Vanderswalmen, R., Vrijders, J., & Desoete, A. (2010). METACOGNITION AND SPELLING PERFORMANCE IN COLLEGE STUDENTS (pp. 367-394). In A. Efklides & P. Misailidi (Eds.). Trends and Prospects in Metacognition Research. Springer: New York.

Running head: Metacognition and spelling skills

METACOGNITION AND SPELLING PERFORMANCE IN COLLEGE STUDENTS

Ruth Vanderswalmen [a], Joke Vrijders [a] , & Annemie Desoete [a,b]
[a] University College Arteveldehogeschool, Ghent, Belgium, & [b] Department of Clinical Psychology, University of Ghent, Belgium

Address: Ruth Vanderswalmen, Arteveldehogeschool, campus Kantienberg, Opleiding Logopedie, Voetweg 66, B-9000 Gent, Belgium. E-mail: ruth.vanderswalmen@arteveldehs.be

Abstract
Metacognitive knowledge (MK), skills (MS) and experiences (ME) and spelling skills were assessed in 2,095 first year bachelor students. Two questionnaires were created for the present study, namely a prospective and a retrospective metacognition questionnaire. *The Prospective Metacognition Questionnaire (PMQ)* assessed student's MK of the self as speller and student's use of MS in spelling, namely checking of spelling. *The Retrospective Metacognition Questionnaire (RMQ)*. The RMQ assessed metacognitive experiences, namely feeling of confidence (FOC; metacognitive feeling) and estimate of the number of spelling errors (EOSE; metacognitive judgment). Also, a score showing the correspondence between the ratings of FOC and actual performance was calculated as well as a calibration index using the EOSE. At the performance level the type of spelling errors were analysed. Moreover the relationship between spelling performance and MK, ME, and MS was studied to investigate if incompetent spellers had poor MK and MS, and less accurate ME. In addition, the "above-average effect" or the tendency of the average person to believe he or she is above average was looked for. Finally the type of metacognitive measures (MK, MS, ME) that predicted most adequately predict proficient spelling was studied.

Keywords: metacognitive knowledge, metacognitive skills, metacognitive experiences, spelling, adolescents

1. Introduction

Proficient spelling is crucial in convincing someone of your expertise (Harris, Graham, Brindle, & Sandmel, 2009). The volume of studies on spelling in younger children shows the importance of the topic (see, Defior, Jiménez-Fernàndez, & Serrano, 2009; Landed, Thaler, & Reitsma, 2008; Savolainen, Ahonen, Aro, Tolvanen, & Holopainen, 2008; Verhoeven, Schreuder, & Baayen, 2006; Wakely, Hooper, de Kruif, & Swartz, 2006). Several of these studies show that being proficient at the lower levels of writing skills, such as spelling, helps to ease the demands on working memory when writing. When students allocate their working memory resources to figuring out how to spell a word, they may forget what ideas they were going to write next (Carlisle, 1994). Also Wakely et al. (2006) found that students who had more problems with spelling wrote a rather undeveloped story, that is, a story with sentences that described more than one event but with few details about the setting. They conjectured this may be due to a lack of automaticity in spelling, which undermines students' ability to produce ideas fluently and disrupts their composition of sentences and their monitoring of the writing process.

Students seem to have increasing difficulties with spelling nowadays compared to the past (Claes & Moeyaert, 2003). A study by Herbots (2005) revealed that one out of three university students could not write a short text without making some spelling errors. In the Netherlands, we also see ominous messages in the media: 68% of first-year students undergoing teacher training fail a test in their mother tongue (Grezel, 2007). Harris et al. (2009) described a similar case. Specifically, only 25% of the students in the United States were classified as competent writers. In addition, almost one in every five first-year college students in the United States requires a remedial writing class and more than a half of new college students are unable to write a paper relatively free of errors. Most importantly, spelling errors are

not made in rarely used words; rather, basic errors in everyday words have become common in higher education.

What are the reasons for these weak written-language skills? There are many different reasons, but none of them, by itself alone, is sufficient to explain the phenomenon. Among the reasons advocated are, first of all, the priorities in language teaching. Nowadays, clusters such as grammar, spelling, and sentence composition receive less attention than in the past. Teachers' overemphasis on macro-level writing processes (i.e., planning, organization, and self-monitoring) and lack of emphasis on improving lower level skills necessary for writing (i.e., fluent handwriting, grammar, and spelling) are often reported (e.g., Hayes, 1996).

Another potential reason is the use of new communication technologies. According to Dutch teachers (Soenens, 2002) text messaging and instant messaging culture is the main 'culprit'. The impact of new communication technologies is not to be underestimated (Vlaamse Onderwijs Raad [VLOR], 2006). Due to the speed of communication, less attention is being paid to proper and appropriate language.

Third, students' spelling is not only insufficient in terms of prior knowledge and skills. In addition, students often lack the attitude and self-awareness of proficient spellers (Vrijders, Vanderswalmen, & Beeckman, 2007). The experience of teachers in higher education suggests that students cannot judge their own strengths and weaknesses correctly. For example, they make three verb errors in an e-mail but still say they almost never make spelling errors in verb spelling.

To sum up, although spelling receives a lot of research interest in the context of young students' emerging literacy skills, there is less research on older students' spelling skills and metacognitive awareness of their spelling behaviour. This chapter is focusing on the latter issue. In what follows, first we present a theory on spelling and a classification of spelling errors. The aim is to make explicit that spelling depends on phonological, morphological and lexical skills. Then, the facets of metacognition in relation to spelling are discussed. We claim that metacognitive experiences, metacognitive knowledge, and metacognitive skills are all involved in proficient spelling. Then, an empirical study is presented regarding the relations of the facets of metacognition with spelling performance and the implications for future research are discussed.

1.1. Spelling and spelling errors

Spelling depends on the appropriate translation of phonemes (sounds) into graphemes (letters) and on a proficient segmentation of graphemes (Steffler, Varnhagen, & Friesen, 1998). Transparent orthographic systems are characterised by high degree of consistency in the translation of phonemes into graphemes and are mainly governed by bi-univocal phoneme-to-grapheme correspondence (PGC) rules (Defior et al. 2009); in the bi-univocal rule there is one-to-one grapheme-to-phoneme correspondence. In contrast, opaque or deep orthographic systems, such as English, have graphemes with various corresponding phonemes and vice versa, with a large number of irregular, orthographically exceptional and inconsistent words (Verhoeven et al., 2006). French, Portuguese, and Danish are also orthographically deep languages (Verhoeven et al., 2006), whereas the Spanish orthographic code is characterised by high level of consistency (Defior et al., 2009). Spelling words that have regular phoneme-grapheme correspondences is influenced by phonological skills (Gentry, 1982; Henderson & Beers, 1980) in addition to orthographic knowledge (Templeton & Morris, 2000). Such words can be spelled by applying a phonological strategy

because of the fully consistent relationships between phonemes and graphemes (e.g., <pen>, [pen] in Dutch). The same is true for consonant clusters, although correct segmentation is crucial in this case. For example, poor spellers often omit the consonant immediately following the vowel in consonant clusters (e.g., writing <stop> instead of [stomp] in Dutch; Van Bon & Uit De Haag, 1997). In addition, some words can be spelled via reasoning by analogy because of similar phonemes (e.g., [aai] in Dutch) or letter combinations (e.g., [cht] in Dutch). If children know how to spell <maaien> and <lucht>, then they can also spell <laaiend> and <zuchten> through reasoning by analogy.

However, the orthographic depth hypothesis does not provide us with sufficient insights into the access to orthographic representations in the mental lexicon, because it is not fine-grained enough (Verhoeven et al., 2006). Learning to spell words without a regular phoneme-grapheme correspondence (i.e., morphological words) is more than merely memorizing letter sequences. Written Dutch also includes aspects of morphology that are not represented phonologically. For some words the environment of the phoneme is determinative for the manner of writing, and a rule-based approach is necessary (Keuning & Verhoeven, 2008). In order to arrive to a full understanding of the spelling processes, it is also necessary to take into account that spelling rules are not always directly governed by phonotactic rules. The reader must convert sounds to an underlying orthographic representation to which spelling adaption rules are applied, independent of the pronunciation (Verhoeven et al., 2006). In Dutch polysyllabic words there is the complicated grapheme-phoneme conversion rule, pertaining to vowel and consonant letter doubling. Long vowels in Dutch can be written in two ways, namely as two identical vowel letters as in <boom> or with a single vowel letter as in <bomen>. Dutch short vowels are represented by a single vowel letter (e.g., <bom>); in plural formation this consonant is geminated (e.g., <bommen>, i.e., "bombs") with a consonant geminate (e.g., [mm]) (see Verhoeven et al., 2006). The general rule is that the contrast between short and long vowels in open syllables is expressed by the alternation of single and double consonant letters.

Another morphological rule is also needed to write correctly (Sénéchal, Basque, & Leclaire, 2006). In Dutch word-ending devoicing is a systematic phonological process. For example, words like <bed> and <krab> are pronounced [bet] and [krap]. However, the orthography operates as though this devoicing did not take place. Writers have to use their morphological understanding of the relationship between <bed> and <bedden> and <krab> and <krabben> in order to spell accurately.

