Writing to learn writing skills – a case study

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The paper describes a case study in which the main objective is to understand how engineering students can improve their writing skills, regarding spelling and syntax, when taught specifically on these issues. The methodology Writing To Learn is applied in two courses and, making use of the written texts, the students' writing skills are assessed and evaluated. In one course, writing skills are taught and assessed and in the other they are only assessed. The comparison allows conclusions on the success of teaching writing skills, the influence of text styles and the differences between basic and advanced writing skills. It was found that writing skills were successfully taught, particularly with regard to basic writing skills. Advanced writing errors are twice as common as basic writing errors. Schematic writing styles favour a reduced number of writing errors.

Keywords: course development; electrical engineering education; writing skills; writing to learn

1. Introduction

Writing skills are an important part of engineering soft skills, some of which have been pushed into engineering curricula during the last 10 years. The case study describes the process of teaching writing skills to engineering students over a period of three years, and the learning outcomes, in the curricula of two different Electronic Engineering degree courses, one at Bachelor's and one at Master's level.

The main objective was to understand how engineering students can improve their writing skills, regarding spelling and syntax, when taught specifically on these issues. The case study includes subject matters that can be expressed as four research questions:

(1) How many writing errors do engineering students make?
(2) During the engineering curriculum years, how do writing skills evolve?
(3) Would teaching grammar rules and the mechanics of writing help students to acquire better writing skills?
(4) How does the number of writing errors depend on the writing style?

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Section 2 of this paper describes the two courses on which the case study is based. Section 3 describes the state of the art with a review of what has been published and is relevant to the subject. Section 4 presents the methodology. Section 5 discusses all the results and section 6 summarises the final conclusions.

2. Case study – comparing two engineering courses

The Portuguese Educational System follows the same configuration as other European educational systems, which are structured according to the International Standard Classification of Education from UNESCO (1997). General data can be retrieved from the Organisation for Economic Co-operation and Development (OECD) Directory of Education databases (OECD 2010).

This study takes place at Instituto Superior Técnico (IST), the oldest and largest engineering school in Portugal, with a population of about 8000 students and 900 professors, a school of the Technical University of Lisbon. The case study reported here focused on the two following engineering courses: oral and writing communication (OWC) and value of technology and innovation (VTI), in the years 2007 to 2009. Both courses were taught in the Portuguese language (now all Master courses are offered in English) and their main characteristics are described in Table 1.

The OWC course is mandatory in the second curricular year, autumn term, of a three-year Bachelor's degree in Electronic Engineering. The whole Bachelor's degree has 180 European Credit Transfer System (ECTS) credits and the OWC course has only 1.5 ECTS credits. It started in 2003 and its curriculum was revised according to the Bologna agreement in 2006 when the OWC course was introduced. It proposes to help students to improve their communications skills. This course (15, 14 and 28 students from 2007 to 2009) runs for 12 weeks with one 1.5-hour class per week. Five classes, every other week, were dedicated to learning specific grammar rules and the remaining five classes to written, oral and non-verbal communication skills, as shown in Table 2.

The VTI course is placed within a curriculum space of 3 ECTS called Free Course II in the first curricular year, autumn term, of a two-year Master's degree also in Electronic Engineering. The

Table 1. Case study courses' main characteristics

Year	2007		2008		2009	
course	OWC	VTI	OWC	VTI	OWC	VTI
N° presential hours/week	1.5	3	1.5	3	1.5	3
N° of weeks	12	12	12	12	12	12
N° of students	15	14	14	24	28	11
Average student age	20-21	22-23	20-21	22-23	20-21	22-23
% female	7	14	7	13	21	0

OWC = oral and writing communication; VTI = value of technology and innovation.

