Akawi, 2009).

Studies of Rubric-Referenced Self-Assessment and Writing

In the two studies of the quality of student writing, we looked for a main effect of rubric-referenced self-assessment on scores assigned to students' writing. We also asked whether that effect was mediated by gender, grade level, time spent on writing, prior exposure to rubrics, and/or previous achievement in English.

Sample, procedures and instruments

Both studies—one conducted in grades three and four and one in grades five, six and seven—employed purposive samples of over 100 students ($N = 116$ *and* $N = 162$, respectively) from public and private schools in the Northeastern United States. Each sample consisted of intact classes matched by grade level and subject matter; half of the classes were in the treatment group ($n = 9$), half were in the comparison group ($n = 9$).

Each class was asked to do a writing assignment. The writing process resembled a Writers' Workshop: Students engaged in prewriting, wrote rough drafts, received feedback from their classroom teachers, and then wrote final drafts. As a teacher-imposed condition of participation in the study, topics were related to the curricula and included the impact of European settlers on Native Americans, year-round schools, child labor laws, and the bombing of Japan during World War II. The majority of the classes ($n = 11$; 65%) wrote about year-round schools. All students wrote persuasive essays, except for one third-grade treatment class which wrote stories about their families.

Models. The treatment classes were given model essays or stories. The essay or story was read aloud to the class and students were asked to critique it in terms of strengths and weaknesses. Once students had soundly critiqued the model, they were asked to list the criteria for their own written assignments. Their brainstormed list of criteria was tracked on a chalkboard. Students were told that their list of criteria would be included in the rubric they received during the next class. Although the rubrics given to each class were identical, the students' lists of criteria were in fact included, since students always identified the major characteristics of effective writing. The students in the comparison groups did not read a model essay or story, but they did generate a list of qualities of an effective essay or story.

Rubrics. The rubrics given to the students in the treatment conditions referred to six commonly assessed criteria for writing (e.g., the 6+1 Trait® Writing Method; see Spandel & Stiggins, 1997): ideas and content, organization, voice and tone, word choice, sentence fluency, and conventions. Four gradations of quality for each criterion were written at a vocabulary level appropriate for the student participants, and in language generic enough to be applied to different topics (see Appendix A for one such rubric). The comparison classes did not receive a rubric.

Self-assessment. Students in the treatment classes were guided through a highly structured process of self-assessment of their drafts. They were asked to underline key phrases in the rubric with colored pencils (e.g. "clearly states an opinion"), then underline or circle in their drafts the evidence of having met the standard articulated by the phrase (i.e., his or her opinion). If students found they had not met the standard, they were asked to write themselves a reminder to make improvements when they wrote their final drafts. This process was repeated for each criterion on the rubric using a different colored pencil, except for the conventions criterion, which was not formally self-assessed. Students in the comparison groups did not use rubrics to self-assess their first drafts but were asked to review their drafts and note possibilities for improvement in the final draft.

Time to write. Students were given time in class to complete each step of the writing process, at the discretion of the classroom teacher. Time spent on writing—not instruction or the treatment—was recorded.

Results

Analyses of the data from both the third and fourth grade sample and the fifth, sixth and seventh grade sample indicated a main effect of treatment, even controlling for previous achievement and time spent writing. On average, the essay scores for the students in the treatment classes were higher than the scores for the students in the comparison classes and the differences were statistically significant ($M = 28.5$, $SD = 4.9$ and $M = 30.4$, $SD = 4.7$ for essays written by the elementary and middle school students in the treatment group; $M = 24.3$, $SD = 4.7$ and $M = 27.4$, $SD = 4.3$, for essays written by the elementary and middle school students in the comparison group). The differences were also practically significant; roughly translated into typical classroom grades (an admittedly subjective process that can be undertaken in a variety of ways) by equating a score of six on each criterion with 100%, a five on each criterion with 90%, a four with 80% and so on, the average grade for the elementary and middle school treatment groups would be a low B, compared to the average comparison groups' grade of a high C. Girls in grades 3 through 7 tended to have higher essay scores than boys (elementary girls $M = 27.7$, $SD = 5.1$ vs. boys $M = 25.8$, $SD = 5.2$; middle school girls $M = 29.3$, 4.7 vs. boys $M = 28.3$, $SD = 5.9$), but the difference was not statistically significant.

Multivariate tests were run to examine the relationship between the treatment and the particular criteria for writing included in the rubrics—ideas and content, organization, paragraph formatting, voice and tone, word choice, sentence fluency, and conventions. The results showed that the treatment had a statistically significant relationship with each criterion for both middle and elementary students, except sentence fluency and conventions for elementary students (see Table 1).

Table 1. Relationships Between Treatment and Criteria

Elementary School				Middle School		
Criteria	F	p	Partial η2	F	p	Partial η2
Ideas	20.7	.00	.13	16.2	<.0001	.10
Organization	15.9	.00	.13	5.2	.02	.03
Paragraphs	6.7	.01	.06	28.7	<.0001	.16
Voice	11.2	.001	.09	5.6	.02	.04
Word Choice	11.4	.001	.09	26.1	<.001	.15
Sentences	2.9	.09		9.1	.003	.06
Conventions	.48	.49		8.4	.004	.05

Study of Rubric-Referenced Self-Assessment and Self-Efficacy

In a third study (Andrade, Wang, Du, & Akawi, 2009) we sought to test claims about the potential of rubric-referenced self-assessment to promote self-efficacy (e.g. Arter & McTighe,

2001; Quinlan, 2006; Stiggins, 2001) by examining the effects of the treatment described above on students' self-efficacy for the writing assignment.

Sample, procedures and instruments

A purposive sample of 268 students in grades three through seven from public and private schools in the Northeastern United States was utilized. The treatment and comparison conditions each included nine intact language arts or social studies classes.

Self-efficacy measure. An adapted version of the Writing Self-Efficacy Scale (Pajares, Hartley, & Valiante, 2001) was used to measure self-efficacy (Appendix B). The 11-item scale measured students' confidence in their writing abilities, including their skill in handling the commonly assessed qualities of writing included in the rubrics discussed above: ideas and content, organization, paragraph formatting, voice and tone, word choice, sentence fluency, and conventions (Spandel & Stiggins, 1997). After a brief practice session that involved rating their self-efficacy for jumping short distances, students were instructed to rate on a scale of 0-100 their confidence levels for the essay they were about to write.

Writing assignments. Each participating class was asked to do a writing assignment; two third-grade classes wrote stories and the remaining 16 classes wrote persuasive essays.

Procedures. The treatment and comparison conditions were identical to those described above. That is, the students in the treatment group read a model story or essay, critiqued it in terms of strengths and weaknesses, and generated a list of qualities of an effective story of essay; received a written rubric; and used the rubric to self-assess their first drafts. The students in the comparison group did not read a model, but did generate a list of qualities of an effective story or essay. The comparison group did not receive a rubric. Students in the comparison group were asked to review their first drafts and note possibilities for improvement but did not self-assess their drafts according to a rubric.

Self-efficacy ratings. All students' were administered the Writing Self-Efficacy Scale three times: (a) during Class Period 1, after the writing assignment was introduced and the students generated a list of criteria for their writing; (b) during Class Period 2, after the rubric was handed out or not; and (c) during Class Period 4, after rubric-referenced self-assessment or review of drafts. In accordance with Bandura's (2006) advice, the first administration of the instrument was preceded by briefly practicing self-efficacy rating: Students were asked to rate their confidence in jumping increasing distances (three, five, and seven floor tiles) on a scale of 0-100, and then actually attempted the jumps.

In-class writing. Students were given class time to complete each phase of the writing process. Teachers determined the amount of time to devote to writing. On average, the treatment and comparison groups had equivalent amounts of class time for writing, and writing time was not significantly correlated with any of the three self-efficacy ratings.

Results

Analysis of the first and second administration of the Writing Self-efficacy Scale revealed no differences in self-efficacy scores between treatment and comparison conditions (time 1: treatment $M = 82.45$, $SD = 18.204$, comparison $M = 82.76$, $SD = 16.032$; $p = .885$; time 2: treatment $M = 83.98$, $SD = 16.905$, comparison $M = 82.94$, $SD = 17.764$; $p = .626$). At the third administration of the instrument, which occurred after rubric-referenced self-assessment or review of the draft, students in the treatment condition had higher scores for writing self-efficacy than the comparison group; this difference approached but did not reach statistical significance (time 3: treatment $M = 89.29$, $SD = 13.078$, comparison $M = 86.20$, $SD = 15.016$; $p = .075$).

Differences by gender. Girls had higher self-efficacy scores than boys at the first administration of the measure ($t(266) = 2.48$, $p < .05$) . At the second administration, the difference in average writing self-efficacy scores for boys and girls were not statistically significant. By the third administration, girls' self-efficacy was again higher than boys', and the difference approached statistical significance ($t(266) = 1.92$, $p = .06$).

Differences by grade level and school type. No significant differences in writing self-efficacy scores were found across grade levels for any of the three administrations of the self-efficacy assessment ($t(266) = -0.46$, $p = .644$; $t(266) = 0.10$, $p = .919$; and $t(266) = 0.20$, $p = .840$, respectively). In addition, no statistically significant differences in writing self-efficacy scores were found between students in public versus private schools ($t(266) = 0.90$, $p = .37$; $t(266) = 0.72$, $p = .47$; and $t(266) = 0.78$, $p = .43$, for the three administrations of the self-efficacy assessment, respectively).

CONCLUSION

The two studies of the relationship between rubric-referenced self-assessment and the quality of student writing reviewed above provide support for the hypothesis that having elementary and middle school students use model papers to generate criteria for a writing assignment and carefully self-assess first drafts according to a rubric is positively associated with the quality of their writing. The treatment had a statistically significant, positive association with essay scores, even controlling for the powerful effect of previous achievement in English/Language Arts. The influence of gender on writing scores was relatively predictable: We found that girls tended to receive higher scores for their writing than boys, but the differences were not statistically significant. In the analysis of the scores received for the individual criteria (ideas and content, organization, paragraph formatting, voice and tone, word choice, sentence structure, and conventions), the treatment had a statistically significant association with every criterion for middle school writers, and every criterion except sentence structure and conventions for elementary school writers. It is important to note that the conventions criterion was not formally self-assessed. It is possible that the older students informally self-assessed and revised the mechanics of their writing but we do not have the data needed to test this claim.

These findings regarding the effect of treatment on criteria such as ideas and voice content—arguably two of the most important qualities of effective writing—stand as a rejoinder to recent critiques of rubrics (Kohn, 2006; Wilson, 2006). Kohn and Wilson argue that rubrics promote weak writing by focusing attention only on the most quantifiable and least important qualities of assignments. The fact that rubric-referenced self-assessment was associated with higher scores on important qualities of writing testifies to the potential of the process to help students master significant, meaningful aspects of writing—at least when the rubrics emphasize those important qualities and when students are actively involved in using them, as in these two studies.

The third study reviewed above, which focused on rubric-reference self-assessment and self-efficacy for writing, provides only partial support for the popular claim that rubric-referenced self-assessment is related to students' self-efficacy for a written assignment: Only girls were more self-efficacious in regard to writing, and only after engaging in the structured process of self-assessment according to a rubric (Andrade, Wang, Du & Akawi, 2009).

Attribution theory may help us understand the gender difference in self-efficacy. Research has shown that, in general, girls tend to hold task, or mastery goals, whereas boys tend to hold performance approach, or ego goals in writing (Pajares, Britner, & Valiante, 2000) and mathematics (Middleton & Midgley, 1997). In other words, girls tend to be more concerned with mastering a task and boys tend to be more concerned with showing someone else that they are capable. Given those tendencies, girls may derive more satisfaction and confidence from self-generated evidence of progress, as was done in our study, and boys may seek confirmation of progress from others, perhaps their teachers and peers. Furthermore, girls' tendency to make effort attributions might have led to increased feelings of self-efficacy. Boys, in contrast, might have been less influenced by the presence of a rubric because they placed less value on self-generated feedback.

Implications for Practice

The three studies reviewed here suggest that elementary and middle school students should be actively engaged in a process of formative assessment that involves critiquing model pieces of writing, generating the criteria contained in the rubrics by which their writing will be evaluated, and carefully scaffolded self-assessment of their works in progress in order to become better writers and, at least for girls, more confident about their writing. By involving students in the assessment process in the ways recommended throughout this chapter, teachers can blur the distinction between assessment and instruction and transform classroom assessment into a moment of learning (Zessoules & Gardner, 1991).

Implications for Future Research

In the three studies reported in this chapter, students experienced rubric-referenced self-assessment only one time: Research is needed on the longitudinal effects of the treatment. Studies of the long-term effects of self-assessment on self-regulated learning would be particularly useful. In addition, studies like this one are needed in other domains, including

and especially science and math, which tend to involve students in qualitatively different kinds of work. We also suggest that research is done on rubric-referenced assessment in secondary schools and higher education, with diverse populations, and with students with learning disabilities.

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APPENDIX A. PERSUASIVE ESSAY RUBRIC (GRADES 5 AND 6)

	4	3	2	1
Ideas and Content	The paper clearly states an opinion and gives 3 clear, detailed reasons in support of it. Opposing views are addressed.	An opinion is given. One reason may be unclear or lack detail. Opposing views are mentioned.	An opinion is given. The reasons given tend to be weak or inaccurate. May get off topic.	The opinion and support for it is buried, confused and/or unclear.
Organization	The paper has an interesting beginning, developed middle and satisfying conclusion in an order that makes sense. Paragraphs are indented, have topic and closing sentences, and main ideas.	The paper has a beginning, middle and end in an order that makes sense. Paragraphs are indented; some have topic and closing sentences.	The paper has an attempt at a beginning &/or ending. Some ideas may seem out of order. Some problems with paragraphs.	There is no real beginning or ending. The ideas seem loosely strung together. No paragraph formatting.
Voice & tone	The writing shows what the writer thinks and feels. It sounds like the writer cares about the topic.	The writing seems sincere but the writer's voice fades in and out.	The paper could have been written by anyone. It shows very little about what the writer thought and felt.	The writing is bland and sounds like the writer doesn't like the topic. No thoughts or feelings.
Word choice	The words used are descriptive but natural, varied and vivid.	The words used are correct, with a few attempts at vivid language.	The words used are ordinary. Some may sound forced or clichéd.	The same words are used over and over, some incorrectly.
Sentence fluency	Sentences are clear, complete, begin in different ways, and vary in length.	Mostly well-constructed sentences. Some variety in beginnings and length.	Many poorly constructed sentences. Little variety in beginnings or length.	Incomplete, run-on and awkward sentences make the paper hard to read.
Conventions	Spelling, punctuation, capitalization, and grammar are correct. Only minor edits are needed.	Spelling, punctuation and caps are usually correct. Some problems with grammar.	There are enough errors to make the writing hard to read and understand.	The writing is almost impossible to read because of errors.

APPENDIX B. SELF-EFFICACY SCALE

Research ID number: _____   Date: _____

Directions: On a scale from **0** (**cannot do it**) to **100** (**completely sure I can do it**), show how

confident are you that you can perform each of the writing tasks below on this week's essay. You

may use *any* number between 0 and 100.

| 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

Cannot do it   Medium sure   Completely

I can do it   sure I can do it

    _____   1. Write a clear, focused essay that stays on topic.

    _____   2. Use details to support my ideas.

    _____   3. Write a well-organized essay with an inviting beginning, developed

            middle, and meaningful ending.

