Use of Writing Fellows to Support an Engineering Capstone Course: Preliminary Results

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A Writing Fellows (WF) program has been implemented at the University of Nevada, Reno. The goal of the WF program is to develop targeted writing feedback and instruction for discipline-related communication that leverages existing university resources. Each WF is trained by the University Writing Center (UWC) and serves as a dedicated peer-reviewer who is able to provide constructive feedback on both the disciplinary content and communication aspects of each assignment. This paper reports the impacts of the initial WF implementation in the Mechanical Engineering capstone design course, which has been assessed using a variety of techniques. The assessment generally indicates positive results. In particular, students favor the continuation of the program and find it more helpful than group consultations within the UWC alone. This is due in part to having a WF engaging with students from the same discipline while developing professional writing skills. Self-assessment by the students indicates higher confidence in their communication skills. Preliminary analysis suggests that the writing fellow improved the scores of graded assignments by approximately one-third of a letter grade overall. Assessment efforts also highlight the need for deeper interaction between the WF and engineering faculty.

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Introduction

The ability to communicate effectively is a critical skill for engineers, and there are many reports documenting the efforts to increase the focus on communication within engineering programs.[1–4] Capstone design courses are a natural opportunity to concentrate on communication, within the context of an open design problem, due to the similarities between the writing and the design processes.[5] In both, an iterative approach must be pursued. As new information comes to the fore, previous work must be revisited to ensure harmony throughout the project. Furthermore, there are few instances where design or communication has a single "right" answer.

Different approaches have been pursued to support the students in their writing and communication within capstone courses. At one end of the spectrum, engineering faculty have partnered with writing faculty to divide the instructional duties.[6] In these cases, the engineering faculty typically focus on instructing the students on technical aspects of the capstone course while the writing faculty, who may come from the English department or even be an expert in technical communication, focus on communication aspects. While this approach has been effective, it is resource intensive and requires "buy-in" from many stakeholders across the university. At the other end of the spectrum, engineering faculty may simply rely on existing resources such as the University Writing Center (UWC) to support the educational objectives related to communication. While this approach leverages resources that are in place, the UWC is challenged to provide specialized instruction for the engineering students.[7] Therefore, this option can be less effective.

This paper will focus on the implementation of a Writing Fellows (WF) program in the Mechanical Engineering (ME) capstone design course at the University of Nevada, Reno (UNR). The WF program, a middle ground approach, uses the existing infrastructure provided by the UWC and attaches a single writing consultant, i.e. a WF, to the capstone course. This approach retains some elements of a dedicated instructor while requiring fewer resources than team-teaching. This paper will provide an overview of the program and report preliminary assessment results.

The Writing Fellow

The first WF program was founded at Brown University in 1982.[8,9] In the 30+ years since, WF programs have diversified in their focuses: departments, courses with high failure rates, writing-intensive faculty and courses, and specific disciplinary writing.[9] Fellows can work to support student writers individually, support/inform faculty, and most often some combination of the

two.[10] WF programs share characteristics with peer review, faculty conferencing, writing centers, supplemental instruction, TAs, and writing studio courses; all of this can lead to challenges in WF implementation. While these differentiations can make WFs less clearly defined, they more importantly testify to the adaptability of WFs to an array of educational demands and contexts. Still, their central purpose remains stable: providing specialized support for discipline-based writing.

UNR's WF program has been operating successfully since the spring semester of 2013. The WF program was born out of a successful UWC that takes pride in adapting to demands and interests across the curricula. The fellows have been selected largely by the faculty members whose students the WF will support. The fellows operate based on the needs and interests of the target faculty, students, courses, and programs. UNR has had success in matching abilities, resources, and fellows through implementation of the WF program. Obviously, the primary benefit of a WF program is better student writing. However, two other regular benefits are also worthy of note: ongoing professional development for all involved and comparatively low costs.