Knowledge of spelling rules appears to be critical in the ability to spell words without a regular phoneme-grapheme correspondence (Rittle-Johnson & Siegler, 1999). However, the vowel reduction rule (needed to write <bomen>), the consonant doubling rule (needed to write <bommen>) and the word-ending devoicing rule (needed to write <bed>or <krab>) are not sufficient to spell lexical words without errors. Some words (so called "lexical words") can only be learnt by memorizing them because current spelling rules do not apply to them and analogical reasoning cannot offer a solution. In the case of the graphemes [au], [ou], and [ei], [ij], one just has to know which of the two alternatives is the correct one based on a visual imprint strategy. The same applies to the spelling of foreign words or loan words such as <mail> where PGC rules cannot be applied. In this case lexical knowledge is needed.

The development of a child's abilities underlying the spelling skills has been studied within several theoretical frameworks. It is often assumed that spelling skills and strategies are acquired during the learning process following a sequence of qualitatively distinct stages in which different sources of knowledge are used (Ehri,

1992; Henderson, 1992; Templeton & Bear, 1992). All stage theories presume a transition from relying on phonological properties of words to recognizing and representing orthographic and morphological regularities and rules (Keuning & Verhoeven, 2008). However, some researchers have suggested that variability of strategy use in spelling may be better described in terms of the general learning framework of "overlapping waves" as proposed by Siegler (2000).

1.2. Metacognition and its facets

Metacognition has been introduced to describe and explain how people gain control over their learning and thinking, particularly in the case of cognitive failures (Efklides & Sideridis, 2009; Flavell, 1976) and difficulties they meet when dealing with information processing and problem solving (Brown, 1980, 1987; Desoete & Veenman, 2006; Efklides, 2001; Flavell, 1976; Montague, 1998). The model of metacognition by Nelson and Narens (1990) has served as a theoretical framework for the conceptualisation of metacognition. Three principles underlie this model: (a) mental processes are posited to function at two levels, the cognitive (or object) level and the metacognitive level, (b) the metacognitive level represents a dynamic model of the cognitive level and (c) there are two dominant functions, namely control and monitoring, which are defined in terms of the direction of flow of information between the meta-level and the object-level. It is widely accepted that metacognition influences reading, writing, and text studying (Afflerbach, 1990; Nist, Simpson, & Olejnik, 1991; Otero, Campanario, & Hopkins, 1992; Pugalee, 2001; Van Kraayenoord & Schneider, 1999; Veenman & Beishuizen, 2004; Zhang, 2001). However, before looking at the relations of metacognition with spelling, a brief description of the facets of metacognition will be made in order to highlight the complexity of notion of metacognition and its relations with cognition.

Metacognition has been described as having three facets, namely metacognitive knowledge, metacognitive experiences and metacognitive skills (Efklides, 2001, 2008; Flavell, 1979). Metacognitive knowledge has been described as the knowledge and deeper understanding of cognitive processes and products (Flavell, 1976). Children may know, for example, that they have to check their spelling after writing a text or email. According to Efklides (2008, p. 208) metacognitive knowledge is «declarative knowledge stored in the memory and comprises models of cognitive processes. It also encompasses information about people (including one's self), as well as information about tasks, strategies, and goals. Metacognitive task-knowledge involves task categories and their features, relations between tasks, as well as the ways they are processed. Metacognitive strategy-knowledge involves knowledge of multiple strategies as well as the conditions for their use (e.g., when, why and how a strategy should be used). Finally, metacognitive goal-knowledge involves knowledge of what sort of goals people pursue when confronted with specific tasks or situations.»

Another related conceptualization of metacognitive knowledge distinguishes declarative, procedural and conditional (or strategic) metacognitive knowledge. Declarative metacognitive knowledge is described as «what is known in a propositional manner» (Jacobs & Paris, 1987, p. 259) or the assertions about the world and the knowledge of the influencing factors (memory, attention and so on) of human thinking. Procedural metacognitive knowledge (also called "metacognitive strategies" or "metacognitive skills") can be described as «the awareness of processes of thinking» (Jacobs & Paris, 1987, p. 259), or «the knowledge of the methods for

achieving goals and the knowledge of how skills work and how they are to be applied. Procedural knowledge is necessary to carry out procedures in order to apply declarative knowledge and reach goals» (Harris et al., 2009, p 133). Conditional or strategic metacognitive knowledge is considered to be «the awareness of the conditions that influence learning such as why strategies are effective, when they should be applied and when they are appropriate» (Jacobs & Paris, 1987, p. 259). Conditional knowledge is critical to effective use of strategies (Harris et al., 2009). Novices have been found to possess poorer metacognitive skills than experts (Kruger & Dunning, 1999). Students doing poorly on tests predicted less accurately which questions they would get right than students doing well (Kruger & Dunning, 1999; Sinkavich, 1995)

Metacognitive experiences are «what the person is aware of and what she or he feels when coming across a task and processing the information related to it» (Efklides, 2008, p. 279). They take the form of metacognitive feelings, metacognitive judgments/estimates, and online task-specific knowledge. Metacognitive feelings are non-analytic representations of knowing states with an affective and cognitive character. The affective character of metacognitive experiences can be explained by two feedback loops. The first one is related to the outcome of cognitive processing and detects the discrepancy from the goal set. Error detection (as discrepancy from the goal) and feeling of difficulty (as lack of processing fluency) are associated with negative affect (Efklides, 2006). Metacognitive judgments/estimates include analytic and non-analytic processes, such as judgment of learning, estimate of effort expenditure, estimate of time needed or spent, but also estimate of solution correctness. When people are asked to make a judgment about their confidence there are two sources of information on which they rely, according to Efklides (2008), namely their estimate of solution/response correctness (as discrepancy of the response to the goals) and their feeling of difficulty (as cue that the response might not be correct). Metacognitive experiences, in essence, make the person aware of his or her cognition and trigger control processes that serve the pursued goal of the self-regulation process (Efklides, 2008; Koriat, 2007). However, the person can feel highly confident, even if the outcome of cognitive processing is not correct, just because the solution was produced fluently, thus endangering appropriate control decisions. This is particularly true for persons who are not aware of their ignorance (Efklides, 2008; Kruger & Dunning, 1999).

Metacognitive skills refer to «the deliberate use of strategies (procedural knowledge) in order to control cognition» (Efklides, 2008, p. 280). According to Brown (1980), executive control (or "metacognitive skills") can be seen as the voluntary control people have over their own cognitive processes. There are four basic metacognitive skills identified in the literature: prediction, planning, monitoring, and evaluation (Desoete, 2007a, 2007b; Lucangeli & Cornoldi, 1997). In spelling, test prediction refers to student activities aimed at differentiating which words will require attention and possible further action (such as words with [ei] or [ij]). Planning involves analysing the demands of the spelling exercises, retrieving relevant domain-specific knowledge and skills (e.g., when to use capitals), and sequencing of problem-solving strategies. Monitoring is related to questions such as "am I following my plan?", "should I write a word on another piece of paper to check if the spelling on the test sheet is correct?" and so on. In evaluation there is self-judging of the answer and of the process of getting to this answer.

There are different methods of assessing metacognition (Desoete, 2008; Sperling, Howard, Miller, & Murphy, 2002; Tobias & Everson, 2000; Veenman, Van

Hout-Wolters, & Afflerbach, 2006). Self-report questionnaires are frequently used to assess metacognitive knowledge and self-ratings are usual measures for metacognitive experiences (Efklides, 2008). The prospective measurement of metacognitive knowledge has to do with metacognitive judgments elicited before problem solving. Retrospective measures of metacognitive knowledge involve self-reports of strategies or metacognitive experiences after problem solving. Several studies underlined the importance of questionnaires and ratings (Busato, Prins, Hamakers, & Visser, 1998; Zimmerman & Martinez-Pons, 1990). However, Veenman et al. (2006) pointed out the limited explained variance towards learning outcomes by self-report questionnaires. Moreover, only moderate correlations were demonstrated between prospective and retrospective measurements of metacognitive knowledge (Veenman, 2003). Hence, in addition to the self-report measures, think-aloud protocols or systematic observation of behaviour can take place to measure metacognitive skills (Veenman & Elshout, 1999). These analyses were found to be very accurate, but time-consuming, techniques to assess metacognitive skills (Pressley, 2000). Recently, multi-method techniques are also being used. Often these techniques combine measurements of metacognitive experiences and/or knowledge (e.g., Dermitzaki & Efklides, 2003). For example, students are asked, before and after the processing of a task, to assess the difficulty they experience, the correctness of the solution (conceived or produced), the effort required, and to make subjective estimations about the use of problem-solving strategies. Finally, in calibration studies a comparison is made of whether the prediction before the tasks ("calibration" or comprehension paradigm) or the evaluation after a task ("performance calibration" or postdiction paradigm) corresponds with the actual performance on the task (Glenberg, Sanocki, Epstein, & Morris, 1987; Lin & Zabrucky, 1998; Schraw, Potenza, & Nebelsick-Gullet, 1993). Calibration studies are therefore most closely related to the assessment of metacognitive experiences and refer to the reliability of metacognitive experiences.

To conclude, several problems emerge in the assessment of metacognition (Artzt & Armour-Thomas, 1992). On the one hand, there seem to be various facets of metacognition (metacognitive knowledge, metacognitive experiences, and metacognitive skills) to be assessed with different techniques. On the other hand, from mathematical problem-solving research, we know that how we test influences what we find (Desoete, 2007a). The present study aimed to add some data into the debate on the value of questionnaires and ratings in combination with calibration measures to predict spelling skills during adolescence. Moreover, we aimed to investigate the relationship between spelling performance and spelling-related metacognitive knowledge, metacognitive skills, and metacognitive experiences of college students.

