In this paper, we examine how the students’ writing culture changed over time, while using computer mediated communication in two Computer Science courses. We investigate how the students started using mostly casual language in online messages and posts at the courses’ e-fora and subsequently, how they adopted a more formal communication with their professors and peers over time. The only driving force for this change was the positive examples from the professors’ formal replies, since students never received criticism –or any kind of other feedback– for their casual messages or replies. For this study, we have collected and analysed a total of 315 messages from these two courses, send by 75 individual students. These messages were classified into two categories ‘casual’ and ‘proper’, using a set of strict criteria that the fulfilment of all was required for a message to be classified as ‘proper’. The results of the analysis of these messages revealed that, using only the professor’s formal responses as a positive example, students changed significantly their writing culture over time and, while they had started communicating using casual language at the beginning of each course, after a few weeks they had adopted a more suitable language.

Keywords: Online forum, writing skills, writing culture, undergraduate education, STEM education.

1 INTRODUCTION

Good writing skills are essential for university students, since writing is not only the principal way to prove their knowledge and skills [1], but also an important skill for a successful professional career. In particular, for Computer Science (CS) graduates, the ability to communicate their ideas using good writing skills and the ability to plan, organize, and write technical manuals, documentation, and reports is an important factor for their professional development [2]. Therefore, it is essential for students to improve their writing skills during their studies and a step towards this goal is by learning from the professor’s online communication examples and improving themselves.

In a rapidly changing university culture [3], the traditional face-to-face meetings between campus-based students and professors are becoming less frequent and more task specific, while these students communicate frequently online with short messages with their professors and peers. During such communication, issues such as e-politeness [4] and, in general, the use of proper ways for students to communicate with their professors and peers are into academic culture spotlight and had led to numerous miscommunication anecdotes.

This work focuses on the communication between campus-based students and their professors, using either direct online messages at the university Learning Management System (LMS) infrastructure, or communicating with their professors and peers on an e-forum. The analysis is based only on online communication etiquette and not on the message content per se, even if in some cases messages included unreasonable, or even impolite, requests (i.e. in one of the messages we analysed, a student asked the professor to pre-grade an essay before submitting it). In most cases, students are uncertain on how to communicate with their professors and peers, since various professors may have adopted different approaches and, mostly, since there aren’t available many examples of proper communication that students could rely on. Such a lack of proper communication may cause problems not only in hierarchical relationship (student-to-professor messages), but also during communication with their peers.

In this paper, we examine the change of students’ writing culture using computer mediated communication (CMC) in two CS courses and we measure how, over time, they shifted from using casual language, towards a more formal communication with their professors and peers. Toward this goal, students’ messages were collected, grouped into two periods of time (7 weeks each) and characterised as ‘casual’ or ‘proper’. The analysis of the messages showed a significant improvement in the quality of students’ online messages over time, even though the only means for improvement was the professor’s ‘proper’ messages that served as examples.
The rest of the paper is structured as follows. Section 2 presents the research background related to student messages, writing skills and online writing culture, as well as the tools and methods to analyse online discussions. Section 3, presents the methodology, the data cleansing procedure and the limitations related to data analysis, while Section 4 outlines the results of the study. Finally, Section 5 presents the main conclusions and discusses directions for future work.

2 RESEARCH BACKGROUND

The use CMC is becoming part of the everyday experience of campus-based students, so is no longer meaningful to ask why students communicate online, but how this CMC could improve their campus-based experience [5]. Although the online discussions have been recognised as a valuable learning process [6-8], it is also pointed out that CS students sometimes have poor communication skills [9, 10]. Therefore, it is challenging to develop such skills, while this is not part of a typical CS curriculum. Following the widespread usage CMC many CS students communicate with their professors in a very casual manner and tend to adopt this behaviour in various CMC situations after graduation (i.e. in a job application, or an application for postgraduate studies). To justify this behaviour, we must acknowledge that students are unaware of online written communication etiquette, because this is not explicitly taught, and as result crafting an appropriate message takes a lot of guesswork [4]. A reason for this phenomenon could be that the users of a relatively new language technology arrive at stylistic conventions for employing that technology and students adopt a laxer attitude toward stylistics [11]. Another reason could be that students had been negatively influenced by the various instant messaging tools they are using on a daily basis, where a more casual language is adopted [12].

The extend of each student's participation in online discussions is related to various demographics [13], as well as to the student's personality and this affects their comfortableness within the CMC (i.e. in an e-forum) [14]. The technology usage is also affected by disciplinary differences [15], where students in applied disciplines (such as the CS students) are more confident users and this may lead them into a more laxed attitude during CMC. Finally, the way students communicate online is affected by various social perceptions like the sense of invisibility [16] when communicating online. Therefore, students behave differently when online –which might go as far as to change their moral judgement [17, 18]– and this is reflected in the way they communicate with their professors and peers.

