

# Volunteer Expert Readers for STEM Student Writers

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**Abstract:** This paper reports on a novel approach to providing undergraduates with feedback on STEM writing assignments via an otherwise untapped educational resource: university alumni and employees who normally play no role in the institution's educational mission. In the Volunteer Expert Reader (VER) approach, students are paired with volunteers whose backgrounds make them suitable readers for specific writing assignments. Given the realities of labor in STEM undergraduate teaching contexts, VER may be particularly valuable there, facilitating student interactions with experienced STEM professionals who have the time and inclination to give them substantive feedback on their writing based on real-world experience. Results from this 3-year study suggest that (1) VER can be an effective means of increasing student engagement in STEM writing assignments and may also improve the quality of student writing and increase learning of course content; and (2) how well VER works for any STEM writing assignment is dependent on a number of factors including whether student participation is required, whether students write alone or as a team, how well readers' backgrounds fit the assignment, and reader engagement and availability to students. VER is also an effective faculty development tool: it offers faculty in STEM disciplines a compelling reason to collaborate with writing program administrators and necessitates the inclusion of best practices in writing assignment design, such as making explicit the rhetorical context and aims of the writing task and setting a reasonable pace for drafting/revision cycles.<sup>[1]</sup>

*For it is time—or lack of it—that so often manages to redeem us from the admission that we have corrected, circled, checked, and assigned points to our students' writing but forgotten, in the arduous and painful process, to listen to what they have been saying.*

—Chris Anson, *Writing and Response: Theory, Practice and Research*

When engineering employers were asked recently to rank the relative importance of various learning outcomes for prospective hires, communicating effectively came out on top—above engineering problem solving (Lattuca et al., 2006). This would surely surprise (and probably distress) those many undergraduate engineering students who assume that having chosen a major in a Science, Technology, Engineering or Math (STEM) discipline, they were safe from a future of writing.

While suggested approaches for improving written communication skills in STEM vary markedly, there does appear to be broad consensus about this: students need feedback on their writing that is timely and that sponsors serious rethinking and revision (see for example Harris & Schaible, 1997; Jerde & Taper, 2004; Gottschalk & Hjortshoj, 2004; McLaren & Webber, 2009). To date, research on innovation in STEM writing pedagogy has developed under the assumption that such feedback would necessarily come from the course instructor, a teaching assistant, classroom peers, or writing center tutors. Here I propose another option: members of the university community who are not on the teaching staff but who have the scientific, technical, or STEM management background needed to

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respond to STEM student writing as members of the target audience. In what I am calling the "Volunteer Expert Reader" (VER) approach, alumni and employees of the institution are solicited as "readers" for a course and then matched with students, giving them feedback on their work-in-progress. Depending on each reader's physical location and preferences, readers interact with the students in person or by webcam or phone, as well as in writing shared via email.<sup>[2]</sup>

The broad goals of the current research were to learn whether VER could be an effective addition to STEM curricula and to uncover the factors associated with more or less favorable outcomes of the approach in various STEM course settings. This essay is intended to provide a big-picture view of this approach and this research to date. My objectives here are (1) to provide a description of the VER approach broadly conceived, in concept and in practice; (2) to present results, primarily from assessment surveys of students and volunteer readers, showing the major trends across a range of STEM courses; (3) to identify lessons learned to date from this research.

The main findings from this research are as follows:

- VER can be an effective means of increasing student engagement in STEM writing assignments; it may also improve the quality of student writing and increase learning of course content.
- How well VER works for any STEM writing assignment is dependent on a number of factors including whether student participation is required, whether students write alone or as a team (and if the latter, whether each student is assigned an individual reader), how well readers' backgrounds fit the assignment, and reader engagement and availability to students.
- VER is an effective faculty development tool; VER offers a compelling reason for faculty to work with writing program administrators and necessitates the inclusion of best practices in writing assignment design such as making explicit the rhetorical context and aims of the writing task and setting a reasonable pace for drafting/revision cycles.

I begin with a brief discussion of response to student writing, showing the importance of personalized, reader-centered feedback and the barriers that have historically limited students' ability to receive such feedback, especially in STEM. I then discuss VER in relation to these barriers and explain that why it offers a valuable type of feedback that many students are unlikely to get elsewhere followed by an overview of the VER approach. Next is an overview of assessment data from my research of VER in ten STEM courses followed by a discussion of lessons learned. I conclude with suggestions for future research. In this paper I use *VER* to refer to the pedagogical approach itself, in which students are matched with *VE readers*. *Duke Reader Project* refers to the particular enactment of VER at Duke University.

## Response to Student Writing

While formal research on feedback, or "response" to student writing dates back at least to the middle of the twentieth century, it has been a particular focus within writing studies research since the early 1980's resulting in a large and varied literature. Like any aspect of teaching, many strategies for giving feedback have been identified that might be productive in one educational setting or another. Yet is there anything we might identify as essential?