1.3. Spelling and metacognition

Hacker, Keener, and Kircher (2009) argued that metacognitive monitoring and control are essential components of proficient writing and spelling. Actually, Hacker et al. (2009) defined writing as applied metacognition. In writing, declarative metacognitive knowledge can take many forms. First, there is the knowledge that the writer has about himself or herself as a writer, including what knowledge they are comfortable with and which components of spelling they have not yet mastered. In addition, there is metacognitive knowledge regarding the writing task, including strategies specific to a particular writing task. Also, declarative knowledge includes the writer's knowledge about their own affect related to writing, including their self-

efficacy for writing in general and specific writing (with students overestimating or underestimating themselves), their motivation to write and how these and other affective factors may influence their writing (Harris et al., 2009). In addition, writing procedural metacognitive knowledge includes general and genre-specific strategies the writer is knowledgeable of as well of knowledge of how skills work and when they are needed and the knowledge of one's own optimal writing environment (Harris et al., 2009). Finally, conditional metacognitive knowledge includes evaluating the writing task and determining the skills and strategies needed, selecting among alternative strategies, identifying the environmental conditions that can be addressed to make writing conducive, identifying when and why to engage in different components of the writing process and so on (Harris et al., 2009).

Metacognitive experiences and metacognitive knowledge may be involved in what people are aware of when spelling such as awareness of similarly sounding but different diphthongs ('ou' or 'au' and 'ij' or 'ei') in spelling. However, Kruger and Dunning (1999) and Kruger (2002) showed that people who are unskilled in, for example, spelling suffer a dual burden. Not only do these people reach erroneous conclusions and make unfortunate choices in their spelling, but their incompetence also robs them of the metacognitive competence to realise it. For example, they found that participants scoring in the bottom quartile on a test of English grammar grossly overestimated their spelling performance and ability. Improving the spelling skills of participants and thus increasing their metacognitive competence helped them recognize the limitations of their ability to produce and recognize written documents that conform to grammar rules and facts. The skills that engender competence to write grammatical English are the very same skills necessary to evaluate competence in that domain. Because of their incompetence, individuals lack the ability to know how well one is performing, when one is likely to be accurate in judgment and when one is likely to be in error. The same skills that enable one to spell without errors are the skills necessary to recognise an error, and these are the same skills that determine if an error has been made. In short, the same knowledge that underlies spelling ability to write without errors is also the knowledge that underlies the ability to make correct estimates about one's spelling.

1.4. The present study

Research comparing different types of measures of older students' metacognition related to spelling is relatively limited; namely, few studies combine measures on metacognitive knowledge (MK), metacognitive skills (MS), and metacognitive experiences (ME). In the present study we aimed to contribute to the body of knowledge concerning the relationship between the different facets of metacognition and spelling in higher education.

1.4.1. Research questions - Hypotheses

There were three research questions:

1. At the performance level, what type of spelling errors do college students make? Is there a variability in the errors, that is, do they make basic errors (e.g., <misdrijfen> instead of <misdrijven> for "crimes") as well as rule-related errors (e.g., <kerstmis> instead of <Kerstmis> for Christmas) and memory-related errors (e.g., <copie> instead of <kopie> for "copy")? Or do they only make errors in the higher stages of spelling acquisition (only memory-related and non-spelling-related errors)? Following the stage theories, such as that of Ehri (1992), it was hypothesized that no

basic errors or rule-related errors would occur but only memory-related errors or non-spelling-related errors, because the transition from relying on phonological properties of words to recognizing and representing orthographic and morphological regularities and rules has already taken place in their earlier school years (Hypothesis 1).

2. What is the relationship between spelling performance and MK, ME, and MS? It was hypothesized that incompetent spellers will have poor MK and MS, and less accurate ME (Hypothesis 2a). In addition, it was predicted an "above-average effect", or the tendency of the average person to believe he or she is above average (Hypothesis 2b), as found by Kruger and Dunning (1999).

3. Which type of metacognitive measures can most adequately predict proficient spelling? It was hypothesized that measures of MK, MS, and ME would equally well predict spelling, because there is no available evidence to suggest that some facet of metacognition would be more accurate in predicting spelling than the others (Hypothesis 3).

2. Method

2.1. Participants

A total of 2,095 first year bachelor students participated in the study (594 boys and 1,501 girls). At the time of testing their mean age was 18.82 years (SD = 1.80). The professional and academic bachelor students were registered in colleges and universities in Ghent, Brussels and Leuven. Several fields of study were selected in order to make the sample representative. These fields were grouped to three major study fields. Specifically, the study field Education was represented by the bachelor of primary education and the bachelor of secondary education. The study field Business and Languages was represented by the bachelor of business management and the bachelor of translation studies. The study field Health Care was represented by the bachelor of audiology, occupational therapy, speech therapy, podiatry, and the bachelor of nursing. Students taking the bachelor programme in Social Work were also tested. Participants were informed about the research and consented to participate.

2.2. Instruments

2.2.1. Dictation test

To measure spelling performance of participants a Dictation test was developed. The instrument met the following three criteria: (a) The instrument should test spelling skills rather than spelling knowledge; that is, to test whether students use rules in practice (during dictation of sentences) so that the test is not limited to word recognition. (b) The instrument should reveal the type of errors students make. Hence, the sentences in the Dictation test contained several phonological, morphological, and lexical target words. The words were of low, medium and high frequency. (c) Finally, the instrument should also address spontaneous writing, that is, use of complex sentences; however spontaneous writing is not included in the data presented in the present chapter. The result was a Dictation test consisting of 12 paragraphs. Each paragraph comprised three coherent sentences.

2.2.1.1. Classification of spelling errors. Performance on the Dictation test was scored by counting the number of spelling errors. Also, the errors were classified

in four main categories based on the classification by Kleijnen (1992) and the AT-GSN[1] dictation (Gauderis, Heirman, & Vandehoof, 2004). In this way the spelling errors were both quantitatively and qualitatively analysed. The analyses of spelling errors provided a more differentiated picture of spelling performance. Examples of spelling errors are shown in Table 1.

Insert Table 1 about here

The first three categories reflected the three strategies spellers use, that is, the phonological, the morphological, and the lexical or mnemonic strategy. Category 1 was labelled "Basic Errors". It included errors in words that could be spelt by the phonological strategy. This kind of errors is often made by dyslexics or novice spellers. Category 2 was labelled "Rule-Related Errors" and regarded errors in morphological words that could be explained by spelling rules. Verb spelling in Dutch is rule-based, as is the spelling of capitals, of open and closed syllables and the spelling of hyphenated and spaced words. Category 3, called "Memory-Related Errors", involved memory of similar (e.g., <looplank> instead of <loopplank>) and lexical words. Rules are not sufficient to explain the orthography of this kind of words. In this category three types of errors were included: (a) Errors in loan words (e.g., <computer>, <fitness>); (b) Errors in similarly sounding diphthongs [ei/ij] or [ou/au] (e.g., <lijden> means "to suffer", whereas <leiden> means "to lead"); (c) Errors in adopted words, which in the past quite often had two accepted spellings, a traditional and a progressive one (e.g., <apotheek> and <apoteek>, <chronisch> and <kronisch>, <productie> and <produktie>; since 2007, however, one of them was chosen as the preferred one. Category 4, called "Non-Spelling-Related Errors", involved errors in the Dictation test that are not related to spelling. When a word was added or forgotten it was included in this category. This was also the case when a word was replaced by another word that was meaningful in the context.

The psychometric properties of the classification scheme of the dictation errors were tested on a sample of 2,089 Dutch-speaking students in Flanders (Vrijders et al., 2007). The internal consistency for this test was very satisfactory (Cronbach's $\alpha = .89$).

2.2.2. Metacognition questionnaires

Two questionnaires were created for the present study, namely a prospective and a retrospective metacognition questionnaire.

2.2.2.1. The Prospective Metacognition Questionnaire (PMQ). The PMQ assessed student's MK of the self as speller and student's use of MS in spelling, namely checking of spelling.

The MK of the self as speller was measured as follows. Participants were required to rate their own spelling skills, as compared to peers, on a 7-point scale ranging from 1 (very bad) to 7 (very good).

They were also required to report the kind of spelling difficulties they had by selecting one of the spelling categories, such as verb spelling, English verbs, use of apostrophe and dieresis, use of capital letters, memory-related words (e.g., [c/k] or [ij/ei]), and writing words with/without hyphenation (e.g., "semi-" or "semi…"). Their responses were on a 3-point scale ranging from 1 (many difficulties) to 3 (not many difficulties).

[1] AT-GSN stands for "Algemene Toets Gevorderde Spelling van het Nederlands" (Ghesquière, 1998).

The use of MS was assessed with one item by asking participants how often they read through their own texts, letters, and e-mails to check for any spelling errors. Responses were on a 5-point rating scale, varying from 1 (never) to 5 (always).

The PMQ was tested in previous studies in order to determine its reliability. Test-retest correlation of .81 ($p < .01$) was found.

2.2.2.2. The Retrospective Metacognition Questionnaire (RMQ). The RMQ assessed metacognitive experiences, namely feeling of confidence (FOC; metacognitive feeling) and estimate of the number of spelling errors (EOSE; metacognitive judgment). Also, a score showing the correspondence between the ratings of FOC and actual performance was calculated as well as a calibration index using the EOSE.

To assess the feeling of confidence (FOC) participants were asked to look at 10 words of the Dictation test. They were asked to rate how sure they were for the spelling of each word on a 4-point rating scale, ranging from 1 (I am absolutely sure it is incorrect) to 4 (I am absolutely sure it is correct).