    _____   4. Correctly use paragraph format in the essay.

    _____   5. Write with an engaging voice or tone.

    _____   6. Use effective words in the essay.

    _____   7. Write well-constructed sentences in the essay.

    _____   8. Use correct grammar in the essay.

    _____   9. Correctly spell all words in the essay.

    _____   10. Correctly use punctuation in the essay.

    _____   11. Write an essay good enough to earn a high grade.

Chapter 6

HOW BUSY CLINICIANS CAN WRITE SCHOLARLY PAPERS

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ABSTRACT

Some of the difficulties busy clinicians face are time constraints and limitations on creativity. It is difficult to have a strong clinical focus and yet find the time and energy to devote toward scholarly productivity. Often, there seems to be insufficient time to "put pen to paper." When time permits, creativity is often lacking because of fatigue or concerns about other issues. As the day-to-day responsibilities take their toll, it can be difficult to express the scholarly interest that serves as the foundation for an academic career. An interesting project or study can become lost in the shuffle of accomplishing more mundane tasks.

This manuscript serves as a template to guide busy clinicians in writing papers of scholarly value. Input from surgeons at various levels of accomplishments and at wide ranging stations in their careers makes this of value to a broad audience. Our focus is on young academicians without notable experience in writing scholarly papers. In the pages that follow we elaborate on the writing of the essential elements of a peer-reviewed manuscript.

I. GETTING STARTED

A. The Question

Clinicians often feel they are at a disadvantage in being scholarly because they are busy. Actually, they have a tremendous advantage. They are blessed with a plethora of

inspiration—the very patients that occupy their time and thoughts. When struck by inspiration or a question, write it down. It may be difficult to remember later, particularly in the context it was conceived. There is much truth to the adage: "good ideas" or "good questions" lead to "good papers." With a question formed, run a Medline or similar search to see what has been written on the topic. Many times the question has been previously addressed. If so, your question has been answered and your knowledge base expanded. If the question has not been answered, the Medline and resultant readings will help focus the idea, and dually serve as your burgeoning list of references. This search will also help to place the clinical question in context. Without context and a unique approach to a clinical question, it is unlikely that the resultant manuscript will be accepted for publication.

B. Construct an Outline

Following an exhaustive search, an outline should be created. This way the writing is focused and will flow logically. Too often, information in a manuscript is jumbled or mixed up like cards in a shuffled deck. An outline helps prevent this and keeps the author on track. Outlining ideas in a logical order to begin a manuscript goes a long way to expeditiously expressing the important points of a scholarly project. The outline should be reviewed and then expanded. At this point each coauthor can focus on part of the project and the parts can later be fused. The outline should be reviewed and expanded sequentially. The more detailed the outline, the easier it is to write a focused manuscript.

C. The First Draft

Once the outline includes the points of the manuscript in detail, the writing begins. The first draft is the most difficult to write. Therefore, no one can ever be critical of a first draft. While some first drafts are better than others, none are great. Therefore avoid consternation regarding sentence structure and specific wording; instead focus on conveying the important points from the outline. Perhaps the most important role of the first draft is the personal satisfaction gained with completing the daunting task of compiling data and ideas into words. Because the first draft is so important, this manuscript will focus on developing it.

II. THE MANUSCRIPT

A. Title

Pick a title. In developing a manuscript the importance of the title cannot be over emphasized. It might not be *The* title, but it is the place to start. After writing the paper, the title may need to be changed because it is wrong, inappropriate, or incongruous with the important theme of the paper. The working title can be a question, a statement, or a conclusion. It can be provocative. There are no rules. A simple declarative statement is acceptable. Preferably the title should be strong, short, and to the point. Make sure the title is

consistent with the conclusions of the study. Generally, straightforward titles that state an outcome are preferred as they lead the reader to a manuscript. A weak, non-specific, or unusually long title may lose the author, and later the reader, and the manuscript will not be focused, or read.

The title effectively becomes a billboard for the manuscript to follow. Keep in mind that online search engines find manuscripts based on keywords. An appropriate title will catch the reader's eye among the sea of other manuscripts. A weak, non-specific, or long title may lose the reader and the manuscript will not be focused or read. One of the purposes of the title is to specifically place the paper in the vast pool of peer-reviewed articles.

B. Introduction

Writing a paper is a lot like telling a joke and the purpose of the introduction is to "set the hook" for the punch line (i.e. the results and conclusions). The Introduction must flow in such a way that the reader is urged to continue reading. The Introduction should be presented in a thoughtful manner with a sequence that leads the reader into a story.

The Introduction must contain pertinent background material from other studies on the topic. Uncertainties forming the clinical question leading to the study should be presented in a manner that interests the reader. Ideally, a manuscript focuses on a question never before asked. If a manuscript is not based on an original question, it must validate, confirm, refute, or provide another approach to work previously done, thus, decreasing the originality of the manuscript. Another paper about a common problem (e.g., bile duct injuries after laparoscopic cholecystectomy) lacks originality and significance unless it is somehow unique (large number of subjects, different treatments, longer follow-up, different types of patients, etc.). We suggest avoiding "copy cat" papers as they are simply too much work for too little recognition.

The end of the Introduction should explicitly state why the study was done and what the hypothesis was, or what the hypotheses were. The purpose of the study and hypothesis ought to be clearly stated. Without each, the reader cannot fully understand the writer's intent and point of view (i.e. bias). We suggest the use the phrases "we undertook this study to" or "the purpose of this study was to" or "our hypothesis in undertaking this study was". If you do not use such explicit wording, then the purpose and hypothesis of the study is merely implied.

As authors, it is important to state that there was a formulated hypothesis, which the work is intended to prove or disprove. The hypothesis does not need to be stated as a null hypothesis but rather as the hypothesis that the authors undertook in begetting the study to denote any bias that might exist.

While it is not fitting in the Introduction to note funding that has been received to support the study, sources of funding must be noted somewhere in the manuscript and it is acceptable to have an acknowledgement on the title page of the submitted manuscript. Source of funding will be very important as it may give a bias to the study in many different ways, including study design, data collection, data analysis, or data interpretation.

C. Methods

The Methods section should begin by stating that IRB approval was obtained, if applicable. A critical part of the methods section is to state the design of the study. The design should be appropriate to test the hypothesis. When designing a study and writing about that design, definitions of clinical terms should be defined so that there is a clear understanding as to what is meant by certain terms. Clinical entities such as "fever," "pneumonia," or "seizure" and disease states like "pancreatic cancer" or "myocardial infarction" should be clearly defined. For example, a manuscript that focuses on pancreatic cancer should be detailed in the description of cell types included and excluded. In a group of patients with pneumonia, the criteria for diagnosis are essential, as "pneumonia" can mean different things to different readers.

Clearly state how patients were identified. The method by which the data was collected, tabulated, codified, and analyzed should be clearly delineated and statistical methods should be clearly stated. Ideally patients are identified prospectively and data recorded as their care unfolded, although this is often not possible. A power calculation is essential to support that sample size was sufficient to validate conclusions. A common pitfall is when authors fail to use appropriate statistical methods for parametric or nonparametric data. Each statistical test has specific rules for its use and the application of a test outside these limitations is unacceptable. Assistance by a statistician is acceptable and encouraged but not necessary. Seek such assistance early in the conceptualizing the project as it will greatly facilitate collecting, storing, presenting, and analyzing data.

The definition of variables is important. Variables measured should be appropriate to test the hypothesis. Many times the effectiveness of therapy is judged in terms of survival, but survival is clearly dependent on *multiple* variables. Rather, therapeutic regimens might be better judged in terms of their efficacy in treating relevant physiologic variables such as oxygen delivery, blood loss, cardiac output, or tumor burden. In some cases, stating that a given therapy does not improve survival is not necessarily an indictment of that therapy. It may have been intended to improve physiology as well as survival. Any critical analysis of therapy should look at multiple endpoints, not just survival.

Keep in mind that it takes less time to write a "good" paper from a "good" data set then it does to write a paper from a "bad" data set. Therefore, study design and thought before undertaking data collection is recommended. If your number of subjects is small, study them in detail as much can be learned from small, complete data sets. In short, the Methods section should be written in such a way that the reader could undertake the study at his or her institution.

D. Results

The Results section should begin with demographic data of the study subjects and should then progress through the data of the study at hand. This section should conclude in comparative analysis of different data groups within the study. The Results section is data driven and, as such, data should be stated. It is inappropriate to use words like "most", "commonly", "majority", or "usually." These terms confer an opinion based on the data and

should be reserved for the Discussion. Rather, numbers should be presented, like "70%," or "41 of 50." The reader should be clearly able to identify the individual data points leading to the conclusions. In other words, each subject should be clearly identified and statements accounting for dropouts are essential. Data presentations would ideally be clear enough for readers to redo the statistical analysis.

The formality of the manuscript should be maintained in this section. Results can be divided with subheading to aid the reader. Care should be taken to avoid a colloquial tone with terms such as "the heme positive stool group" or "the trauma ex lap group." Better terms for these patients would be "those with heme occult positive stool" or "the trauma patients undergoing exploratory celiotomy." If a formal writing style is employed, the manuscript and the authors are viewed in a more favorable light.

E. Discussion

i. The first paragraph—Why the paper should be accepted

The first paragraph of Discussion is the most important paragraph of this section. It should include a statement as to why the paper should be accepted. This does not have to be directly stated but should be very clear within the first paragraph. If this is not obvious then either the authors are asking the readers and reviewers to do their work in terms of perceiving the importance, or there is no reason the paper should be accepted. Do not expect the reviewers to do your work. You should assign the originality, importance, weight, and value to the manuscript succinctly to your advantage. Examples of stating relevance include declarations such as "the largest study ever written", "first study undertaken", a novel study design, or "expanded follow up of an expanded trial previously reported". There are good reasons why manuscripts should be accepted and those should be clearly pointed out to the reviewers. No one is more motivated than you to present your paper in a favorable, yet honest, light.

ii. The second and third paragraph—Summarize the results

The subsequent several paragraphs of the discussion should discuss the results of the study in the context of the medical literature on the subject. The unique aspects of the current report should be emphasized however to support publication of the manuscript and to denote the importance and originality of the manuscript. One sentence may cover a significant amount of data, such as "The patients involved in this trial were generally older white alcoholic males with advanced hepatic dysfunction, similar to the demographic norms reported for this disease". This sentence covers many data points, including age, gender, race, and severity of hepatic dysfunction. It may summarize one paragraph within the Results section, while conveying that the results were not based upon some obscure patient selection or other anomaly. All pertinent data presented in the Results should be discussed in summary fashion, so that the reader gets a general impression of the data in the manuscript. Here, words like "majority", "usually", or "most" and similar words are used to put the data in some context and to leave the reader with some summary sense of the information contained.

iii. The final paragraphs—Placing the study in context

The remaining portion of the discussion should help place the manuscript into the body of existing medical literature. Other studies on the subject should be noted and comparisons, particularly favorable ones, between the given study and previous reports should be made. The unique aspects of the current report should be emphasized to support publication of the manuscript and to denote the importance and originality of the manuscript.

Any concerns regarding the study should be mentioned following the summarization of the data. If there is a conceivable bias through a data collection process, or through the selection process for the patients, that bias should be stated. In this way the reader is easily led to the relative merits and place of the manuscript. As well, this can disarm reviewers since some of the disclaimers or concerns may not have been otherwise apparent to the reviewer and the reader. This kind of honesty is necessary to make sure that the manuscript finds its proper place in medical literature. Appropriate disclaimers represent the authors very well.

The very last portion of the Discussion should re-emphasize the "take home" points of the manuscript. It may also identify work that needs to be undertaken in the future and the questions that remain. However, care should be taken to avoid diminishing the work having been undertaken with overemphasizing future directions.

III. TABLES AND FIGURES

Tables and figures should not be redundant with the Results, but should be additive and illustrative. They serve as a visual aide for presentation to promote understanding or present the data not stated specifically in the Results section. Tables and figures are also an opportunity to dress up a manuscript and to improve the "marketability" of a manuscript. However, overtly fancy tables and figures are to be avoided. Tables that merely restate the data and excess information should be avoided.

IV. REFERENCES

References serve two purposes in the manuscript. The first is to establish the authors' role as well-read experts in the field. The second is to frame the manuscript in the medical literature. Manuscripts with less than 20 references generally do not appear to be scholarly and more than 30 references appear long and superfluous. The intent is to document the scholarly nature of the manuscript, but not to overwhelm the reader with numerous references which are redundant and which extend the length of the manuscript. Only the most recent work on a given topic should be cited. Historical articles relevant to a topic are not needed and it should be assumed that readers are familiar with the historically sentinel articles on a given topic.

The role of technology in the citing of references cannot be overstated. Literature searches are almost exclusively electronic and thus the citations are created electronically as well. We recommend using a software package to collect, collate and cite the references in the manuscript. After revisions it is common that the order of references is changed. Contemporary software will adapt the final bibliography to these inevitable manuscript

changes. Furthermore, the format of the bibliography can be set to that of the journal of submission.

It is important for the authors to utilize previous work that they have published, because it further promotes their position as experts in the field and helps support the strength of their manuscript. This seems a subtle point but it reinforces the importance of manuscript acceptance. If the authors have published nearly every recent article on a given topic then it would follow that the current manuscript is relevant to the larger body of medical literature as well and need be published.

V. AUTHORSHIP

The busy clinician should not work alone in his academic pursuits but with a team of trusted colleagues, each of whom strives to expand the academic pursuit. Said differently, the whole team should be greater than the sum of its parts. Each member should bring a unique perspective to the project and a different set of talents. In this way the team becomes a puzzle of interlocking members that create a manuscript through rigorous writing, reading, and editing. In the end, the result is beyond what any single member could have produced.

This team concept inevitably leads to assignment of authorship. This assignment should note the contributing persons who have made the study possible. Every author in the manuscript should have participated in some aspect of the manuscript and every effort should be definable and defensible. Importantly, if asked, the first author should be able to specifically state the contributions of each author along the lines of study concept and design, IRB approval, data acquisition, data retrieval, data analysis, and manuscript preparation and review.

The order of authorship merits consideration. For young academicians, recognition as "first author" is important. Such recognition denotes their contributions were essential to completion of the research and begins to solidify them as a thought leader in their field. Authorship beyond the first positions generally signifies more limited involvement in the intellectual process of the work, with the exception of the last author listed. The last author listed can be the senior author, whose guidance and tutelage was essential in the completion of the project, including the manuscript. Authorship should never be gifted, only earned.

It is recommended that authorship be inclusive. If more than one physician has generated data, authorship should be discussed among all involved and authorship decided early, with concomitant assignment of forthcoming work. If some potential authors do not fulfill their subsequent obligations, the senior author should reconfigure authorship with reassignment of work.

In doing the work of reviewing and finishing a manuscript, the authors should work in series. If separate authors with separate drafts do the work in parallel, the final amalgamation of text and thoughts will be scattered and unfocused. It is easier for one author to work on one draft at a time, presenting sequential copies to subsequent authors until a final form is accomplished.

Table 1. Key Points

Element	Key Points
Idea	• The foundation of the manuscript in response to a clinical question
Medline Search	• Determine if the question has been answered • Genesis of bibliography
First Draft	• No one can be critical
Title	• Short and declarative • Consideration of keywords for search engines
Introduction	• Create interest in the reader • Summarize the background • State the purpose and hypothesis
Methods	• Details should allow for re-creation of the study
Results	• Just the facts—no interpretation • Disclose the study subjects
Discussion	• Address why the manuscript should be accepted • Summarize the results • Place the manuscript in the body of medical literature
Tables and Figures	• Only illustrative, not repetitive
References	• 20-30 up to date references focusing on important papers in the field
Authorship	• Order should represent level of contribution of the authors • Roles should be definable and defensible

VI. MISCELLANEOUS THOUGHTS

There are several caveats in writing scholarly manuscripts. It is unforgivable to plagiarize. With all the information available in an electronic format, it is amazingly easy to "cut and paste" a manuscript together. If information is assessed and accumulated through a "cut and paste" approach with the intent of later modifying it to put it into your own words, the stage is set for something to appear in your manuscript that is someone else's intellectual property.