Horvath (1984) provides a summary and synthesis of the literature on response as "formative evaluation" to that date. Of the conclusions that Horvath draws, three are particularly relevant here and are broadly accepted within writing studies today: First, students benefit most from feedback that is neither "so tied to specific texts that students cannot discover in them general guidelines"

(138) nor so generic that it fails to engage with the students' actual work on the page. Second, building on Sommers (1982), feedback is generally more effective when offered as a response to work-in-progress rather than to a finished product. Finally, and perhaps most important for VER, feedback should consider "the essay's full rhetorical situation" and "respond to it as an integrated work intent on accomplishing a certain aim—the student's intended aim—in the world" (140). (It does not go without saying, unfortunately, that providing such a response requires first that the student *have* an intended rhetorical aim beyond the obvious instrumentalist one of securing the desired grade. The matter of providing effective feedback thus circles back to the problem of designing rhetorically meaningful assignments.)

*Writing and Response* (Anson, 1989), a diverse collection of essays published just a few years later, presents response as an activity too complex to be reduced to a single technique or approach. Yet the importance of offering students the chance to be *read* is reiterated in many of these essays. In "Transactional Theory and Response," Robert E. Probst (1989) emphasizes the need for feedback that eschews the "narrow focus implicit in the roles of editor or diagnostician" (p. 74). Russell A. Hunt (1989) writes that "the most important change" we might make in how we give feedback is "finding ways to...make it real," and that "the most effective way to do this is to create situations in which student writing ... is read for its meaning, for what it has to say..." (p. 95). Taken as a whole, these essays confirm that whatever assistance and guidance students might receive, constructive response from an engaged reader is essential. Such detailed, personalized feedback continues to be identified as an essential component of effective writing pedagogy into the twenty first century (Gibbs & Simpson, 2004; Higgins, Hartley, & Skelton, 2002; Lipnevich & Smith, 2009).

We might also approach the question of what is essential in providing feedback by analogy. The jazz pianist must indeed master her "chops," but to really learn how to backup a singer or soloist, or to get "in the pocket" with a drummer and bass player, requires interacting with other musicians. Without the feedback of hearing the musical choices she makes in the context of what others play, how they respond with their own choices, and what they have to say about her playing, she can only imagine (hope) that her approach "works." Similarly, the aspiring basketball player learning to play a zone defense may understand it conceptually, but would we expect her to develop even the slightest proficiency on the court without the frequent opportunity to test those moves against real opponents? Finding out what happens when one does one's best in the context where it matters provides the feedback most essential for true advancement. For writers, such feedback comes from testing out our drafts with members of the target audience, finding out how they react to our texts.

Yet we rarely provide such opportunities for STEM undergraduates. Instead, we ask them to write *as if* they were making a pitch for a design to a potential investor, *as if* they were writing a research report for a journal, *as if* they were writing a policy memo on environmental policy to government officials. But how are they to judge whether these hypothetical attempts at writing are successful? Therein lies the challenge inherent in learning to write in school: *as if*. Without such feedback, students well know that they are not "engaged in real writing but only an exercise, an empty simulation of writing" (Probst, 75). The realities of undergraduate STEM education must necessarily limit such opportunities, but if we acknowledge that these are indeed limitations, we will provide students with such feedback when we can.

## Barriers in STEM

Readers of this essay will not be surprised that instructor labor is often identified as a primary barrier to students receiving personalized feedback from engaged readers on their written work (Carless, 2006; Gibbs & Simpson, 2004; National Commission, 2003). Anson, who notes in his introductory

essay to *Writing and Response* that ample instructor time is not sufficient to guarantee high-quality feedback, nevertheless acknowledges it as a problem. (See the epigraph to this essay.) Within STEM, providing personalized feedback for undergraduates can be especially challenging. STEM units tend to have sizable "service" roles—providing prerequisite courses for students in other STEM departments, pre-med majors, and so on. These courses tend to have large enrollments, and, as prerequisites for other STEM courses, are often required to cover a great deal of specific content.

Conventional alternatives to instructor labor are often inadequate for this task. Graduate-student teaching assistants who work most closely with student writing in many STEM courses are usually novice writers of science themselves, tend to have little pedagogical training or teaching experience—especially in relation to student writing, and often have the additional challenge of being non-native speakers. Tutors and peer feedback can both be used to some advantage, although perhaps less so than for non-STEM courses. Tutors especially can offer a "safe" space for students to discuss their work away from the evaluative gaze of the professor. Tutors, especially if trained through a campus writing center program, may have more knowledge of some aspects of writing pedagogy than the faculty member teaching the course. But while writing centers tend to be well staffed with tutors trained in the humanities, they are rarely able to hire enough tutors with the variety of STEM backgrounds needed to provide STEM student writers with the kind of feedback I have discussed.

With proper guidance, peers can provide useful feedback on those aspects of each other's writing that do not require "insider" knowledge of the field or genre, and giving feedback to peers is beneficial for the giver as well as the receiver. But for the forms of professional discourse STEM faculty increasingly assign in WID contexts, inexperience limits the value of peer input.<sup>[3]</sup> Peer feedback may also be a poor fit in lab-based courses which are not "inquiry-based" since the students are, in effect, all attempting to write the same paper (Moskovitz & Kellogg, 2005).