The use of WFs also accomplishes important programmatic goals. While the imposition of writing expectations from outside a department can often provoke resistance, WFs provide resources that disciplinary faculty can deploy in ways that make sense for their courses, students, and assignments.[11] More importantly, for the programs making use of fellows, the support is knowledgeable and resource-efficient. There are some risks inherent in WF programs, too. The seeming ambiguity of WF responsibilities can leave the fellows vulnerable.[8] By extension, the students with whom they work can then be at some risk of misguidance, which not only does not serve the intended purposes of a WF program but complicates them. Direct, open, and honest communication between the faculty, fellows, and directors of programs offering fellows is essential. Regardless of other concerns, these communications must always be protected and, at UNR, we have consistently found these conditions with our participants.

Course Overview

The capstone courses within the ME department at UNR were recently changed to a two-semester sequence (ME451 and ME452) starting in the fall semester of 2011. Students typically work in teams of five on a year-long project that culminates in a spring exposition where the teams demonstrate their prototypes. To support engineering communication as one of the primary educational objectives, the students are required to report on their projects in a variety of modes:

1. Tasks – Throughout the fall semester, students periodically submit five 2-3 page written reports on their progress. These reports focus on the early and middle stages of the design process.
2. Design Reports – At the end of the fall semester, students build on the information previously reported in the Tasks in a "Preliminary Design Report." This report is revised in February and again in May to capture their progress. These revisions are called the "Intermediate Design Report" and "Final Design Report," respectively.
3. Oral presentations – In the spring, the students give regular oral, team report presentations on their progress. These presentations are analogous to the written "Tasks" from the fall semester.
4. Other communication assignments – Throughout the year, students build a website for their project. In the spring semester, students write a business plan. Finally, students prepare a poster for the spring exposition to accompany the live demonstration of their projects.

Writing Fellow Responsibilities

For the ME capstone class WFs were either recruited by the primary engineering instructor and trained by the UWC or selected from the existing pool of UWC writing consultants and trained by the primary instructor. In all cases the WF was an undergraduate engineering student. WFs were trained to develop student abilities in shaping practices to specific writing tasks, all within the context of UWC policies and best practices. Student teams were required to meet with the WF a minimum of 3 times during the semester. Student teams had some flexibility in which assignments were used in these meetings and were required to meet for the larger assignments. The primary responsibility of the WF was to support both the student teams and faculty by providing feedback on drafts of assignments ahead of submission. In essence, the WF was a specialized writing consultant attached to the capstone class. The WF would meet with the engineering faculty member to discuss the goals and expectations for each assignment. The student teams were required to provide a draft to the WF at least 24 hours before their meeting. The WF would respond to both higher-order and lower-order concerns as a peer reviewer.[12] WFs did not revise student work directly but, rather, facilitated student writing practice and skill development. Functionally, the WF was somewhat insulated from the day-to-day aspects of the class, which allowed a unique perspective on the drafts. After each meeting, the WF would write a short report documenting attendance and outcomes. The logistics of scheduling the meetings and reporting were

handled through the UWC web interface. The WF was prohibited from grading.

Evaluation

The observations and data reported here cover the Fall 2012 (F12), Spring 2013 (S13), and Fall 2013 (F13) semesters. For the F12 semester, there was no WF; instead, students were required to meet in groups with regular UWC staff. For the ME course, there was one WF for the S13 semester. A second WF started in the F13 semester but resigned in the middle of the semester. Another engineering student, who was already a writing consultant in the UWC, was able to assume the WF role for the remainder of the semester and has continued through S14.

The current assessment of the WF was accomplished in four ways. First, anonymous surveys were deployed to the students via online instructional tools (Blackboard). Second, the engineering faculty informally interviewed the student teams. Third, since the student teams were able to choose which assignments they would bring to the WF meeting, the engineering faculty and graduate TA graded the assignments without knowing which submissions had input from the WF (referred to as blind grading). Finally, the WFs were asked to provide short reflective essays on their impressions and observations.