Table 2. Oral and writing communication course contents and planning

Week n°	1	2	3	4	5	6
Subject	How to write a CV	Grammar 1	How to write a thesis (1)	Grammar 2	How to write a thesis (2)	Grammar 3

Week n°	7	8	9	10	11	12
Subject	How to write a report	Grammar 4	Non-verbal communication	Grammar 5	How to make an oral presentation	How to make an oral presentation (2)

Table 3. Value of technology and innovation course contents and planning

Week n°	1	2	3	4	5	6
Subject	Knowledge and technology	Technology and capital	Knowledge, work and value	Economic value	Value quantification	International data bases

Week n°	7	8	9	10	11	12
Subject	Technology and engineering value	Added value and the value chain	Technological innovation	Productivity and growth	Analysis of firms	Final report structure

Master's degree has 120–122 ECTS. It proposes to complement Electronic Engineering with the fundamentals of value theory and the importance of technological innovation. This course (14, 24 and 11 students from 2007 to 2009) runs for 12 weeks with one 3-hour class per week. Each class was dedicated to a specific set of concepts related to economic value, as shown in Table 3. The concepts were to be discussed by all students in class and then applied to a real firm, previously chosen by each student.

The author was responsible for both courses in the three-year period, and was the only lecturer. No relevant changes to either contents or course structure were introduced in the three years reported here.

3. Literature review

In 2000, the Accreditation Board for Engineering and Technology (ABET)'s criteria for accrediting engineering programmes re-established, in criterion 3, a list of (a) to (k) programme outcomes, six of them being considered as soft skills and particularly (g) reading, 'an ability to communicate effectively' (Williams 2000, ABET 2010). In the last decade, this movement has resulted in pushing soft skills into engineering curricula, both in the USA and in some European countries. In 2006, an impact study in the USA revealed some degree of success, as seen by employers, students and faculty, specifically with regard to communication skills (Lattuca *et al.* 2006).

In Europe, the last decade showed a general movement to safeguard quality assurance of higher education. The Bologna Declaration of 1999 started constructing the European area of higher education, promoting the establishment of the ECTS (European Commission Education & Training 2010). This credit system is based on the workload that students need to complete in order to achieve expected learning outcomes. A key feature of this system is that '60 ECTS credits are attached to the workload of a typical full-time academic year of learning within a formal learning programme', which requires about 1500 to 1800 hours of total workload. As in ABET's criteria, the framework of qualifications for the European Higher Education Area defines several learning outcomes for the first and second cycle qualifications, namely, students 'can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences' (Bologna Process 2010).

Different methodologies are referred to in the literature for both teaching and grading writing skills: (a) linking English courses and their faculty with engineering conceptual courses along a curriculum sequence (Lengsfeld *et al.* 2004); (b) cognitive level and quality of writing assessment (Flateby and Fehr 2008); (c) writing across the curriculum (WAC) for promoting upper-level engineering classes' writing (Yalvac *et al.* 2007) and for improving self-assessment and communication (Hanson and Williams 2008); (d) situated learning, where there is a specific control of the context interaction between instructor, individual learner and the class (Carter *et al.*

2007, Paretti 2008); (e) the MASUS method used to assess first-year students' academic skills in Australian Universities (Skinner and Mort 2009).

The case study presented here is a supplementary product of the use of the Writing To Learn (WTL) methodology, applied to two different electrical engineering curricula courses. Writing in the disciplines is a category of WAC, and WTL is a related methodology, which helps students to develop higher order thinking skills such as critical and analytical thinking. The WAC movement was initiated in British secondary education and developed extensively during the eighties in the USA (Li and Wu 2008). It is '...the strategic integration of carefully designed writing tasks in any content area to serve the ends of learning, authentic communication, personal engagement, and reflective authorship' (Brewster and Klump 2004). The method of WTL is based on the idea that students can be given writing assignments, where, besides translating their thoughts into written language, they may discover new knowledge as well. As such, teaching the course contents is coupled with writing assignments throughout the term. The large number of written texts that this methodology provides can be systematically analysed regarding spelling and syntax rules, which is the main objective of this study case. To acquire basic writing skills is a difficult issue to a significant number of engineering students and there are many engineering teachers who do not feel duty-bound to correct grammar and syntax (Berthouex 1996). This problem is important when teaching methods include writing as a special instrument (Larson *et al.* 1998, Olds 1998, Wheller and McDonald 1998, Damron and High 2008). Similar problems are detected even for students in English degrees and the preparation of writing teachers has been the object of recent research (Coxhead and Byrd 2007). The author of this case study is the lecturer of the two courses under analysis and is very aware of the writing difficulties of his engineering students. The case study describes Portuguese engineering students learning Portuguese grammar and writing.