Even when conditions make it practical for faculty to provide personalized feedback for their students, their responses can be limited in other ways. First, giving useful reader-based feedback requires significant experience with the assigned genre—if not as a producer of such texts than as a consumer. A tenet of Writing in the Disciplines philosophy is that while faculty in the various disciplines may need training and guidance in writing pedagogy, they are uniquely positioned as disciplinary experts to instruct their students in the writing practices of their field. Carter and colleagues expressed this idea recently (2011):

[W]hat is most important about communication, i.e., its effectiveness, lies squarely within the disciplinary boundaries. ...There is no such thing, we argue, as effective communication in general, only effective communication in particular situations, including those defined by disciplines. Consequently, the people best able to teach effective communication in any discipline ... are the discipline's practitioners and faculty. This does not mean that students cannot learn the general communication skills of writing, speaking, and reading typically taught by specialists in those areas. Rather, it means that those general skills need to be shaped and honed for use in a discipline by specialists in that discipline. (p. 21)

One might, then, reasonably assume that faculty in a given discipline are also experts in the various disciplinary genres their students most need to learn. Yet my experience as a writing program administrator and consultant has taught me that this assumption is not always accurate in STEM. While professors in STEM typically *are* expert in genres such as the journal article and research grant proposal, many lack experience with workplace genres common in industry or government settings.

Other challenges are inherent in the school context itself, which can make it difficult for both students and their teachers to treat student writing as "a communication activity between audience and author" (Cohen & Riel, 1989, as quoted in Cho & MacArthur, 2010, p. 329). Even as instructors attempt to switch roles between reader and evaluator, students are well aware that the giver of feedback is also the giver of grades. Also, instructors often know too much about the students' work to stand in meaningfully for an audience who would not have this familiarity. This is especially problematic in lab courses where students often end up parroting information about an experiment back to their lab instructor.<sup>14</sup> In these situations, students may perceive the writing task as "a pointless exercise in error-avoidance" (Probst, 1989, p. 75). Even after required courses in first-year writing, students often have difficulty shifting their concept of good writing from the school-situated "what the professor wants" perspective to the more sophisticated understanding of "what is expected in a discourse community" (Fraizer, 2010, p. 51).

## The Value of Volunteer Expert Readers

While instructors, peers, and writing center tutors can all play useful roles in providing feedback on student writing in STEM, their feedback is necessarily limited by institutional and structural constraints. Because VE readers can be selected specifically for each course, their professional expertise, genre familiarity, and topic knowledge can be more closely aligned with student writing assignments. Consider for example the research grant proposal, an increasingly common undergraduate assignment in STEM. VE readers can be solicited whose background closely matches the target audience: they are familiar with grant writing and have a working knowledge of the field but know little if anything about the particulars of the research being proposed.

A second benefit is that VE readers generally work with only one student or student group during the semester. As volunteers, they can devote considerable time to their interactions with individual students. And because responding to student writing isn't part of their normal grind, VE readers tend to have more energy and enthusiasm than even the most devoted faculty members are likely to muster once they've reached the middle of a stack of papers. Third, because VE readers are recognized by students as working professionals, their involvement may encourage students to approach the writing task as an apprentice activity rather than just a school assignment. Finally, many students are motivated by the networking opportunity VE readers might provide. While such opportunities cannot be expected, the possibility does seem to encourage some students to participate and perhaps put more effort into their writing.

The VER approach can also affect teaching. The prospect of securing 3 to 4 hours of expert writing consultation per student is a strong motivator for faculty to participate in the needed work of revising their assignments and syllabi to make them suitable for VER. Faced with the task of specifying what constitutes "appropriate" readers, many instructors recognize that they have not adequately articulated the rhetorical dimensions of the writing they are asking their students to attempt.

Finally, there are benefits for the institution itself. Offering alumni and staff from the various parts of the institution a meaningful role in the educational mission of the school could be an effective tool for community building. Alumni affairs units are always looking for new ways to engage alums and VER offers opportunities for alums to give back to the institution in ways other than monetary gifts or event planning. All of this hinges, of course, on whether members of the institutional community will in fact volunteer. At Duke, there has been strong interest, especially among alumni. While there have indeed been challenges in soliciting volunteers for some courses; response to solicitations for volunteers has far surpassed my initial expectations, as I explain below.



It is worth noting that in some STEM courses, notably engineering capstone projects, it has become fairly common for students to work with/for industry clients. The goal of these partnerships is give students experience designing for a real-world setting. Such clients may give students feedback on written documents produced as part of the design work. In spite of the similarities, differences between this arrangement and VER are important. For one, VE readers' interactions with students are off the record. Since these are private exchanges between student and reader, students are freer to make mistakes, ask what they might consider foolish questions, and interact informally in ways that are likely to be educationally useful. Another important distinction is that the timing of interactions in VER is designed to maximize learning, while for clients it is driven by the needs of the project and the availability of the clients. Finally, clients may have neither the time nor inclination to give the type of extended feedback we expect in VER, nor could most clients be expected to spend time learning how to give appropriate feedback. From my conversations with instructors of such courses, it is frequently the case that if students get any substantive feedback from clients on written materials, it arrives after the project has been completed and revisions are no longer possible. That said, I believe that VER could serve as a useful model to help students get more benefit from their interactions with such clients.

## Investigating VER

I began the current research project with NSF support after three years of implementing VER in over forty different courses across the undergraduate academic landscape at Duke. I had figured out many of the important questions, but I also understood that few of these could be answered outright given the complexities described above. My goals for this research, then, have been more modest: to better understand the practicalities of implementation in various undergraduate STEM contexts and to get a first cut in identifying factors that make VER more or less likely to be successful in those contexts. By experimenting with VER in a broad range of STEM undergraduate settings—different disciplines, different sizes and types of courses, different types of writing and so on—I hoped that this research could provide some guidance for those who might wish to implement VER at other institutions.