In the big picture it is important to write a complete paper that answers a question with a complete report. In other words, don't break manuscripts into smaller parts or what has been called the "least publishable unit." As stated above, each manuscript should be driven by a unique question with a complete answer. Given that, duplicate publishing will be avoided. Duplicate publishing must be avoided—it can ruin a career.

It is important to note any funding that has been received to support the study. Source of funding will be very important as it may give a bias to the study in many different ways, including study design, data retrieval, data analysis, or data interpretation.

VII. CONCLUSION

In conclusion, we have presented a concise a guide to writing a scientific manuscript. The writing of manuscripts based on original work is fundamental to the maturation of an academic clinician. Without evaluating and writing about the data collected either in the laboratory or in clinical practice there is a great risk of becoming suboptimal as a provider and having your career languish. Medicine changes rapidly and without constantly questioning and evaluating current therapies and interventions the field becomes merely a "patient factory". Without asking questions and working to answer them, we become enablers of such factories.

SUGGESTED READINGS

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Chapter 7

TEACHING UNDERGRADUATES TO WRITE PUBLISHABLE MATERIAL

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ABSTRACT

A writing assignment, which develops the skills required of a published author, is hereby described. It has been developed for undergraduate chemistry students with limited research and writing experience. This assignment is part of a writing intensive program developed at Simon Fraser University (SFU), where writing is used as an educational tool. As part of this assignment every student is required to submit a *Chemical Laboratory Information Profile* (CLIP) on one of the chemicals used or produced in a second year chemistry laboratory course. These profiles are used to introduce students to the riggers of publications, the requirements of efficient exchange of ideas and how to research the hazards related to the chemicals used in the undergraduate laboratory setting. The CLIPs are later used by the students in the laboratory.

Keywords: Second-Year Undergraduate, Upper-Division Undergraduate; Chemical Education Research, Safety/Hazards; Collaborative / Cooperative Learning, Communication / Writing.

INTRODUCTION

The movement to change the role of writing from solely a tool to evaluate to one in which writing is seen as an effective teaching method continues to experience growth. Most undergraduate chemistry courses are focused on teaching the theories and facts of the field, or the development the laboratory skills. Instructions on the how to effectively write in chemistry, to allow for a meaningful exchange of ideas, or to use writing as a tool to learn are

now becoming accepted components of the curriculum [1]. Writing is being used to engage the students in developing critical thinking skills as well as independent and active learning [2,3]. The growth of this approach in science courses has been the subject of numerous articles [1,4,5].

A challenge for chemistry instructors teaching writing intensive courses at the second year level is the inexperience of the students [6]. With these students it is difficult to move beyond the basic writing styles, such as laboratory report sheets, and to begin to develop the writing skills required of a published author. As stated by a reviewer of this manuscript "it is difficult to motivate students to write in a manner that will someday make it easier to get material published in a peer review publication." Presented here is an exercise developed for a writing intensive course where students produce a publishable manuscript. The students are taken through the processes of investigating the importance of writing in an agreed upon format (i.e. The format adopted by the field for the specific type of writing they are doing.) The *Chemical Laboratory Information Profile* (CLIP) format is analyzed and students are given an opportunity to produce their own CLIP [7,8]. Before it is submitted to the instructor it first must pass the review process, which is performed by their fellow students. The ultimate goal of this exercise is to develop the communication skills of the students. The important of this was best summarized by another reviewer of this manuscript who wrote that "[helping] students understand that the ability to communicate information is more important, more useful, and more necessary, than the ability to acquire and apply that same information."

STRUCTURE OF THE COURSE

This writing assignment was developed for a second year inorganic chemistry laboratory course at SFU, which was recently altered to adopt a writing intensive approach [5]. The course consisted of a weekly one hour tutorial session, which focused on the aspects of writing in chemistry, and a weekly four-hour laboratory period. In the tutorial setting, the students received instructions on how to properly maintain a laboratory notebook, fill out laboratory report sheets and write a formal laboratory report. This was accomplished through analysis of previously reported and published works, handouts, writing assignments, peer reviews and discussions. These are methods often employed in writing intensive courses [6].

A challenge for the course was to devise an assignment, which would introduce the students to the rigors of producing a manuscript worthy of publication in a peer reviewed journal. Although a limited number of exercises tailored for third or fourth year undergraduate students have been published [1,2], none appears to focus on teaching second year students how to write a publishable work, a skill which is applicable to all writings styles.

DESCRIPTION OF THE ASSIGNMENT

In order to introduce students to idea that communication become more effective when a message is presented in a format known to the recipient, an assignment was devised to produce material worthy of publication. The criteria for the assignment included (a) that the

students write on a topic of importance to others and not just a subject chosen solely to complete the exercise and (b) the completed work be submitted to a scientific journal for publication rather than solely based on the guidelines of a specific journal or submitted to an in house publication. (This aspect is discussed in a later section.).

The topic of the assignment was chosen to reflect the abilities of the students and their limited writing and laboratory experience. It was devised for students enrolled in a second year inorganic chemistry laboratory course. As for any laboratory course safety was given the importance it deserves. This included a close examination of the hazards associated with the reagents and solvents used and the products made during the experiments. As it is extremely important that students know how to obtain the hazard information for a given compound and effectively communicate this information to other, this was chosen as the subject of the assignment.

It is convenient to obtain chemical safety information from existing safety data sheets, such as the Material Safety Data Sheet (MSDS), but without knowledge of where the information on these sheets are taken from and the exact meaning of the presented data a full understanding of the hazards is not obtained [7]. Also, the standard data sheets used (i.e. MSDS) are mainly for industrial purposes and not the undergraduate chemistry laboratory environment. The information from a MSDS must be interpreted and applied to the undergraduate chemistry laboratory setting. This can be a problem for undergraduate students with a limited chemistry background. In order to address this, the *Journal of Chemical Education* published the *Chemical Laboratory Information Profile* (CLIP) a simple one page safety data sheet detailing the hazards of chemicals used in undergraduate chemistry laboratories.

During the semester the students were asked to produce one CLIP on one of the reagents, solvents or products used or obtained in one of the experiments performed during the course. These data sheets were later provided as reference material for use by other students.

Pre-Assignment

Each student was assigned a chemical, unaware that three other students had the same assignment, and were given one week to devise a laboratory safety data sheet. The instructions for the laboratory safety data sheet provided at this point was that they were to include the information they felt was important and to use a style they believe effectively communicated this information. The students where therefore required to think about what information should be included, in which format it should be written and the level of language to be used (i.e. Who is their audience?).

Once these data sheets were completed the students with the same chemical were grouped where they presented their data sheet and discussed the merits of their approach in this peer review setting. To aid in the examination of the different approaches the students were asked by the instructor various questions, such as (a) In an emergency situation, which format allows for the quickest access to specific information such as the toxicity or flammability of the compound? (b) Which format would you use if you were writing a term paper on that chemical? (c) Which format was the easiest to read? Within in their groups the students discussed the effectiveness of each safety data sheet in the different situation it may

be used. As a collaborative effort, these groups devised their ideas for an effective safety data sheet. As a class the data sheet format devised by each group was discussed, including the format employed by the CLIPs. This exercise was done in order to promote critical thinking and to get the students to understand what is important information and what should be included. It was also intended to show that how one presents the information is almost as important as the message and that how the material is presented depend the purpose of the written work. It was also intended to show the students that feedback from their peers is a positive tool and that collaborative efforts can produce results [9].

Assignment

Through the use of example handouts the students were shown that the format employed by different journals and books are not the same. It was explained to them that one of the criteria for a manuscript to be accepted is that the format of the submitted work be identical to that used in the journal or book. By use of samples CLIPs the format of the CLIP (see Figure 1) was discussed in detail from both (a) a formatting perspective and (b) the amount and type of information provided [8]. Important aspects of formatting such as the font, font size and font style used, as well as the layout of the approach, were discussed. The type of information included, the different sections of the CLIP, the meaning of the values, as well as the quality of the language to be used were highlighted.

Table 1. Summary of data sources used

Exposure Limits	Occupational Safety and Health Administration (OSHA)	http://www.osha.gov/SLTC/index.html
	American Conference of Governmental Industrial Hygienists (ACGIH)	http://www.acgih.org
Hazardous Characteristics	Patty's: Industrial Hygiene and Toxicology	
	Gosselin's: Clinical toxicology of commercial products	
	Merck Index: An Encyclopedia of Chemicals and drugs	
	JTBaker Co. Catalogue	www.mallbaker.com
	SigmaAldrich Co. Catalogue	www.sigmaaldrich.com
Incompatibles	Bretherick's: Handbook of Reactive Chemical Hazards	
Carcinogenic	National Toxicology Program (NTP)	http://ntp-server.niehs.nih.gov
Reproductive Toxin	Frazier and Hage: Reproductive Hazards of the Workplace	

CLIP, Chemical Laboratory Information Profile

'Only when you know the hazards, can you take the necessary precautionary measures.'

Silver(I) Oxide Ag_2O **CAS No.:20667-12-3**

Synonyms: Argentous oxide, disilver oxide

Physical Properties:	**Exposure Limits**:
Brownish-black, odorless powder Vapor pressure at 20° C: negligible Decomposes at: 200 -300° C	OSHA PEL: 0.01 mg/m^3 (as Ag) ACGIH TLV: 0.01 mg/m^3 (as Ag)

Hazardous Characteristics:

Overall toxicity	Flamma- bility	Destructive to skin/eye	Absorbed thru skin?	Sensi- tizer?	Self- reactive?	Incompatible with: Organic materials, ammonia, reducing agents*
2	0	3	0	No	No	

0: None (or very low), 1: Slight, 2: Moderate, 3: High, 4: Severe

*Reactivity Hazards

An extremely explosive precipitate forms upon the addition of Ag_2O to an ammonia solution. It is a strong oxidizer and the heat of reaction with reducing agents or combustibles may cause ignition. The oxidation of CO can reach a temperature of 300 ° C. Ignition occurs upon grinding of mixtures of Ag_2O with Se, S, P, SeS_2, or metal sulfides. See Bretherick's *Handbook of Reactive Chemical Hazards* (entry number 0032) for details and for other incompatibilities.

Cited as known to be or reasonably
anticipated to be carcinogenic in *NTP-11*?   No

Identified as a reproductive toxin in Frazier and
Hage *Reproductive Hazards of the Workplace*?   No

Typical symptoms of acute exposures:

In the eyes or skin, irritation. The effects on skin are worse if skin is moist. If ingested, severe gastrointestinal tract irritation with nausea, vomiting and possible burns. If inhaled, causes burning pain in the nose and throat, with coughing, wheezing and shortness of breath.

Principal target organ(s) or system(s):

Eyes, skin, gastrointestinal and respiratory tract.

Storage Requirements:

Store with other oxidizing agents in a tightly sealed container away from strong light and from flammables, combustibles and other reducing agents.

Additional Remarks:

A bluish discoloration of the skin, called cyanosis may occur after exposure. Inhalation of Ag_2O may cause fever known as "metal fume fever". Oxygen from the decomposition of Ag_2O increases the rate of combustion of any nearby combustible material. Ag_2O is light sensitive.

Notes:

Readme

This Chemical Laboratory Information Profile is **_not_** a Material Safety Data Sheet. It is a brief summary for teachers and their students that describes some of the hazards of this chemical as it is typically used in laboratories. On the basis of your knowledge of these hazards and before using or handling this chemical, *you need to select the precautions and first-aid procedures to be followed*. For that information as well as for other useful information, refer to Material Safety Data Sheets, container labels, and references in the scientific literature that pertain to this chemical.

Reproductive toxins

Some substances that in fact are reproductive toxins are not yet recognized as such. For the best readily available and up-to-date information, refer to 'DART/ETIC'. See the TOXNET home page at www.sis.nlm.nih.gov and click on 'Toxicology search'. *Note that some of the data in DART/ETIC have not been peer-reviewed.* See also Linda M. Frazier and Marvin L. Hage, *Reproductive Hazards of the Workplace,* Wiley, 1998 and T.H. Shepard, *Catalog of Teratogenic Agents*, Johns Hopkins University Press, 9th Edition, 1998

Abbreviations

ACGIH TLV–American Conference of Governmental Industrial Hygienists-Threshold Limit Value. CAS–Chemical Abstracts Service. mg/m^3–milligrams per cubic meter. NTP-11–National Toxicology Program, Eventh Annual Report on Carcinogens. OSHA PEL—Occupational Safety and Health Administration-Permissible Exposure Limit. STEL/C–Short term exposure limit and ceiling.

Prepared by: John P. Canal   Date of preparation: May 2, 2007

Figure 1. Shown is an unpublished CLIP on silver(I) oxide. The template for the CLIP was provided by Dr. Jay. A. Young, Feature Editor (CLIP).

The data used by the students was not taken from the standard safety data sheets (MSDS) often seen in laboratories, as these are a summary of primary sources obtained by others. Although not incorrect they are intended for a purpose other than the undergraduate laboratory environment [7]. The students were asked to examine more primary sources when

obtaining the data for their safety data sheet. A list of the books and websites used by the students is summarized in Table 1. Based on the data collected and the examples done in tutorials, the student would decide on the numerical values to assign each Hazardous Characteristic and the information to be included in each section of their CLIP.

Grading Criteria

The students were required to submit both their completed CLIP and a copy of the data they used as references. Since this assignment was meant to teach student new writing skills and not serve as a judgment of their final course grade, the assignment marks had a very minimal effect on the final course grade. Each CLIP was given an initial mark of 10, with a one-half mark deduction for every formatting or information error. "Formatting marks" were deducted if the following were not correct: font, font style or font size, grammar, placement of the information, inclusion of all the required components, spacing between and within a section, including section dividers. "Information marks" where deducted if the following were not correct: Name, date of preparation, the information provided, the level of the language used, and the style of writing (*i.e.*, point form *vs.* full sentences).

The grades obtained by the 75 students who have already completed this assignment ranged from zero to a perfect score of 10, with an average mark of 7. This means that on average students made 6 mistakes on a simple one page assignment. These errors ranged from answering yes/no types questions with a number, to writing paragraphs when the format required brief sentences and to skipping sections.

Most students were surprised by the type and number of mistakes that they had made. It was pointed out to them that if they can not correctly fill out a simple safety data sheet they will not be able to correctly complete other more complex written works. They should take the time to do the work correctly. This will allow for the student to catch errors the presentation but also errors in the information they are presenting.

Post-Assignment

The results of the assignment were discussed in the tutorial setting. As mentioned many students were surprised by the type and number of errors they had made. Reasons for their mistakes ranged from carelessness to others who still presented the information in a format they liked and not the correct one. One student questioned why marks were lost when the error made was small. The errors made by the students were then used as an example of how the exchange of information is impeded when the material is presented incorrectly.

This assignment stressed to the students the need to follow the rules of a particular writing format, that small deviation are not acceptable and care must be taken to avoid errors. This was a lesson that was translated to the rest of the course, for example in the discussion other writing styles, such as how to write a formal laboratory report. This assignment made the students more perceptive to the criteria of the other writing styles.

The completed CLIPs were collected and are to be used as reference material for future classes (once the data has been verified by the instructor as being correct). The students also

used the knowledge gained from their own CLIPs in the laboratory. As part of the pre-laboratory lecture, the students are randomly chosen to discuss (chalk-talk) to the class the experiment to be carried out. As part of this lecture, the students are to include the potential hazards of the experiment based on the CLIPs they wrote.

The final effect of this assignment on the writing skills of the students in subsequent courses is hard to quantify. Within this course, the skills addressed in this assignment were included as requirements in their subsequent written works. For these subsequent works the CLIP assignment had a positive effect.

Publication

Initially another goal was to have the best assignments written by the students published in the *Journal of Chemical Education* as part of their CLIP feature. The best student CLIP would be chosen and with the help of the instructor a manuscript would be prepared for submission. The steps required for publication were explained to all students to inform them of the publication process as well as to give them a realistic idea of their chance of having their work published. The potential of being published made this an assignment that the students wanted to do well in, not solely for marks, but for the prize of seeing their name in print. The success of this assignment was seen in the interest the students had semesters after they took the course. If an assignment is remembered and asked about, there is a greater chance that the student retained the message that was taught. Although numerous CLIPs were in the process of being prepared for submission or already submitted for publications, the CLIP feature was canceled before any appeared in print.