In previous works [19, 20] we have analysed students' messages in online fora, by creating a language which was used to describe the message sequences in relation to their content. A similar approach could be used only when the number of messages in each thread in the online fora was much higher than what it was measured in this case. Therefore, in this case analysis was done for each message individually. Similar works is the study of Chen [21], where is examining how previous messages affected later messages, but this work focuses only in opinions expressed in online messages (agreement or disagreement) and not in the style of the messages. Biesenbach-Lucas [4] examines politeness in e-mail requests from students to their professors in English language and variations among different type of requests, without examining if and how student messages changed over time.

3 METHODOLOGY

The data for this survey were collected from two CS courses, namely ‘Software Engineering’ and ‘Writing and Presenting Technical Documents’, hereinafter ‘Course A’ and ‘Course B’ respectively. In both courses, a large number of students were registered (around 300 students for each course), but a much smaller number of students participated in the discussions in the online e-fora, or send a direct message to the professor using the university LMS. This represents a typical behaviour of online students, where most students just consume information and very few contribute in the discussion [22]. Based on the views count (the university LMS provides this measure for each thread and not for each message), the ‘speak-to-read’ ratio in the e-fora was 1:38. This is the upper limit, since the assumption that a ‘read’ in each thread means reading all messages was made (which make sense, since the average messages per thread for both courses was just 2.63).

The actual net duration (without counting the 2 weeks of Easter holidays) of each of the two courses is 14 weeks (one semester). The data from student messages were grouped into two periods. Each period was 7 weeks long and there was a break of two weeks between them (Easter holidays). The first period (weeks 1 to 7) is called ‘period 1’ and the second period (weeks 8 to 14, after the Easter break) is called ‘period 2’ hereinafter. The two periods were used to investigate the change in the
students’ messages over time. Although 118 individual students had ‘spoken’ online (either in an e-
forum, or using a direct message), only 75 of them had at least one message in each period, thus their
messages could be used in this survey. Table 1, presents all numbers related to students’ participation
in each course and overall for both courses combined.

Table 1. Students’ participation in discussions.

<table>
<thead>
<tr>
<th></th>
<th>Course A</th>
<th>Course B</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td># of individual students that posted something in the e-forum (set A)</td>
<td>35</td>
<td>29</td>
<td>64</td>
</tr>
<tr>
<td># of individual students that sent at least one message to the professors (set B)</td>
<td>22</td>
<td>49</td>
<td>71</td>
</tr>
<tr>
<td>A ∪ B</td>
<td>51</td>
<td>64</td>
<td>115</td>
</tr>
<tr>
<td># of individual students that had at least one message or one post in each period</td>
<td>32</td>
<td>43</td>
<td>75</td>
</tr>
</tbody>
</table>

Messages from these 75 students were collected from threads in online discussion e-fora (two e-
forums, one for each course with various threads in each) and from direct student-to-professor
messages in the same environment. All these student messages were combined, since both posts in
the e-fora and direct messages were of a similar nature: short messages (mean number of words per
message is 21.17 and mean number of characters with spaces per message is 130.45), asking for
clarifications or directions. These messages were classified into two categories named ‘casual’ and
‘proper’. A message is considered as ‘proper’ if all the following criteria were met:

- The student first presented the problem and then asked a question (i.e. “Regarding the issue of .....
  I would like to ask...”), rather that asking a question straightforwardly (i.e. “Is it correct to ...
  “What is the ...

- The student used the plural term when referring to others (professors or peers), which is
  considered the polite way to address others in the Greek language.

- The student hasn’t used any diminutives, which are very common in casual language in Greek.

- The message had at least an introduction (i.e. “My name is ... and ...
  “Good afternoon,...”), or a thank you note (i.e. “Thank you for your time
  “Thanks in advance for your reply”), but not
necessarily both.

Following these criteria, any message that failed to fulfil even one of them was classified as ‘casual’.
The hypothesis (H₁) that the students will change their writing culture and adopt a more suitable
language over time, was tested using the proper-to-overall messages ratio in both periods of time,
therefore the null hypothesis was:

H₀: The students will continue to communicate in the same manner in both periods

3.1 Data cleansing and limitations

Although during the design of the study –and before having the data in hand– a goal was to analyse
the messages automatically, using a method we have developed [19, 23] this wasn’t feasible, since
this method requires larger sequences of messages to be utilised, whilst in this case the average
number of messages per thread has been just 2.63. Word clustering [24] also wasn’t feasible, due to
the large variety of message categories. Therefore, since the number of messages was just 315, the
classification of students’ messages was done manually, allowing us to create a proper data set that
could be used as training data set, for machine learning techniques to automatically analyse further
messages. This allowed us to overcome particularities of the Greek language that could make
automatic classification challenging.