Participants might be sure that their spelling was correct whereas they had spelled the word incorrectly or vice versa. To assess the correspondence between FOC and actual spelling performance the ratings of FOC that fully corresponded to the actual spelling performance (e.g., the response "I am absolutely sure I wrote the word correctly" and correct answer and the response "I am absolutely sure I did not write the word correctly" and incorrect answer) received 2 points; the response "I am sure I wrote (did not write) the word correctly" and corresponding spelling performance received 1 point, while the response "I am absolutely sure I wrote (did not write) the word correctly" and not corresponding spelling performance received a 0 point. Cronbach's alpha for the scores was .87.

To assess the estimate of the number of spelling errors (EOSE), participants were asked to estimate the number of errors they had made (e.g., six errors) in three randomly selected paragraphs of the Dictation test (paragraphs 10, 11, and 12).

To assess the students' calibration index between the actual performance score and the estimated score of their spelling performance (e.g., "If I lose 0.5 point for each error, I think I will score 7/10 on this paragraph for the six errors I have made" the score participants attributed to their performance (e.g., 7 out of 10) was subtracted from their actual performance score (e.g., 8 out of 10 for four errors they made).

The PMQ and RMQ were tested in a pilot study in order to determine their reliability for measuring individual differences in spelling and metacognition. Gutmann's split-half and Spearman-Brown's coefficients were .70 and .72, respectively. Furthermore, all variables were normally distributed and test-retest correlations of .85 ($p < .001$) were found.

2.3. Procedure

Participants took the Dictation test during the first semester of the academic year. The test was dictated in the following way. First, a paragraph was read aloud twice. Then students had to write down on a sheet of paper the paragraph that was dictated in sentence parts. After dictating all 12 paragraphs the complete dictation test was read aloud once more to give the students the opportunity to check for mistakes. The PMQ was completed before the Dictation test. The RMQ was completed after the Dictation test. All sessions were carried out collectively in classrooms, after assuring good testing conditions.

3. Results

3.1. Spelling performance

On all paragraphs of the Dictation test students made an average of 24 spelling errors (SD = 13) in 410 words. Concerning the Basic Errors category, 637 students (30.5%) made no errors at all, 571 (27%) made one error and 348 (16.7%) made two errors (M = 1.95, SD = 3.25), that is, there was a downward trend with the increase in the number of errors. This trend did not occur with the Rule-Related Errors category. In this case there was a normal distribution in relation to the number of errors (M = 15.74, SD = 6.79), that is, the number of students rose in direct proportion to the number of errors until a peak was reached with 150 students (7.2%) who made 13 errors; after that peak, there was a decrease in the number of students who made such errors. In the case of the Memory-Related Errors category, the errors were less than in the case of Rule-Related Errors category (M = 1.63, SD = 1.70). Finally, concerning the Non-Spelling-Related Errors category, students made a relatively large number of non-spelling-related errors (M = 4.82, SD = 5.47).

Our main focus, however, was on the spelling of relatively "incompetent" participants, which we defined, in line with Kruger and Dunning (1999), as those whose test score fell in the bottom quartile (n = 520); their mean errors were 41.29 (SD = 13. 59), whereas college students in the 3rd quartile made 25.11 errors (SD = 2.78), students in the 2nd quartile made 18.65 (SD = 2.02) errors, and students in the top quartile made 12.01 (SD = 2.94). It is worth noting that incompetent spellers made all kinds of errors, but mainly rule-related errors. Specifically, they made a mean number of 4.61 basic errors (SD = 5.37), 23.83 rule-related errors (SD = 6.63), 2.46 memory-related errors (SD = 2.78), and 10.14 non-spelling-related errors (SD = 8.16).

The very competent spellers (in the top quartile) also made mainly rule-related errors. Specifically, they made a mean number of 0.43 basic error (SD = 0.65), 9.00 rule-related errors (SD = 2.57), 1.00 memory-related error (SD = 0.76), and 1.58 non-spelling-related errors (SD = 1.32).

The MANOVA with group (bottom quartile, 3rd quartile, 2nd quartile, top quartile) as independent variable and the four types of spelling errors as dependent variable was significant, Wilks's lambda = .27, $F(12, 5511.39) = 292.47$, $p < .001$, partial $\eta^2 = 35$. There were differences between groups for basic errors, $F(3, 2086) = 225.19$, $p < .001$, partial $\eta^2 = .25$, for rule-related errors, $F(3, 2086) = 1231.28$, $p < .001$, partial $\eta^2 = .64$, for memory-related errors, $F(3, 2086) = 75.61$, $p < .001$, partial $\eta^2 = .09$, and for non-spelling-related errors, $F(3, 2086) = 381.66$, $p < .001$, partial $\eta^2 = .35$. For a summary of the mean number of errors (M) and the SD per error category, see Table 2.

Insert Table 2 about here

3.2. Metacognitive knowledge and metacognitive skills

The Prospective Metacognition Questionnaire (PMQ) was used to assess student's MK of the self as speller and student's use of MS in spelling, namely checking of spelling.

Overall, in our sample students rated themselves as above medium spellers (M = 4.30, SD = 0.95). Approximately 40.3% of the students in the sample considered

themselves almost as good as their peers as far as their spelling skills were concerned (score 4), whereas 34.4% thought they were slightly better compared to their peers (score 5). In addition 6.9% believed that they were better spellers than their peers (score 6), and 0.6% thought they were much better than their peers (score 7). Only 12.2% of the students rated themselves as doing rather worse than their peers (score 3), 3.4% rated themselves as worse than their peers (score 2), and 0.6% admitted performing much worse than their peers when it came to spelling (score 1).

The PMQ also included a rating of the difficulties students had with spelling. Students reported difficulties with verb spelling (M = 2.30, SD = 0.72), English verbs (M = 2.09, SD = 1.28), the use of apostrophe and dieresis (M = 2.18, SD = 0.63), the use of capital letters (M = 2.64, SD = 0.55), memory-related words (M = 2.53, SD = 0.64), and writing words with/without hyphenation (M = 1.95, SD = 0.59). These are all rule- and memory-related errors, and this finding suggests that the difficulties reported correspond to the kind of errors most often made in the Dictation test.

In addition the ANOVA with group (bottom quartile, 3rd quartile, 2nd quartile, top quartile) as independent variable and MK of the self as speller as dependent variable was significant, $F(3, 2074) = 130.19$, $p < .001$, partial $\eta^2 = .16$. Post hoc analyses revealed that all groups significantly differed from each other. Participants in the bottom quartile rated themselves as less competent (M = 3.76, SD = 1.02) than students in the 3rd quartile (M = 4.18, SD = 0.86) and students in the 2nd (M = 4.46, SD = 0.81), or top quartile (M = 4.79, SD = 0.79).

The PMQ also included an assessment of MS. Participants had to rate how often they read through their own tests, letters, and e-mails to check for spelling errors. The mean number of checking for spelling errors was 2.85 (SD = 0.96). Approximately 42.6% of students in the sample stated that they usually checked the material they were writing themselves, while 22.3% claimed that they always checked it. Finally, 2.1% of the students admitted that they never and 9.7% that they very seldom checked their spelling. The other 23.3% of the students rated that they sometimes checked the material they were writing themselves.

The ANOVA with group (bottom quartile, 3rd quartile, 2nd quartile, top quartile) as independent variable and use of MS as dependent variable was significant, $F(3, 2067) = 25.36$, $p < .001$, partial $\eta^2 = .04$. Post hoc analyses revealed that students in the bottom quartile checked their texts less (M = 2.51, SD = 0.99) than peers in the 2nd quartile (M = 2.77, SD = 0.95) and peers in the top quartile (M = 3.01, SD = 0.89). Students in the 3rd quartile (M = 2.63, SD = 1.01) differed from peers in the top quartile. Students in the 2nd quartile differed from students in the bottom and top quartile.

3.3. Metacognitive experiences

In response to a 10-word list the students were asked to report retrospectively, after the Dictation test, their FOC; correspondence of FOC with actual spelling performance was further investigated. Also, based on the three paragraphs (i.e., paragraphs 10, 11, and 12) of the Dictation test students were asked to report their EOSE; a calibration index between actual and estimated performance scores was also calculated.

3.3.1. Feeling of confidence (FOC)

There were three words that were written incorrectly by a high number of students; specifically, <gecanceld>, <lijdt>, and <antisociale> (see Table 3). These

words were most frequently misspelled without the students realising it. A total score of FOC was firstly computed for all ten words together for each student. The mean total FOC score for the whole sample was M = 20.84 (SD = 3.64). The ANOVA with the sum score as dependent variable and the group (bottom quartile, 3rd quartile, 2nd quartile and top quartile) as independent variable was significant, $F(3, 2036) = 122.18$, $p < .001$, partial $\eta^2 = .15$. Post hoc analyses revealed that students in the bottom quartile had a significantly lower FOC (M = 18.95. SD = 3.46) compared to students in the 3rd quartile (M = 20.13, SD = 3.48), or to students in the 2nd quartile (M = 21.57, SD = 3.40), and to high proficient spellers in the top quartile (M = 22.72, SD = 3.05). Students in the 3rd quartile had lower FOC compared to students in the 2nd or top quartile, while students in the top quartile were more confident than all other students.