A main limitation of this research is the prevalence of confounding factors. A pedagogical intervention this intertwined with writing and research projects of multiple courses cannot be studied in a controlled manner varying one parameter at a time; there are simply too many variables at play to sort out their effects with any certainty. Nevertheless, if future scholars are to build on this preliminary research, it makes sense that I share whatever insights I have obtained knowing that others will understand the limitations of those insights and thus the need to investigate them further.

While conducting this research on courses just adopting VER, I have simultaneously overseen the implementation of VER in dozens of other courses—some STEM, some not. My understandings and insights about VER in STEM are informed, then, not only by this formal research but also by internal assessment data regularly collected for many other courses along with many informal conversations and correspondences with our paid project coordinators, instructors, students, and readers. Some of my early hunches about implementing VER have been supported; others have not. In order to make this essay as useful as possible, I will try to articulate the reasons for decisions I made along the way and what I think can be learned from those experiences.

## VER in Practice

VER is simple in concept: students are matched with appropriate volunteers who give them feedback on drafts of their writing. Yet once we move from concept to implementation the complexities soon become evident, for each combination of instructor, course, and assignment poses its own

implementation issues. This is especially true in STEM, given the wide variety of writing contexts: students write alone or in teams; they produce one major multi-section paper turned in a section or two at a time, or they write half a dozen smaller papers turned in complete; they write research reports intended for experts in the field or design proposals intended for potential investors without advanced technical training; and so on. In a real sense, each course has its own teaching/learning context and culture requiring adaptation for VER. Here are a few of the questions that regularly arise when preparing to add VER to a course: What kind of writing will students be doing and what kinds of readers can be expected to give appropriate feedback? Are students writing alone or in teams? Can we recruit enough volunteers with the right kinds of backgrounds? Is the written product only a tool for learning within the course, or are their stakes beyond the course—perhaps actual clients or a real grant application—that impose additional constraints and complications? Will written products be short enough that readers can respond cold in real time or will readers need a significant turnaround time to read and comment on the draft?

Given these complexities, implementing VER involves a sequence of steps, each of which includes a number of distinct tasks: (1) preparatory instructor consultation; (2) reader recruiting and matching; and (3) guiding reader-student interactions. Here I sketch out the tasks and rationale for each step for a typical course. As will be discussed below, particulars often varied from this template due to the needs of different course contexts as well as intentional variation for purposes of experimentation.

### Preparatory Instructor Consultation

To be a good fit for VER, a course should meet two conditions: There should be at least one substantive writing project in a genre that exists *beyond* the classroom setting; we must be able to imagine potential volunteers who have experience as writers or readers of such texts. In addition, there must be adequate time for a meaningful writing-response-revision sequence that can accommodate the schedule of volunteer labor. The first step, then, is a meeting with the course instructor to decide whether the proposed course is in fact suitable for VER. If these conditions can indeed be met we then consult with the instructor to develop or revise the writing assignment(s) as needed, articulate the writing and feedback tasks so the goals of VER are clear to students and readers, and map out a plan for reader-student interactions.

For students to get useful feedback, the context—whether real or imagined—must be clear to both student and reader and in line with instructor expectations. If the student believes she is writing for, say, an audience of disciplinary specialists with a high level of technical knowledge while the reader gives feedback from the perspective of a non-specialist with policy interest in the work, much of the reader's response will be off-base. VER personnel, then, need an accurate understanding of the rhetorical context to solicit appropriate readers and make good student-reader matches. As noted above, many instructors will not have articulated a specific rhetorical context for their writing assignments prior to our first conversation, and even among those who have, the contexts they have specified may not be in alignment with other aspects of their assignment. Most instructors will need some help thinking through their options regarding audience and genre and figuring out how to articulate the context in a way that will give both students and readers a clear understanding of the writing task.

Instructors will also need assistance working out a set of student-reader interactions that fit the nature and pacing of the course and the requirements for VER. While readers often get back to their students with feedback within a day or two of receiving a draft, we try to build in a one-week window for turning around drafts. In practical terms, this means students will typically need at least two weeks between when they send the draft to the reader and when they are expected to have completed

revisions. The amount of time instructors allot for major assignments is often insufficient for the scope of the task—even without VER. In those cases I help the instructor figure out how to get students started on the first stages of the assignment earlier in the term.

For the Duke Reader Project, I have developed two preparatory documents to facilitate the consulting process. One asks for details such as the number of students in the course, whether students will be writing solo or co-authoring, how the assignment is staged and paced during the term, and so on. This information is used to determine how many readers will likely be needed and when matches need to be in place. The other articulates the type of writing students will be doing and the audience for that writing in a way that makes the task clear to volunteer readers and students as well as for VER personnel. For some courses, an existing writing assignment will work for VER with only minor adjustments. More often I meet two or three times with the instructor to guide them in revising (or reimagining) an assignment and to figure out how to pace the writing process in line with the other needs of the course.