The selection of two periods of 7 weeks each, wasn’t an easy choice and had reduced the volume of
data, since at least one message in both periods was required. Many students send one or more
messages in one period and no messages in the other period, therefore these messages were not
included in the survey. An alternative selection that was considered was to analyse data from students
that had at least 4 messages and place the first half of them in the first group and the second half of
them in the second group. This way we could have a larger data set (118 students and 407 messages
after data cleansing). The limitation of this approach is that the professor’s impact to this student’s writing culture could be different if the student had sent all the messages over the first weeks of the course, rather than the last weeks. Since there are many cases of students in such category, we decided that it was better not to use their data, rather than having another variable (the exact weeks the communication took place).

Regarding students’ messages, 23 messages that were too simple to be classified (i.e. “Thank you for your reply.”), or replying to a specific question providing a short answer (i.e. a student asked for a link and another student replied, sending just the link) were not included in the data set. Finally, in both courses, lectures were given by two professors, but in both courses the same professor was almost entirely responsible to reply online. Still, there existed very few messages that were replied by the other professor, or send elsewhere (i.e. using the professor’s e-mail). E-mail messages weren’t replied and the students were asked to use the course LMS’s messaging system. Nevertheless, the formal reply of the professor in these few cases asking the students to use the LMS, might be considered as noise. However, this noise had a very low effect on data integrity, since the professor was very active, posting almost daily in the courses e-fora, therefore all the students had the same exposure.

4 RESULTS

The analysis of the data focused on the 315 messages collected and on the 75 individual students who submitted these messages. The results are presented in the following subsections.

4.1 Results from the analysis of messages

Table 2, presents the basic descriptive statistic results (total number of messages, sum of all messages, minimum number of messages per student, maximum number of messages per student, mean, median, and standard deviation) for the students’ messages for both periods. The columns contain the values for each course (labelled ‘CA’ and ‘CB’ for ‘Course A’ and ‘Course B’ respectively), as well as the combined values for both courses (labelled ‘ALL’) classified into both periods (labelled ‘P1’ for the first period and ‘P2’ for the second period).

<table>
<thead>
<tr>
<th>Messages</th>
<th>CA P1</th>
<th>CA P2</th>
<th>CB P1</th>
<th>CB P2</th>
<th>ALL P1</th>
<th>ALL P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total messages</td>
<td>57</td>
<td>81</td>
<td>87</td>
<td>90</td>
<td>144</td>
<td>171</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>8</td>
<td>12</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Mean</td>
<td>1.78</td>
<td>2.53</td>
<td>2.02</td>
<td>2.09</td>
<td>1.92</td>
<td>2.28</td>
</tr>
<tr>
<td>Median</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.39</td>
<td>2.54</td>
<td>1.32</td>
<td>1.60</td>
<td>1.35</td>
<td>2.06</td>
</tr>
</tbody>
</table>

The results shown that each student send a small number of messages (in most cases a couple of messages in each period), while very few students communicated frequently. Since there were no significant differences in the descriptive statistic results for both courses and since the conditions were almost the same (the same professor responded to all these messages), combining messages from both courses to a group named ‘ALL’ for both periods, to better present the results is valid. This was confirmed by using one-way ANOVA having the ‘Course A’ and the ‘Course B’ as groups for the ‘period 1’: $F(1,73) = 1.751, p = 0.190$, as well as for the ‘period 2’: $F(1,71) = 0.024, p = 0.877$. The results showed no statistically significant difference between these two groups.

Table 3 presents the results after classifying each one of the 315 messages as ‘proper’ or ‘casual’, based on the criteria presented in the previous section, using the same column labels as in Table 2. The rows present the results for the overall number of messages (Tm), how many of these messages are classified as ‘proper’ (Pm) and how many as ‘casual’ (Cm). The Pm/Tm and Cm/Tm ratios, show that there was a substantial change from ‘period 1’ to ‘period 2’ from ‘casual’ to ‘proper’ messages. Since the ‘Course B’ is somehow related to proper writing, students started using more ‘proper’ messages in the first period for this course ($P_{m/T_m}= 0.322$), while just ($P_{m/T_m}= 0.175$) for ‘Course A’. The results from
both courses shown a clear shift from casual language to proper language over time, where the overall 'proper' messages were only 26.4% of the overall messages in 'period 1' to 60.2% in 'period 2'.

