Practikon: a mobile-first practice/feedback application to support the development of communication skills in technical subjects

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Practikon: an online practice environment to support the development of rhetorical awareness in technical communication

Introduction

More than ten years ago, the National Commission on Writing found that, for many companies, only about a third of their new employees possessed the required communication skills, and estimated that $3.1 billion is spent annually on efforts to remediate the situation[1]. Such reports are not uncommon or surprising, and their results align with what almost all alumni surveys from several institutions of higher education point to: graduates, especially in Engineering and the Sciences, consistently report that they are underprepared for the communication demands of their workplace[2]. Such surveys provide significant indicators for external evaluators, such as the Accreditation Board for Engineering and Technology (ABET), about the need to support both the instruction and practice of professional communication[3]. Driven by such accreditation and workplace demands, several institutions have embarked into establishing full scale Engineering Communication programs within their curriculum (e.g. University of Toronto, Mercer University), or have developed stand-alone courses for their students. In a few instances, such as the case of MIT, communication instruction is embedded within the disciplinary curriculum.

The key challenges in introducing communication pedagogy into an existing engineering curriculum are scalability and limited resources. Conventional approaches to teaching communication are geared towards small class sizes and are difficult to adjust for large groups of students. Directly scaling this approach would require a large number of qualified instructors—i.e., to support and assess students' communication activities—at a significant cost. Some researchers have addressed these problems by developing online writing centers, resources and tutorials for communication skills[4-7] .Online peer tutoring has also been suggested as a potential approach[8]. However, these efforts are still new and further investigations are necessary.

Despite the increasing efforts, a large scale survey by Reave[9] found that there is still a "large gap between the workplace needs and graduating engineers' communication skills." Based on Reave's work, Evans and Gabriel criticize the current conception of communication skills as independent "soft skills" and postulate that communication should be understood as social action that is bound in the context of engineering practice[10]. Hence, they suggest that communication should be "learned through processes of participation" where communication is directly associated with "performing engineering." Our project builds on the approach suggested by Evans and Gabriel, by situating learning activities in authentic professional contexts where students are expected to perform tasks that require clear and effective communication.

Studies of teacher comments on student writing in the Sciences and Engineering suggest that feedback focuses on lower-order concerns such as grammar and formatting[11-12]. Recently, some studies indicate that instructors have begun to focus on higher order rhetorical concerns as well[13], which are, in fact, the type of concerns most prominent in workplace reviews[14]. Research in the Learning Sciences has shown us, however, that effective feedback has to be targeted and coupled with goal-directed practice[15]. In short, to help students or technical staff improve their communication skills, goal-directed practice on higher-order rhetorical issues is necessary.

However, researchers have long recognized that working within authentic contexts introduces new complications, as workplace problems are typically ill-structured and complex[16]. Successfully addressing such problems requires what Sheppard et al called "engineering knowledge," which is knowledge that extends beyond the "what" (the science) and the "how" (its implementation) into the "when and where" (deploying the appropriate skills in each situation to solve particular problems)[17]. Such an approach essentially points to the rhetorical nature of engineering practice, which is a whole layer of engineering knowledge that rarely gets addressed, even within the context of engineering communication. In many ways, employing critical and thoughtful strategies towards solving engineering problems is what Mitcham calls the "true Grand Challenge of Engineering": the attainment of Self-knowledge, especially in terms of designing and constructing the world we would like to live in[18]. We believe that such engineering self-knowledge is inextricably linked to an understanding of engineering communication as rhetorical problem-solving, taking into account audiences, purposes, contexts and available tools and technologies to solve the problems.

Guided by this general approach, we designed and implemented a working prototype of an electronic learning environment, called *Practikon*, which is intended to provide technical professionals with rhetorically-relevant practice on near-authentic communication problems. *Practikon* consists of a series of interactive, online learning activities framed within an authentic context, and it is designed to be accessible via a computer, tablet, or smartphone. The currently working prototype was developed using HTML5 with Javascript. While the prototype was designed for multiple platforms, it was primarily implemented and tested for iPads for the study reported in this paper.