### **Reader Recruiting and Matching**

In recruiting readers, we direct our solicitations to members of the institutional community who do not otherwise play a direct role in the education of our undergraduates. In spite of their good intentions, instructional staff who act as VE readers tend to be less involved and enthusiastic readers than others. This is not surprising, since VER involves tasks similar to their routine work. In contrast, helping students with writing assignments is a novel experience for most of our volunteers so they generally bring a higher level of attention and enthusiasm to the task. In fact, many readers report that participating in such intellectually oriented activities is one of the pleasures of their involvement.

We recruit readers in two ways: general and targeted. General recruitment involves solicitation of volunteers with any background. This is done through notices in newsletters for alumni of Arts and Sciences and our professional schools. Those who respond to these announcements complete an online survey that adds them to the pool of volunteers who receive invitations to participate each semester. Targeted recruitment, conducted in cooperation with the Office of Alumni Affairs, various professional school alumni offices, and other on-campus contacts, is used to locate volunteers with specific backgrounds whenever the current pool is insufficient to meet demand. This is usually done by email blasts or postings to list-serves.

A few weeks before the start of each term, the volunteer pool is sent a link to an online list of upcoming courses. For each course there is a description of the writing assignment(s) and a statement about the kind of background readers should have, along with the standard course description. Volunteers who feel they would be a good reader for one or more of these courses respond with their preference through an online survey. The project manager then compiles this information for the match process and additional readers are solicited as needed. If there are still not enough readers for all interested students in a given class, students are matched with readers on a first-come basis. For most courses, readers who are a good fit for a course are randomly matched with students in that course. In those courses in which students would benefit from readers with specialized knowledge related to their individual projects (especially capstone courses and independent research projects), the project coordinator collaborates with the instructor to match specific readers with individual students.

### **Guiding Reader-Student Interactions**

Because instructors are assisted in designing a protocol that fits the context and pacing of their specific courses, the actual plan for student-reader interactions for any given class will vary from that



described in the "standard" version here—which is the template from which we develop course-specific plans.

At the appropriate point in the semester, the Project Manager notifies students and their assigned readers of the match by email, providing each with the other's contact information, and asking them to schedule an introductory meeting (in person or via webcam or phone). In this first meeting participants get to meet each other and the student learns about the reader's background relevant to the project. In some cases students have a short written document already prepared—perhaps a prospectus or statement of a research question—and readers give input on that document after the introductions. When students have a reasonably coherent draft ready for feedback, they e-mail a copy of the draft to their reader who is asked to provide feedback in a timely fashion, typically within one week. Students then revise the draft taking into account the reader's feedback (along with any other feedback they may have received). They then meet with their reader again to discuss the revised draft in advance of preparing the final version of the paper. Once that project is completed, the student is expected to share the final version with the reader, and both student and reader participants are asked to complete an online assessment survey.

## Reader Training

Giving feedback for VER involves special considerations. Because feedback from experienced professionals comes with considerable authority, students can be tempted to accept the input without considering for themselves whether particular changes are warranted. VE readers, then, need to understand that whereas the aim of providing feedback on writing in the workplace is to improve the text, the goal for VER is to help students grow as writers and thinkers. We want volunteers to recognize that, beyond concerns relating to plagiarism, students will learn more if readers help them recognize what might need changing and why, rather than making the changes for them. In our guidelines for giving feedback ([Appendix B](#)), we ask readers to give mainly "reader-based" feedback—addressing the text as a sincere attempt to accomplish its rhetorical aims, expressing their honest reactions and struggles with patience and good will. When readers encounter a passage or feature of the text they see as problematic, we ask them to explain their concern (they got lost, bored, confused, and so on), rather than telling the student what to *do*. That said, there are many occasions when students can benefit from direct advice given by an experienced practitioner. When advice is warranted, we ask readers to give it in relation to principles students can apply in the future, rather than as only as fixes to specific problems.

In addition to our standard guidelines, we ask each instructor to note two to four issues that they would particularly like readers to address in their comments for each writing project. These course-specific feedback notes are included on the VER webpage for the course. We also provide models of written feedback. Initially we used only a small set of examples representing different response methods and disciplines. As we collect models from more courses we are able to provide course-specific examples for readers in those courses.

## Methods

The research described here involved data collection over a three-year period, starting in the fall of 2011. Courses included in this research were intentionally selected to include a broad range of course types and writing assignments, and diversity of disciplines. Table 1 lists participating courses and the modal educational year of the students. Basic information about writing assignments in each course is given in Table 2. Whether student participation would initially be optional or mandatory was decided on a course-by-course basis in consultation with each instructor. As shown in Table 2,

participation was required in three of seven courses for 2011/2012: COMPSCI, ENGINEER, and CHEM PHYS. For the 2012/2013 year, student participation for ENGINEER was changed to optional.

None of the courses included in this research were new and all had included substantial writing assignments prior to involvement with VER. Using the information forms in [Appendix A](#), I worked with instructors individually to revise writing assignments as needed and to make decisions about the kind and pacing of student-reader interactions as described above. Readers were provided with guidelines as shown in Appendix B.

