Quality of Academic Writing for Engineering Students at Lund University

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ABSTRACT: The development of good writing skills is fundamental not only to publish scientific results, but also to have a deeper understanding of complex subjects. However reports from the Swedish Higher Education Authority from 2012-2015 suggest that engineering students at Lund University have unsatisfactory academic writing skills. Our paper investigates how students of the Faculty of Engineering at Lund University perceive academic writing and the effects of a writing intervention.

To obtain information on students' education in, attitude, perception of its difficulty and their own skill towards academic writing, we constructed a survey which was sent out to engineering students at Lund University. This yielded 62 responses showing that students want more opportunities to develop their writing, but that they grade their writing skill high and the difficulty low.

The effects of a simple writing intervention, briefly discussing the importance of good writing practices during a laboratory session, was investigated for one student group. This was done using a random selection of laboratory reports for one control group and one intervention group. The overall quality of the students' writing was not significantly improved with the intervention. However the quality of the conclusions, the report section with the lowest quality rating, was higher for the intervention group.

1 INTRODUCTION

Academic writing in higher science, technology, engineering and mathematics (STEM) education has been shown to have many benefits for students. Within the field writing-to-learn it has been shown that writing gives students a deeper subject matter understanding and enhances students' conceptual knowledge [1-3]. Reynolds *et al.* show that writing which requires reflection and argumentation, where the student has to explain and relate science matters within a wider perspective is more effective than pure scientific writing [1]. Similarly Pelger and Nilsson suggest that writing popular science articles is an effective way to promote student learning [3]. Writing and communicating subject matter to non-specialist and collaborative writing are highly valued skills when finding employment after finishing higher education [4, 5]. Treise and Weigold stress that writing aimed at communicating science to the public is a complex matter, requiring understanding of scientific findings and sophisticated translation into language understood by people outside the field. It is also observed that this ability to communicate science to a wider audience is something many within the STEM fields lack [6].

Although writing has been shown to have many benefits, a study by Badcock *et al.* showed that there is not necessarily a significant relationship between writing skills and length of studies for science students in higher education [7]. North found that students' views on and skills in academic writing differed much depending on their study background. Science students did not find writing very taxing and produced shorter essays focuses solely on facts rather than balancing different viewpoints. Students with a background in arts however, reported essay writing as time consuming and produced essays with more sophisticated evaluations and conclusions [8]. This difference in attitude is supported by Leckey and McGuigan, who found that students at the faculties of Business and Management, Education, and Humanities valued writing and communicating as one of the most important skills, while engineering students emphasised the importance of a knowledge base [9]. When looking at the scientific thesis and popular science articles of biology students, Pelger and Sigrell found that the most common shortcomings were the choice of perspectives and level of abstraction [10].

The Swedish Higher Education Authority (Universitetskanslersämbetet, UKÄ) evaluated the education at universities in Sweden during 2012-2015. The evaluations were in large part based on the quality of the Master theses of graduating students, indeed stressing the importance of good writing skills. The

initial reports deemed many engineering degree programmes at higher education institutions below standard, this despite Sweden being ranked as having the 5th best national higher education system [11, 12]. One of these programmes at Lund University, Engineering Physics, found in their following investigation that a lacking focus on academic writing was a main reason for the failure to meet the UKÄ standards [13]. The department of Physics decided to introduce an academic writing course to improve the quality of their education.

Our paper investigates how students of the Faculty of Engineering at Lund University (LTH) perceive academic writing and their writing skills, using a survey aimed at Bachelor and Master students attending varying degree programmes. The effects of a small writing intervention is also evaluated. Pelger and Sigrell suggest that feedback is the best way to improve writing skills and Jones and Freeman stresses the importance of good examples [10, 14]. We investigate if an improvement can be achieved by simply reinforcing the importance and benefits of good writing in laboratory reports. Laboratory activities are a fundamental tool to learn science in higher education and perceived by students as an important way to develop scientific knowledge [15]. However this may fail if the laboratory does not provide the opportunity to analyse, compare and question the relevant topics. The aim of this study is therefore to provide a better and objective overview on the academic writing skills at LTH in order to set the bases for proper intervention that can improve the quality of the laboratory report writing.