4. Methodology

All students of the OWC and VTI courses had a writing assignment every week, which was graded by the lecturer with the same marking criteria and returned within one week. This quick feedback is considered of vital importance (Ahern and Abbott 2007). In both courses, the goal of writing without spelling and syntax errors is explicitly announced. Therefore, these particular writing skills are assessed and graded in both courses. The main difference between the two situations is that, in the OWC case, students were specifically taught spelling and syntax rules. This is a small but significant difference, which will allow understanding of how relevant teaching grammar rules to engineering students might be. This section is divided in four parts: Course goals; Writing assignments; Student performance measures; Course evaluation by the university.

4.1. *Course goals*

The OWC course provides an effective learning environment for both basic and advanced communication skills. The former refers only to basic writing skills and the latter are here considered to be advanced writing skills, oral communication skills and non-verbal communication skills. In this course students are taught to write well and are expected to write well.

The VTI course provides an effective learning environment of economic concepts concerning value adding and intends to ensure that the students acquire that knowledge. Moreover, students, in addition to understanding the concepts and their epistemology, should be able to recognise and deal easily with them in the authentic context of a real firm. In this course students are not explicitly taught to write well but are expected to write well.

4.2. *Writing assignments*

For the OWC course, students were overall evaluated by their writing skills (60%), oral presentation skills (30%) and their contribution to class discussions (10%). There are 10 writing assignments, which are of two kinds, N and G, alternating every week. The first kind, N (N1 to N5), is a one page (20 to 40 lines) summary of a journalistic news article consisting of the most important front page news from a Monday morning newspaper. This summary should be written every other week, five times. The writing period is about 24 hours, which is to say that it is written in the students' own time, and it is delivered to the lecturer on Tuesday, as a hardcopy document, at the beginning of the week's class. Students are given a set of rules to follow for writing this summary. This was a two-page document with two parts. In the first, about contents and style, nine rules were recommended regarding what should and should not be done (for example, the need to distinguish clearly the following three levels: the subject matter of the news; the journalist's voice; the student's voice as the document's author); the second part was about the summary's general structure.

The second kind of writing assignment, G (G1 to G5), is a one-page (20–40 lines) summary of a selected grammar rule. This should be written in approximately one hour, in the classroom, and delivered to the lecturer in electronic form by the end of the class. This is done five times, every other week. The five grammar rules to be summarised are read and studied from a concise grammar book. Typically, in that book, one grammar rule in covered in five to 10 pages in a rather schematic style. The five chosen grammar rules are the ones most students have difficulty with: (1) spelling and semantics of a specific number of words they frequently confuse; (2) accents (diacritical marks), which are critical word components in the Portuguese language; (3) punctuation, the correct use of full stops, commas, colons and semi-colons; (4) subject-verb agreement, tense, person and voice; (5) the correct capitalisation.

Both writing assignments, N and G, are assessed for two levels of writing skills: basic (*ba*) and advanced (*ad*). The former groups three aspects: the proper use of spelling; subject–verb agreement; capitalisation. The latter comprises four aspects: semantics; punctuation; sentence morphology; style. The style for the N assignment is recommended to be clear, descriptive, with short and balanced sentences, factual and without opinions expressed by the summary's author. For assignment G, the style is recommended to be clear, schematic and with short sentences. Use of online help for spelling and grammar correctors is suggested, as well as, for the N assignment, use of dictionaries or grammar books.

The lecturer provides feedback to individual students within one week, such that they can understand their difficulties and correct their errors in the next assignment. The main points of both writing assignments are listed in Table 4.

For the VTI course, students are overall evaluated by their writing skills (50%), oral presentation skills (30%) and their active contribution to class discussions (20%). Students have 10 writing assignments (R), which are reports related to the subjects presented in each class, as shown in Table 3. Each week has a three-hour class, which is typically divided into two parts. In the first, the lecturer presents the concepts to be discussed and their epistemology, moderating a discussion with all students about their application to real and actual firms previously chosen by each student. The second part is dedicated to report in writing about what was discussed, namely, the concepts and their application to each student's specific firm. Each report is a one- to two-page document comprising, if necessary, figures or tables and about 20 to 40 lines of text. It must be delivered to the lecturer in electronic form by the end of the class. Use of online help for spelling and grammar correctors is recommended.