**Table 1: Participating Courses and Modal Education Year of Students**

Course Abbreviation	Department/School	Course Name	Majority Class Standing
CHEM PHYS	Chemistry	Physical Chemistry Laboratory	junior
CHEM THESIS	Chemistry	Honors Thesis Seminar	senior
COMPSCI	Computer Science	Mobile Apps: From Concept to Client	senior
ENGINEER	Mechanical Engineering	Engineering Innovation	junior/senior
ENV CONFL	Environmental Science	Environment and Conflict	junior/senior
ENV CONSERV	Environmental Science	Conserving the Variety of Life on Earth	junior/senior
ENV POL	Environmental Science	Integrated Environmental Science and Policy	soph
ENV REST ECO	Environmental Science	Restoration Ecology: Theory and Applications	junior/senior
GENOMICS	Biology	Genomic Perspectives on Human Evolution	junior/senior
GLOB HEALTH	Global Health	Fundamentals of Global Mental Health	soph

**Table 2: Assignment Details by Course**

Course	# Assigns with Ver	Genre of Student Writing Assignment	Individual or Coauthored
CHEM PHYS	2	journal-style research report	indiv
CHEM THESIS	1	senior thesis	indiv

COMPSCI	2	(1) project plan (2) design documentation	coath
ENGINEER	2	(1) problem description (2) design proposal	coath
ENV CONFL	1	policy analysis	indiv
ENV CONSERV	1	video congressional testimony	indiv
ENV POL	2	policy memo	indiv
ENV REST ECO	1	restoration and monitoring plan	coath
GENOMICS	1	research grant proposal	indiv
GLOB HEALTH	2	research grant proposal	indiv

### Survey Administration

All assessment surveys were administered using Qualtrics online survey software.

For student surveys, instructors were asked to administer the survey in class if possible, and to ask any students who were not in class that day to complete the survey out of class. Readers received the survey link by email. The student survey had two major sections: the first was for all students in the course, whether or not they participated in VER; there was no mention of VER prior to or within this section. The survey then bifurcated, asking different questions depending on whether students had participated in VER. Numbers of student responses by course are shown in Table 3; each entry shows the number of student respondents who participated in VER and the total number of responses for the course. Assessment methods including informed consent processes were approved by the Duke University Office of Human Subjects Research.

**Table 3. Student Survey Sample Size by Course and Year**

	#RESPONSES(VER/total)		
	2011-2012	2012-2013	2013-2014
CHEM PHYS	2/2*	4/4*	-
CHEM THESIS	4/12	-	-
COMPSCI	7/7*	17/18*	6/7*
ENGINEER	15/15*	17/18*	6/7*
ENV CONFL	7/7	-	-

ENV CONSERV	-	-	4/12
ENV POL	-	6/16	7/15
ENV REST ECO	12/22	15/55	23/43
GENOMICS	11/22	12/19	-
GLOB HEALTH	-	-	9/13
<b>Total</b>	<b>58/87</b>	<b>62/114</b>	<b>67/114</b>

\*Student Participation Required

## Major Findings

For this exploratory study, assessment data for each course from one semester was used to guide changes implemented the next. Given the substantive differences in reader-student interaction plans, matching arrangements, and so on between courses and even between subsequent offerings of the same course, detailed comparative analysis of pooled research data is excessively complicated and potentially misleading. Detailed data analysis focusing on specific subsets of these data most relevant to faculty and administrators in particular fields will be presented in forthcoming publications.

Here I discuss results highlighting general trends across course settings. I first present data for student participants, including their assessment of the quality and quantity of interactions with their readers and their perceptions of how they benefited from participation. This is followed by comparisons of responses from student participants and non-participants regarding their experiences with writing in the course. The final set of student results reports on problems and challenges students faced. The second major subsection includes results from reader surveys followed by a short section on instructors.

## Student Perspectives

In planning this research, I posed for myself two primary questions: Can VER increase student engagement in STEM writing assignments, and if so, what makes it more or less likely to work well? The first question is now easy to answer—at least according to student survey data. As I will show, these data suggest that VER participation does enhance engagement for most students who participate and that most would participate again if offered the chance or would recommend VER to other students. That said, results vary considerably across courses, which makes answering the second question more challenging. Given the limited data for each course, sorting out the factors that might account for these differences requires finding patterns across different measures. Because this is difficult to present sequentially, I state my general interpretations of these data here and then discuss trends related to these interpretations as I present specific results.

The most important trend I find in these data is that fewer students reported benefits or satisfaction with the experience when their participation was required or when the writing was done as part of a team. Of the many questions on the survey, I see the one asking whether students would recommend participation to other students as the best measure of overall satisfaction with the experience. For the first year of this study, 19% of students who wrote papers as the sole author said

they would *not* recommend participation to other students, compared with 46% of those who coauthored papers with classmates. While data from the following semesters shows improvement in this measure for both groups, the trend continued. In the most recent data, 6% of students writing on their own would not recommend participation vs. 20% of those who coauthored.

Comparison of specific results from courses with collaboratively written papers is revealing. The two courses with the weakest student results for this question in the 2011-2012 year were the engineering and computer science courses; both had coauthored papers with a single VE reader per team and student participation was required. An additional course with team projects, Restoration Ecology, was added the following year. In response to the first round of assessment data from the engineering and computer science course, students in Restoration Ecology and the second offering of the engineering course were given individual readers and participation was made optional. That semester student satisfaction with VER in both courses was strong. In the final year of this study, the course Global Health was added, in which students also coauthored papers. Following on prior success in the ecology and engineering courses, participation was optional and students were assigned individual readers. Student assessment was also quite positive for this course. These results suggest that students can indeed have positive experiences with VER in collaborative writing contexts as long as students have their own readers.

