Improving Technical Writing Skills Through Lab Reports

Dr. Ilan Gravé, Elizabethtown College

Ilan Gravé received B.Sc. in Physics and Electrical Engineering and M.Sc. in Physics from Tel-Aviv University in Israel, and a PhD in Applied Physics from Caltech, in Pasadena, California (1993). In the past he has lead high-tech R&D avionics projects at the Israeli Aircraft Industries; has been a senior researcher and adviser at the Fondazione Ugo Bordoni, in the Ministry of Post and Communications in Rome, Italy; and has been on the faculty of the Department of Electrical Engineering at the University of Pittsburgh. He is currently an Associate Professor of Physics and Engineering at Elizabethtown College in Pennsylvania. He has on his record numerous publications in a number of fields in Applied Physics and Engineering, including superconductivity, semiconductor quantum devices, nonlinear optics, semiconductor lasers, infrared detectors and signal processing of medical signals.

©American Society for Engineering Education, 2019
Improving Technical Writing Skills through Lab Reports

In the last few decades, there has been an effort to address how to complement the teaching of scientific and technical skills to scientist/engineers with other attributes needed for a successful career within diverse work environments [1]-[6]. Among them, most prominently are writing and presentation skills. A parallel curriculum addressing these non-scientific/technical skills is usually a strong contributor towards these goals. Another tool generally more directly controlled by science/engineering faculty is using courses in the discipline, especially laboratory courses, to emphasize writing components and/or presentation skills. Lab reports can serve as a very good tool to sharpen writing skills or, more extensively, the skills needed to produce a coherent, well thought, well-written scientific paper or technical report.

A more comprehensive approach to different paths and philosophies for the teaching of writing skills and its balance can be found in the notions “writing across the curriculum (WAC)” versus “writing in the disciplines (WID).” Quoting from the conclusions of such a study [7], “…the interdisciplinary discussion, out of which this point of departure developed, revealed a need for a discipline-specific writing strategy; at the same time, and seemingly perversely, the same discussion of discipline-specific solutions to discipline-specific problems also highlighted the extent to which writing is a problem, indeed the same problem, across disciplines appearing to have little in common. And it is precisely this commonality, the outsourcing solution that it has engendered, which is creating this gap between writing and the disciplines.”

Additional studies tried to provide guidelines and a framework for teaching writing in the discipline for engineering students [8]-[9]. These include pointing to technical and report writing attributes that should be emphasized, such as planning, clarity, simplicity, brevity, word choice and more.

There have also been several attempts to facilitate report writing by developing frameworks and applications that guide and help students in preparing technical and scientific reports, both in engineering schools in the United States [10]-[11] and abroad [12].

At our institution, we have an engineering department embedded in a liberal-arts general education setting. Engineering students are required to take a wide core curriculum to integrate their scientific and technical education in engineering. Still, to obtain best results and comply with the department’s (and ABET’s) program outcomes, we found that we strongly benefit from addressing the students’ reports during their first laboratory courses as tools to achieve these goals - and progressively improve their writing and presentation skills.

In this paper, we present the different formats and requirements of report writing in a sequence of four scientific/technical labs: The Physics 1, Physics 2, Circuit Analysis and Control Systems Labs. We will try and show how various requirements have been set in order to enhance different aspects of report writing. Additionally, we will attempt to describe – in some cases qualitatively and in others quantitatively – the corresponding progress of our engineering students from their incoming first year to their graduating year.
The lab routines and handouts pertinent to the lab courses addressed in this work were written over a decade ago and maintained in their essence – with light changes and updates as required by an evolving curriculum. The faculty members who initially proposed and wrote these lab routines and syllabi were originally motivated by the desire to provide the best lab complements to the parent courses: Physics 1, Physics 2, Circuit Analysis, and Control Systems. These principles were maintained through eventual revisions and/or updates of the syllabi. The links between the lab routines and the evolution of the written communication skills of the students across the different labs in sequential semesters were noted and discussed in faculty forums.

Starting from 2013 I was assigned a sequence of instruction that for many years covered the different labs in succession. Therefore, I realized I would be able to follow the evolution of the writing skills of large parts of our engineering classes through grading their lab reports. This also brought me to try to adjust the lab parameters – assignments, handouts and especially the written reports’ requirements as presented to the students in the syllabi.