The report writing assignments, R (R1 to R10), are assessed for three performance levels: (1) *ba* writing skills; (2) *ad* writing skills; (3) analytic and practical understanding of economic concepts. The first and second performance levels relate to the use of grammar rules, as described above for

Table 4. Oral and writing communication and value of technology and innovation writing assignment characteristics

Assignment	N - Summary of news	G - Summary of grammar rule	R - Report
Information source	Monday morning newspaper	Grammar book	
Language help	Dictionaries, automatic spelling and grammar correctors, etc.	On-line dictionaries and automatic spelling and grammar correctors	On-line dictionaries, automatic spelling and grammar correctors
Time to deliver (hours)	About 24	About 1	About 1.5
Place to write	Homework	Classroom work	Classroom
Length of summary	20 to 40 lines	20 to 40 lines	20 to 40 lines of text plus figures or tables
Basic writing skills:	Spelling	Spelling	Spelling
	Subject-verb agreement	Subject-verb agreement	Subject-verb agreement
	Capitalisation	Capitalisation	Capitalisation
Advanced writing skills:	Sentence morphology	Sentence morphology	Sentence morphology
	Semantics	Semantics	Semantics
	Punctuation	Punctuation	Punctuation
Style:	Clear	Clear	Clear
	Descriptive	Schematic	Descriptive
	Balanced sentences	Short sentences	Analytical
	Factual		
	No opinions		

assignments N and G. The style here is recommended to be descriptive, clear and analytical. The third performance level relates to the concepts discussed, their correct comprehension and their application to each student's chosen firm.

There is feedback from the lecturer to individual students within one week. The main points and characteristics of the report writing assignment, R, are listed in Table 4.

4.3. *Student performance measures*

All assignments were evaluated and graded with the same criteria and by the same lecturer. Overall evaluation considered five levels: very good; good; sufficient; insufficient; mediocre.

The criteria for grading each assignment were the following. The number of grammar errors was added up for each student assignment. Two types of grammar errors were considered separately: basic writing errors (*ba* errors) and advanced writing errors (*ad* errors). One error was recorded for every error in the basic writing group, *ba*, and in the advanced writing group, *ad*, according to Table 4. For example, one spelling mistake is one *ba* error, and two commas out of place or missing are two *ad* errors. The number of errors was correlated with the number of text lines. The basic performance measure is number of errors per 20 lines. One line was always considered to have about 10 words, such that if, in a schematic text style, there were two lines with about five words each, only one line would be counted. Accordingly, for each student assignment, the number of text lines was counted, the number of *ba* errors and the number of *ad* errors.

For statistical purposes, the standard deviation was computed between the student assignment results of *ba* errors per 20 lines and of *ad* errors per 20 lines. This analysis was done only from 2009 data, for assignments N and G from course OWC and for assignment R from course VTI.

4.4. *OWC course evaluation by the university*

The OWC course was introduced into the Electronics Engineering Bachelor degree curriculum in 2006 to compensate for the increasing inflow of low level soft skills students. The value of this initiative had to be assessed, i.e. the university thought it was necessary to understand if this course would contribute to improving students' communication skills and to quantify that improvement.

As concerns writing skills, the OWC course can be evaluated by comparing its outcomes with equivalent outcomes from the VTI course. In fact, the two courses use the same WTL methodology, have the same grading criteria and share the same lecturer. The only difference is that, on the OWC course, students are specifically taught to write without errors, from the perspectives of *ba* and *ad* writing skills, and on the VTI course they are not, but they are still expected to write well and are graded accordingly. As such, for the university to evaluate the OWC course success, it will be necessary to compare the results of *ba* and *ad* errors from both courses during the teaching period. If the results are different and more positive for the OWC course, it is perhaps proof that teaching students to write is an adequate tool for this goal.

5. Results and discussion

Student performance was measured over a period of three years. As concerns *ba* and *ad* writing skills, the results are presented in Tables 5, 6 and 7 for assignments N, G and R, respectively.

5.1. *Basic writing errors*

First degree engineering students, with about 13 school years behind them, should make barely any mistakes. Moreover, they knew this was a critical measure and, for the OWC course, they were being taught specifically on that subject. Additionally, the use of dictionaries and online spelling

Table 5. Results for assignment N – summary of news, for oral and writing communication course

Year	Total no. of lines	Total *ba* errors	*ba* errors/20 lines	Total *ad* errors	*ad* errors/20 lines
2007[a]	858	49	1.14	147	3.43
2008	1486	102	1.37	251	3.38
2009	2307	384	3.33	583	5.05
Total N	4651	535	2.30	981	4.22

ba = basic; *ad* = advanced.
[a]Data from only the second half of the term.