Appendix A presents a series of screenshots from the working prototype on a tablet, which illustrates the steps in one of the activities. In the beginning, the user is presented with a brief scenario or context for the activities (Fig. A-1). Immediately following, the user is presented with the initial screen that introduces the technical communication problem (Fig. A-2) and then asked to (1) identify a problematic segment of a text (Fig. A-3), and (2) select an appropriate alternative text to remedy the problem (Fig. A-4). While the user interface does not impose specific writing tasks, the revision tasks we used focused on revising a given text for either technical or non-technical audiences in various contexts. In some cases, where the whole sentence needs to be revised, the problem recognition step (i.e., Step 1) is not necessary. The user, then, receives feedback based on the appropriateness of the response (Fig. A-5). Each activity also includes a guide page that provides hints for completing the given task. The user may use the guide page at any point while he or she is interacting with the learning activity.

The long-term goal of this study is to assess to what extent the online activities help improve the quality of the participants' technical writing and rhetorical awareness. This paper reports on an exploratory pilot study we conducted recently to examine the value of our instructional approach and develop better insights regarding the design of *Practikon*.

Overview of Study

During the early summer of 2014, we conducted an exploratory pilot study with a group of IT professionals working for a local university in Doha, Qatar. Seven professionals participated in

this study. Six of them had a bachelor's or a master's degree in computer science related fields (4 BS, 2 MS). One participant held a certificate in engineering. This study was conducted in the following five steps:

(1) **Conduct Interviews:** The goal of the first step was to develop an understanding of particular communication activities found in the participants' workplace. We interviewed participants in small groups, and collected writing samples from the participants. Our questions focused primarily on what the participants perceived as challenges in their writing tasks at work. This step required approximately 30 minutes from each group.

(2) **Determine Content and Design:** The second step involved the development of content for a set of online learning activities based on the outcomes of the initial interviews and the writing samples we collected. The participants in this study all agreed that one of the most difficult aspects of their communication tasks was to communicate to non-technical audiences. Therefore, we decided to focus primarily on addressing a situation where the writer needs to make appropriate rhetorical choices according to their audience. The content used for the learning activities was developed based on some of the writing and revision examples from commonly used online sources[19, 20, 21].

(3) **Perform Online Activities:** We then asked the participants to work on five sets of online learning activities on *Practikon*. Each set included 3 to 4 simple activities. On average, each participant spent roughly 30 minutes to complete the activities. The usage data (which buttons/links were clicked) along with time stamps were collected for each individual participant.

(4) **Post-*Practikon* Writing Task:** We asked the participants to work on individual writing tasks. The manager of the IT group helped us generate a specific writing task relevant to each participant's area of responsibility. The samples produced by the participants were analyzed for discourse and rhetorical features in relation to previous writing samples.

(5) **Gather Feedback:** In the last step, we collected and analyzed the participants' opinions about the usability and value of *Practikon*. Participants were interviewed individually. Each interview required 20–30 minutes.

After all the steps were completed, we analyzed the data collected. We used an exploratory qualitative methodology to examine the applicability of our instructional approach for improving the rhetorical awareness of engineering students and professionals. The following sections present and discuss the results of the current study specifically focusing on the post-*Practikon* writing samples and individual interviews (Steps 4 and 5).

Analysis of the Interview Data

During the interviews, participants were asked to provide general feedback on their interaction with *Practikon*, as well as respond to the question: "Do you think using *Practikon* affected the way you wrote your post-*Practikon* writing task?" The results suggest that they were making a distinction between correctness and appropriateness, especially in relation to audience

expectations and level of knowledge. Participant 3, specifically, privileged rhetorical appropriateness over correctness by claiming that

"… if it's the end goal to actually use the proper writing and to have a fluent writing, or to be relevant, it doesn't matter grammar (sic), it's actually how relevant it's to the non-technical person looking at that text,"

For this participant, appropriateness seems to be correlated to a level of fluency that is not an objective or an external measure, but it can only be defined in relation to the audience of the text. The issue of "relevance" is again explained by the same participant as "proper verbiage" or in the words of participant 5:

"It would be something good for us to understand if we are typing [writing] correctly to the non-technical user or typing [writing] incorrectly,"

where "correctness" to the non-technical user is precisely the issue of rhetorical appropriateness for the particular audience. The qualitative claim made by participant 5 that such a skill "would be good" is stated in an even stronger manner by participant 6:

"… when I want to say something, I say it from my background [which] is technical background, I say it very technical, while I found that OK, you know that we can say it in different way, more polite way."