I tried to set some criteria while grading the lab reports for evaluating them specifically with respect to writing skills. At the same time, I gave introductory talks conveying guidelines and motivational arguments for the students to seriously address and try to improve their writing skills. Additionally, I followed up with continuous feedback to the class about each batch of graded lab reports, briefly describing the main deficiencies noted. Also, I usually used one or two weekly meetings to concentrate solely on feedback and improvements of the written reports submitted so far. This usually happened after three or four experiments had been completed, reports graded, and feedback provided to the class. The last graded report was returned to the lab teams with extremely detailed corrections and discussions of the problems noted. The class was then assigned the task to rewrite the report, taking into consideration all remarks and to resubmit the report the week after. The incentive for the students was that the grade reported for the experiment would be the one earned with the resubmitted version.

In the next sections I’ll first describe the four experimental labs and the current requirements and formats of the lab reports. I will then address the criteria and the method chosen for assessing the writing skills and their improvement. I will also share some quantitative measures of the enhancement of writing skills for three different engineering classes as they progressed along the different labs in sequential semesters. Finally, I will try to summarize these findings, while also providing some thoughts and critical considerations of the difficulties and limitations of these assessments.

**Physics 1 and Physics 2 Labs**

All entering engineering students take the courses Physics 1 and Physics 2 and their associated labs. Almost all students in the period covered by this work took the Physics 1 course in their entering (fall) semester, while only few, with a weaker background in Mathematics and/or Physics, deferred it to the second (spring) semester, first enrolling in a course that enhanced their mathematical skills. The Physics 2 course was usually taken the following semester, either the spring semester of the freshman year or fall semester of the sophomore year.
Students take these labs within the Physics 1 and 2 courses, and the lab grades count as 20% of the overall course grades. Students work in teams of two, and they complete about ten experiments during each semester. Physics 1 focuses on mechanics, while Physics 2 on electromagnetics.

Among the requirements, as detailed in the syllabus, the students must read and understand the handout during the week preceding the lab meeting and come prepared to perform the experiment and the following data analysis. While performing the experiment they report procedures and results in their lab notebooks; one week later they turn in a written report, one per lab team. For part of the experiments (about 60%) the required submissions are hand-written “notebook” reports. Students use one of their notebooks to write the report, in continuation of the pages filled with notes and results taken during the experiment in the lab. Guidelines for these handwritten reports are provided in the syllabus, and they direct the students toward an ordered layout, a logical presentation sequence, thoroughness and completeness in presenting and analyzing the experiment and the results. For the remaining 40% of the lab experiments, the students are required to submit, a “formal” report. This report must be computer generated and printed and must follow a strict two-page limit and some journal-like formatting requirements. The students are also provided with a template for the “formal” report, which requires a double column format and other specific options.

The “notebook” report structure and the associated requirements help the students develop a sound routine in data acquisition and analysis as well as in presenting the experimental results in a logical, clear way. The students also learn how investing in preparation and prelab work makes the experimental tasks more comprehensible, interesting and efficient, while saving time in understanding the results and in post-lab analysis.

The “formal” report requires the students to compress in the short-assigned space of two pages the description of the experiment and the results, including eventual tables and graphs. The underlying goal and emphasis are to develop synthesis skills - identifying the essential parts for a meaningful description of experiments and results. Another important goal is to develop the ability to comply with a forced format or space-limit when needed.

It is important to remember that the main goal of the lab routine is to introduce the students to the principles and practices of experimental work: from pre-lab preparation to lab routines and etiquettes as well as from data collection and recording to data analysis and interpretation. Students are encouraged to keep and document experimental records and to write a clear and sound report on the experiment and its results. The attention for, and concern with writing skills is just one consideration in a complex mix of important skills needed towards proficiency in experimental work.

These first two lab courses in the curriculum are crucial in trying to set some basic guidelines and common goals towards skill improvements in all aspects of experimental work. Usually there is a large variance in writing skills in the students of an incoming class; from “natural” report writers (usually not too many) to the other extreme of very weak report writers.
Circuit Analysis Lab

The Circuit Analysis Lab is the complement to the Circuit Analysis course, which covers material from introductory and basic topics in electrical circuits (Ohm’s and Kirchoff’s laws, Thevenin and Norton theorems, resistors, capacitors and inductors, operational amplifiers) to first and second-order circuits.