Insert Table 3 about here

3.3.2. Correspondence of feeling of confidence with actual spelling performance

There was a significant correlation between FOC and the number of spelling errors, $r = -.38$, $p < .001$. The correspondence was also significant for FOC and basic spelling errors, $r = -.20$, $p < .001$, FOC and rule-related errors, $r = -.37$, $p < .001$, FOC and memory-related errors, $r = -.13$, $p < .001$, and for FOC and non-spelling-related errors, $r = -.27$, $p < .001$.

3.3.3. Estimate of number of spelling errors (EOSE)

Concerning the EOSE in the three paragraphs of the Dictation test, it was observed that the students usually gave a higher estimate of errors than they actually had made in the three paragraphs. Over 60% of the students thought that in each paragraph, they were making two or fewer errors while, on average, they made one error in paragraph 10 and 11, and two errors in paragraph 12. For the overall results see Table 4.

Insert Table 4 about here.

To look for differences in EOSE between the groups of students as regards their spelling performance (quartiles), a MANOVA was conducted with the EOSE scores in the three paragraphs as dependent variables and group (bottom quartile, 3rd quartile, 2nd quartile, top quartile) as independent variable. The multivariate effect was significant, Wilks's lambda = .85, $F(9, 5042.85) = 37.69$, $p < .001$, partial $\eta^2 = .05$. Students in the bottom quartile estimated that they made more errors compared to students in the other quartiles on paragraph 10, $F(3, 2074) = 55.07$, $p < .001$, partial $\eta^2 = .07$, on paragraph 11, $F(3, 2074) = 108.19$, $p < .001$, partial $\eta^2 = .14$, and on paragraph 12, $F(3, 2074) = 61.77$, $p < .001$, partial $\eta^2 = .08$. Specifically, the students in the bottom quartile estimated that they made more mistakes in paragraph 10 (M = 1.87, SD = 1.59), in paragraph 11 (M = 2.92, SD = 1.65), and in paragraph 12 (M = 3.03, SD = 2.17) than students in the top quartile, whereas students in the top quartile estimated that they had made few mistakes in paragraph 10 (M = 0.94, SD = 1.01), in paragraph 11 (M = 1.40, SD = 1.19), and in paragraph 12 (M = 1.75, SD = 1.75).

3.3.4. Calibration index

To calculate the calibration index and to see if the calibration discrepancy was larger in spellers within the bottom quartile (Kruger & Dunning, 1999), we took the difference between the actual performance score and the performance score estimated by the student (see Figure 1) for each of the three paragraphs of the Dictation test.

Insert Figure 1 about here

For paragraph 10, 38.40% of the students had a calibration index of 0, that is, perfect calibration, whereas for paragraph 11 and for paragraph 12, 27% and 25.10%, respectively had perfect calibration. To compare proficient spellers with below average spellers, a MANOVA was conducted on the calibration indices. The MANOVA with the calibration indices in the three paragraphs as dependent variables and group (bottom quartile, 3rd quartile, 2nd quartile, top quartile) as independent variable showed a significant multivariate effect, Wilks's lambda = .98, $F(9, 5042.85) = 4.04$, $p < .001$, partial $\eta^2 = .01$. However, students in the bottom quartile did not differ significantly in calibration from the other groups on paragraph 10, $F(3, 2074) = 0.39$, ns, or on paragraph 12, $F(3, 2074) = 1.96$, ns. They only differed significantly on paragraph 11, $F(3, 2074) = 8.21$, $p < .001$, partial $\eta^2 = .01$. Specifically, the students in the bottom quartile were better calibrated in paragraph 11 ($M = 0.22$, $SD = 1.00$) than the other students who tended to underestimate their spelling performance even more. They differed from students in the 3rd quartile ($M = 0.42$, $SD = 0.89$) and students in the 2nd quartile ($M = 0.41$, $SD = 0.73$) and from students in the top quartile ($M = 0.45$, $SD = 0.61$). Students in the bottom quartile estimated 2.92 errors ($SD = 1.65$). Thus, their estimated spelling score was $10 – 2.92/2 = 8.54$, whereas their actual spelling score was 8.76 out of 10 (SD = 0.73). Post hoc analyses revealed that students in the 3rd quartile (actual score 9.24, $SD = 0.51$; estimated score 8.82, $SD = 0.79$), 2nd quartile (actual score 9.49, $SD = 0.42$; estimated score 9.09, $SD = 0.64$), or top quartile (actual score 9.75, $SD = 0.32$; estimated score 9.30/10, $SD = 0.60$) did not differ from each other but they did differ from students in the bottom quartile. These data reveal that incompetent spellers underestimated their spelling skills less compared to peers with better spelling skills.

3.3.5. Relations between MK, MS, and ME

To investigate the relations between MK, MS and ME, Pearson correlations were computed on the respective scores (see Table 5). Table 5 also shows the correlations between the facets of metacognition and the actual spelling performance.

Insert Table 5 about here

Most metacognitive measures were significantly intercorrelated. Low, but significant, and positive correlations between MK of the self as speller and FOC ratings were found. Moreover, there was a low, but significant, and positive correlation between the MS (i.e., checking for spelling errors) rating assessed prospectively and the FOC rating assessed retrospectively. There was also a high and significant positive correlation between the EOSE rating and the calibration index, which is understandable since the calibration index includes the EOSE. Moreover, there were moderate and negative correlations of MK, MS, and FOC with EOSE in the three paragraphs. The correlations between MK of the self as speller and MS with the calibration index were negative. As regards actual performance, the number of errors actually made were negatively correlated with MK of the self as speller and

MS, although the latter correlation was low, and with FOC. The relation with EOSE was positive and moderate.

3.4. Can metacognition predict proficient spelling?

3.4.1. Can prospective metacognitive measures predict spelling performance?

A regression analysis was performed on spelling performance as dependent variable with MK of the self as speller and MS entered simultaneously as predictor variables. The MK of the self as speller and MS predicted 16% of the variance of spelling performance, and MK was a stronger predictor, $\beta = -.375$, $t = -18.229$, $p < .001$, than MS, $\beta = -.073$, $t = -3.531$, $p < .001$. The negative sign suggests that the higher the MK and MS, the less the errors made.

3.4.2. Can retrospective metacognitive measures predict spelling performance?

A regression analysis was performed on spelling performance as dependent variable with the retrospectively assessed word-specific FOC scores entered simultaneously as predictor variables (see Table 6). This treatment was dictated by the fact that the various words represented different categories of spelling errors and word-specific FOC was assumed to represent a more accurate predictor than an undifferentiated overall FOC score. The FOC ratings predicted 23.8% of the variance of spelling performance. Of the various predictors, FOC ratings on the words <Oost-Vlamingen>, <hondenweer>, <geleide>, <ondervraagd>, <vind>, and <georganiseerd> were significant. These words are all words that belong to the Rule-Related Errors category.

Insert Table 6 about here

In addition, a regression analysis was conducted on spelling performance as dependent variable with the EOSE scores in the three paragraphs entered simultaneously as predictor variables. The R^2 was .157 and $F(3, 2074) = 130.16$, $p < .001$. All three predictors were significant. Specifically, for paragraph 10, $\beta = .110$, $t = 3.938$, $p < .001$; for paragraph 11, $\beta = .232$, $t = 7.874$, $p < .001$; and for paragraph 12, $\beta = .112$, $t = 4.228$, $p < .001$.

Finally, a regression analysis was conducted on spelling performance as dependent variable with the three calibration indices in the three paragraphs as predictor variables. The R^2 was .028 and $F(3, 2074) = 20.71$, $p < .001$. However, only the calibration index for paragraph 10, $\beta = .116$, $t = 4.604$, $p < .001$, and for paragraph 11, $\beta = -.178$, $t = -6.971$, $p < .001$, were significant predictors of spelling performance. What is worth noting is that the calibration index for paragraph 10 positively predicted spelling performance, whereas for paragraph 11 negatively. This reflects the more accurate calibration that was detected in paragraph 10 and the less accurate in paragraph 11. In the latter case students tended to underestimate their performance. In paragraph 12 there was a very accurate calibration which probably did not leave score variability to sufficiently predict performance.

4. Discussion

Following the stage theories, such as that of Ehri (1992), it was hypothesized that no basic errors or rule-related errors would occur in college students but that only memory-related errors or non-spelling-related errors, because the transition from

relying on phonological properties of words to recognizing and representing orthographic and morphological regularities and rules has already taken place in their earlier school years (Hypothesis 1). The findings of the present study do not confirm the proposed stage hypothesis. Since both weak and proficient spellers made several types of errors, and since they made especially rule-related errors a stage paradigm is not tenable.

Moreover, the present study revealed that quite a large number of college students made spelling errors. Three words were misspelled with striking frequency, namely <gecanceld>, <lijdt>, and <antisociale>. Half the students were unable to assess themselves correctly (correspondence score) when it came to the spelling of these words. For the spelling of the word <hondenweer>, the correspondence between FOC rating and actual performance appeared completely wrong in two-fifths of the cases. Writing of words like <firma's>, <vind>, and <georganiseerd> was estimated as "definitely correct" by two-fifths, two-thirds and two-fifths of cases, respectively, although these words were spelled correctly by more then four out of five students. A potential explanation for the good spelling performance with these words is that they are frequently recurring words in the Dutch language. The two past participles are regular weak verbs which have a clear conjugation rule, namely the "t'kofschip" rule (mnemonic for voiceless consonants of Dutch; [ge] + stem + [d], [ge] + stem + [t] when the stem ends in a consonant contained in the mnemonic "t'kofschip"). The conjugated verb <vind> drops the final [t] because of the [je] after the finite form. This is a rule that is already taught in primary school. This also applies to the plural of nouns that end in a consonant preceded by one grapheme, such as <firma's>.