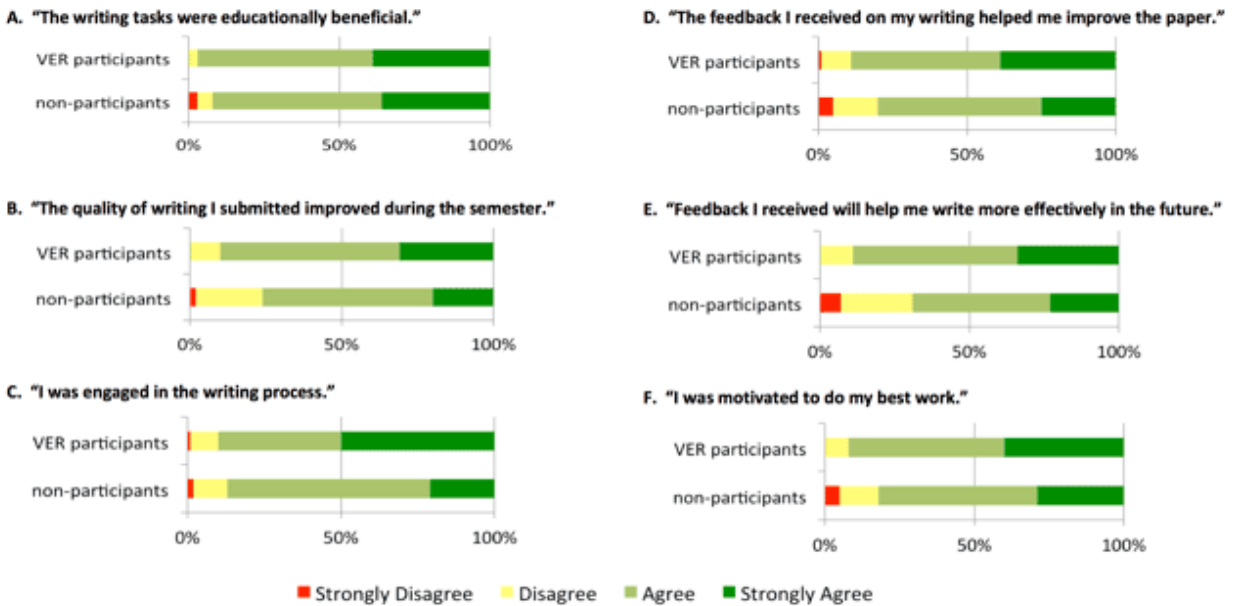
### ***Self-reported Benefits of Participation***

Student surveys began with a series of questions about their experience with writing in the course without reference to VER, which provided comparison group data. I note that though these comparisons are useful, there was no true control: students self selected into VER (for courses not requiring it) rather than being randomly assigned to VER or the comparison group. After the first set of questions the survey bifurcated, with different questions for VER participants and non-participants. VER participants were asked about the VER experience; non-participants were asked why they chose not to participate, what they heard about VER from those who did, and whether they would have chosen differently given what they knew about VER now.

[Figure 1](#) presents a comparison of responses from student participants and non-participant to a set of prompts regarding their experience with writing in the course from fall 2012 through fall 2013 for courses in which student participation was optional. There are two notable differences between the VER participant and comparison groups. Of VER participants, 50% strongly agreed that they were engaged in the writing process, compared to 21% for non-participants. Of participants, 39% strongly agreed that the feedback they received helped them improve their papers and 34% strongly agreed that the feedback will help them write more effectively in the future; for non-participants the values were 25% and 23% respectively. Participants were also more likely than non-participants to report that they were motivated to do their best work. While these data reflect favorably on VER they should be interpreted with caution since students self-selection into the VER or comparison groups could have resulted in a sampling bias, particularly regarding issues of engagement and motivation.