The course and associated lab are taken together, albeit with different instructors in most cases, usually during the fall semester of the sophomore year. Students from all engineering concentrations must complete this course. All enrolled students have usually completed the Physics 1 and Physics 2 courses, including the respective labs as prerequisites. They have also usually completed a year-long Introduction to Engineering course, where they experience some design and hands-on engineering tasks that also require written reports. Accordingly, most students should start this lab being more prepared with regards to writing lab reports. Still, a minority of lab groups still struggle with writing, especially at the beginning of the semester.

In the Circuit Analysis lab, the students perform about ten circuit-related experiments spread over weekly meetings during the fall semester (about 14 weekly meetings). The labs/experiments focus on analysis and measurement of selected electrical linear circuits, exercises with circuits software tools (PSpice) as well as a design component in some of the labs.

The lab requirements, as detailed in the syllabus, still carry many of the points emphasized in the introductory Physics labs. The students must read and understand the handout during the week preceding the lab meeting and come prepared to perform the experiment and the following data analysis. The students keep a lab notebook where they record in real time all the experimental details, results and issues and then must turn in a written “notebook” report, one per lab team. In some of the experiments a written prelab report is required, in most cases demanding the theoretical analysis/solutions of the circuits explored in the lab.

As detailed in the lab syllabus, all final reports for the Circuits Lab must be computer generated and printed, with hand written allowances only for an appendix of formula-heavy analytical solutions of the circuits explored. However, the report format and requirements are different from the previous labs. A main report comprised of a maximum of four printed pages should convey all aspects of the lab, including: analysis of the circuits, measurement methods, PSpice simulations, experimental results and their analysis. Appendices are allowed, even suggested, for different parts of the report, to expand on details that cannot be included in the main body due to space limits or other considerations.

Beyond the four-page limit, the format is not constrained by a template – as in the previous lab courses – but rather left to the choice of each lab group. In this way, the students have more freedom in setting their own guidelines and format according to their preferences. They are given the opportunity to explore different ways to display their results, and they usually spend some time and thought in finding their optimal solution. Some lab groups, but not too many, automatically write their first reports following the guidelines and format of the previous Physics labs. However, within a few reports, they usually realize that the familiar format is less suited for
an experiment about electrical circuits, measurements and simulations, and they try new styles of presentation.

Control Systems Lab

The Control Systems Lab, associated with the Control Systems course, is a requirement for most of the students in our Engineering degree, and specifically for those who want to graduate within the mechanical or electrical concentrations of our Engineering degree as well as for our Computer Engineering degree majors. Students usually enroll in this course/lab combination in the spring semester of their junior or senior year. For many it is the last semester before graduation. The students at this stage have experienced at least three lab courses and, in addition, have also had a few project courses: the sophomore project course and the junior project course. While these project courses are mostly set to develop and enhance design skills, as well as team-work skills, they also contribute to better communication skills, through required presentations and written interim and final reports.

Following this progression, we expect the students’ lab reports to display a wide range of improvements and a new level of maturity. This includes the ability to set their own goals and formats to convey the experimental objectives, results and analysis in a coherent, reader-friendly report. Accordingly, the syllabus of the Control Systems Lab provides general guidance for lab preparation and timing of report submission but is rather general in the required content and format. On the other hand, the assessment of the students’ written reports can be a measure to monitor the augmented skills acquired during their progression.

I do believe that the different requirements and formats adopted for the labs as described above contribute to the progressive enhancements of technical and general writing skills of our engineering students.

The requirements for the Control Systems Lab are the most general and relaxed and at this stage the students are usually empowered by the work in the three previous labs (and possibly one or two additional labs not addressed in this work). The students have also usually completed the core curriculum that includes language skill courses and one writing intensive course, and they have had various opportunities to explore and discover their writing style. The expectations of the instructors in this lab are to receive well-rounded, reader-friendly reports, very much improved with respect to the reports in the previous lab courses.