CONCLUSION

A writing assignment geared towards second year students was developed that introduced students to the writing demands of a publishable manuscript. This was done before the students had gained much experience in chemical research and writing styles, thus a simple assignment was created that taught them the desired skills. Although this assignment was implemented in a second year inorganic chemistry course, it can easily be modified to fit other course descriptions. Initially the best student CLIPs were to be submitted for publication. The goal of "being published" got the students excited about this assignment, which made teaching an easier process. The skills developed by this assignment, aided the students in their other assignments as they applied more scrutiny to their written work.

ACKNOWLEDGMENTS

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Chapter 8

BREAKING THE RULES: WRITING REFLECTIVELY FOR YOURSELF

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ABSTRACT

The rules which epitomise good writing may on occasions be broken, deliberately and with good purpose. This can well occur when students or staff set out to engage effectively, and through reflective writing, with their personal and professional development in mind. The rationale for this unusual decision to engage in what is frankly disorderly writing is set out briefly. Its characteristics are summarised, in implicit contrast with more conventional styles of writing. Brief mention is made of claims for the effectiveness of this style when used for developmental purposes; and reference is made to the publications of some of those who have endorsed this approach.

ANECDOTAL INTRODUCTION

I received an unexpected and flattering e-mail message from Nova Science. They told me that they had learned of my published research on writing, and would like to invite my participation in their publishing programme. I was unaware of having conducted, let alone published, scholarly research on writing. So I concluded that a mistake had been made; or that I was somehow included in generous blanket coverage of educationists, seeking possible contributors.

Idly I went on to read the publishers' description of what they sought. It seemed to cover conventional forms and aspects of writing. I found my thoughts drifting to the distinctly unconventional advice which I forcefully give to my students and colleagues when they undertake to venture into the strange experience of writing reflective learning journals [Cowan, 2006: pp 60-70, 173-4; Graham et al, 2008; Cowan and Westwood, 2006]. I urge them explicitly to break the rules about writing which they have hitherto been urged to

follow. For the "stream of consciousness" writing required of a reflecting practitioner involves disregarding most of the conventional rules of "good" writing. I wondered if this line of thought, and experiences associated with it, might be relevant in the present volume.

Shortly afterwards, chance circumstances brought to me for comment a current and well-researched paper on reflective writing [Morton, 2009]. This did much to bring me up to date, and also prompted me to complete my tentative response to the publishers' invitation.

DESCRIPTION

In the stream-of-consciousness style of writing, the writers do not:

- Write with a third party in mind as their reader;
- Determine beforehand the substance of what will be written, and in what order it can best be presented;
- Structure and subsequently hone reader-friendly sentences;
- Employ well-aligned subordinate clauses;
- Devote attention to punctuation and syntax;
- Worry about spelling errors, detected or otherwise;
- Edit drafts, in order to enhance them.

Instead the writers simply " let it all pour out" , with the writing or keying fingers trying to accompany the brain as it runs along. The emerging words prompt new or changed thinking, rather as do the interchanges in a classical brainstorming session.

A person who sets out, in whatever medium, to write reflectively as a means of stimulating and carrying forward their thinking, should have a question in mind. While they are writing, they should be seeking an answer, or a part answer to their question, which they will then value and (it is to be hoped) will use [Cowan, 2006, p173-4]. But when they begin to think about what the answer may be, and, as they commit some of that thinking to words, they will usually have no explicit vision of where their thinking will be taking them, or their writing. Consequently any summary statement which eventually emerges from their reflective writing will do just that. It will simply emerge in their minds, often unexpectedly, as their reflections progress, and usually before appearing in their written words. It follows that reflective writers can have no thesis statement or overall plan in mind when they begin to write. They will certainly lack a detailed plan to follow, since they should be trying to record their thinking almost immediately as it happens. They certainly cannot begin with a conclusion in mind.

RATIONALE

What purpose does such disorderly and unprepared writing serve? The past three decades have seen an increasing emphasis for all professionals to each become "a reflective

practitioner" [Schön, 1983]. The reflective practice to which they should aspire "questions values and actions which may hitherto have been taken for granted" [Anderson, Knowles and Gilbourne, 2004; p192]. In most reported cases, this has entailed *writing* reflectively, in parallel with the more important and creative activity of *thinking* reflectively. Moon, a recognised authority in this field, states that "Journals favour learning through the encouragement of conditions for learning. Journal writing also produces good conditions for reflection ...." [Moon, 1999; p196]. Such engagement then offers potential for "a different way of knowing" [Sparkes, 1998] and "provides an avenue to explore what is really going on inside the minds" of those who opt to so reflect [Morton, 2009].

Some of the enthusiastic advocates of this practice have explicitly stressed the desirability of thinking reflectively, no earlier than *just before* expressing such thoughts in writing. They certainly advocate thinking *while* writing [Cowan, 2006; Brockbank & McGill, 2007; Moon, 1999]. In this way new trains of thought are opened up, even as words, phrases and sentences are being committed to paper or to a screen. Those who write with a pen or pencil (rather than a keyboard) further testify persuasively to the increased impact on reflective thinking when the writing operation progresses slowly in recording their current thoughts. They find that this slow pace keenly encourages further thinking to emerge simultaneously.

In stream-of-consciousness writing, the words and phrases on paper or screen are but a means to an end. They are stepping-stones across which the reflective writer's thinking progresses. So there is usually little for the writer to gain by editing, by correcting spelling or grammar, or even by restructuring sentences to make them a clearer record. Such refining activity, in other writings, is generally only undertaken for the benefit of third party readers. This is not necessary with reflective writing. For the reader who matters there is the writer. And the writer's thinking will already have advanced beyond the now historical record of the route which took them onward. Occasionally a reflective writer may wish to re-read their reflective writings, with intent to deepen their understanding, or to mop up unfinished thinking. If they do so, then they will welcome the immediacy provided by what is in effect a recorded protocol. That is a benefit which they risk being denied if they are concerned to tidy up the minutiae of their proper use of language.

To summarise, the reflective writer should avoid having third parties in mind as the intended readership. Indeed, it is questionable if the writer should have *any* subsequent readership, even perhaps his or her own, in mind. Worse still, if the trail is polished and re-presented in a tidy and structured manner, this result may well obscure the evidence of the original thinking, although this was admittedly untidy and far from structured, yet accurately recorded how the writer was engaging with the issue in hand – at the time. In particular, editing can obscure the ways in which profitable options emerged from amongst unprofitable ones, and can give less than valid credit to the creative role which serendipity played in the process of eventually productive thinking.

DESIRABLE CHARACTERISTICS OF THIS STYLE

Ghaye [2006] suggested Da Vincian criteria for evaluating reflective writing, and has clearly and helpfully set out the qualities which epitomise best practice in such writing. It should embody the writer's desire to know, to learn more and to discover more about their

chosen topic (*curiosita*). It should be a means for them to scrutinise their ideas, in particular questioning assumptions and beliefs held by themselves and others (*dimostrazione*). It should embrace ambiguity, identify and consider valid options and the implications of uncertainty in their account (*sfumato*). Generally it should lead to a more balanced and considered view, through a holistic consideration of their chosen topic (*arte/scienza*).

CONCLUSION

So what is the purpose and value of such apparently disorganised writing? In a phrase, it is to facilitate dynamic learning [Bolton, 1999] and personal development. Morton [2009] recently commented on his experiment with the approach that "this style of writing was foreign to me and could not be further from the 'scientific writing' style...." to which he is accustomed. Nevertheless, after an initial trial with the method, he concluded that "... the reflective processes undertaken at that time caused me to completely re-evaluate my previous teaching philosophy." That is a powerful, and clearly sincere, claim regarding perceived worth for himself.

Similarly, one mature colleague of the present writer, after involvement in a modest pilot centred on reflective writing, declared that "In terms of my own CPD, the experience has changed the way I think about things and my behaviour has changed as a result." [Cowan & Westwood, 2006; p69] Another wrote that "... of particular benefit is the freewheeling style of committing ideas to paper and then challenging them as they arise." [Cowan & Westwood, 2006; p66]. These also, I suggest, are strong and sincere claims of perceived worth for the writers themselves.

A year ago, in an undergraduate module devoted to developing skills from part-time employment [Graham et al, 2008], students kept weekly reflective analyses of critical incidents, and what they learnt from them. The present writer facilitated these reflections. He was pleased when roughly a third of those students volunteered that they had enjoyed increases in remuneration during their period on this module. A lesser fraction reported having been promoted. It is ever difficult to distinguish correlation from causation (Morrison, 2009; p56); but certainly the students concerned had no doubts about the origins of their success, as reflective practitioners, in terms of added value to their employers and themselves.

In the earlier example, seven experienced university teachers opted to explore then potential of facilitated reflective writing. They kept six or fewer journals. In these, they dealt with questions which they chose as significant for their continuing personal development [Cowan & Westwood, 2006]. In their concluding journals, they evidenced such consequent changes in their practice as that:

- Two had decided on major changes in one of their modules;
- Three had introduced a new type of learning activity;
- Two had radically changed the way they managed their time;
- One had (amicably) terminated an important and effective working relationship.

One reported that:

> "I find myself questioning my actions a lot more and thinking about what I am doing before I do it, and asking if there is another way I could do/approach something/someone. I feel quite comfortable with this, and don't think I did enough of it before."

Such sincere witness and tangible outcomes offer testimony to the worth of this unconventional writing form, if adopted to promote the personal and professional development of the writer.

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Chapter 9

DEVELOPING THE SELF-REGULATION OF WRITING PROCESS IN STUDENTS WITH LEARNING DISABILITIES

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1. ABSTRACT

Since the seminal theoretical models of writing (such as Bereiter & Scardamalia, 1987; or Hayes & Flower, 1980) there has been considerable progress as regards the understanding of the cognitive processes and personal variables involved in writing (Alamargot & Chanquoy, 2001; MacArthur, Graham, & Fitzgerald, 2006). The majority of these models recognize writing as a complex and demanding task which involves a large set of higher and lower order cognitive processes, which must be activated and coordinated recursively throughout the entire writing process. This complexity explains that achieving proficiency in writing requires the deployment of a great load of writer's cognitive resources to cope with managing and monitoring the writing environment, the constraints imposed by the writing topic and task, and the processes and variables involved in composing a text (Graham and Harris, 2000; Kellogg, 1987a; Ransdell and Levy, 1996; Zimmerman and Risemberg, 1997). In fact, coordinating these processes in such a way that yields a text which fulfills the requirements of the writing task requires high levels of self-regulation. Since the greater importance afforded to the self-regulatory processes in writing, in this chapter, firstly, we analyze the specific role of self-regulation in the more recent theoretical models of writing and in the instructional field of writing composition. In the second part of the chapter, we summarize in part our previous intervention study (see García & Fidalgo, 2006), developed with 5th and 6th grade Spanish primary students with Learning Disabilities. The study presents the effectivenes of a self-regulation strategy intervention program based on the Social Cognitive Model of Sequential Skills Acquisition to improve LD student's writing competence, analyzing changes in writing product and process through on-line measures. Finally, proposals for future researches and implications for educative practice are suggested.

2. THE ROLE OF SELF-REGULATION IN THE THEORETICAL MODELS OF WRITING

Although the theoretical models of writing agree on the necessity to recursively manage the application of processes and their control during the writing process, there is not agreement about the nature of their management, control and their mode of functioning (Alamargot & Chanquoy, 2001; Fidalgo & García, 2008).

Previous reviews have analyzed the pioneering models of writing regarding issues of self-regulation (Zimmerman & Risemberg, 1997) and have shown the heavy emphasis placed on the self-regulatory aspects of composing in the two main seminal models of writing, such as, Hayes and Flower (1980) and Bereiter and Scardamalia (1987). But, which is the key role that self-regulation play in the most recent models of writing, such as, Kellogg's model (1996; 1999), and the revision of Hayes' model (1996; 2004).

The revisions of Hayes and Flower's model (1980) by Hayes (1996; 2004) supposed a considerable change with relation to the self-regulation processes. At first, the monitoring process of previous theoretical formulation (Hayes & Flower, 1980), whose specific function is the management and control of the remaining writing cognitive processes and their recurrence disappears. Despite this fact, the actual model continues to assume the necessity of some type of self-regulation in writing, which is attributed to other processes. One of these processes is concerned with task schemas, which refer to a type of procedural knowledge stored in the writer's Long Term Memory and that ensure the procedures to guide and control the effective realization of the text production, because, these task schemas have the power to modify the progress of the writing composition by replacing the realization of one writing process by another (Alamargot & Chanquoy, 2001). The other process which supposes coordination and control of the cognitive operations through scheduling and other attentional control would be included in the role of Working Memory in a writing activity. Nevertheless, although the working memory component included in Hayes' model is largely based on Baddeley's model (Baddeley, 1986; Baddeley & Logie, 1999) it does not specifically include the central executive component dedicated to the coordination and monitoring of the cognitive processes. Only, three working memory components are included: phonological memory, the visuo-spatial sketchpad and semantic memory, which focus on maintaining and processing the phonological, visuo-spatial and semantic representations, overlooking the control structure of the central executive.

As for the other prominent and contemporary theoretical model, Kellogg's model (1996; 1999), is concerned with integrating and explaining how working memory functions in the writing process according to Baddeley's model (1986). In this way, the model assumes the central executive component of working memory, which is involved in almost all of the writing processes: planning and translating formulation processes, reading, editing and monitoring processes, and programming the execution process if motor skills are not automatic (Kellogg, 1999). Only the executing processes of the writing execution component does not infer control and monitoring of the central executive component of working memory. Moreover, a monitoring component is included, whose function is specifically to manage, control and regulate the sequencing of the writing processes. This monitoring component supposes two writing processes: the reading and editing processes, both related to a revision process, as, these processes allow the writer to control the activation of the various

writing processes for the continuation of writing or the modification of the already written text according to the re-reading and revision of the existing text (Alamorgot & Chanquoy, 2001).

Definitely, the review of the prominent models of writing concerned with the self-regulation processes allow for the assertion that, in spite of the differences between the definitions, nature and mode of functioning of the self-regulation processes which focus on the management and control of the writing processes; all the theoretical models of writing reviewed concur with the necessity for self-regulation processes in writing (Alamargot & Chanquoy, 2001; Fidalgo & García, 2008; Zimmerman & Risemberg, 1997).

3. THE SELF-REGULATION INTERVENTION APPROACH IN WRITING

The importance placed on the self-regulatory aspects of composing by the models of writing suggests that writing competence requires a high degree of self-regulatory skill (Graham & Harris, 2000). For this reason, teaching self-regulation in writing should yield a marked improvement in the quality of the texts that students subsequently produce.

Accordingly, the development of self-regulation in writing is an important instructional goal, and which explains the rapid growth and development of cognitive and self-regulation strategy instruction studies in the last two decades (Graham, 2006; Graham & Harris, 2003; Graham & Perin, 2007; Wong, Harris, Graham, & Butler, 2003), especially, in students with LD, who have serious problems in managing the processes involved in the writing process and who experience an ineffective use of strategies (Troia, 2006).

A review of the empirical studies has demonstrated that self-regulatory processes play an important role in developing proficiency in writing texts (Fidalgo & García, 2007; Graham and Perin, 2007; Wong, Harris, Graham, and Butler, 2003). The results of instructional programs based on different models, such as: the self-regulated strategy development model (for a review see Graham & Harris, 2003; Graham, 2006); the cognitive strategy instruction in writing model (Englert et al., 1991; Englert, Raphael and Anderson, 1992); the strategy content learning instruction program (Butler, 1994; 1995); the genre-specific writing strategies research study (Wong, Butler, Ficzere, Kuperis, & Corden, 1994; Wong, Butler, Ficzere & Kuperis, 1996; 1997); or the social cognitive model of sequential skill acquisition (Zimmerman & Kitsantas, 1999; 2002), provide strong evidence for the efficacy of self-regulation writing strategies in the improvement of writing performance (Fidalgo & García, 2008).