We can notice the difficulty participants have in describing their understanding of the rhetorical nature of writing, especially in direct contrast to "technical" or content-driven writing. In this case, participant 6 repeatedly used the term "polite" to refer to the kind of writing that would be appropriate (or not offensive) to the audience. Later in the interview, the comparison was even more pronounced, as the participant stated: "You know, for example, if it's a grammar problem or if you need to improve it in a polite way" distinguishing between correctness and appropriateness (or politeness). Another participant (#8) used another way to address rhetorical (in)appropriateness by stating: "it's a bit patronizing… to show off with high, complex vocabulary for this group of users," pointing to the problematic positioning of the technical author in relation to non-technical readers.

All of the above, point towards the understanding of the IT professionals participating in this study in terms of the value of an audience-sensitive rhetorical approach when they compose. As most of the participants came from cultures where relationships between people are highly valued, their ways of explaining the concept of rhetorical appropriateness focused on concepts of politeness or power differential. Overall, the results suggest that brief online activities the participants worked on helped them heighten their rhetorical awareness toward the importance of writing for target audiences and occasions.

In addition, a few of the participants seemed to point to a larger goal or value for their work, that of being able to hold higher management positions if they achieve a certain level of rhetorical fluency. One of those participants stated that:

"I would like to move into a leadership position so I have to start thinking, you know, that way, use the proper verbiage, proper writing, especially when addressing upper management or, let's say, other entities outside a company, not necessarily inside the IT group."

This way of "thinking" or approach may not necessarily be part of the set of expectations for professionals, but participants seemed to realize its importance for moving up to higher-level roles in their career. For those participants, the need to use write effectively became clear in their mind as a necessary condition to reach higher management levels. For this reason, it seems that the value of a learning environment like *Practikon* can be more significant for new entrants in the workforce than it was originally conceived to be.

The observation from the interview data is also supported by the analysis of the writing assignments that the participants were given for this study. The participants were asked to write brief texts, primarily explanations of processes or presentation of technical information for lay audiences. Only one prompt was argumentative, aimed at making a case to the Director for the timely implementation of a process.

Analysis of the Writing Samples

Despite the small number of writing samples we analyzed, some important patterns emerged both at the rhetorical level and at the discourse level.

At the rhetorical level, we identified a number of clear markers of metadiscourse, directly targeting the intended audience. For example, phrases such as "as we discussed in our last meeting" (participant 2) or "In light of what was discussed with [other CTO from main campus]" (participant 8) provide necessary connections to previous conversations so that there is continuity. Such metadiscourse was noticeably absent in the writings we obtained from participants before their interaction with *Practikon.* Additionally, there are instances of contextual metadiscourse, especially for the informational pieces, which are aimed at providing the audience with a basic framework around which the rest of the message will be presented, such as "We have recently completed the audio-visual upgrade at the lecture hall" (participant 3) or "[We] are pleased to announce that the new FileShare and FileSync systems have been upgraded" (participant 6). These are typically sentences at the beginning of emails or formal memos, which were not common in the writings composed before the introduction of *Practikon.*

More significantly, however, the assignments of the participants showed an increased concern for applying appropriate rhetorical moves based on genre and purpose. In addition to providing information or explaining a process, most participants, after interacting with *Practikon*, seemed to attempt to find ways to make their text do the kind of work their audience would expect. For example, participant 1 was tasked with a description of how to connect both to the departmental and the personal network drive, which would be sent to faculty and staff. Recognizing that the idea of a "network drive" might be unfamiliar to some audience members, he decided to begin by providing a definition, thus establishing common ground: "*Network drives are those folders that contain your personal/departmental data."* By using present tense, the author essentially describes network drives not as a technology that could or might be used, but as a technology that is already in place (which now the faculty can learn how to use). In that sense, this rhetorical

move functions at several levels both to meet audience expectations and to accomplish the author's goals.