Students’ Progress

The first and foremost concern of the various faculty involved in setting up requirements and formats for the different labs has been integrating the experimental work with the topics learned and enhancing the experimental skills of the engineering students. Yet written communication skills play an important part in the ability to convey the description and results of an experiment to an external agent, such as a scientific audience or a future client. In a more general view, deficiencies in writing skills can influence the ability to proceed in an ordered, well-thought track during an experiment or in writing a report.
While writing communication skills are so important, it is usually difficult to track the progression of the students along the different labs and along their four-year curriculum. This is due mainly to the fact that the assignment of course and lab duties among the faculty varies from year to year. Each instructor in charge of a lab in a given semester is free to change the syllabus and the requirements for the lab/the reports to his/her parameters. Most often the list of experiments and their handouts are kept the same from year to year, notwithstanding small edits or updates. Moreover, it is not common for a faculty member to be assigned a succession of lab instruction assignments. As such, only general assessments on the level of the class can be made. These assessments are routinely done for every lab class, as part of the preparation for the ABET accreditation/reaccreditation process; but they focus mainly on ABET outcomes.

Due to a particular set of scheduling circumstances over the last few years, I had the unique opportunity to be the instructor in the four lab courses under scrutiny in three different complete sequences: teaching the Physics 1 Lab (Fall 2013), Physics 2 Lab (Spring 2014), Circuit Analysis Lab (Fall 2014), Control Systems Lab (Spring 2015); and then again the same sequence from Fall 2014 to Spring 2016; and then again from Fall 2015 to Spring 2017.

Under these circumstances, I was in control of setting requirements and formats for each one of the labs during this extended three-year period. As such, I was able to follow the evolution and progress of three of our engineering classes along sets of four semesters with respect to experimental skills in general, and to written report writing specifically. I graded all the reports in each lab, and, in addition to the grades marked and provided to the students, I set a few parameters to characterize the quality of every report as for writing/communication skills, on a scale from 1 (lowest = completely unsatisfying) to 5 (highest = extremely satisfying).

The parameters I used are a subset of those suggested in Ref [9]:

A – Clear display of the experiment in a logic sequence
B – Completeness
C – Synthesis skill – conciseness without sacrificing completeness
D – Language (grammar, expressions, repetitions)

I chose these parameters hinging on my experience with instruction in these labs in previous academic years, especially in the Physics 1 and 2 Labs and the Circuit Analysis Lab. I had had the opportunity to teach these labs for a few years before the beginning (2013) of the first lab sequence described above. All these lab instruction assignments were in addition to courses that I have taught over the years such as Physics 2 (the course); Circuit Analysis (the course); Control Systems (the course); Electromagnetism; Fiber Optics; and Semiconductor Devices. I had repeatedly noticed various deficiencies in the written reports of the different labs. As such, when I had the opportunity to follow sequences of the four labs in progression, I tried to classify these deficiencies, and came up with these four parameters.

Having closely monitored the students’ performance in real time during the lab sessions, it became clear to me that in most cases the major deficiencies resided in post-lab work and in their
ability to submit a coherent, well written final report. Trying to dissect the source and location of the deficiencies, I decided to keep track of the performance of the various lab classes with the metric of these parameters. The hope was to be able to characterize with some quantitative measures (a) the progress of the class, if any, within the same semester/lab and (b) the progress of the class along the sequence of the four lab courses described above.

Accordingly, while all the reports were graded following the syllabus description, I also kept a record for myself with the marks assigned in each one of the four categories described above.

Considering the average grade obtained over all reports in each class for all experiments, I could then check the improvement of the class within the same semester. I could also observe the improvements in average scores for the same engineering class over time as it progressed along the four labs in successive semesters.

**Results**

I was the faculty instructor for the labs under consideration and relevant to this study, in the following semesters: (F= Fall Semester; S= Spring Semester).

Table 1 – Lab Assignment Sequence from Fall 2013 to Fall 2018

<table>
<thead>
<tr>
<th>Lab\Semester</th>
<th>F 13</th>
<th>S14</th>
<th>F14</th>
<th>S15</th>
<th>F15</th>
<th>S16</th>
<th>F16</th>
<th>S17</th>
<th>F17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 1</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 2</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit Analysis</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Systems</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As one can see from Table 1 above, my lab teaching assignments in the four academic years from 2013/14 to 2016/17 (inclusive) covered the four lab courses considered in this study with an (almost) complete coverage mesh for the standard offerings (Physics 1 and Circuit Analysis in fall semesters; Physics 2 and Control Systems in spring semesters). During this period, in most semesters, I was the instructor in two labs (Physics 1 and Circuit Analysis in the fall, Physics 2 and Control Systems in the spring). The students in these two labs belonged to two different engineering classes.