Results and Discussion

Although a variety of assessment methods were employed, the survey data was the most insightful. This is partially because UNR's WF program is still under development. Student feedback has helped to improve the WF program. Response rates were 75%, 50%, and 41% for the F12, S13, and F13 semesters respectively. The first and second survey question asked the students to evaluate their own writing or communication skills on a scale of 1-10 before and after taking the course. The results of this self-assessment showed that ~20% more students ranked themselves at 7 or higher after taking the course as compared to their ranking before the course (Fig. 1). Interestingly, the survey responses for each semester were remarkably similar and the impact, if any, of the WF over the UWC could not be discerned from these questions.

When looking at the questions that were specifically about the WF, the responses were much more favorable. When asked if the ME capstone class should continue to use a WF, 68% of responders either agreed or strongly agreed while 18% disagreed or strongly disagreed. Furthermore, 61% of responders stated that the WF was either much more helpful or somewhat more helpful than the UWC, as opposed to 16% who felt that the WF was somewhat less helpful or much less helpful. These results are encouraging and demonstrate that the students saw the value of the WF. Most student responses showed improvement in their writing quality. Even when they did not, their responses demonstrated increased awareness of the quality of their writing.

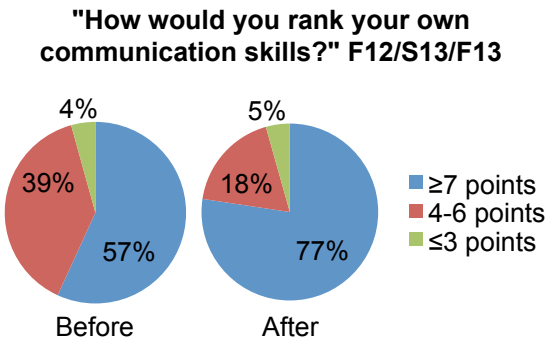

Figure 1: Self-Assessment Survey Results (10 pt. scale)

Two survey questions asked how the meetings with the WF helped students with their writing (if at all), as well as inviting suggestions for improvement in the WF's effectiveness. These questions were open-ended, allowing the students to respond in short answer fashion. Two major positive themes emerged about the WF meetings: "*I[t] was good to have an outside perspective review our papers*," and "*He understood the technical elements of the papers*." The most common negative comment was some version of, *"No, ...would more just check for grammatical errors."* On the other hand, some students did value the focus on grammar. Whether positive or negative, the focus on grammar was surprising as the WFs were instructed to focus on higher-order concerns (focus, organization, development, etc.) first, followed by lower-order concerns (sentence and word-level).

While many students found their meetings with the WF to be beneficial; suggestions for how the WF's role might be improved overwhelmingly sought deeper interaction between the Capstone instruction team and the WF to create clear-cut writing expectations for each assignment. Another suggestion involved having the WF give 1-2 lectures on common issues that occur with technical writing. Some students thought that the WF should have been a senior student or even graduate student due to the level of writing experience associated with the capstone class. However, finding a qualified and interested senior undergraduate engineering student who was not taking the class was not possible.

Informal discussions between engineering faculty and student teams covered writing and communication within the context of the capstone class, including the implementation of the WF. The informal discussions supported the same conclusions gathered from the surveys regarding the WF. Additionally, students stated that the group-written reports helped ensure that the

team *"was on the same page"* and exposed individual assumptions about the design project. In this regard, the written reports were more than just a reporting mechanism and actually contributed to the design process.

Tracking assignments that received input from the WF for the blind grading assessment only occurred during the F13 semester. There were a total of 70 Tasks submitted (5 tasks for 14 teams), of which 15 received input from the WF. The impact of the WF was evaluated in 3 ways: a) all tasks collectively, b) each task individually for all teams, and c) each team individually for all tasks. The results of each of these calculations showed that the input of the WF helped the students by slightly better than 1/3 of a letter grade (e.g. C to C+ or B- to B, etc.) Interestingly, six of the teams received their best scores with input from the WF.