As to Hypothesis 2a (incompetent spellers have poor MK and MS and less accurate ME), in line with Hacker et al. (2009) the present study revealed that students who spell well and, therefore, make few errors (i.e., in the top quartile) also appear to perceive themselves as competent spellers, that is, their MK of the self as speller represents their competence; they also assess themselves as using more often MS and have higher FOC after the Dictation test than students of the other quartiles. Concerning spelling performance, participants in the bottom quartile rated themselves as less competent spellers compared to students in the other quartiles. Therefore, in line with Harris et al. (2009) and Zimmerman and Risemberg (1997), spelling performance was related to MK of the self as speller and use of MS. Moreover, in line with Efklides (2002), ME, such as FOC and EOSE, were also found to be related to spelling performance. Students in the bottom quartile rated themselves lower compared to all other groups and they had a lower feeling of confidence than students in the other quartiles.

To investigate (Hypothesis 2b) if the calibration discrepancy was bigger in spellers within the bottom quartile (Kruger & Dunning, 1999) compared to spellers in the top quartile, the difference between the actual score on spelling and the spelling score estimated by the students was computed. Students differed significantly only on paragraph 11 of the Dictation test. However, in contrast with the Kruger and Dunning (1999) data, the students in the bottom quartile in this study did not overestimate themselves more than proficient spellers. Moreover, there was only a very weak prediction of the variance in spelling performance by calibration indices. It can be concluded that, in line with Desoete (2008) and Desoete and Roeyers (2006), the way in which calibration is assessed and, especially, the facet of metacognition that is involved in the computation of the calibration index (FOC vs. EOSE), are important. Calibration might be a time-saving assessment technique. It is not, however, a good way to predict spelling performance in college students.

Moreover Hypothesis 3 stated that measures of MK, MS, and ME would equally well predict spelling. The present study revealed that all three facets of metacognition were significantly correlated with performance. Specifically, ratings of MK of the self as speller and use of MS predicted about one sixth of the variance of spelling performance. Also FOC ratings predicted about one fourth of the same variance. Finally, EOSE predicted about one sixth of the same variance and in all three paragraphs of the Dictation test EOSE predicted proficient spelling. However, calibration indices only predicted about one thirtieth of the spelling performance. Perhaps, for FOC ratings the choice of the words on which FOC was reported was important. Higher FOC rating on <Oost-Vlamingen>, <geleide>, <ondervraagd>, and <georganiseerd>, in particular, predicted making few spelling errors, whereas the opposite was true for the FOC rating on <hondenweer> that positively predicted spelling performance.

The present study had a number of limitations. Since we opted for a large group of students, we could not incorporate other kinds of measures of metacognition such as think-aloud protocols or online recording (see also Veenman, 2003) into our study. Follow-up research using those techniques to assess metacognitive skills is certainly to be recommended. Furthermore, we studied only a limited number of aspects of the three facets of metacognition, namely MK of the self as speller, use of MS such as checking for errors, FOC, and EOSE, because these aspects have been shown by clinical experience to be frequently disturbed in poor spellers. Of course, follow-up research is necessary into other MS (such as prediction, planning and monitoring skills) and into other aspects of the broader metacognition related to spelling. It was certainly not the intention to deny the importance of these aspects, but merely to make a start with research into an instrument that could assess (screen) the metacognition of spellers, in order to be able subsequently to research into those who underperform in terms of spelling and/or metacognition. In addition, the difference between our data and the data of Kruger and Dunning (1999) might be caused by our calibration instrument and by the rather limited number of errors that were taken into account for the calibration measure in this study. Additional research is needed to investigate whether another instrument might lead to other conclusions.

Nevertheless, based on these studies, we can conclude that metacognitive knowledge, skills and experiences are successful in predicting part of the variance in spelling performance. Certainly in the case of students with problems, it may be advisable to examine these metacognitive facets. There is evidence that metacognitive knowledge and skills can give valuable information on the spelling skills of college students. We suggest that researchers who are interested in students' skills should use multiple-method designs, including ratings, questionnaires and think aloud protocols.

References

Afflerbach, P. (1990). The influence of prior knowledge on expert readers' main idea construction strategies. Reading Research Quarterly, 25, 31-46.

Artzt, A. F., & Armour-Thomas, E. (1992). Development of a cognitive-metacognitive framework for protocol analysis of mathematical problem solving in small groups. Cognition and Instruction, 9, 137-175.

Brown, A. L. (1980). Metacognitive development and reading. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), Theoretical issues in reading comprehension (pp. 453-481). Hillsdale, NJ: Erlbaum.

Brown, A. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanisms. In F. Reiner & R. Kluwe (Eds.), Metacognition, motivation, and understanding (pp. 65-116). Hillsdale, NJ: Erlbaum.

Busato, V. V., Prins, F. J., Elshout, J. J., & Hamaker, C. (1998). Learning styles: A cross-sectional and longitudinal study in higher education. British Journal of Educational Psychology, 68, 427-441.

Carlisle, J. F. (1994). Morphological awareness, spelling, and story writing: Possible relationships for elementary-age children with and without learning disabilities. In N. C. Jordan & J. Goldsmith-Philips (Eds.), Learning disabilities: New directions for assessment and intervention (pp. 123-145). Boston: Allyn & Bacon.

Claes, B., & Moeyaert, S. (2003). Opstelling en aanzet tot normering van een instaptoets spelling voor beginnende logopediestudenten [Setting up of and encouragement to standardise an entry test in spelling for new logopaedics students]. Tijdschrift voor Logopedie & Audiologie, 33(4), 157-166.

Defior, S., Jimenez-Fernandez, G., & Serrano, F. (2009). Complexity and lexical effects on the acquisition of Spanish spelling. Learning and Instruction, 19, 55-65.

Dermitzaki, I., & Efklides, A. (2003). Goal orientations and their effect on self-concept and metacognition in adolescence. Psychology: The Journal of the Hellenic Psychological Society, 10, 214-227.

Desoete, A. (2007a). Evaluating and improving the mathematics teaching-learning process through metacognition. Electronic Journal of Research in Educational Psychology, 5(3), 705-730.

Desoete, A. (2007b). Students with mathematical disabilities in Belgium: From definition, classification and assessment to STICORDI device. In T. E. Scruggs & M. A. Mastropieri (Eds.), Advances in learning and behavioural disabilities: Vol. 20. International perspectives (pp. 181-222). Oxford, England: Elsevier.

Desoete, A. (2008). Multi-method assessment of metacognitive skills in elementary school children: How you test is what you get. Metacognition Learning, 3, 189-206.

Desoete, A., & Roeyers, H. (2006). Metacognitive macroevaluations in mathematical problem solving. Learning and Instruction, 16, 12-25.

Desoete, A., & Veenman, M. (Eds.). (2006). Metacognition in mathematics education. New York: NOVA.

Efklides, A. (2001). Metacognitive experiences in problem solving: Metacognition, motivation, and self-regulation. In A. Efklides, J. Kuhl, & R. M. Sorrentino (Eds.), Trends and prospects in motivation research (pp. 297-323). Dordrecht, The Netherlands: Kluwer.

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? Educational Research Review, 1, 3-14.

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13, 277-287.

Efklides, A., & Sideridis, G. D. (2009). Assessing cognitive failures. European Journal of Psychological Assessment, 25, 69-72.

Ehri, L.C. (1992). Review and commentary: Stages of spelling development. In S. Templeton, & D. R. Bear (Eds.), Development of orthographic knowledge and the foundations of literacy: A memorial festschrift for Edmund H. Henderson (pp. 307-332). Hillsdale, NJ: Erlbaum.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), The nature of intelligence (pp. 231-235). Hillsdale, NJ: Erlbaum.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. American Psychologist, 34, 906-911.

Gauderis, K., Heirman, E., & Vandenhoof, T. (2004). Normering van AT-GSN, TTR en CDR-5 bij leerlingen van het zesde jaar Algemeen Secundair Onderwijs [Standardisation of AT-GSN, TTR and CDR-5 among sixth-year students in General Secondary Education]. Unpublished doctoral thesis, University College Arteveldehogeschool, Ghent, Belgium.

Gentry, J. R. (1982). An analysis of developmental spelling in GNYS AT WRK. The Reading Teacher, 36, 192-200.

Ghesquière, P. (1998). Algemene toets gevorderde spelling van het Nederlands (AT-GSN), verantwoording en handleiding. Rapport van een specialisatiejaar: onderzoek AT-GSN-dictee [General Test in Dutch Advanced Spelling (AT-GSN), justification and manual. Report of a specialisation year: study on AT-GSN dictation]. Unpublished manuscript, University of Leuven, Belgium.

Glenberg, A. M., Sanocki, T., Epstein, W., & Morris, C. (1987). Enhancing calibration of comprehension. Journal of Experimental Psychology: General, 116(2), 119-136.

Grezel, J. E. (2007). Die spelfouten maken toch niets uit? Zorgen over taalvaardigheid van studenten [So those spelling errors don't matter? Concerns about students' language skills]. Onze Taal, 76, 148-151.

Hacker, D. J., Keener, M. C., & Kircher, J. C. (2009). Writing is applied metacognition. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), Handbook of metacognition in education (pp. 154-172). New York: Routledge.