Similarly, participant 6 used another rhetorical move to introduce the email to his intended audience, that of creating excitement for the implementation of long-awaited improvements. The message begins:

"Information Technology in Qatar is pleased to announce that the FileShare and FileSync systems are upgraded to a new system ***which*** *provides and supports …"*

What follows this excerpt is a list of the new features; however, in writings before the introduction of *Practikon*, such lists were presented without any introduction or any consideration for rhetorical moves. Although we can't establish a causal relationship between the use of our system and the increased emphasis on rhetorical skills, there is certainly evidence that the participants had a change in approach to their writing.

The final point arises out of a brief comparative discourse analysis between the two writing samples that the participants provided us with: at the level of grammatical correctness and sentence structure, there were almost no differences. Each participant showed the same types of patterns (e.g. missing commas or misspelled words) in both samples. This is not unexpected, as the time elapsed between the two pieces or writing was very short and the interactions with *Practikon* did not have a focus on correctness. However, some differences were noticed at the level of diction, especially as it related to words that the intended audience would respond favorably to or would recognize as "known" information. For example, initially participant 5 was using the term "files" to refer to items that can be uploaded on Sharepoint, whereas in the second writing (post-*Practikon*), the participant used the term "documents" which is a more familiar term to faculty in non-technical disciplines. However, since the number of participants is so small and the length of the texts they produced quite short, we cannot make generalizations from this data. In the future, a more detailed analysis at the discourse level is expected yield more nuanced results.

Discussion and Conclusions

The results of this exploratory pilot study suggest that participants showed gains in their understanding of the rhetorical situation and in employing strategies that would lead to effective solutions (revisions) to the communication problems they encounter. More systematic experimental studies are necessary to confirm this preliminary finding.

The results also indicated that *Practikon* can be an efficient learning tool. The relatively short time spent in the activities points to the potential of our approach for a system that does not require a significant time commitment by the users, at least not in the traditional sense of uninterrupted stretches of time spent in communication classes. Of course, we would still need to examine if the results of the writing samples would be transferable for other pieces of writing or genres over a period of time, but this would require a longitudinal study.

Finally, one of the more interesting, and unexpected, results of this pilot study is the recognition on the part of the participants that communication skills lead to advancement and managerial positions, especially if they are accompanied with an understanding of rhetorically effective strategies. Such a finding is in line with the results from a survey of Engineering graduates, where a direct correlation between the amount of technical communication instruction and career advancement emerged[22]. As the results of the interviews suggest, the ability to translate technical information into language and concepts accessible to non-technical audiences is a marker of expertise recognized by our participants. The instructional approach that guided the design *Practikon* seems to highlight the role of effective communication in career development. We believe further studies in this area to connect the development of communication skills and career development would be a fruitful area of research that may lead to the motivational aspects of communication pedagogy.

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Appendix A: Screenshots from Practikon.

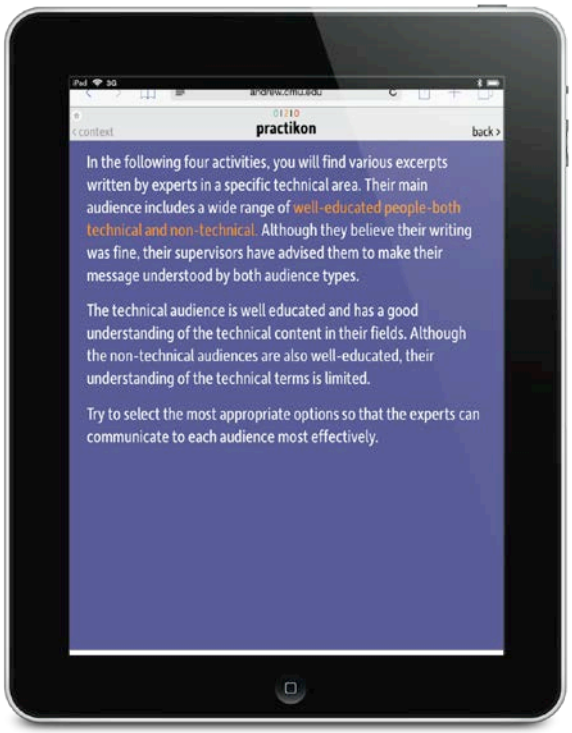

Figure A-1: Introductory screen for a set of activities that describes the task at hand