### Table 3. Messages data analysis.

<table>
<thead>
<tr>
<th></th>
<th>CA P1</th>
<th>CA P2</th>
<th>CB P1</th>
<th>CB P2</th>
<th>ALL P1</th>
<th>ALL P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total messages (Tm)</td>
<td>57</td>
<td>81</td>
<td>87</td>
<td>90</td>
<td>144</td>
<td>171</td>
</tr>
<tr>
<td>Proper (Pm)</td>
<td>10</td>
<td>46</td>
<td>28</td>
<td>57</td>
<td>38</td>
<td>103</td>
</tr>
<tr>
<td>Casual (Cm)</td>
<td>47</td>
<td>35</td>
<td>59</td>
<td>33</td>
<td>106</td>
<td>68</td>
</tr>
<tr>
<td>Pm/Tm</td>
<td>.175</td>
<td>.568</td>
<td>.322</td>
<td>.633</td>
<td>.264</td>
<td>.602</td>
</tr>
<tr>
<td>Cm/Tm</td>
<td>.825</td>
<td>.432</td>
<td>.678</td>
<td>.367</td>
<td>.736</td>
<td>.398</td>
</tr>
</tbody>
</table>

To test the null hypothesis, the Pm/Tm results from both courses were used as groups and the null hypothesis was rejected, since there is a statistically significant difference between the two groups as determined by one-way ANOVA: \( F(1,148) = 32.096, p = 7.41 \times 10^{-8} \). Therefore, we argue that the positive examples of the professor’s replies on students’ messages helped students to change significantly their writing culture over time and, while they had started communicating using casual language at the beginning of each course, after a few weeks they adopted a more suitable language.

#### 4.2 Results for the individual students

Finally, for individual students, we have used a strict rule: A student is considered having communicated properly in a period, only if all his/her messages were ‘proper’ in that period. Therefore, even a single ‘casual’ message among many ‘proper’ ones had as result to classify this student as one that had communicated casually.

### Table 4. Individual students’ data analysis.

<table>
<thead>
<tr>
<th></th>
<th>CA P1</th>
<th>CA P2</th>
<th>CB P1</th>
<th>CB P2</th>
<th>ALL P1</th>
<th>ALL P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total students (Ts)</td>
<td>32</td>
<td>43</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Properly (Ps)</td>
<td>4</td>
<td>17</td>
<td>7</td>
<td>22</td>
<td>11</td>
<td>39</td>
</tr>
<tr>
<td>Casually (Cs)</td>
<td>28</td>
<td>15</td>
<td>36</td>
<td>21</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td>Ps/Ts</td>
<td>.125</td>
<td>.531</td>
<td>.163</td>
<td>.512</td>
<td>.147</td>
<td>.520</td>
</tr>
<tr>
<td>Cs/Ts</td>
<td>.875</td>
<td>.469</td>
<td>.837</td>
<td>.488</td>
<td>.853</td>
<td>.480</td>
</tr>
</tbody>
</table>

Table 4, presents the results for the individual students, using the same column labels as in both previous tables (Tables 2 and 3). The rows present the results for the overall number of students (Ts), how many of these students communicated properly (Ps) and how many casually (Cs) during each period. The Ps/Ts and Cs/Ts ratios, show that there was a substantial change from ‘period 1’ to ‘period 2’ in the overall student’s attitude towards online communication. Starting from as low as 14.7% for the students in the ‘period 1’, at the end of the semester half (50.2%) of the students communicated using more suitable language in all their online messages in ‘period 2’.

### 5 CONCLUSIONS AND FUTURE WORK

This paper presented that the professor’s positive examples of online messages helped students to improve the quality of their own online messages regarding academic etiquette over time. Using data from two courses we showed that while students communicated at the beginning of both courses using casual language, after a few weeks they adopted a more suitable language for online communication.

A future goal is to exploit this data set and use it as training data set for machine learning techniques to automatically analyse further messages. Another interesting idea—which wasn’t feasible to investigate in this study, since both courses had the same professor—would be to use the course as a control parameter and investigate how different professors’ styles affect student changes in writing.
culture over time. Finally, this survey didn’t get into details for individual students, i.e. an interesting point to investigate is how many times a student went back to ‘casual’ communication after using a ‘proper’ message. This was due to the low mean of students’ messages, but further investigating such cases in a different data set, where student communication is more frequent, is another future goal.

REFERENCES