These results are encouraging, and it must be emphasized that they are preliminary. In addition to concerns about sample size, variations in grading between the TA and faculty, and changes from task to task have not been considered. Furthermore, two different WFs were used in the F13 semester, which may have impacted the results. It should also be noted that the teams were allowed to resubmit one task for a re-grade. The re-graded submissions were improved by approximately one and a half (1.5) letter grades. This lends support to the student's observations that the WF should work more closely with the engineering faculty because there was a markedly greater improvement in grades when the students interacted with the professor as compared to the WF alone. In particular, the expectations of the faculty must be made clearer to the WF to support their roles.

The reflective essays provided by the three WFs used over the S13 and F13 semesters provided valuable insight into strengths and weaknesses of their role with the ME Capstone course. All three WFs expressed that students seemed to appreciate the extra set of eyes reviewing their work; this was helpful in improving the cohesion of Tasks and Design Reports authored by student teams rather than single authors. The WFs also agreed that the group discussions in their meetings facilitated the student teams' abilities to reach their own conclusions while addressing the structure and purpose of each assignment. The statement of one WF, in particular, characterized these sentiments: *"Engineers tend to write papers by checking boxes, rather than examining the overall reason for creating what they are writing, and I was doing my best to get that to change."* The WFs also agreed that the majority of the writing issues they encountered stemmed from this linear thought process, along with a "*black-and-white*" approach many students applied to their reports. The WFs also identified several potential areas for improvement in the future implementation of their roles, including working further on helping students develop an adaptable writing style and setting clear assignment expectations with the course instructor. Overall, the WFs were pleased with their interactions with students and believed that the skills they tried to elicit during their sessions would be useful to students in their professional lives beyond the Capstone course.

Conclusions and Future Work

In short, the implementation of WFs in the ME capstone course is showing signs of success, yet more work is needed to both improve the program and assess its effectiveness. From an institutional perspective, the WF program leverages existing resources from the UWC and allows for focused writing support at low costs. Student reactions to the WF have been generally positive with most students agreeing that the WF program should be continued. Early assessment on the effectiveness of the program suggests that the WFs do contribute to student learning. However, these assessment efforts have highlighted a critical aspect for improvement. Namely, the engineering faculty needs to work more closely with the WFs in communicating expectations to the students. Future work will focus on improving the implementation of the WF within the course and refining the current assessment methods.

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References

1. Akorede, M. *IEEE Potentials* **2009**, *28*, 10–15.
2. Ford, J. D.; Riley, L. A. *J. Eng. Educ.* **2003**, *92*, 325–328.
3. Wheeler, E.; McDonald, R. L. *J. Eng. Educ.* **2000**, *89*, 481–486.
4. Winsor, D. A. *Coll. Compos. Commun.* **1990**, *41*, 58.
5. Paretti, M. C. *J. Eng. Educ.* **2008**, *97*, 491–503.
6. Hendricks, R. W.; Pappas, E. C. *J. Eng. Educ.* **1996**, *85*, 343–352.
7. Mackiewicz, J. *IEEE Trans. Prof. Commun.* **2004**, *47*, 316–328.
8. Corroy, J. *Young Sch. Writ. Undergrad. Res. Writ. Rhetor.* **2003**, *1*, 20–34.
9. Cairns, R.; Anderson, P. *Discipl. 5*.
10. Zawacki, T. *Discipl.* **2008**, *5*.
11. Halasz, J.; Brinckner, M.; Gambs, D.; Geraci, D.; Queely, A.; Solovyova, S. *Discipl.* **2006**, *3*.
12. McAndrew, D. A.; Reigstad, T. J. *Tutoring writing: A practical guide for conferences*; Boynton/Cook Pub, 2001.