2   STUDENT SURVEY

2.1   Method

In order to obtain information on students' education in and attitudes towards academic writing as well as their perception of its difficulty and their own skill, we constructed a survey including some background questions, and 6 fixed choice questions and 2 Likert scale questions on academic writing. The survey was sent out to students at LTH who were currently attending one of two courses in Mathematical Statistics. The courses were selected because courses in Mathematical Statistics are offered to students from many different degree programmes and the particular courses had the largest student groups at Bachelor and Master level respectively. The survey was sent around 250 students who had two days to complete it.

2.2   General results

The survey resulted in 62 accepted responses, *Table 1* shows from which degree programmes the students were and if they studied at Bachelor or Master level.

Degree programme	Number of Bachelor student	Number of Master students	Total number of students
Biomedical Engineering	0	2	2
Information and Communication Engineering	4	2	6
Computer Science and Engineering	11	5	16
Electrical Engineering	0	1	1
Engineering Physics (F)	0	8	8
Industrial Engineering and Management (I)	14	1	15
Mechanical Engineering	0	1	1
Mathematical Engineering (Pi)	12	1	13
All programmes	41	21	62

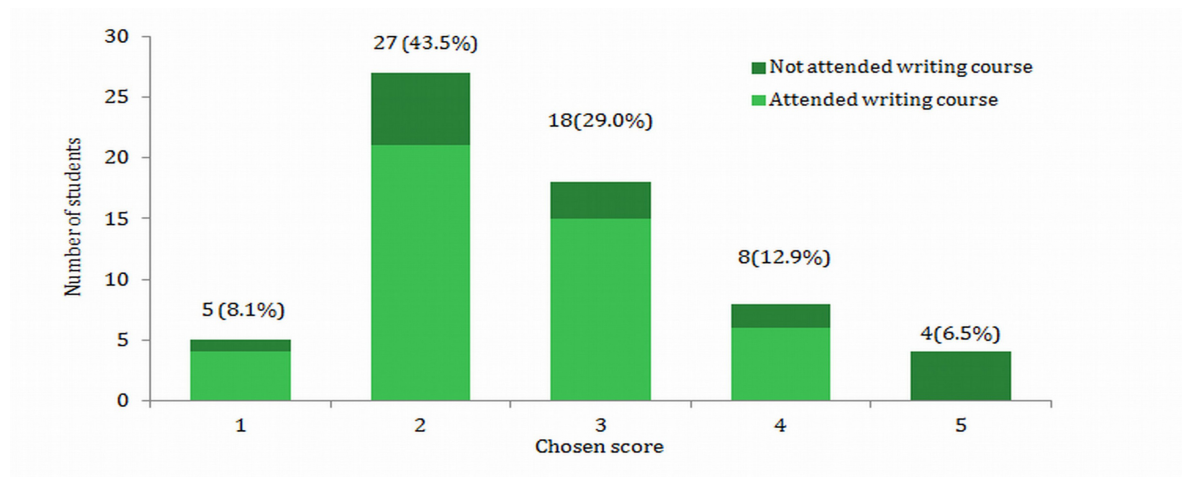*Table 1. Distribution of student who answered the student survey on academic writing.*

Fig. 1. The perceived difficulty, from (1) not at all difficult to (5) very difficult, of academic writing by students who have (light green) and have not (dark green) attended a full or partial writing course.

2.3 Opportunities to learn academic writing

Students were asked if they had participated in a full course in academic writing (full writing course), almost no student had, and if they had taken a course in another subject where academic writing had been a significant part (partial writing course), which 69% stated that they had. Most interestingly all I programme students had attended a partial writing course, while only 25% of F programme students had. These results can be supported by the UKÄ evaluation of LTH, which stated that the I programme offered many opportunities for students to learn and work on their written and oral communication [16]. As mentioned above, the F programme has had problems with writing and it is reasonable that it takes time before the improvement efforts impact all students.