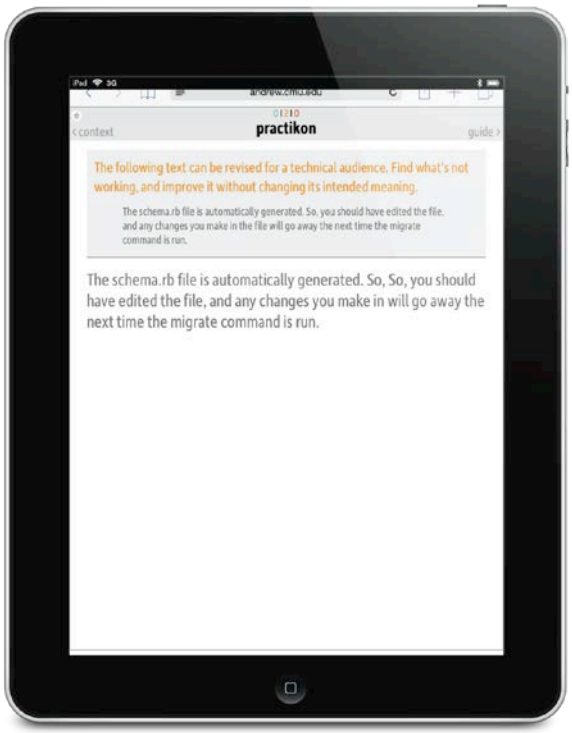

Figure A-2: Activity screen that includes a prompt for actions to take

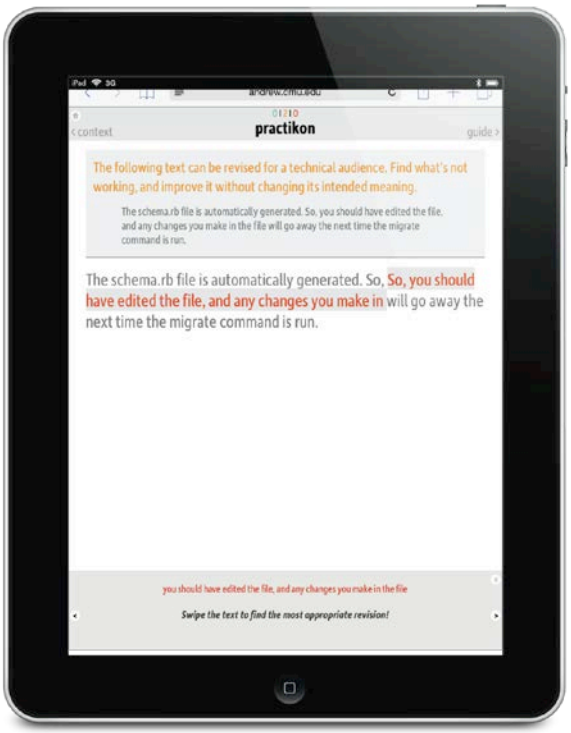

Figure A-3: Activity screen that illustrates the identification of the problematic segment.