The reviewed literature about self-regulatory interventions has proved successful in improving the writing of children with learning disabilities (e.g., for a comprehensive review and meta-analysis see Graham, 2006 and Graham & Perin, 2007). However, the main part of the previous studies have tended to assess the efficacy of these intervention programs solely in terms of changes in the end products of writing and in personal variables such as knowledge of writing, self-efficacy, or motivation. But, it seems pertinent to also explore the ways in which this kind of training which focuses on self-regulation affects also the processes involved in writing and their orchestration. It would be necessary to extend the knowledge of this kind of self-regulated and strategy instruction and to explore the ways in which this type of intervention affects the writing process. In this sense, the remainder of this chapter presents

and discusses the results of an intervention study which focus on the effects of specific self-regulatory intervention program in the writing products and processes, in fifth and sixth grades students with LD (García & Fidalgo, 2006). A complete presentation of the findings of our research can be found in García and Fidalgo (2006).

4. A SELF-REGULATORY INTERVENTION PROGRAM TO IMPROVE WRITING COMPETENCE OF STUDENTS WITH LEARNING DISABILITIES

4.1. Self-Regulation Processes of the Cyclical Phases of Self-Regulation in Writing

Firstly, the self-regulation processes and strategies included in all the cyclical phases of self-regulation and executed in composition writing which were followed in the intervention studies, as well as the type of instructional model based on the social cognitive model of sequential skill acquisition, which provides the pattern of instruction are presented in general.

There are a considerable number of regulatory skills described in the literature which writers can use to enhance writing. Specifically in writing, according to the self-regulatory processes proposed by Zimmerman (2000) who divided them up into three cyclical phases, we proposed the following self-regulation strategies in writing.

In the first phase *forethought,* which refers to the influential processes that set the stage and precede the action of writing, there are two distinct but closely linked categories of self-regulation processes, *task analysis* and *self-motivational* beliefs. Table 1 summarizes the self-regulation processes, strategies, and examples of self-instructions included in the first cyclical phase of self-regulation, forethought phase, executed in composition writing.

The *task analysis* category comprises two types of self-regulation processes: 1) *goal setting,* this refers to deciding on the specific learning or performance outcomes; 2) *strategic planning* which refers to the purposive personal processes and actions directed at acquiring or displaying a skill. For a skill to be mastered or performed optimally, learners need methods or strategies that are appropriate for the task and the setting. The other category in the forethought phase, namely, s*elf-motivational beliefs* includes a set of personal variables such as *self-efficacy, outcome expectations, intrinsic interest or valuing,* and *goal orientation* which are linked to the self-regulation strategies, because self-regulatory skills are of little value if a person cannot motivate themselves to use them (Zimmerman, 2000).

The second phase is concerned with *performance or volitional control* which involves those processes that occur during the motoric efforts and which affect both attention and action. This includes two types of processes: *self-control* and *self-observation. Self-control processes* include a set of self-regulation processes, such as *self-instruction, imagery, attention focusing* and *task strategies.* And the *self-observation process* refers to a person's tracking of specific aspects of their own performance, the conditions that surround it, and the effects that are produced (Zimmerman, 2000). It is related to monitoring strategies which refer to the awareness of the writing task during its execution and the control of the processes. The self-regulation processes, strategies and possible self-instructions included in the second

cyclical phase of self-regulation, performance or volitional control phase, executed in composition writing are summarized in Table 2.

Table 1. Self-regulation Processes, Strategies and Self-Instructions of Forethought Phase in Writing Process

Sub-processes	Strategies	Self-instructions
Task Analysis Goal setting	To think about the purpose or aim of the text To set oneself a goal in writing To think about the audience of the text To aim the text at a specific audience To decide the features and elements of writing task To determine the required effort for the writing task	What is the aim of this writing task? …then, what is the first that I must do? The first… The second… I have to remember the planning strategy "the vowels": the first vowel is O Objective; …the second vowel is A Audience; …the third vowel is I Ideas; …the fourth vowel is U United; and the final vowel is E Draft paper.
Strategic planning	To think about the content of the text To write a draft or an outline To establish an action plan	Always, I must remember the goal of the task I have to remember the revising strategy "RED" The first is Read the text; the second is Evaluate the text; and the third is Do the necessary changes.
Self-Motivation Beliefs Self-efficacy	Personal beliefs about having the means to learn or effectively perform the task	If I follow the steps of the writing strategy I will not have any problems I feel capable of writing a good text
Outcome expectations	Personal beliefs about the ultimate outcome of the performance	I am sure that I will write a good composition I can master the writing task Now, there are no texts which I can't attempt
Motivation	Sense of intrinsic motivation	I can apply this knowledge in other subjects and contexts and I will improve my compositions

Table 2. Self-regulation Processes, Strategies and Self-Instructions of Performance or Volitional Control Phase in Writing Process

Sub-processes	Strategies	Self-instructions
Self-Control Help learners and performers to focus on the task and optimize their effort	To include changes in outline according to the new requirements of the task To bear the aim and goal of the text in mind To bear the audience of the text in mind To correctly link the ideas according to needs of the text	Am I following all the steps? Is this idea right? I have to bear the future readers in mind I have to read the text and continuously assess all my ideas There are not enough ideas Are there enough ideas? This idea is wrong This paragraph includes the ideas that…
Self-Observation Person's tracking of specific aspects of their own perform-ance, the conditions that surround it, and the effects that they produce	To frequently read the text during the writing process To frequently check writing process and products	I am going to read the text I have written I have to frequently read the text during its composition I did the first step, now the second step will be…

The third phase is *self-reflection* and *involves* those processes that occur after the performance efforts and influence forethought in the subsequent motoric efforts. This phase includes two self-reflective processes: *self-judgment* and *self-reactions. Self-judgment* concerns self-evaluating one's performance according to an evaluation criterion, such as

previous performance, peer's performance, normative, or mastery; and attributing causal significance to the results and the process. And *self-reactions* comprises two processes: 1) *self-satisfaction* which involves the perception of satisfaction or dissatisfaction regarding one's performance; 2) *adaptive or defensive inferences,* which are conclusions about how one needs to alter his or her self-regulatory approach during subsequent efforts to learn or perform. Table 3 summarizes the self-regulation processes, strategies, and self-instructions included in the third cyclical phase of self-regulation, self-reflection phase, executed in composition writing.

Table 3. Self-regulation Processes, Strategies and Self-Instructions of Performance or Volitional Control Phase in Writing Process

Sub-processes	Strategies	Self-instructions
Self-Judgment Self-evaluation	To remember the aim of the text for assessing it To read the text as if I were one if the future readers To assess any mistakes in the text To do a plan for revising the text To correct first the substantive mistakes of the text, and later the mechanical mistakes	What must I do when I finish the text? RED strategy will help me, if I follow all steps I will achieve a great performance First I must revise… Second I must revise… Is this word right? I am not sure, I'm going to look for it so that I can be sure
Causal attribution	To promote internal and variable attributions about the results; attributions of errors to learning strategies are highly effective in sustaining motivation.	I have made a big effort and I got a good result I followed the steps and I wrote a great text
Self-Reaction Self-satisfaction Adaptive/defensive	To promote perceptions of satisfaction regarding one's performance according to writing strategies	I am very satisfied My text is great! My text will get a good mark

4.2. A Social Cognitive-Model of Sequential Self-regulation Skill Acquisition

The instructional pattern used to teach self-regulation processes and strategies in writing was based on a social cognitive model of sequential skill acquisition, which had proved successful in the acquisition of skills in writing, revision and self-regulation in previous studies with non LD students (Zimmerman & Kitsantas, 1999; 2002). According to this pattern students can optimally acquire new writing skills in four sequential levels: observation, emulation, self-control and self-regulation (Schunk and Zimmerman, 1997; Zimmerman, 2000; 2002).

At the first level observation is the focal point. The instructor provides a clear image of how a specific skill, in this case a writing process, should be performed. The instructor modeled how to perform the writing process by thinking aloud whilst doing it. The thinking aloud feature was partly spontaneous, but also included specific self-regulatory statements that the instructor had previously been trained to incorporate, corresponding with the three cyclical phases of self-regulation (Zimmerman, 2000): the forethought phase which refers to influential processes that precede the efforts to act and set the stage for action; the

performance or volitional phase which involves the self-regulation processes that occur during motoric efforts and affect attention and action; and finally the self-reflection phase which involves those processes that occur after the performance efforts and influence forethought regarding subsequent motoric efforts, such as: self-evaluation, causal attributions and self-reactions.

The second level deals with emulation. At this level, students learn to emulate a model's performance that had been previously developed. Students work in pairs during this level, using a cognitive model which incorporates modeled explanations and demonstrations with verbalization of the model's thoughts and reasons for performing certain actions. This modeling was based on the exemplary performances implemented by the instructor in the previous sessions. This emulative performance experience provides aspiring writers with behavioral and social feedback to refine their performance and to develop self regulative standards that are essential for higher levels of learning (Zimmerman & Kitsantas, 2002).

At the third level, which is concerned with self-control, students learn from self-directed and individual practice to achieve automation in their behavioral writing process, focusing on the process rather than on the outcomes, that is to say, the quality of the written text (Zimmerman & Kitsantas, 2002). At this level, students work individually using a cognitive model based on the exemplary performances implemented by the instructor and themselves in the previous sessions.

Finally, at the fourth level which considered self-regulation, the students learn to adapt their performance to changes in the contextual environment, either internal or external. To accomplish this level, students shift their attention from the modeled processes to the performance outcomes (Zimmerman & Kitsantas, 2002).

The intervention studiy developed subsequently shared these self-regulation processes of writing and the instructional pattern based on the social cognitive model of sequential skill acquisition.

4.3. An Empirical Study. Self-Regulation Writing Instruction Program in Students with LD

The present study examined the effects on the writing product and processes of a cognitive and self-regulatory strategy intervention program based on the social cognitive model of sequential skill acquisition (SCM intervention) carried out with 5th and 6th primary grade Spanish students with LD.

4.3.1. Method

Participants

Our sample comprised 73 (24 girls and 49 boys) from fifth (22) and sixth (51) primary grade Spanish students with LD and/or LA, ranging between ten and twelve years old. All participants had previously been identified as having a writing specific learning disability. Participants were randomly allocated to either the experimental or the comparison group. 41

students (26 boys and 15 girls) formed the intervention group, and 32 (23 boys and 9 girls) formed the control group.

Measures

Measures of Written Products

Several types of writing measures were used: both text and reader based.

Measures based on the text included: productivity (number of words); coherence (total number of linguistic markers: referential coherence (anaphoric and lexical ties) and relational coherence (metastructural, structural, connective, reformulation, argumentational ties) per 100 words of text); and structure (number of parts of expository text: introduction, main body and conclusion).

In addition the reader based measures included: measures for structure (scored from 1 to 4), coherence (scored from 1 to 4), and general quality (scored from 1 to 6); the measures were adapted from Spencer and Fitzgerald's study (1993).

Measures of Writing Process

As for the writing process, the measures were taken on-line, during the writing process, using a time-sampled self-report, adapted from several previous studies (e.g., Torrance, Thomas, Robinson, 1999).

Whilst performing the writing task students heard a one second tone played with a mean interval of 93 seconds. On hearing the tone students were instructed to respond by indicating in the writing log the activity in which they were currently engaged, selecting from the following: reading references, thinking about content; writing outline; writing text, reading text, changing text, and unrelated. These activities were collected in a blank writing log divided into multiple sections each listing the seven possible writing activities where students had to mark the activity by a simple mark so as to minimize the extent to which completing the log diverted their attention from the writing task. Students were trained in using this method prior to completing the baseline assessment, and later we determined students' accuracy in using the categorization scheme of the writing processes.

For the analysis, the time spent on each of the seven activities in the writing log was estimated by multiplying the frequency of each particular activity in the writing log by the mean inter-tone interval. We calculated the time per each activity throughout the writing process and their temporal organization distributed over the three moments.

Instructional program

The experimental groups followed a specific instructional program focusing on the promotion of cognitive self-regulation strategies in the writing process, which was based on the social cognitive model of sequential skill acquisition. The instructional program comprised 25 sessions, at least 3 times a week, lasting approximately 1 hour each, the sessions were developed by specifically trained educational psychologists. The general pattern of instruction consisted of the following: developing declarative knowledge of the writing processes, planning, editing and revising processes, supported by the use of mnemonics; and subsequently, sequences of modeling and emulation with self-regulation

strategies were designed to transform declarative knowledge into useable procedures for all the various writing process (planning, editing and revising processes).

Table 4. Summary of the Instructional Program Based on Social Cognitive Model of Sequential Skill Acquisition

Instructional Phase	Number of session	Instructional focus
Develop prior knowledge	1st – 3rd	Writing functionality; importance of writing; writing products, text types, self-regulation strategies; writing process.
	4th	Planning process of writing
	10th	Editing process: coherence, structure
	16th	Revising process: mechanical & substantive
Observation level		Coping and mastery model:
	5th-6th	Planning process
	11th –12th	Editing process
	17th –18th	Revising process
	22nd	Writing process
Emulation level		Emulation working in pairs:
	7th	Planning process
	13th	Editing process
	19th	Revising process
	23rd	Writing process
Self-control & self-regulation levels		Individual performance
	8th –9th	Planning process
	14th-15th	Editing process
	20th –21st	Revising process
	23rd -25th	Writing process

4.3.2. Results

With the regard to the written products, there was a statistically significant improvement with a large effect size in all text-based measures for students in the intervention group compared to those in the comparison group, who received the normal curriculum in their classes. The pre/post differences in interaction with the treatment (comparison-experimental groups) for the compare-contrast task show statistically significant contrasts in the total indicators of: productivity (number of words) (F(2, 72) = 34.31; p < .001; η^2 = .36); density of coherence (F(2, 72) = 19.25; p < .001; η^2 = .26); and total structure (F(2, 72) = 56.40; p < .001; η^2 = .48); with a large effect size. Furthermore, the results showed a substantially significant improvement in all the reader based writing measures with a large effect size in all the reader-based measures for students in intervention group compared with students in the comparison group, for structure (F(2, 72) = 57.63; p < .001; η^2 = .51); coherence (F(2, 72) = 34.90; p < .001; η^2 = .39) and quality (F(2, 72) = 34.53; p < .001; η^2 = .38).

With regard to the changes in the writing processes, the *time spent on the writing task* for the students in the intervention group at post-test was significantly higher than for the comparison group (F (2, 72) = 21.00; p < .001), with a large effect size (η^2 = .26). Specifically, this significant improvement was due to an increase in the experimental group versus the comparison group in the categories *writing full text time* (F(2, 72) = 13.92; p < .001; η^2 = .19); in planning activities such as: *reading references time* (F(2, 72) = 5.77; p = .004; η^2 = .08); and, revising activity categories such as, *reading text time* and *changing text time* were also statistically significant, being higher in the intervention group versus the control one (F(2, 72) = 3.75; p = .026; η^2 = .06) and (F(2, 72) = 3.21; p = .044; η^2 = .05) respectively.

5. CONCLUSION AND DISCUSSION

The evidence reviewed and presented in this chapter supports the key role of self-regulation in writing and in the development of LD students' writing competence.

From a theoretical perspective it is possible to confirm that the prominent models of writing share the need of some type of self-regulation process as an essential component of the writing process. However, although there has been considerable progress as concerns understanding the processes involved in writing as well as their function and orchestration during the writing process, there is, to date, no agreement about the specific nature, structure and functioning of the self-regulation processes in writing.