Table 6. Results for assignment G – summary of grammar rules for oral and writing communication course and totals for assignments N and G

Year	Total no. of lines	Total *ba* errors	*ba* errors/20 lines	Total *ad* errors	*ad* errors/20 lines
2007[a]	884	50	1.13	129	2.92
2008	1113	61	1.10	147	2.64
2009	2105	182	1.73	293	2.78
Total G	4102	293	1.43	569	2.77
Total N and G	8753	828	1.89	1550	3.54

ba = basic; *ad* = advanced.
[a]Data from only the second half of the term.

Table 7. Results for assignment R – report for value of technology and innovation course

Year	Total no. of lines	Total *ba* errors	*ba* errors/20 lines	Total *ad* errors	*ad* errors/20 lines
2008	4903	311	1.27	395	1.61
2009	2469	141	1.14	355	2.88
Total R	7372	452	1.23	750	2.03

ba = basic; *ad* = advanced.

and grammar help was recommended. Still, results for the three assignments show 1.1–3.3 *ba* errors per 20 lines.

In the assignments N and G of the OWC course, it can be seen from Tables 5 and 6, fourth column, that the number of *ba* errors per 20 lines was lower for the G assignment. Considering the total number of lines and the total number of *ba* errors, the N assignment shows 2.30 *ba* errors per 20 lines, while the G assignment shows 1.43. The total for the two assignments together was 1.89 *ba* errors per 20 lines.

There are three additional comments relevant to understanding these figures. Results from 2007 were taken only from the second half of the term, which typically has better results than the first half, as shown below when looking at results during the term, for 2008 and 2009. As such, the full year's average figures for 2007 are most probably slightly smaller. The second comment is that in 2009 this measure shows values considerably higher than for the previous two years. As a matter of fact, there are years when the student group is clearly better or worse than in previous years. The third comment is that the different styles of the two assignments may help to explain the different results.

The lower number of *ba* errors in the G assignment is probably related to two facts. The first is the plain and schematic style that was recommended, which was similar to the style of the book they were extracting the information from. The second is the fact that students were reading the text in the book and writing their summaries, such that some students would use most of the words and some sentences from the book. On the other hand, when writing the N assignment students were not allowed to extract sentences from the original text, so they had to write new sentences using their own words.

In the VTI course, it can be seen from Table 7, fourth column, that the R assignment's number of *ba* errors is lower than in assignments N and G. It shows 1.23 *ba* errors per 20 lines, while the N and G assignments showed 2.30 and 1.43, respectively. The different students' age may explain the difference. Indeed, the engineering students' cultural and scientific maturity progression is fast and very obvious during the years they spend at the university. As such, the two year difference between students from the OWC course and the VTI course may explain the lower numbers of *ba* errors in the VTI course. However, another factor could have balanced that effect. Students were being taught in the OWC course to write well, which was a goal they were conscious of. The results show this second factor was not strong enough to balance the first effect. The main conclusions for *ba* errors are that a schematic style will probably reduce the number of *ba* errors and that older students make fewer *ba* errors.

The numbers analysed above refer to the whole term. It will now be shown how *ba* errors evolved during the terms. For assignments N, G and R, Figures 1, 2 and 3 describe results during the terms. For assignments N and G (OWC course, Figures 1 and 2), there is a clear tendency to reduce the number of *ba* errors during the terms. For 2008 and 2009, using (exponential function) trend lines to measure the tendency, the reduction is about 40%, which is very relevant. On the other hand, for the R assignment (Figure 3), there are no gains for *ba* errors. This is an interesting result, which may be explained by the fact that, in this course, the teaching matter was neither grammar rules nor writing skills, even if students were well aware that they were being graded for writing errors as well.

5.2. *Advanced writing errors*

From Tables 5, 6 and 7 (sixth column), results show 1.6 to 5 *ad* errors per 20 lines. Students make almost twice as many *ad* errors as *ba* errors.