2.4 Students' attitudes

According to the survey 29% of students want to attend a full writing course, 39% answered maybe. Even more, 47% of students want a partial writing course to be part of their programme, and 26% said maybe. Interestingly all F programme students were positive to a full and partial writing course, however overall students were not more positive or negative depending on if they had previously attended a full or partial writing course.

Most students, 90%, stated that they want writing instructions for laboratory reports. When asked if they thought that academic writing should be assessed in laboratory reports and "other academic writing assignments", not including minor grammatical errors and spelling errors, 69% of students thought it should, while 13% answered no. Out of these 13%, only one would like to attend a partial writing course, compared to almost one in two when considering the whole population of students, suggesting a significant difference in attitudes between students.

2.5 Perceived difficulty

The students rated how difficult they find academic writing to be on a scale from 1 (not at all difficult) to 5 (very difficult). There did not seem to be a correlation between finding academic writing difficult and thinking writing should or should not be assessed in laboratory reports and other assignments. However the only students who found academic writing very difficult were students who had not attended a full or partial writing course, this is illustrated in *Fig. 1*. It is also worth noting that there is no significant difference between Bachelor and Master students, however I programme students rate the difficulty a little lower than the rest of the students.
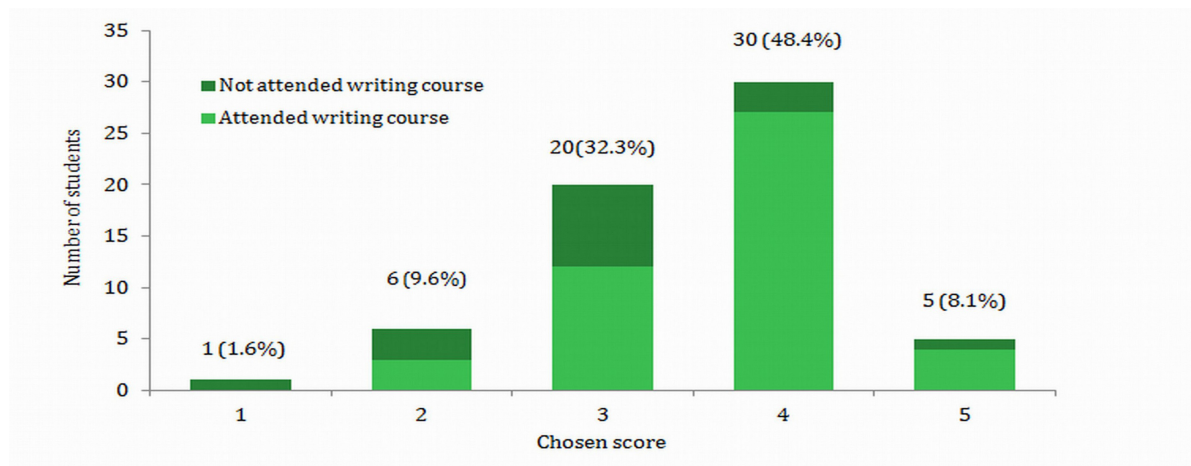
Fig. 2. The perceived academic writing skill, from (1) poor to (5) very good, of students who have (light green) and have not (dark green) attended a full or partial writing course.

2.6 Perceived skill

Students also rated their writing skills between 1 (very poor) and 5 (very good). Again there did not seem to be any correlation between perceived skill and thinking writing should or should not be assessed in laboratory reports and other assignments. Only one student rated their skill a 1, the same student rated difficulty a 5 and has thus not attended a full or partial writing course. *Fig. 2* shows that more students who have taken a full or partial writing course rate their skill a 4 or above compared to students who have not taken a writing course. Also Master students rate their skill higher than Bachelor students, and no I or Pi programme students rate their skill 2 or less.