Harris, K. R., Graham, S., Brindle, M., & Sandmel, K. (2009). Metacognition and children's writing. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), Handbook of metacognition in education (pp. 131-153). New York: Routledge.

Hayes, J. (1996). A new framework for understanding cognition and affect in writing. In M. Levy & S. Ransdell (Eds.), The science of writing: theories, methods, individual differences, and applications (pp. 1-27). Mahwah, NJ: Erlbaum.

Henderson, E. H. (1992). The interface of lexical competence and knowledge of written words. In S. Templeton & D. R. Bears (Eds.), Development of orthographic knowledge and the foundations of literacy: A memorial festschrift for Edmund H. Henderson (pp. 1-30). Hillsdale, NJ: Erlbaum.

Henderson, E. H., & Beers, J. W. (1980). Developmental and cognitive aspects of learning to spell: A reflection of word knowledge. Newark, DE: International Reading Association.

Herbots, K. (2005, October, 27). Een op de drie studenten kan niet zonder fouten schrijven [One in every three students cannot write without mistakes]. De Morgen. Retrieved July 6, 2009, from the World Wide Web: http://www.standaard.be/Artikel/Detail.aspx?artikelId=dmf27102005_002

Jacobs, J. E., & Paris, S. G. (1987). Children's metacognition about reading: issues in definition, measurement, and instruction. Educational Psychologist, 22 (3&4), 255-278.

Keuning, J., & Verhoeven, L. (2008). Spelling development throughout the elementary grades: The Dutch case. Learning and Individual Differences, 18, 459-470.

Kleijnen, R. (1992). Hardnekkige spellingfouten. Een taalkundige analyse [Persistent spelling mistakes. A Linguistic Analysis]. Lisse, The Netherlands: Swets & Zeitlinger.

Kruger, J. (2002). Unskilled and unaware – but why? A reply to Krueger and Mueller. Journal of Personality and Social psychology, 82, 189-192.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. Journal of Personality and Social Psychology, 77, 1121-1134.

Koriat, A. (2007). Metacognition and consciousness. In P. D. Zelazo, M. Moscovitch, & E. Thompson (Eds.), The Cambridge handbook of consciousness (pp. 289-325). Cambridge, UK: Cambridge University Press.

Landed, K., Thaler, V., & Reitsma, P. (2008). Spelling pronunciations: Transforming irregularity into regularity. Learning and Instruction, 18, 295-308.

Lin, L.-M., & Zabrucky, K. M. (1998). Calibration of comprehension: research and implications for education and instruction. Contemporary Educational Psychology, 23, 345-391.

Lucangeli, D., & Cornoldi, C. (1997). Mathematics and metacognition: What is the nature of the relationship? Mathematical Cognition, 3, 121-139.

Montague, M. (1998). Research on metacognition in special education. In T. E. Scruggs & M. A. Mastropieri (Eds.), Advances in learning and behavioural disabilities (pp.151-183). Greenwich, CT: JAI.

Nelson, T. O., & Narens, L. (1990). Metamemory: A theoretical framework and new findings. The Psychology of Learning and Motivation, 23, 125-141.

Nist, S. L., Simpson, M. L., & Olejnik, S. (1991). The relation between self-selected study processes and test performance. American Educational Research Journal, 28, 849-874.

Otero, J., Campanario, J.M., & Hopkins, K.D. (1992). The relationship between academic achievement and metacognitive comprehension monitoring ability of Spanish secondary school students. Educational and Psychological Measurement, 52, 419-430.

Pressley, M. (2000). Development of grounded theories of complex cognitive processing: Exhaustive within- and between study analyses of thinking-aloud data. In G. Schraw & J. C. Impara (Eds.), Issues in the measurement of metacognition (pp. 262-296). Lincoln, NE: Buros Institute of Mental Measurements.

Pugalee, D. K. (2001). Writing, mathematics, and metacognition: Looking for connections through students' work in mathematical problem solving. School Science and Mathematics, 101, 236-245.

Rittle-Johnson, B., & Siegler, R. S. (1999). Learning to spell: Variability, choice and change in children's strategy use. Child Development, 70, 332-348.

Savolainen, H., Ahonen, T., Aro, M., Tolvanen, A., & Holopainen, L. (2008). Reading comprehension, word reading and spelling as predictors of school achievement and choice of secondary education, Learning and Instruction, 18, 201.

Schraw, G., Potenza, M. T., & Nebelsick-Gullet, L. (1993). Constraints on the calibration of performance. Contemporary Educational Psychology, 18, 455-463.

Sénéchal, M., Basque, M.T., & Leclaire, T. (2006). Morphological knowledge as revealed in children's spelling accuracy and reports of spelling strategies. Journal of Experimental Child Psychology, 95, 231-254.

Siegler, R. S. (2000). The rebirth of children's learning. Child Development, 71, 26-35.

Sinkavich, F. J. (1995). Performance and metamemory: Do students know what they don't know? Instructional Psychology, 22, 77-87.

Soenens, D. (2002, May 8). Een nul voor Nederlands [They failed Dutch]. Knack. Retrieved July 6, 2009, from the World Wide Web: http://makr.knack.be/archief/ShowArtikel.do?printen=ja&artikelId=44911

Sperling, R. A., Howard, B. C., Miller, L. A., & Murphy, C. (2002). Measures of children's knowledge and regulation of cognition. Contemporary Educational Psychology, 27, 51-79.

Steffler, D. J., Varnhagen, C. K., & Friesen, C. K. (1998). There are more to children's spelling than the errors they make: Strategic and automatic processes for one-syllable words. Journal of Educational Psychology, 30, 492-505.

Templeton, S., & Bear, D. R. (Eds.). (1992). Development of orthographic knowledge and the foundations of literacy: A memorial festschrift for Edmund H. Henderson. Hillsdale, NJ: Erlbaum.

Templeton, S., & Morris, D. (2000). Spelling. In M. L. Kamil, P. B. Mosenthal, D. P. Pearson, & R. Barr (Eds.), Handbook of reading research (pp. 525-543). Hillsdale, NJ: Erlbaum.

Tobias, S., & Everson, H. (2000). Assessing metacognitive knowledge monitoring. In G. Schraw & J. C. Impara (Eds.), Issues in the measurement of metacognition (pp. 147-222). Lincoln, NE: Buros Institute of Mental Measurements.

Van Bon, W. H. J., & Uit De Haag, I. J. C. A. F. (1997). Difficulties with consonants in the spelling and segmentation of CCVCC pseudowords: Differentiation among Dutch first graders. Reading and Writing: An Interdisciplinary Journal, 9, 363-386.

Van Kraayenoord, C. E., & Schneider, W. E. (1999). Reading achievement, metacognition, reading self-concept and interest: A study of German students in grade 3 and 4. European Journal of Psychology of Education, 14, 305-324.

Veenman, M. V. J. (2003, August). The assessment of metacognitive skills: What can be learned from multi-method designs? Paper presented at the 10th Conference of the European Association for Research on Learning and Instruction, Padova, Italy.

Veenman, M. V. J., & Beishuizen, J. J. (2004). Intellectual and metacognitive skills of novices while studying texts under conditions of text difficulty and time constraint. Learning and Instruction, 14, 619-638.

Veenman, M. V. J., & Elshout, J. J. (1999). Changes in the relation between cognitive and metacognitive skills during the acquisition of expertise. European Journal of Psychology of Education, XIV, 509-523.

Veenman, M. V. J., Van Hout-Wolters, B. H. A. M., & Afflerbach, P. (2006). Metacognition and learning. Conceptual and methodological considerations. Metacognition Learning, 1, 3-14.

Verhoeven, L., Schreuder, R., & Baayen, R. H. (2006). Learnability of graphotactic rules in visual word identification. Learning and Instruction, 16, 538-548.

Vlaamse Onderwijs Raad. (2006). De lat hoog voor talen in iedere school. Goed voor de sterken, sterk voor de zwakken [High standards for languages in every school. Good for the best, tough for the weaker ones]. Retrieved December 7, 2006, from the World Wide Web: http://www.ond.vlaanderen.be

Vrijders, J., Vanderswalmen, R., & Beeckman, A. (2007). Tien vragen over de spelling van studenten Hoger Onderwijs [Ten questions about the spelling of higher education students]. Logopedie, 20(4), 77-88.

Wakely, M. B., Hooper, S. R., de Kruif, R. E. L., & Swartz, C. (2006). Subtypes of written expression in elementary school children: A linguistic-based model. Developmental Neuropsychology, 29, 125-159.

Zhang, L. J. (2001). Awareness in reading: EFL students' metacognitive knowledge of reading strategies in an acquisition-poor environment. Language Awareness, 10, 268-288.

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. Journal of Educational Psychology, 82, 51-59.

Zimmerman, B., & Reisemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. Contemporary Educational Psychology, 22, 73-101.