For the OWC course, there are different results from assignments N and G, as concerns *ad* errors, much as happened with *ba* errors. The N assignment shows 4.22 *ad* errors per 20 lines,
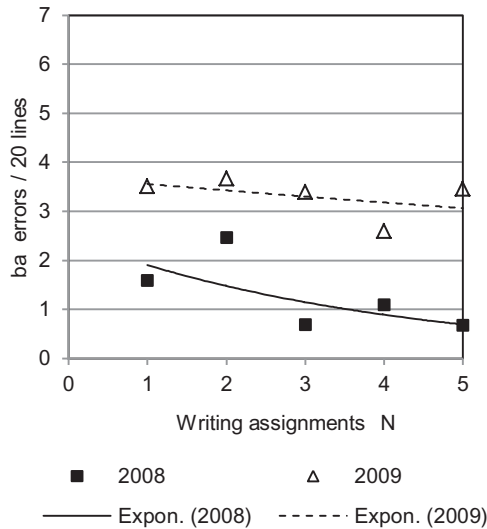
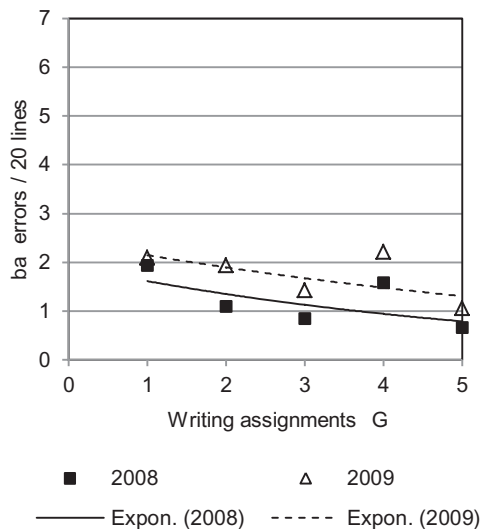Figure 1. Number of basic (*ba*) errors per 20 lines for assignments N1 to N5, during the term.

Figure 2. Number of basic (*ba*) errors per 20 lines for assignments G1 to G5, during the term.

while the G assignment shows 2.77. The total for the two assignments together was 3.54 *ad* errors per 20 lines. Results for *ad* errors are much better for assignment G. This may be related to the different text styles. For the N assignment, style was descriptive, while for the G assignment, style was schematic. The latter must have short and clear sentences, so errors such as punctuation and sentence morphology are more unlikely.

For the VTI course, R assignment, the number of *ad* errors measured was lower than in the OWC course, 2.03 *ad* errors per 20 lines, instead of 3.54, comparing the last columns and last lines of Tables 5, 6 and 7. Again, there are two possible reasons for this difference. The first is that students are two years older and the second is that they had to ensure that their prose made sense and was clear, because they were being graded mainly on that specific criterion.
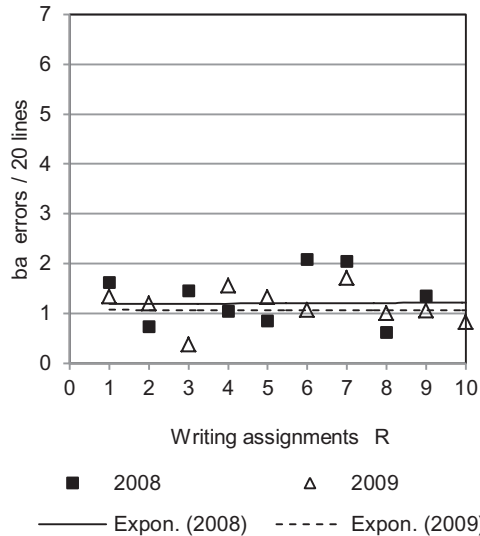
Figure 3.   Number of basic (*ba*) errors per 20 lines for assignments R1 to R10, during the term.

The main conclusions concerning *ad* errors are that these are more numerous than *ba* errors, almost twice as many. They depend heavily on the text style, being significantly lower for a schematic than a descriptive style, and their numbers will reduce if students know they are being graded for clear sentence meanings.