From an empirical perspective, there is a considerable literature which has demonstrated the effectiveness of cognitive and self-regulated approaches to improving writing competence. Previous reviews have illustrated a comprehensive list and meta-analysis of instructional studies which focus on self-regulation in writing, which corroborates the theory that the development of writing competence depends on high levels of self-regulation and that self-regulation instruction programs in writing significantly improve writing proficiency of students with and without LD (Graham 2006; Graham and Harris, 2003; Graham & Perin, 2007; Wong, Harris, Graham, and Butler, 2003).

In this line of research, the study summarized and presented in this chapter support the effectiveness of self-regulation in writing to improve the writing competence in students with

LD, and broaden the existing research in several ways. First of all, it reports on the generalization of the effects of the cognitive and self-regulatory strategies instruction models in students with LD from a different language group and educational culture, providing effectiveness data in a different country with different educational traditions in writing instruction than the USA. Secondly, it confirmed the effectiveness of the instructional pattern based on the social cognitive model of sequential skill acquisition, in students with LD, whose efficacy has been proved in acquiring skills in writing, revising and self-regulation in previous studies with non LD students (Zimmerman & Kitsantas, 1999; 2002). And finally, it explored the ways in which this type of intervention program affects the writing process by combining online measurements (writing log measurements) with written product measurements. This study has not only determined whether intervention results in improved texts but have also explored the nature of this action. In this sense, the changes in writing process in students with LD were linked principally to revision activities. However in previous studies with normally achieving students the changes seen in the writing processes were principally in the planning process (Torrance et al., 2007; Fidalgo et al., 2008). This supports different effects of self-regulation instruction in students with and without LD. The possible explanations for these different findings in writing process of students with and without LD may be found within personal variables such as writing style. Perhaps LD students who commonly make more mistakes in writing, also show a tendency to revise their texts. Or the differences may be due to specific differences between the writing processes employed by these populations, which suggests future research lines should focus on the comparative study of the writing process in students with and without LD by means of on-line research methods (García & Fidalgo, 2008; Olive & Levy, 2002), or based on the differential effects of self-cognitive and self-regulated interventions in planning (García & Marbán, 2003) or on the revising process used in writing (García & Arias, 2004) in these different populations.

Finally, as for the implications for teachers' practice in students with learning disabilities, the content summarized above supports the argument that teachers should be aware of the importance of self-regulation specifically in composition writing, and should try to incorporate these instructional models and strategies to foster high levels of self-regulation in LD students' writing for improving their writing competence into their educative practice and curriculum.

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Chapter 10

COGNITIVE STRATEGIC AND SELF-REGULATED INSTRUCTION IN WRITING PROCESSES

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1. ABSTRACT

Writing is a complex and cognitively demanding activity. It cannot be performed as a sequence of discrete steps; it requires the simultaneous combination of several strategies and the application of various mental resources. Writing is, therefore, both a recursive and a dynamic process. To be successful, writers need an understanding of the components of a quality text as well as knowledge of writing strategies that can be used to shape and organize the writing process. In particular, writing competence requires appropriate and self-regulated knowledge of strategies for planning what to write, and then revising what has been written.

In this chapter, we first present a review of the recent research on the planning and revision processes in writing in order to show the importance that these have in the development of writing competence. Then, we describe the existing research, evaluating strategy-focused intervention studies, to provide an overview of the nature of the interventions programs and an indication of which have been most successful. In the second part of the chapter, we describe and summarize findings from our own studies (Torrance, Fidalgo, & García, 2007; and Fidalgo, Torrance, & García, 2008). These studies move beyond existing research by (a) evaluating the effectiveness of this kind of intervention programs for developing self-regulations strategies in writing with normally achieving writers without learning disabilities, b) exploring the effects of strategy focused instruction on students' writing processes as well as on their written products and (b) demonstrating the long-term effects of this kind of intervention. In a final section, we discuss the practical implications of this body of research (both ours and others) and

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make suggestions for how lessons learned from this research might be applied in the classroom.

2. PLANNING AND REVISION PROCESES: STUDY AND INSTRUCTION

Currently, the writing process is considered as a dynamic system in that diverse cognitive factors are influential with special consideration given to working memory (Kieft, Rijlaarsdam, & van den Bergh, 2006; McCutchen, 2006; Rijlaarsdam & van den Bergh, 2006; Torrance & Galbraith, 2006). According to this approach, writing is understood as much more than just a motor activity, that is, it is understood as recursive process which demands reflective thinking processes to be used when planning text, whilst drafting, and when the text is revised. Thus, writing is a complex task that requires the coordination of several mental activities. These do not necessarily occur in a set sequence. Rather, writers simultaneously and dynamically combine various strategies and resources. Writing is also a communicative act and a social event between the writer and audience. The writer has to clearly establish the communicative intention, the goal and the type of text (McCutchen, 2006). The writer also has to consider the audience, in terms of the reader's characteristics and expectations to determine what they can or must write (Boscolo & Ascorti, 2004). In fact, to know the purpose of the text to be written and the potential audience significantly influence in the writing process and in the quality of the text (Midgette, Maraia, & MacArthur, 2008). Moreover, the writer has to master the topic that they are writing about as well as generating relevant ideas that will be expressed in the text (McCutchen, Francis, & Kerr, 1997; Perez, 2001). The writer must also control the coherence of the entire text by clarifying the message, reorganising and/or modifying ideas. Throughout the writing process it is necessary to translate from ideas into words. This activity does not mean writing isolated words or sentences; they must be organized so that they cohere. It is rare that the first draft that a writer completes successfully communicates their message. It is necessary to create one or more versions. Thus, revision requires awareness of audience, a mental representation of goals and plans for the text, ability to read critically, knowledge of common evaluative criteria and writing problems at the text level as well as the local level, a repertoire of revising strategies, and the general language and writing skills to improve problematic aspects of the text (MacArthur, Graham, & Harris, 2004). Students tend to have difficulty in implementing these writing processes and this problem persists in teaching writing at school.

The seminal and original cognitive model of writing processes proposed by Hayes and collaborators (1980, 1996, 2004) describes three processes used in writing: planning, translating, and revising; they are under executive control and are driven by specific task schemas. Arguably, a core component of writing expertise development is the learning of appropriate schemas.

If the goal of writing instruction is to help novice writers to develop the skills and strategies that are associated with writing expertise, then it is helpful first to define writing expertise. Boscolo (1995) suggested that an expert writer is a thoughtful planner, a coherent organizer, a careful reviser, and an audience-sensitive message-sender. In order to reach such level of competence it is necessary to develop writing strategies that make novice writers become sensitive to these different aspects of writing. Such strategies would address each

writing process and sub-process, from the planning through to the revision stage (Alamargot & Chanquoy, 2001).

2.1. Study of planning and revision processes

Planning is a reflective process by which content for the text is generated and organized. It combines low-level memory retrieval processes with more strategic problem solving, decision-making and inferencing (Hayes, 2004).

Successful planning involves high-level cognitive skills. As a result, it is costly in terms of cognitive resources (Kellogg, 1996) and can employ as much as two thirds of the total production time (Alamargot & Chanquoy, 2001). Planning can occur on a number of levels. It can involve constructing outlines that represent the global structure of the texts, but can also making decisions about whether to add more content to the current sentence or to start a new one. Therefore, planning can be both general and specific in nature, and plans can develop both prior to the writing of full text and evolve during drafting (Galbraith, 1996). It is also possible to make a distinction between process and content planning. Writers need to not only plan what to say and how to say it but how to strategically order the various different activities and processes that combine to make text generation possible (Hayes & Nash, 1996). There is evidence to suggest that teaching students to understand and apply criteria of text quality can yield substantial improvements in planning and revision processes and in the quality of their first drafts (Hayes, 2004).

It seems clear that planning, and particularly the interrelationships among different planning sub processes is both complex and currently not well understood (Alamargot, Favart, Coirier, Passerault, & Andriessen, 1999). Research does, however, suggest that novice and expert writers differ in how they plan. Expert writers tend to plan more and can be quite articulate about the various aspects of their planning. They formulate goals for their text and then develop plans to achieve those goals. By contrast, novice writers typically carry out little explicit conceptual planning prior to writing (McCutchen, 2006). However, planning behavior can be improved through strategic instruction; thus, planning strategies haven been used to teach paragraph writing skills, stories, persuasive essays, expository texts and narrative texts (Saddler & Asaro, 2007).

Planning behavior, specially the amount of time spent planning, is a critical part of the composing process and is liked to que quality of written text (Troia, 2006). Expert writers tend to spend more time planning than novice writers. Cameron and Moshenko (1996) reported that sixth-grade writers spend on average slightly over two minutes planning before beginning to write. When explicitly asked to plan in advance, novice writers often have difficulty separating planning from translating. Younger writers' planning tends to be dominated by the generation of content, and planning and translating are tightly intertwined. Rhetorical planning – making decisions about how content is best expressed to achieve communicative goals – remains relatively rare, even into late adolescence. Instructional attempts to improve writers' texts by developing more sophisticated planning strategies often meet with limited success (McCutchen, 2006).

Textual revision is considered, from general theoretical writing models, as an important process which affects directly the quality of texts written by students (see review

Arias-Gundín & García, 2006a, 2008). At the present, there appears to be a fairly general acceptance in the research community for an inclusive definition such as the following articulated by Fitzgerald (1987): Revision means making any change at any point in writing process (pp. 484); thus revision in conceived as a cognitive process of self-regulation in solving textual problems. Although revising is an essential element of the writing process, many students do not view revising in this way.

There are few students who revise their text without help of their teacher. They realize a small number of surface revisions, they make scarce use of the self-regulation and the evaluation processes, they revise without metacognitive control and they afford little importance to the role of revision and self-regulation skills (Klassen, 2002, Perez, 2001). These students place greater value on the surface aspects of writing versus the deep aspects. In this way they consider a text to be well written when there are no mechanics mistakes, while the expert writers focus on the semantic aspects (Butler, Elaschuk, & Poole, 2000).

Hayes (1996, 2004,2006) proposed that revision like language generation is guide by an overall task schema, and influenced by working memory and long-term memory resources. The task schema directs multiple cognitive process which include critical reading, problem solving and text production. Revision thus involves schema-guide reading, text evaluation and rewriting when it is necessary. Accordingly they provided evidence supporting the existence of a revision task schema. Generally, novice writers seem to operate under a revision schema which dedicates most effort to revision of the surface aspects of the text at the expense of the changes to message or rhetoric, although there is sometimes a shift to deeper level revision in older writers (Butterfield, Hacker & Plum, 1996). McCutchen et al. (1997) argued that the development of deeper level revision is related to the writers' ability to read texts critically. Wallace, Hayes, Hatch, Miler, Moser and Silk (1996) report an intervention that improves writers' revision by helping them to develop a revision schema that directs attention to the deep rather than to the surface aspects of texts. Similarly, Beal, Garrod, & Bonitatibus (1990) found that young writers revised more effectively when instructed to monitor their text comprehension during revision.

When it is necessary to solve a problem within an existing text, the writer must recognize the problem and then take appropriate steps to correct it. Such problem-solving involves comparing a representation of the actual text to a representation of the intended text. The task definition problems varies from writer to writer. In particular, more experienced revisers have more elaborate and effective task definitions than do novices (Hayes, Flower, Schriver, Stratman, & Carey, 1987); moreover the ability to detect problems is necessary for correcting them, but the ability to correct problems is not necessary for their detection (Hayes, 2004). Several processes in this sequence can be problematic for novice writers (McCutchen, 2006). First, novice writers are less likely to engage in much planning and their memory representations of the intended text are often vague. Second, writers can have difficulty in forming an accurate representation of the text that they have already written and this can inhibit their ability to revise effectively. Novice writers have difficulty distinguishing between information that is presented directly in the text, or might reasonably be inferred by the text's intended reader, and the background knowledge that they themselves bring to their re-reading. They therefore miss errors in their own texts that they readily see in texts written by others. One effective strategy for helping students in this respect is to introduce peer interaction into the revision process (Boscolo & Ascorti, 2004). Third, writers may have difficulty in generating alternative language to correct a problem even though they have detected it.

Fourth, revision processes are likely to place substantial demands on cognitive capacity. This will be particularly the case with younger writers for whom low level writing and reading processes more demanding, and who are likely to have poorer strategies for managing cognitive load (Piolat, Rosoussey, Olive, & Amada, 2004). As a result of these issues, novice writers encounter more difficulties than expert writers in diagnosing and correcting text problems.

2.2. Strategy Focused Writing Instruction

The knowledge that a writer possess about the writing process is important as regards the final text, in how the different processes develop in the elaboration of the text, and, as regards the yield and quality of the text. The majority of students in 4th, 8th and 12th grade demonstrated only partial mastery of the writing skills and knowledge needed at their respective grade levels in the area of writing (Saddler & Asaro, 2007). Thus, texts written by novice writers are shorter, incomplete, poorly organized and weaker in overall quality; in addition, these studetns' compositions typically contain more mechanical and grammatical errors. These problems may be attributed, in part to difficulties in executing and regulating the processes underlying proficient writing, including planning, content generation, revising and transcription (Troia, 2006). Thus, the novice writers need considerably more intensive, individualized, and explicit teaching in planning, transcription and revising skills and in composing strategies that incorporates effective adaptations to task demands, response formats, students supports and teacher practices. In more supportive and authentic situations, students can display more sophisticated skills (McCutchen, 2006).

In this way, there has been recent growth in the number of studies evaluating the effects of different methods of writing instruction (Pritchard & Honeycutt, 2006). Whereas research in the 1970s and 1980s tended to concentrate on how the components of the writing process are related to writer and text variables, there has been a more recent focus on research specifically designed to measure improvements in the quality of the written product as a result of using different teaching strategies. There has been a particular focus on the effects of teaching particular cognitive strategies for managing the writing process. Learners are seen as being actively engaged in all aspects of writing: planning, composing, and revising the multiple drafts of their text (Allal, 2004); likewise, successful instruction would redirect the students' attention (Hayes, 2004). In a meta-analysis of studies evaluating a broad range of different forms of writing instruction identified strategy-focused interventions as the most effective, with a large mean effect size (Graham & Perin, 2007). These include studies of both learning disabled and typically-developing writers of ages ranging from 4th to 10th grade. Studies have explored writing in both expository and narrative genres, and several have demonstrated that training in one strategy generalizes to performance in another. For example Bryson and Scardamalia gave typically-developing 10th-grade writers instruction in both planning and revision strategies. They found that on a persuasive writing task students who had experienced the intervention produced better argued, more reflective, and better quality texts, but found no difference in spelling errors or text length.

A number of studies have demonstrated benefits for teaching planning and revision strategies (e.g., Bryson & Scardamalia, 1996; Danoff, Harris, & Graham, 1993; de la Paz,

2005; de la Paz & Graham, 1997, 2002; Englert, et al., 1991; Simons, et al., 1994; Yeh, 1998). At the same time,   several studies have explored teaching revision strategies independently of planning (e.g., Arias-Gundín & García, 2006b, 2007; Cameron, Edmund, Wigmore, Hunt, & Linton, 1997; Fitzgerald & Markham, 1987; García & Arias-Gundín, 2004), and with appropriate teaching methods this can have a positive effect on the quality of students' texts. Effective instruction appears to require some sort of scaffolding for the revision process by, for example, providing learners with revision guides (Chanquoy, 1997) and that students are given feedback on the effectiveness of their revisions (Matsumura, Petthey-Chavez, Valdes, & Garnier, 2002; Perez, 2001). Sharing revision activities with peers seems particularly effective (Boscolo & Ascorti, 2004; Rouiller, 2004). Peer revision could be implemented first to improving the content of writing, and then students can later make self-revisions for improving the language forms in their texts (Suzuki, 2008).