Next, below are the average scores for the four chosen writing skill parameters computed at the end of each relevant lab class. Each graded report written by each lab team was assigned a mark for each of the four parameters considered. Then a class average for each experiment was
calculated. Finally, the average performance of the class over all experiments was calculated, as well as the average performance for experiments in the first and second half of the semester.

In Table 2 below, I have indicated in the first column on the left the four different sequences of labs that I have taught in the period considered. Each sequence is shown with a slightly different grey tonality, and it covers the progression of one engineering class as it advances through the four labs in four consecutive semesters. The following columns on the right report the average score obtained for each skill parameter (A, B, C, and D) in the first half of the semester (FH) second half of the semester (SH) and for the total semester average (TS). The fourth sequence (Fall 16 to Spring 18) could not be completed with the fourth lab in the series, which is missing in the table, since I did not teach the Control Systems Lab in Spring 2018.

Table 2 – Average performance for each lab as for four writing skill parameters.

<table>
<thead>
<tr>
<th>LAB\PARAMETER</th>
<th>A</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Logic Sequence</td>
<td>Completeness</td>
<td>Synthesis</td>
<td>Language</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FH</td>
<td>SH</td>
<td>TS</td>
<td>FH</td>
<td>SH</td>
<td>TS</td>
<td>FH</td>
<td>SH</td>
<td>TS</td>
</tr>
<tr>
<td>PHYSICS 1 F13</td>
<td>3.1</td>
<td>3.4</td>
<td>3.25</td>
<td>2.8</td>
<td>3.1</td>
<td>2.95</td>
<td>2.7</td>
<td>3.3</td>
<td>3.0</td>
</tr>
<tr>
<td>PHYSICS 2 S14</td>
<td>3.3</td>
<td>3.8</td>
<td>3.55</td>
<td>3.6</td>
<td>4.1</td>
<td>3.85</td>
<td>3.8</td>
<td>4.0</td>
<td>3.90</td>
</tr>
<tr>
<td>CIRCUITS F14</td>
<td>3.9</td>
<td>4.3</td>
<td>4.10</td>
<td>3.6</td>
<td>4.3</td>
<td>3.95</td>
<td>3.7</td>
<td>4.3</td>
<td>4.00</td>
</tr>
<tr>
<td>CONTROL S15</td>
<td>4.5</td>
<td>4.4</td>
<td>4.45</td>
<td>4.2</td>
<td>4.6</td>
<td>4.40</td>
<td>4.4</td>
<td>4.4</td>
<td>4.40</td>
</tr>
<tr>
<td>PHYSICS 1 F14</td>
<td>2.9</td>
<td>3.1</td>
<td>3.00</td>
<td>2.7</td>
<td>2.9</td>
<td>2.80</td>
<td>2.9</td>
<td>3.1</td>
<td>3.00</td>
</tr>
<tr>
<td>PHYSICS 2 S15</td>
<td>3.1</td>
<td>3.5</td>
<td>3.30</td>
<td>3.4</td>
<td>3.9</td>
<td>3.65</td>
<td>3.5</td>
<td>3.6</td>
<td>3.55</td>
</tr>
<tr>
<td>CIRCUITS F15</td>
<td>3.7</td>
<td>4.0</td>
<td>3.85</td>
<td>3.7</td>
<td>4.2</td>
<td>3.95</td>
<td>3.6</td>
<td>4.0</td>
<td>3.80</td>
</tr>
<tr>
<td>CONTROL S16</td>
<td>4.4</td>
<td>4.6</td>
<td>4.50</td>
<td>4.2</td>
<td>4.6</td>
<td>4.40</td>
<td>4.5</td>
<td>4.2</td>
<td>4.35</td>
</tr>
<tr>
<td>PHYSICS 1 F15</td>
<td>3.1</td>
<td>3.1</td>
<td>3.10</td>
<td>2.5</td>
<td>2.9</td>
<td>2.70</td>
<td>3.0</td>
<td>3.2</td>
<td>3.10</td>
</tr>
<tr>
<td>PHYSICS 2 S16</td>
<td>3.3</td>
<td>3.4</td>
<td>3.35</td>
<td>3.3</td>
<td>3.8</td>
<td>3.55</td>
<td>3.7</td>
<td>3.9</td>
<td>3.80</td>
</tr>
<tr>
<td>CIRCUITS F16</td>
<td>3.6</td>
<td>3.9</td>
<td>3.75</td>
<td>3.9</td>
<td>4.1</td>
<td>4.00</td>
<td>3.9</td>
<td>4.0</td>
<td>3.95</td>
</tr>
<tr>
<td>CONTROL S17</td>
<td>4.0</td>
<td>4.3</td>
<td>4.15</td>
<td>4.1</td>
<td>4.4</td>
<td>4.25</td>
<td>4.4</td>
<td>4.4</td>
<td>4.40</td>
</tr>
<tr>
<td>PHYSICS 1 F16</td>
<td>3.2</td>
<td>3.3</td>
<td>3.15</td>
<td>3.0</td>
<td>3.3</td>
<td>3.15</td>
<td>3.1</td>
<td>3.3</td>
<td>3.20</td>
</tr>
<tr>
<td>PHYSICS 2 S17</td>
<td>3.5</td>
<td>3.7</td>
<td>3.60</td>
<td>3.5</td>
<td>3.6</td>
<td>3.55</td>
<td>3.8</td>
<td>3.7</td>
<td>3.75</td>
</tr>
<tr>
<td>CIRCUITS F17</td>
<td>3.6</td>
<td>3.6</td>
<td>3.60</td>
<td>3.5</td>
<td>3.9</td>
<td>3.70</td>
<td>3.9</td>
<td>4.1</td>
<td>4.00</td>
</tr>
</tbody>
</table>