Next, it will be shown how the results evolved during the terms. Figures 4, 5 and 6 describe results during the term for assignments N, G and R, for *ad* errors. For assignments N and G (OWC course), results show a tendency to reduce the number of *ad* errors during the term for both courses. Using (exponential function) trend lines to measure the tendency, the reduction is about 6–9%, which is considerably lower than happened with *ba* errors, for which the reduction
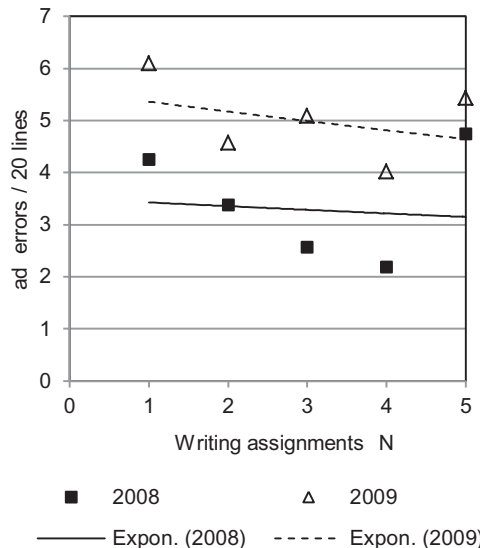

Figure 4.   Number of advanced (*ad*) errors per 20 lines for assignments N1 to N5, during the term.
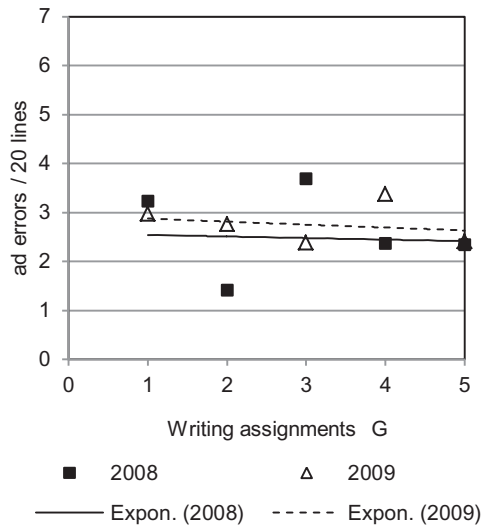
Figure 5.   Number of advanced (*ad*) errors per 20 lines for assignments G1 to G5, during the term.
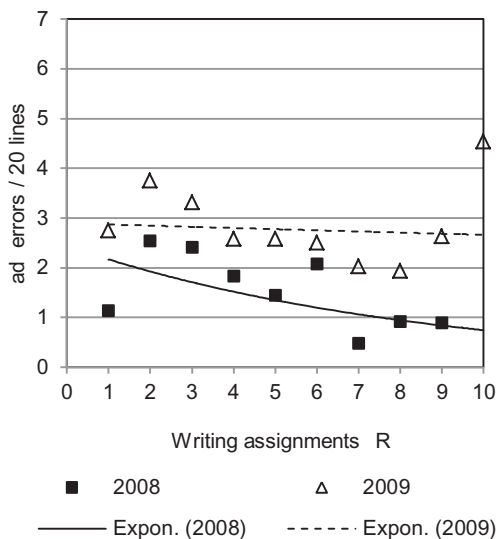

Figure 6.   Number of advanced (*ad*) errors per 20 lines for assignments R1 to R10, during the term.

during the terms was about 40%. Most probably, the reason is that it is more difficult and takes longer to learn advanced writing, such as sentence morphology, than basic aspects such as spelling.

For assignment R (Figure 6), there is also a clear tendency to reduce the number of *ad* errors during the terms, in both 2008 and 2009. Considering the two years, the number of *ad* errors reduced by an average of 33%. This percentage is an average of 66% and zero, which is still considered significant because the zero was influenced mainly by a single extraordinarily high value in report R10 (see Figure 6).

Note that, for *ba* errors, there was no improvement during the term for reports R. However, for *ad* errors, the improvement is very significant. As mentioned above, students had to ensure that their prose made sense and was clear because they were being graded mainly on this specific

Table 8. % of errors' reduction during the term

	% of errors' reduction along the term					
	Assignment N		Assignment G		Assignment R	
	ba	*ad*	*ba*	*ad*	*ba*	*ad*
2008	63.4	7.6	49.7	3.9	0.0	66.4
2009	11.2	11.3	38.4	7.6	0.0	0.0
Average	37.3	9.4	44.1	5.8	0.0	33.2

ba = basic; *ad* = advanced.

criterion. This was a clear goal that the lecturer insisted upon often during the term. The errors' reduction numbers are shown in Table 8.