Table 1
Examples of spelling errors

	Correct spelling in Dutch	English translation
	Basic errors	
een *aanzienelijk aantal	een aanzienlijk aantal	a substantial number
een *effectie	een infectie	an infection
een *aambod	een aanbod	an offer
*ecpletici	Epileptici	Epileptics
*misdrijfen	Misdrijven	Crimes
	Rule-related errors	
*kerstmis	Kerstmis	Christmas
een *anti-sociale houding	een antisociale houding	antisocial behaviour
een *muziek groepje	een muziekgroepje	a music group, a band
de musici werden *geïnspireert	de musici werden geïnspireerd	the musicians were inspired
*Elke's promoter	Elkes promoter	Elke's supervisor, the supervisor of Elke
	Memory-related errors	
een *copie	een kopie	a copy
een *handicap	een handicap	a handicap
Hij wordt door de ziekteverzekering *gewijgerd	Hij wordt door de ziekteverzekering geweigerd	They refused him health insurance.
	Non-spelling-related errors	
enige Oost-Vlamingen	enkele Oost-Vlamingen	some East-Flemish people
een spot	een preventiespot	a prevention advertisement

***Note*: *** Underlined letters refer to the mistakes students make

Table 2
Means (and SD) of spelling errors in the quartiles as a function of error category along with the respective F values

	Bottom quartile	3rd quartile	2nd quartile	Top quartile
Category 1	4.62^{d} (537)	1.76^{c} (1.38)	1.01^{b} (0.97)	0.43^{a} (0.65)
Category 2	23.83^{d} (6.63)	16.84^{c} (3.25)	13.33^{b} (2.39)	9.00^{a} (2.57)
Category 3	2.46^{d} (2.78)	1.66^{b} (1.57)	1.41^{b} (0.92)	1.00^{a} (0.76)
Category 4	10.13^{d} (8.16)	4.73^{c} (2.47)	2.87^{b} (1.79)	1.58^{a} (1.32)

Note: Number sharing the same index (a,b,c,d) did not significantly differ between them.

Table 3
Descriptives of the various measures of feeling of confidence (FOC) as a function of the 10 words

	FOC M (SD)	Correct spelling	++	+	-	--	0 point	1 point	2 points
Firma's	1.72 (0.71)	93.2%	42.5%	43.3%	13.4%	0.7%	33.3%	45.6%	21.1%
Vind	1.45 (0.69)	91.7%	65.1¨%	25.4%	8.2%	1.3%	12.0%	24.6%	63.5%
Lijdt	2.19 (0.94)	12.5%	26.5%	39.0%	24.1%	10.4%	62.4%	25.0%	12.6%
Ondervraagd	1.73 (0.76)	84.2%	44.4%	39.6%	14.1%	1.8%	18.8%	38.2%	43.0%
Georganiseerd	1.61 (0.67)	94.9%	48.9%	41.4%	9.0%	0.7%	10.9%	41.1%	49.0%
Geleide	2.10 (0.78)	73.1%	23.2%	45.8%	28.5%	2.6%	33.3%	45.6%	21.1%
Gecanceld	2.72 (0.75)	29.4%	13.7%	48.3%	33.5%	4.5%	56.2%	37.7%	6.1%
Antisociale	2.05 (0.70)	27.2%	21.4%	53.5%	24.1%	1.1%	63.8%	30.5%	5.8%
Hondenweer	2.79 (0.70)	73.1%	14.4%	51.3%	32.4%	1.8%	40.6%	46.4%	12.9%
Oost-Vlaanderen	3.20 (0.73)	86.6%	37.4%	45.2%	16.5%	0.9%	18.6%	44.5%	36.9%

***Note*: ++** = absolutely sure; + = sure; - not sure; absolutely not sure; 0 point = no correspondence between FOC and actual spelling performance; 1 point = partial correspondence between FOC and actual spelling performance; 2 points = correspondence between FOC and actual spelling performance.

Table 4
Means (and SD) of the estimate of number of spelling errors (EOSE) and of calibration

	EOSE	Estimated score	Actual score	Calibration
Paragraph 10	1.35 (1.26)	9.33 (0.63)	9.51 (0.41)	0.18 (0.65)
Paragraph 11	2.12 (1.54)	8.94 (0.77)	9.31 (0.63)	0.37 (0.83)
Paragraph 12	2.25 (1.71)	8.88 (0.85)	9.01 (0.60)	0.13 (0.92)

***Note*:** Range from 1 to 10.

Table 5
Relations between metacognitive knowledge (MK), metacognitive skills (MS), metacognitive experiences (ME) measures, and actual performance

	MK	MS	FOC Total	Calibration Paragraph 10	Calibration Paragraph 11	Calibration Paragraph 12	PERF
Prospective Metacognition Questionnaire							
MK of the self as speller	--	.197*	.449*	-.195*	-.167*	-.189*	-.389*
MS (checking for errors)	--	--	.174*	-.043*	-.029	-.013	-.148*
Retrospective Metacognition Questionnaire							
FOC total (for the 10 words)	.449*	.174*	--	-.262*	-.230*	-.209*	-.373*
Correspondence of FOC with actual performance	-.437*	-.129*	-.491*	.642*	.595*	.644*	.394*
EOSE for paragraph 10	-.326*	-.102*	-.412*	.798*			.326*
EOSE for paragraph 11	-.413*	-.135*	-.479*		.690*		.375*
EOSE for paragraph 12	-.382*	-.095*	-.376*	.		.776*	.318*

Note: PMQ: Prospective Metacognition Questionnaire; RMQ: Retrospective Metacognition Questionnaire. FOC: Feeling of confidence; EOSE: Estimate of the number of spelling errors. PERF: Actual performance. * $\underline{p} < .001$.

Table 6
Prediction of spelling performance based on feeling of confidence (FOC)

FOC on	β	t	p
Oost-Vlaanderen	-.132	-6.611	< .001
Gecanceld	.035	1.803	.072
Hondenweer	.056	2.889	.004
Lijdt	.012	.596	.551
Antisociale	-.050	-2.593	.010
Geleide	-.120	-5.885	< .001
Firma's	.013	.657	.511
Vind	-.144	-6.849	< .001
Ondervraagd	-.211	-9.281	< .001
Georganiseerd	-.163	-7.281	< .001
R^2 = .21, F(10, 2025) = 64.72, p < .001			

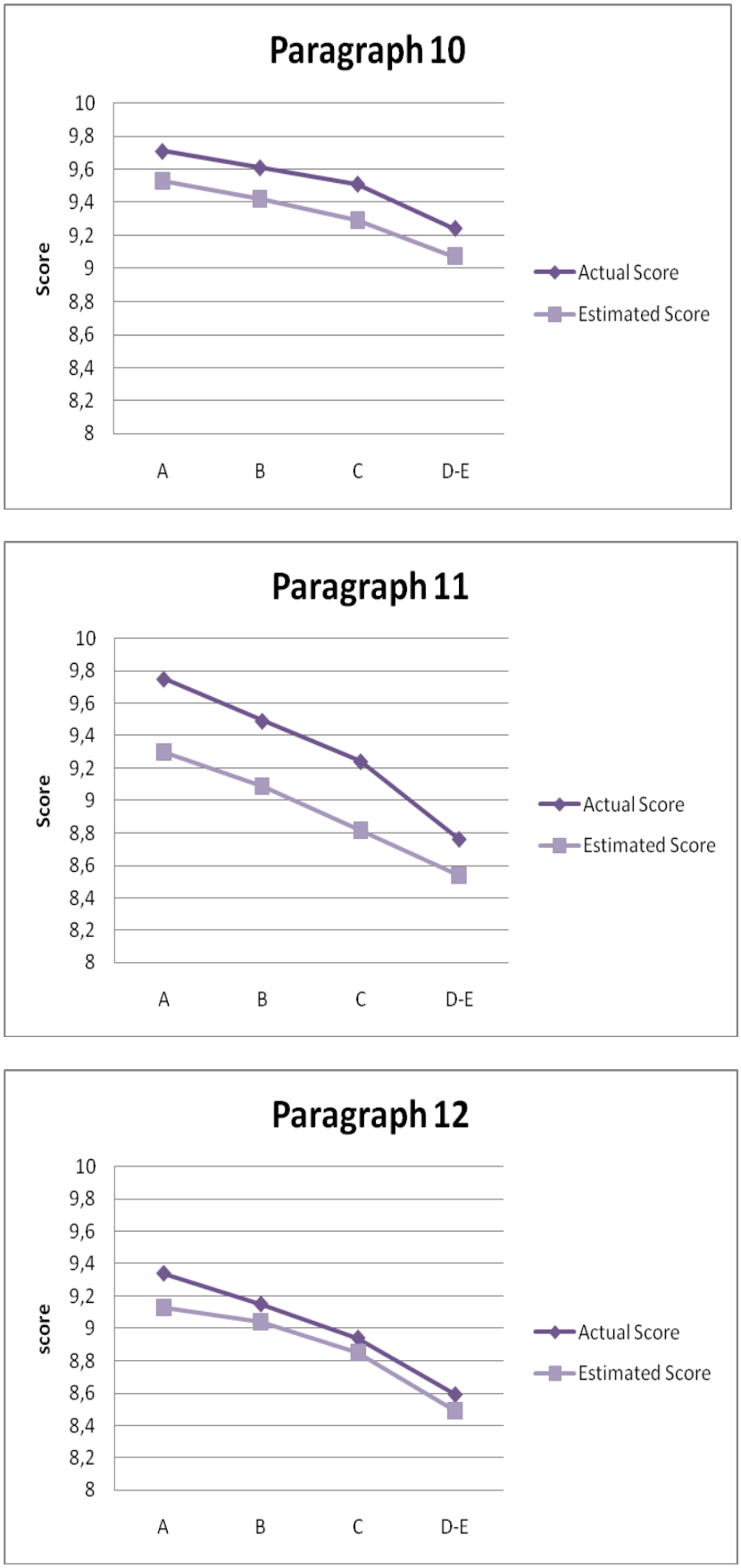

Figure 1. Estimated performance score versus actual performance score in the three paragraphs of the Dictation test.