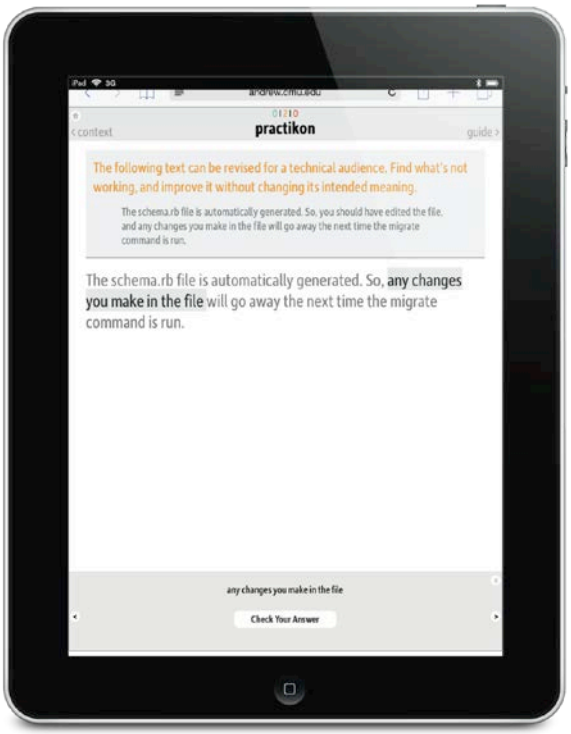

Figure A-4: Activity screen that includes the alternative text selected to improve the statement.

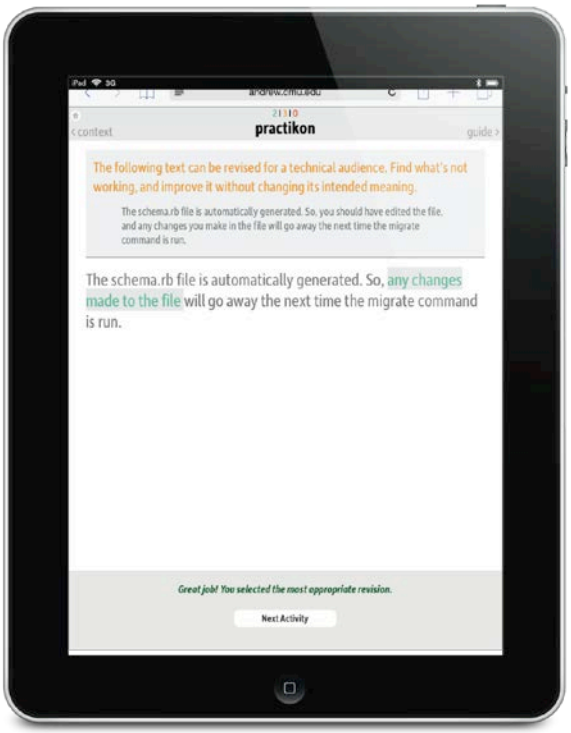

Figure A-5: Activity screen that provides feedback on the quality of the chosen alteration.

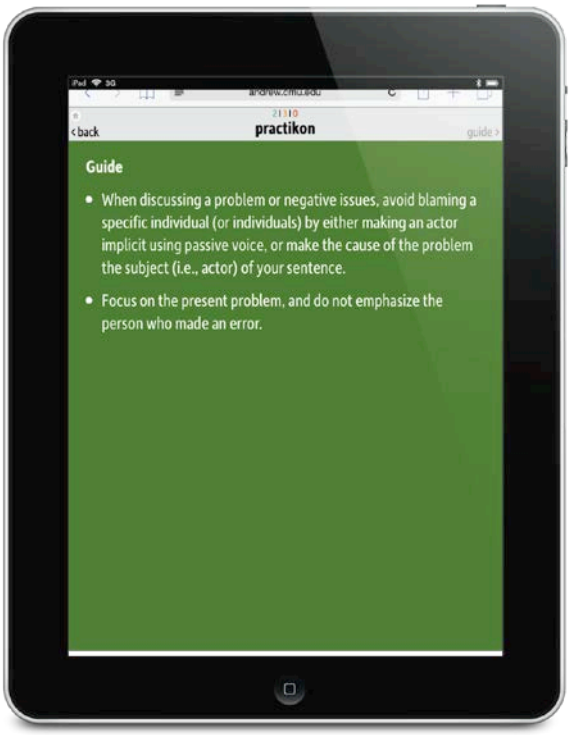

Figure A-6: Guide screen aims to clarify key points of the task and assist students in working through the activity