FH=First Half (Semester) Average; SH=Second Half (Semester) Average; TS=Total Semester
Graphical displays of the results in Table 2, for each sequence, are shown below as well:

Graph 1: Display of the enhancement of writing skills by the scores of the descriptors, for the four lab sequences considered. The bars correspond to the TS columns in Table 2.

From Table 2 and/or Graph 1, one can see a trend of improved assessed proficiencies in each one of the parameters considered. This trend can be observed for each one of the four sequences under considerations, marked in Table 2 with different grey tonalities, and presented separately in each one of the sub charts in Graph 1. Notwithstanding a few exceptions, one can also observe a clear improvement for each parameter within each course when considering the first half of the semester versus the second half in the data of Table 2. In the three complete sequences, (Fall 13 to Spring 15, Fall 14 to Spring 16, and Fall 15 to Spring 17) one can also observe how for the last lab in each series (the Control Systems Lab) all parameters ended up with an average above 4.0 out of 5. This represents a substantial improvement of 1 to 1.5 points with respect to the averages recorded in the first lab of the series (Physics 1 Lab). These can be considered satisfactory results, indicating strong and sustained improvement in the writing skills quality of the reports.

These quantitative results confirmed what had always been a strong “qualitative” impression when grading the reports in the successive labs for each engineering class: the evidence of continuous improvement from lab to lab, and from semester to semester, as to the quality of the writing skills in the submitted lab reports.
Additional Considerations, Critique and Conclusions

While both the general qualitative monitoring and the quantitative approach described in this work tend to confirm the steady progress in the writing skills of our engineering classes, a few considerations and notes about the setup and the model used are in place.

One issue is that the statistical parameters of the sample are not perfect. First, the lab for Control Systems usually included students in their third year (juniors) as well as graduating seniors. Accordingly, there is a mixture of two different engineering classes in each fourth semester of the sequences analyzed. Second, in each one of the lab courses considered in this work there usually are two or three sections. Each section can accommodate up to ten lab teams, or twenty students. My teaching assignments during the period considered (Fall 2013 to Spring 2017) varied from instructing only one section to being responsible for all sections in the same lab. This means that the size of the sample considered was not uniform.

An important issue that remains inconclusive is the distribution of the merit for the monitored progress in the writing skills of the students in the sequence of lab courses.

We the instructors, do in most cases witness a dramatic improvement in student writing skills from their incoming year to their last year reports in advanced courses. These improvements are undoubtedly due to a large variety of factors – including natural maturity, expanding education from all courses, strong contributions from courses in the core curriculum including writing intensive classes, hands-on activities, learning from peers and from teamwork and more. It is probably impossible to isolate each factor and to quantitatively decipher the weight of each contribution. With all these caveats, I strongly believe that the emphases put on our report writing requirements and on the adaptive guidelines and formats, in conjunction with a weekly mentoring and monitoring of the students’ activity in the different labs, do play an important role in the students’ profound transformations and improved skills.
References