In the remainder of this chapter we first describe a strategy focused intervention that we call Cognitive Self-regulation Instruction (CSRI) aimed at developing the quality of writers' texts by developing effective strategic writing processes. We then summarize an evaluation of this approach (García & Fidalgo, 2006; Torrance, Fidalgo, & García, 2007, Fidalgo, Torrance, & García, 2008). Finally, we draw some general conclusions for teaching practice.

3. AN APPROACH OF COGNITIVE AND SELF-REGULATED STRATEGY INSTRUCTION IN WRITING

The proposed Cognitive Self-Regulation Instruction Model (CSRI) is aimed at both normally-achieving students and students with learning disabilities in pre-secondary education and between 11 to 12 years of age. It shares characteristics with other successful instructional models. These include Graham and Harris' self-regulated strategy development model (SRSD; Harris & Graham, 1996; Graham, 2006; Graham & Harris, 2003), Englert and co-worker's cognitive strategy development model (Englert et al., 1991; Englert, Raphael & Anderson, 1992), and Wong and colleagues' intensive writing interventions in students with learning disabilities (Wong, Butler, Ficzere & Kuperis, 1996; 1997; Wong, Butler, Ficzere, Kuperis & Corden, 1994). Each of these approaches aims to achieve a progression from declarative knowledge of writing strategies, through the ability to apply procedures in specific writing tasks (which requires both ability engage strategies and understanding of when they are most appropriately applied), to independence, where the writer has the ability and motivation to spontaneously apply appropriate strategies to their own writing. They also all emphasize dialogue between teacher and students, recognize the social origins of self-regulation, and promote the use of self-dialogue to regulate students' own behavior.

These principles are brought together in an instructional approach that emphasizes teacher modeling and student emulation. Students observe the teacher while he or she models the particular strategy to be taught – planning an expository text, for example – and then emulates what they have seen. The intention is that for each strategy students move through a sequence of observation, then emulation, then self-control and finally independent self-regulation (Schunk & Zimmerman, 1997; Zimmerman, 2000). Students' learning is scaffolded by the use of a range of support materials. These include mnemonics to aid memory about, for example, the different functions of planning, and blank tables or grids

which students can used to structure their thinking, and procedural prompts. These can steadily be removed over the course of an instructional program as students develop fluency and independence in the writing strategies that are being taught.

The instructional pattern of the CSRI model consists of four sequential instructional stages. Through this instructional sequence students are guided towards a self-regulated competence through the guidance provided by materials or the teacher. This scaffolding is faded out through the instruction program. The *first instructional stage* aims at developing in students a mental framework and terminology through which to understand subsequent process-focused instruction. The aim is to broaden students attention to include not just mechanical aspects of writing (spelling, sentence structure, and so forth) but substantive features of both the text (the need for well structured and audience-focused content) and process (the importance of planning and revision). In CSRI students are taught about generation of ideas, planning, or organization of ideas, thinking about audience, revising, and other processes, drawing heavily on established cognitive accounts of wiring (e.g., Hayes and Flower, 1980). In this way students develop specialized cognitive schemas for understanding the kinds of planning, translating and revising skills and sub-processes that are characteristic of more competent writers. The intention is that this framework will allow students to manage and regulate the complex higher level set of cognitive processes associated with the planning or the revision processes taught in later stages.

Knowledge about planning is taught using the mnemonics "POD" and "OAIUE" (or just "the vowels"). POD is drawn from previously evaluated interventions (e.g., Mason, Harris, & Graham, 2002) and represents three steps in the development and use of writing plans: Picking ideas - generating ideas related to the theme of the text, Organizing ideas, and Developing text. Students are encouraged to plan in advance of writing full text and to make use of these plans while writing, but also to be open to the possibility of further developing these plans once writing has started. The Vowels expand the Organizing component of POD. O (*Objetivo*) encourages students to develop high level goals for their text. A (*Audiencia*) indicates the need to identify and accommodate reader needs. I (*Ideas*) points to the need to deliberately generate and list possible ideas for the text. U (*Unir ideas*) stands for "link ideas" and encourages students to explicitly think about and decide how these ideas will be organized. Finally E (*Esquema /* Schema) encourages students to think about standard structures and genre conventions for the kind of text that they were producing (García & Fidalgo, 2006).

Revision is support by the mnemonic LEA (RED in English), which highlights the three main steps of the revision process. Students Read (*Leer*) the text several times and in different ways. First, they must read the text closely paying attention to the structure, paragraphs, and inter-paragraphs links. Secondly, they must quickly reread their text paying attention to lower level features (spelling, punctuation, sentence syntax). Students are encouraged to Evaluate (*Evaluar*) what they read and, lastly, to make (*Actuar*, Do) the necessary changes.

The *second instructional stage* involves modeling the use of mature planning and revising strategies. During this stage the teacher or instructor thinks aloud in front of the students while planning, drafting, and revising text. This demonstrate how the framework and mnemonics introduced in first stage can be used to regulate writing processes. Think aloud is partly spontaneous and partly pre-prepared. The teacher asks themselves questions like "what should I do before the writing task?", "What do should I do first…, second…, later?, "what should I do during the drafting phase?" and so forth. In each case the teacher would then

provide a response based round the mnemonics introduced above, and then relate these to the particular writing task in which they are engaged. Also included in the self-regulation processes are the questions about self-efficacy, attributions and motivation.

After the modeling, the students and the teacher collectively analyze and reflect on the most important actions of the writing process, the necessary steps in writing and their importance. Finally, they should summarize the most relevant conclusions about the writing process performed and the self-regulation strategies and procedures that were used and their importance in achieving good quality text. In the context of writing instruction, as is the case for teaching other procedural skills, modeling and observation has been shown to be more effective than direct instruction. Students who learn by observation "step back" from the writing task and can focus on the learning task, creating a learning opportunity to broaden their knowledge about writing (Braaksma, van den Bergh, Rijlaarsdam & Couzijn, 2001; Braaksma et al., 2004).

The teacher engages offers two forms of this metacognitive modeling: a coping model and a mastery model. Coping modeling involves the teacher occasionally making errors or adopting sub-optimal strategies, but them immediately correcting these mistakes. Mastery modeling involves writing without explicitly making and correcting mistakes. Some researchers have shown that a coping model is more effective than a mastery model (Kitsantas, Zimmerman, & Clearly, 2000; Zimmerman & Kitsantas, 2002). Arguably, though, mastery models are also valuable as they serve to provide a benchmark against which students can evaluate their own performance.

In the *third instructional stage* students learn to emulate the strategies that were modeled in the previous stage. Like the teacher that they were observing, the students thought aloud. Thinking aloud is an excellent technique for developing metacognitive knowledge and self-regulation strategies. In general, it helps students develop greater control and awareness about the cognitive writing processes and the self-regulation skills in writing. It helps them to guide their thoughts during the writing process. It increases their self-control as writers and can also improve their writing performance. Students think more precisely, carefully and systematically when they are thinking aloud. Besides, the teacher or peers can identify and diagnose any misunderstood or misused concepts, rules, facts, important omissions and inadequate or incomplete knowledge, approaches or skills in writing if students are thinking aloud (Hartman, 2001). Students are first trained to think aloud. Later, working in pairs, the first student models the specific writing process while the second student carefully and analytically assesses the student's writing processes and strategies. The second student must have an active role, analyze the strengths and weaknesses of the writing process that they are observing, and provide guidance when necessary. The students then swap roles. Working in pairs in this way, in addition to observing modeling by the teacher, is particularly helpful because observers are more likely to take on the behaviors they are observing when they perceive similarity between the person modeling and themselves (Bandura, 1986). Of course when the model is a peer there is no guarantee that the modeled behavior will be effective. However safeguards are provided both by telling observers that they should be critical, and by close monitoring from the teacher.

When the writing process is finished, all the students along with the teacher, initially in pairs and later in a big group, analyze and reflect on the most important actions of the writing process, their need for the self-regulation strategies and procedures that had been used and their importance in achieving a quality text.

Finally, in the *fourth instructional stage* students work individually, again thinking aloud, observed by the teacher. In this stage all procedural facilitations are eliminated although teachers provide feedback about their performance. During this stage, students should begin to shift their attention from the modeled processes to the performance outcomes (Zimmerman & Kitsantas, 2002). The intention is that they also move from thinking of the strategies as the teachers, and therefore externally imposed, to being their own strategies and adapted to their own personal needs. Progressively, the students will learn to apply strategies flexibly to different writing tasks. This process of personalization is aided by asking students to make their own list of writing strategies that they feel that they can use in their future writing.

Evaluation of the CSRI approach to teaching writing suggest that it is capable of delivering substantial and enduring improvements in the writing competence of typically-developing sixth-grade students. This research is described in detail in Torrance, Fidalgo, & García, 2007 and Fidalgo, Torrance, & García, 2008, and is summarized next.

4. THE EFICACY OF CSRI TO IMPROVE PRE-SECONDARY STUDENTS' WRITING COMPETENCE

CSRI is designed to be implemented by in within mainstream schools and with students with a full range of literacy ability. We therefore implemented CSRI with Spanish sixth grade students (aged between 11 and 12 years old) as part of their normal literacy (Spanish language) lessons and taught by their normal literacy teacher. n the Spanish educational system this is the final year of primary (elementary) level schooling, with students. We compared writing performance prior to and following the intervention with that of a control group who continued in normal literacy lessons and were tested at the same intervals. We explored ways in which CSRI affects students' writing competence both in the short term and over an extended period, and with respect to both product quality and writing process. If CSRI is effective and acts by changing students' writing strategies, then we would expect to see not only improvements in text quality but also a move towards writing strategies that emphasize planning and revision.

4.1. Method

Participants and Design

Our study sampled 95 Spanish sixth-grade primary school students (39 girls and 56 boys) with a mean age of 11 years and 7 months. These students were taken from four different classes. Three of these classes were within the same school (N = 22, 24 and 25, respectively) these students received the CSRI instructional program. The fourth class attended a different but similar school. This class formed the control group (N= 24). Writing performance in these students was assessed prior to intervention, immediately post-intervention, and twelve weeks after intervention (or at equivalent times in the control). We also tested 56 of the original intervention sample two years after they had completed CSRI and returned to the normal literacy curriculum (20 girls and 36 boys with mean age of 14 years and 1 month). These

were compared with a normal-curriculum control group formed of 21 students of the same grade (7 girls and 14 boys) with a mean age of 14 years and 4 months, and who had not participated in the CSRI intervention but who had for the previous two years been studying at the same school and attended the same classes as the intervention sample. This control group had very similar curriculum performance and Standardized Ability Test scores to the intervention sample.

Measures

Writing performance was assessed with tasks that involved students composing short expository essays about topics related to previous curriculum content whilst logging their writing activities at frequent, random intervals. At baseline and post-test, all the participants wrote essays in the same genre, using the compare-contrast genre which had been trained in CSRI condition. To determine whether the effects of CSRI generalized to other kinds of expository task at delayed post-test (12 weeks after the intervention) the three different classes that comprised the CSRI group completed tasks in different genres. Class A completed a compare-contrast task (the same task as the ordinary curriculum group), Class B completed a task that involved expression of an opinion, and Class C completed a task involving the description of a causal relationship. At long-term follow up (two years after the intervention) both groups wrote compare-contrast essays. In each case, the themes of the writing tasks were supported by additional topic-related material.

Product analyses involved more text-based measures of productivity, coherence and structure and reader-based (holistic) quality ratings. Productivity concerns the quantity of text that is produced for each task and was measured by counting the number of words, paragraphs, and sentences. Coherence measures are concerned with the different linguistic indicators of referential or relational coherence ties (Haliday & Hassan, 1976; Sanders, Spooren & Noordman, 1992). These are described and illustrated in Table 1.

These ties that serve to link the different components of the text (clauses, sentences, paragraphs). We identified and counted seven types coherence-tie, based on specific lexical markers: anaphoric, lexical, meta-structural, structural, connective, reformulating, and argumentational. Texts were scored in terms of coherence-tie density (number of ties of a particular type per 100 words) to control for text-length effects. All texts were analyzed by two trained judges with an inter-rater reliability of .97 (Pearson r) across all seven categories, with agreement of .85 for anaphoric ties and of more than .95 for all other categories. Finally, structure was evaluated in terms of whether the text included the three main parts of text: introduction, main body and conclusion.

Reader-based measures involved expert raters scoring each text, as a whole, for the overall quality, for structure and coherence. These ratings were based on a method described and evaluated by Spencer and Fitzgerald (1993), and involved evaluation against a list of specific criteria. These are summarized in Table 2. All texts were rated by two independent judges, both of whom were blind to group membership. Correlations (Pearson's r) between judges' ratings were .91, .83, and .89 for, respectively, structure, coherence, and quality.

Table 1. Coherence ties used in text-based quality assessments

Coherence	Tie	Description	Examples
Referential	Anaphoric	These are pronouns and other devices for anaphoric reference	John is teacher. *He* works at school.
	Lexical	These are semantic overlaps or exact lexical repetitions between words (subjects or objects)	John is teacher at school. *John* got this job in 1990.
Relational	Meta-structural	These are phrases linking sentences or pointing out previous or subsequent text content.	*Now, I will describe…; The previous paragrapsh talks about…*
	Structural	These are specific linguistic markers for structuring the information. For example: at first, second, later,	*First…; second…; finally…; later…; eventually…*
	Connective	These are specific linguistic markers that link different parts of text. For example: and, besides, as well as, also, etc.	*And…; also…; as well as…*
	Reformulation	These are specific linguistic markers that summarize (in conclusion, finally), explain (that is) or reiterate of a point in a different form (in other words).	*In conclusion…; that is to say…; in other words…*
	Argumentational	These are specific linguistic markers that persuade (however, despite this) or provide evidences (for example)	*For example…; however…; despite this…*

Process measures were derived from a "writing log" technique (Torrance, Thomas, & Robinson, 1999) which involves collecting time-sampled, concurrent, probed self-reports of the students' writing activities. While performing the writing tasks students periodically hear electronic beeps (on average one every 90 seconds). When they hear the beep they immediately indicate the activity in which they are currently engaged, choosing from a list of seven on a writing-log sheet. These activities were labeled and defined as follows: *reading references* (I am reading the reference materials), *thinking about content* (I am thinking of things to say in my text); *writing outline* (I am writing a plan of what I'm going to write in the text or I am using my notes to make a detailed outline); *writing text* (I am drafting full text rather than making notes); *reading text* (I am reading though all or part of my text); *changing text* (I am making changes to my text, for example correcting orthographic mistakes, changing words, adding words, eliminating words, etc.); *unrelated* (I am doing or thinking something unrelated to the text, for example: looking for a pen, looking through the window, etc.). Time spent in each of seven activities through writing process was estimated by multiplying the number of times that a participant indicated a particular activity in their writing log by the mean inter-beep interval.

Table 2. The descriptive criteria of reader-based measures of compare-contrast essays (based on scheme developed by Spencer and Fitzgerald, 1993)

Criteria of Measure	Score
For STRUCTURE measure the rater considered the presence and development of six characteristics: ● Background information to present the text. ● Structural cues ● An introduction: a topic or thesis sentence to establish the general comparison-contrast. ● Clearly developed organization either whole by whole or part by part or likeness-differences. ● Unity within individual paragraphs and in the case of a theme within the entire paper. ● A conclusion which reiterates the purpose of the paper, to show comparisons or contrasts or both	1 to 4
For COHERENCE measure the rater considered the presence and development of seven characteristics: ● Topic or theme identified ● Topic or theme extended without digressions ● A context which oriented the reader ● Details which were organized in a discernible plan which was sustained throughout the text. ● Cohesive ties linking sentences and / or paragraphs ● Discourse which flowed smoothly ● Conclusion statement creating a sense of closure.	1 to 4
For QUALITY measure the rater considered the presence and development of seven characteristics: ● Clear sequence of ideas ● Text development with little or no irrelevant ideas. ● Good organization ● Fresh, vigorous word choice. ● Variety of interesting details ● Correct sentence structure ● Correct punctuation, capitalization and spelling.	1 to 6

Writing process activities were collected in a blank writing log divided into multiple sections each listing the seven possible writing activities. Each activity was indicated with a specific symbol or picture which, after training, became familiar to the students. This helped to minimize the extent to which completing the log diverted attention from the writing task. Students were trained in using this method prior to completing the baseline assessment. We then determined the students' accuracy in using the categorization scheme by indicating the activities of a writer at 25 different examples of activities during their writing process. The comparison of the students' categorization with that of an expert judge showed good

agreement (kappa = .87 for both the initial study when assessed again for the long-term follow up).