2.7 Reflections

In general more of the surveyed students were positive towards a full or partial writing course, compared to how many answered that they had attended one. However not all students that want writing instructions for laboratory reports think think that writing should be assessed in reports and a small group of students seem very negative towards writing. The students rated the difficulty of writing low, which also is what North found for students with science background [8]. No difference between Bachelor and Master students existed when rating difficulty, however students from the I programme, mostly Bachelor students, could have influenced this result by rating difficulty lower than the other students. Master students rated their skill higher compared to Bachelor students, which seems natural since they have had more opportunities to develop their writing skills. The survey showed that students which have attended a writing course rated their skill higher and the difficulty lower, which also supports the need for encouraging good writing skills which improves the quality of the student.

3 INTERVENTION

3.1 Method

An intervention and evaluation of laboratory reports were performed for a group of 32 students at the Department of Physics at Lund University. The students were chosen because they attended a course which included for students to "have an increased competence for presenting in writing an accomplished project" in the learning outcomes. As part of a laboratory, students were required to hand in a report, the course provided guidelines on writing a report and a list of topics to be included in the report [17]. The laboratory had seven sessions where a maximum of four students attended at a time. During three sessions, the teaching assistant spent four minutes discussing the importance of the reports, mentioning that writing competence is included in the learning outcomes, emphasising how academic writing is part of the scientific process, explaining that writing will help to achieve a deeper understanding of the laboratory topic and finally handing out a hard copy of the guidelines on report writing, also found on the course web page.
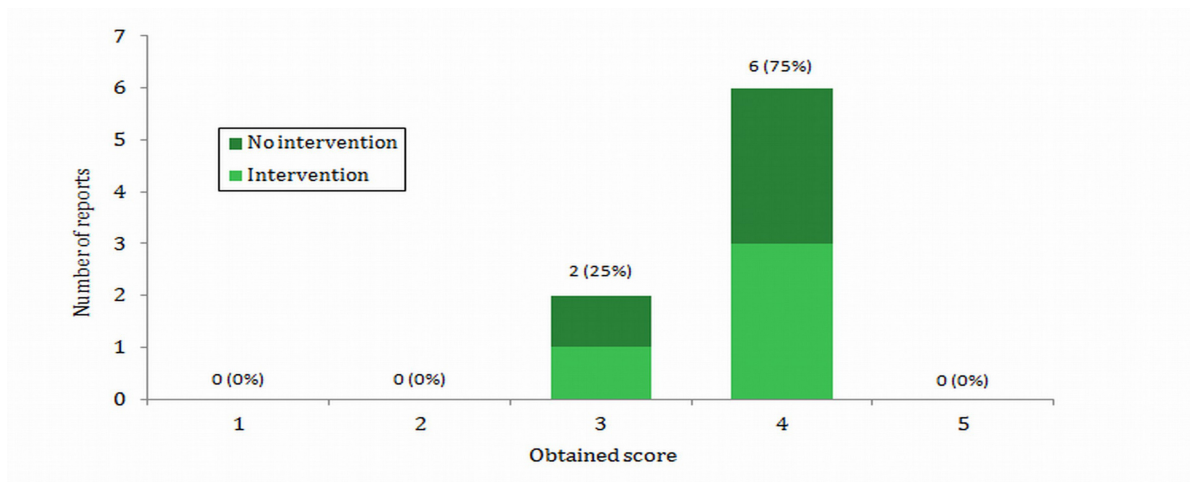
Fig. 3. The average, rounded off total score of the reports, from (1) missing to (5) beyond standard, of students with the intervention (light green) and the control group (dark green).
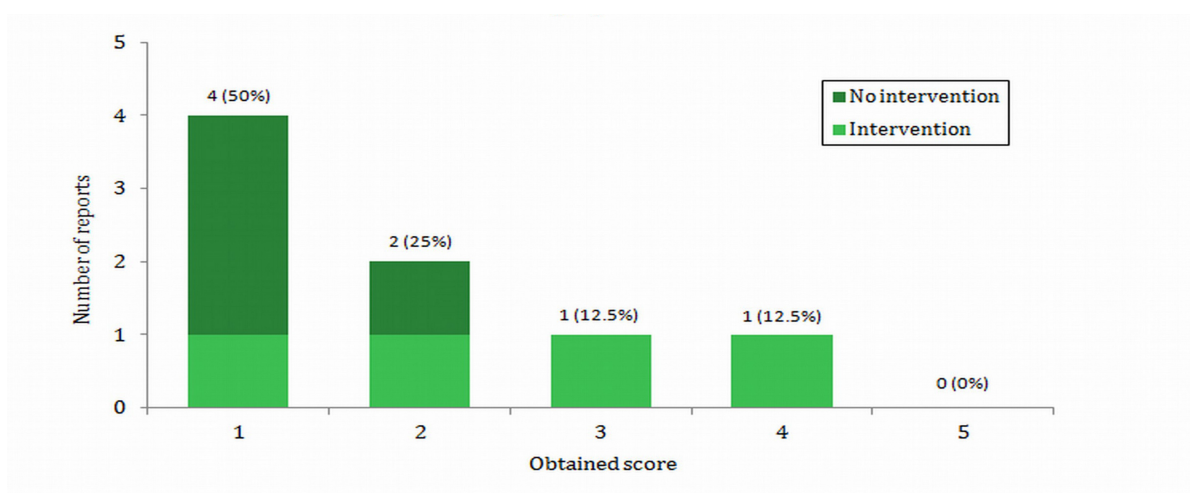