To understand the distribution of errors among students, the standard deviation was computed. This was done from the three assignments' 2009 data. For example, taking the N type assignments (N1 to N5), where there were about 21 students. the standard deviation of errors per 20 lines was computed by multiplying 21 students times five assignments (105 data) values of errors per 20 lines. The results show that only for the N assignment there is a fairly normal distribution, especially for *ad* errors. For G and R assignments, standard deviation values are larger than average, showing that distribution is not normal. In fact, looking at individual data, there is a significant number of cases of either zero errors or a very high number of errors. It shows a strong heterogeneity with two levels of student skills, a low and a high level, and lacking a prevalence of the average student.

5.3. *Overall student performance*

Overall student performance results were similar in the two courses and during the three years, showing a good normal distribution: very good – 2%; good – 44%; sufficient – 48%; insufficient – 3%; mediocre – 2%.

5.4. *OWC course outcomes evaluation*

In section 4.4, the criterion to evaluate the OWC course was set. It would be necessary to compare errors' reduction during the term in both OWC and VTI courses. Looking again at Table 8, it can be seen that, for the OWC course, *ba* errors reduced by about 40%, while for the VTI course the reduction was nil. On the other hand, for *ad* errors, for the OWC course the reduction was about 8%, and for the VTI course it was 33%. Only on the OWC course were students being taught basic and advanced writing skills, such that in this course the outcomes were to write well and without errors. The results show that this was accomplished and so there is a positive evaluation for this course. When compared with the VTI results, the OWC course was much more efficient, as the former did not show any improvements during the term for *ba* errors. Conversely, for *ad* errors, the VTI course had better results. Thus, the overall evaluation is very positive for basic writing skills and neutral for advanced writing skills.

The 2008 and 2009 OWC courses were fairly well evaluated by the students. They graded, from 1 (low) to 9 (high), the course organisation – 7.0; evaluation methods – 6.1; overall course evaluation – 6.3; and how the course contributed to developing six types of skills: enhancing knowledge and understanding; enhancing capacity to apply knowledge; enhancing analytical capacity; enhancing cooperation and communication; enhancing learning capacity – 6.0. For the VTI course there was no evaluation from students.

6. Conclusions

The study's main objective was to understand how engineering students can improve their writing skills, regarding spelling and syntax, when specifically taught these issues. It was found that the four research questions, in which the case study's subject matters were expressed, have the following answers:

(1) It was found that, in the second curriculum year, undergraduate engineering students make 1.43 *ba* errors per 20 lines, in a simple and schematic style text, even if explicitly taught grammar rules and with recommended access to dictionaries, spelling and grammar help. For a more complex and narrative style, the number increases to 2.30 *ba* errors per 20 lines. For advanced writing skills, the respective numbers are 2.77 and 4.22 *ad* errors per 20 lines, which is about twice as much.

(2) Comparing results from the second curriculum year of the Electronic Engineering Bachelor's degree with the first year of the Electronic Engineering Master's degree (two years apart), for about the same text style, the number of *ba* errors decreased from 2.30 to 1.23 *ba* errors per 20 lines. For advanced writing skills, the respective numbers are 4.22 and 2.03 *ad* errors per 20 lines. For both types, the number of errors reduces to about a half.

(3) Writing assignments were used on both courses, but spelling and grammar rules were explicitly taught only on the OWC course. On this course, during the term, *ba* errors reduced about 40%, and *ad* errors about 6–9%. On the other course, *ba* errors reduced 0% and *ad* errors reduced 33%. The conclusion is that this methodology helped to increase writing without spelling and syntax errors, especially when this was explicitly taught.

(4) Comparing descriptive with schematic writing styles, both from the OWC course, the former style showed 1.6 times more *ba* errors per 20 lines than the latter. For *ad* errors per 20 lines, the respective number was 1.52. A schematic style clearly favours a smaller number of writing errors.

The general conclusions from this analysis are that engineering students' writing skills progress positively during their curriculum, but can improve substantially if explicitly taught spelling and grammar rules. Improvements, measured as writing errors, may achieve 40%. It is planned to report, in the future, the results from a few more years from this case study.

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