Table 3. Summary of the instructional program based on Cognitive and Self-Regulation Instruction

Stage	Session	Instructional Focus	Strategies and Techniques
1st Self-knowledge of writing process	1st	Writing functions Types of texts Writing products Importance of writing Writing processes Self-regulation procedures	Brainstorming Group discussion Direct and explicit instruction Previous knowledge Interactive explanation Functional examples
	2nd	Processes directly involved in planning Planning strategy: POD + OAIUE P = Pick ideas O = Organize your ideas O = Object A = Audience I = Ideas U = Unite ideas E = Draft Essay D = Develop your text	Explicit instruction and explanation Mnemonic rules Memory strategies
	4th	Knowledge of the translating process Textual structure Coherence Links The vowels: O = Organize your ideas O = Object A = Audience I = Ideas U = Unite ideas E = draft Essay	Direct and explicit instruction Previous knowledge Interactive explanation Functional examples
	6th	Knowledge of the revision process Mechanical and Substantive revision Revising strategy: RED R = Read text E = Evaluate text D = Do necessary changes	Direct and explicit instruction Previous knowledge Interactive explanation Functional examples of mechanical and substantive revision
2nd Modeling of writing process	3rd	Self-regulation of the planning processes POD + THE VOWELS Strategy	Cognitive modeled – coping model – mastery model Thinking aloud Self-regulation procedures Group discussion
	5th	Self-regulation of the translating processes: THE VOWELS Strategy	Cognitive modeled – coping model – mastery model Thinking aloud Self-regulation procedures Group discussion
	7th	Self-regulation of the revision processes: RED Strategy	Cognitive modeled – coping model – mastery model Thinking aloud Self-regulation procedures Group discussion
	8th	Self-regulation of the writing process	Cognitive modeled, mastery model

Table 3. (Continued)

Stage	Session	Instructional Focus	Strategies and Techniques
			Thinking aloud Self-regulation procedures Group discussion
3rd Emulation of the modeling, working in pairs	9th	Self-regulation of the writing process	Emulative performance Thinking aloud Self-regulation procedures Social feedback Working in pairs
4th Emulation of the cognitive modeling working individually	3rd /home task	Self-regulation of the planning processes	Individual performance Thinking aloud Self-regulation procedures Social feedback
	5th /home	Self-regulation of the translating processes	Individual performance Thinking aloud Self-regulation procedures Feedback social
	7th / home	Self-regulation of the revision processes	Individual performance Thinking aloud Self-regulation procedures Social feedback
	10th	Self-regulation of the writing process	Individual performance Thinking aloud Self-regulation procedures Social feedback

4.2. Results

We first describe effects of CSRI on the students' texts, and then on writing processes. In both cases we made separate comparisons for baseline vs. post-test (for immediate effects of CSRI) and baseline vs. delayed post-test (for more persistent effects). If CSRI is effective we would expect to find increases in quality and use of planning and revision that were greater in the intervention sample than in the controls. If this difference is found and has not occurred by chance then trial (baseline vs. post-test or baseline vs. delayed post-test) by group (intervention vs. control) interactions should, therefore, be statistically significant.

As Table 4 indicates, there were statistically significant improvements in the quality of texts produced by students in the intervention group compared with controls, and this improvement was sustained in the delayed-post-test assessment. We also found that after attending CSRI students were more likely to use anaphoric, structural, and meta-structural devices for making their text cohere. Arguably this demonstrates an increased tendency to attend to reader needs rather than just expressing ideas as they occur.

CSRI also appeared to have a substantial effect on the extent to which participants made use of introductory and concluding paragraphs. At post-test only 2 (8%) of the ordinary curriculum group included introductions in their text, compared with 67 (94%) of CSRI participants. Similarly, only one student in the ordinary curriculum group wrote a concluding paragraph, whilst 61 (86%) of the CSRI students did so. This pattern was repeated at delayed post-test. Of the 22 CSRI participants that performed the compare-contrast task, 21 (95%)

wrote introductions and 20 (91%) wrote concluding paragraphs, compared with two and one students, respectively, in the ordinary curriculum condition. This outcome was generalized to the opinion and cause-and-effect tasks with, 21 (87%) and 25 (100%) of students, respectively, writing introductory paragraphs, and 19 (79%) and 24 (96%) writing conclusions. There was also a substantial increase in the use of paragraphing by the CSRI group at post- and delayed-post tests, effects that were absent in ordinary curriculum group.

Although the intervention focused exclusively on writing compare-contrast essays, the effects generalized well to the opinion and cause-effect tasks that were completed by sub-samples of the intervention group at delayed post test.

Two years after CSRI instruction most of these effects were maintained, albeit with rather more modest effect sizes (Table 5). CSRI students produced better quality text, with more sophisticated coherence ties, compared with controls. They were also more likely to include introductory paragraphs (but not conclusions).

Table 4. Comparison on reader- and text-based quality measures taken at baseline, post-test and delayed post-test (12 week) for CSRI and control students

	Baseline		Post-test		12-weeks		Baseline vs. post-test			Baseline vs. delayed post-test		
	Control	CSRI	Control	CSRI	Control	CSRI	F(1,93)	p	η2	F (1,44)	p	η2
Reader-based measures												
Quality	2.46 (.55)	2.4 (.60)	2.21 (.25)	5.29 (1.06)	2.17 (.50)	4.91 (1.11)	214.4	.001	.70	94.8	.001	.68
Coherence	2.4 (.47)	2.25 (.5)	2.31 (.44)	3.82 (.53)	2.52 (.45)	3.89 (.31)	146.9	.001	.61	94.4	.001	.68
Structure	1.94 (.76)	1.76 (.53)	1.71 (.66)	3.73 (.71)	1.94 (.61)	3.84 (.36)	158.7	.001	.63	91.3	.001	.67
Text-based measures												
Word count	83.2 (29.4)	77.4 (22.5)	84.4 (42.0)	92.9 (26.4)	94.3 (31.2)	106 (23.5)				7.16	.01	.14
Paragraph count	1.4 (.6)	1.7 (1)	1.6 (.9)	3.6 (1.1)	1.8 (.5)	3.8 (.4)	26	.001	.22	44.9	.001	
Anaphoric ties	1.51 (1.24)	1.61 (2.59)	1.44 (1.66)	3.9 (2.48)	2.39 (2.09)	3.98 (2.47)	12.2	.001	.12	7.3	.01	.14
Reformulation ties	0	.09 (.62)	.10 (.34)	1.06 (.60)	.30 (.97)	1.29 (.51)	22.4	.001	.19	4.3	.04	.09
Structural ties	.90 (2.02)	.37 (1.66)	.40 (1.97)	1.51 (1.23)	.32 (.52)	1.52 (.89)	9.1	.003	.09	6.8	.012	.13
Meta-structural ties	.05 (.27)	0	0	1.1 (.55)	.20 (.58)	.94 (.33)	97.3	.001	.51	26.8	.001	.38

- Note: Results are given for just those effects that were statistically significant. Means at 12 weeks are just for students who completed the compare-contrast essay (n = 24). F ratios are reported for test by group interactions.

CSRI had a rather more mixed effect on students writing strategies. There was a much greater tendency, relative to controls, for CSRI students to plan their texts. However, we found no effect of the intervention on students' tendency to read and make changes to their text. Revision was more or less absent for all writing tasks in both groups. As for the long term follow up, the analysis of the differences between the CSRI and the control group concerning the time spent on the different writing processes only showed a statistically

significant higher time spent on writing the outline process in the CSRI than the control group. The explicit planning activity, in the form of outline-writing, was greater for the CSRI group compared to the control group. Again, however, there was no evidence that CSRI students were more likely to engage in revision.

Table 5. Comparison differences in reader- and text-based quality measures between CSRI and control groups two years after intervention. Results shown just for statistically significant effects

	Control	CSRI	Differences between (CSRI vs. control)		
	M (SD)	M (SD)	t	p	r^2
Reader-based measures					
Quality	2.1 (.77)	2.8 (.94)	2.64	.010	.10
Coherence	2.52 (.93)	3.18 (.79)	3.09	.003	.13
Structure	2.95 (1.20)	3.73 (1.14)	3.08	.003	.13
Text-based measures					
Reformulation ties	.13 (.23)	.30 (.48)	2.10	.04	.03
Meta-structural ties	.04 (.11)	.16 (.27)	2.67	.009	.04

CSRI does, therefore, appear to offer substantial benefits for sixth grade writers. Students who experienced CSRI produced better quality text, even two years after intervention Specifically, the texts of CSRI participants suggested greater consideration of audience and of communicative and pragmatic goals. In the terms of Bereiter and Scardamalia (1987) this finding suggests a shift in the students towards a more knowledge transforming approach to writing. This effect was accompanied by, and perhaps resulted from, a substantially increased tendency for students to systematically plan their texts.

These findings are consistent with previous research. As we discussed above, recent systematic literature reviews focusing on instructional practices for teaching writing, indicate that strategy-focused instruction has a strong impact on the quality of students' written products (Graham, 2006; Graham & Harris, 2003; Graham & Perin, 2007). In particular, the Self-Regulated Strategy Development instructional model (SRSD) has been proven effective and yielded a large average effect size. This model shares key instructional techniques and strategies with the CSRI approach to teaching writing. A feature of our evaluation that is absent in the research reviewed by Graham and co-workers was the long-term follow-up. Our findings suggested that the benefits of the CSRI were still present nearly two years after the intervention was delivered. CSRI students continue to produce significantly better quality texts and tended to spend more time planning their texts than their peers who followed the normal curriculum in writing instruction. This suggests that CSRI, and by implication other strategy-focused interventions, promote a more strategic and self-regulated approach to writing, especially in relation to planning processes, which is enduring, and does not developed spontaneously under more traditional writing instruction, at least until after the eighth grade.

5. EDUCATIONAL IMPLICATIONS FOR WRITING INSTRUCTION

Our findings therefore suggest that strategy instruction aimed at developing independent use of self-regulatory cognitive strategies is important if students are to achieve writing competence. On this basis it is possible to draw some recommendations for the teaching of writing in regular school settings. These are summarized below.

There is clearly a relationship between students' knowledge about what constitutes a mature writing process, and their ability to apply mature strategies to regulate their own writing behavior. Metacognitive knowledge and self-regulation strategies should, therefore, be imparted in a complementary fashion. At first, teachers should instill and foster prior metacognitive knowledge of the writing process in their students. The declarative knowledge of writing *(what is writing*) answers questions about, for example, the range of different cognitive strategies that might be adopted and the defining characteristics of different textual genres. Procedural knowledge of writing (*how to write)* enables students to apply strategy and text knowledge to their own writing. It is important also that students have conditional knowledge – understanding of when and why to use declarative and procedural knowledge. In writing this refers to when to use a specific writing strategy, what writing strategies are most suitable for the different kinds of texts, why to use a specific writing strategy at a specific moment of the writing process, or when and why to use a specific textual genre. This kind of metacognitive knowledge of writing should focus on the substantive or higher-order cognitive processes in writing.

There are a variety of approaches to developing metacognitive knowledge of writing. Teachers should support interactive guided dialogues using techniques such as discussion groups, group reflection, questioning or brainstorming. Our experience is that it is important to promote students' self-reflection about their self-knowledge, their gaps and limits. Another effective technique is the use of metacognitive knowledge evaluation matrices. These matrices promote explicit declarative, procedural and conditional knowledge about each writing process (Schraw, 2001). These matrices can be used as to assess students' existing knowledge, as part of an explicit teaching strategy, or to encourage memory and understanding after the training program. They can also be completed in a group context to encourage discussion, self-reflection and dialogue between students. Getting students to engage in analysis of existing texts serves both to provide knowledge of important features of different genres but also, and as importantly, gives them evaluation skills and strategies that they can apply to both production and revision of their own texts.

As students begin to acquire the necessary prior knowledge, instruction can then shift towards developing self regulation. Teacher modeling followed by student emulation appears particularly effective in this respect. This approach appears to be generally effective in developing students ability to self-regulate (Zimmerman & Kitsantas, 2002). In the context of writing this type of learning by observation has been shown to be more effective than other methods (Braaksma, et al., 2001; Braaksma et al., 2004). We have found that think-aloud methods, where teachers (and then peers) externalize their thinking while writing is a particular effective approach to modeling. However in practice we have found that "think-aloud" needs itself to be supported. Teachers need to rehearse particular self-questioning and self-instructing devices in advance of modeling in front of the class. From the students' perspective, therefore, that teacher – as the expert model – is simply doing what she would

normally do when composing a text, and we think that this is important. However, to maintaining this illusion requires that the teacher does some advance preparation. The CSRI intervention made use of think-aloud not just when initially demonstrating strategies to students but during subsequent emulation, both with when students worked in pairs and even when they finally wrote alone. This both helps to make strategies salient and explicit, and means that teachers and other students have at least some access to, and are therefore able to comment on, the internal mental processes that are the focus of the intervention.

Self-regulation in writing can also be promoted by means of specific techniques, such as, mnemonic devices for the cognitive strategies of writing, cognitive modeling and emulation and the thinking aloud technique. The cognitive strategies developed in this way allow students to manage and regulate the complex higher-level set of cognitive processes associated with planning, drafting and revision. Teachers are likely to find that students require considerable support – both through shared writing activities and supporting written materials. This needs to be removed gradually in order to promote autonomous, self-regulatory use of the strategy being taught.

Our evaluation of CSRI suggests that gradual removal of scaffolding in this way results in most students spontaneously adopting pre-planning strategies, even two years after instruction with no subsequent reinforcement. However the same was not true for revision strategies. Students appeared to understand the function and possible benefits of revision, and could emulate teacher modeling, but they did not then spontaneously revise their own texts. This may be for motivational reasons. Whereas deliberate planning necessarily occurs primarily before drafting has starting, particularly when the writing task is short, revision is predominantly a post-drafting activity. Motivation is generally likely to be lower at this point. Students are also likely to feel that if they have carefully planned their text, then followed this plan when writing, there is little to be gained from then reading through what they have written. Unless goals change during writing, which for students completing relatively short, teacher-provided tasks, is unlikely, or there is reader input that reveals that they have not been as successful in communicating their ideas as they though they were, students are unlikely to perceive any need to change their text. Developing an inner-critic – internal processes that allow writers to distance themselves from their text and see it from the perspective of intended readers – may be something that is beyond young writers.

In conclusion, therefore, strategy focused writing instruction in general, and the specific methods used to implement this in the CSRI intervention in particular, appear to be effective in helping students at the top end of elementary school develop into more mature writers. Specifically this approach appears more effective, or at least to add substantial value to, traditional approaches to writing instruction that focus solely on characteristics of the written product. The very large effect sizes found for immediate and short-term effects of CSRI in our evaluation (compared to more modest average effect sizes found by Graham and Perin, 2007) can in part be explained by the almost total absence of process oriented teaching in the Spanish literacy curriculum. In contexts where normal writing instruction is already more processes focused, as is increasingly the case in the UK, for example, effects may be less marked. However, we believe that the range of methods adopted by CSRI, and perhaps particularly the extensive use of think-aloud-based modeling and emulation, are have the potential to make a useful contribution to writing instruction across a broad range of contexts.

ACKNOWLEDGMENTS

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