Fig. 4. The average, rounded off score of the conclusions in the reports, from missing (1) to beyond standard (5), of students with the intervention (light green) and the control group (dark green).

From the reports that the students gave their authorisation to evaluate, eight were randomly selected, four from the groups which had received the intervention and four from the control group. Names were removed from the reports and they were evaluated by two people individually, using an evaluation rubric adapted from [18]. The rubric included seven categories dedicated to each section of the report (Title, Introduction, Theory, Method, Results, Conclusion and Bibliography) and five to the writing (Quality, Structure, Punctuation, Grammar and Citations). The rubric scoring ranged from Missing (1) to Beyond Standard (5), and the scoring for each report was given by the average of the two evaluations.

3.2 Results

The total scores, rounded off to the nearest integer, for the reports are shown in *Fig. 3*, it can be seen that most reports received a score of 4. Looking at the total scores, there is no significant difference between the intervention and control group. The only difference can be seen for the scores on the conclusions of the reports, shown in *Fig. 4*. This is also the category that over all got the lowest scores, the intervention group having an average of 2.4 and the control group an average of 1.3, the averages for all other categories was between 3.1 and 4.4. Of all reports, half did not even include a conclusion, and 88% did not reflect about any result obtained during the laboratory.

3.3 Reflections

The assessed reports were written by Master students, who preferably should have had experience writing and opportunities to receive constructive criticism, however our survey show that this is not

always true. Though most students produced over all standard reports, it is deeply concerning that many students failed to include a conclusion in their reports and that the included conclusions were so poor. Concerning but perhaps not surprising as other also have found that STEM students value facts over evaluation [8-10]. Our small intervention, only taking four minutes, seem to have influenced the students to at least include a conclusion and thus reflecting on the topics of the laboratory, hopefully giving them a deeper knowledge of the subject.

4   SUMMARY AND CONCLUSIONS

The overall high skill score and low difficulty score on the student survey show that despite many engineering programmes being ranked low by the UKÄ, the students believe they have a good quality of writing. Commonly written assignments at LTH are assessed solely on content, rather than writing skills, students may get constructive feedback on writing mistakes but they are not penalised, so there is no incentive to correct these mistakes in future works. One suggestion to improve the writing skills at LTH would be to assess written assignments on both content and style. Whilst preserving the importance of content, some grading factor should be taken into account to enforce a higher standard of academic writing. With this small adjustment an improvement should be observed in academic writing and the quality of learning at LTH.

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