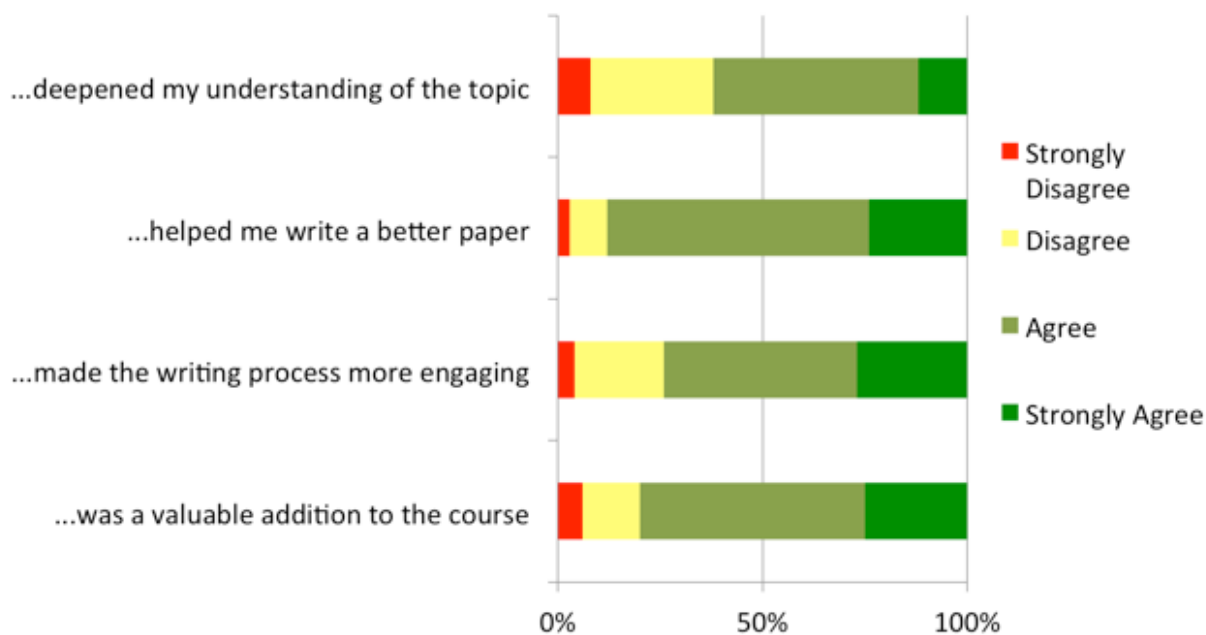


Figure 1. Student Reflections on Their Experiences with Writing in the Course: VER Participants vs. Non-participants



Students who participated in VER were also asked to indicate agreement with a series of statements regarding perceived benefits (Figure 2). Even though enhanced subject matter learning was not an explicit goal of VER, the top graph (a) shows that over half of participating students felt their participation improved their understanding of the subject they were writing about. Nearly 90% of student participants believed that their work was better as a result of the experience (b). Over two thirds reported that the experience made the writing process more engaging, with over one quarter strongly agreeing with that statement. The bottom graph (d) shows 80% of students reporting that VER was a "valuable addition to the course." Results shown in (d) are particularly instructive since their response should take into account both perceived benefits such as those shown in (a) - (c) and any perceived costs—particularly the additional time required.

Figure 2. Responses to the Prompt: "Please indicate your agreement with the following statements: Participating in the Reader Project..."



To better gauge students' overall satisfaction they were also asked, "If you had the opportunity to participate in the Reader Project again, would you?" Of the 50 responses to this question from the 2011/2012-year, 76% answered yes. Given that this was the first attempt at including VER in any of these courses, this was encouraging. However, as shown in Figure 3, results varied markedly by course. All of the students in the chemistry courses and nearly all participating students in the Genomics Perspectives course indicated they would do so again; in contrast, the proportion of favorable responses for CompSci and Engineering were 67% and 52%, respectively.

Figure 3. Student Responses to the Prompt: "If you had the opportunity to participate in the Reader Project again, would you?" (Fall 2011 - Spring 2012)

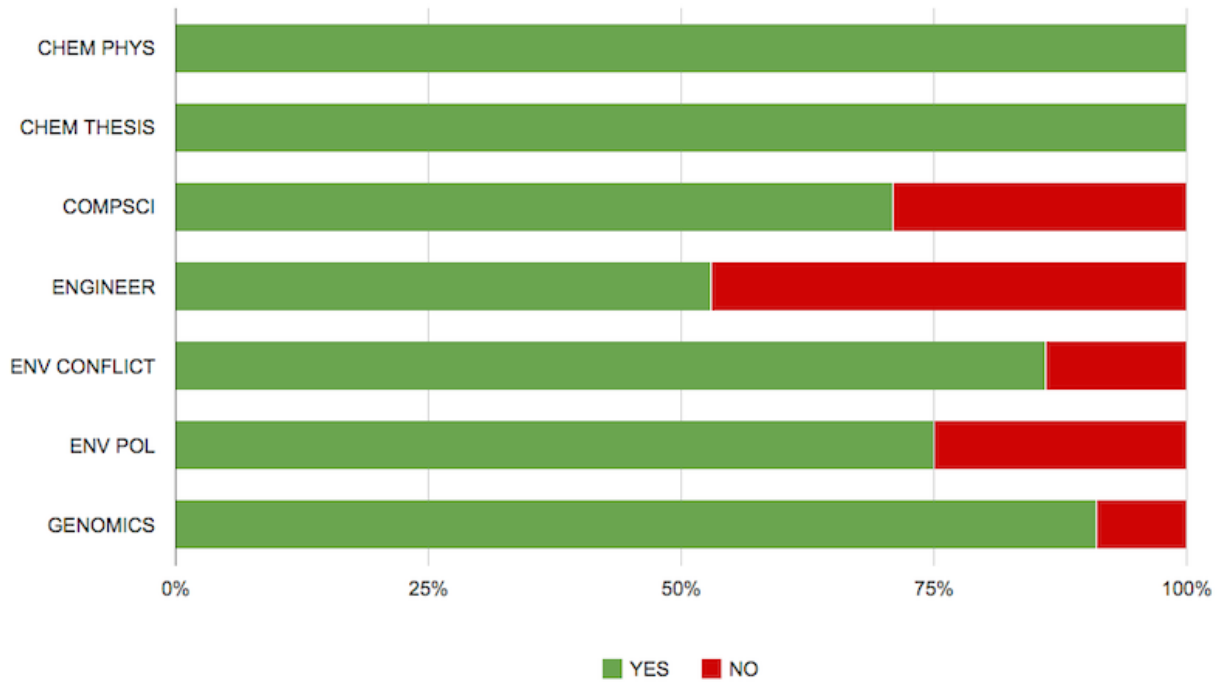
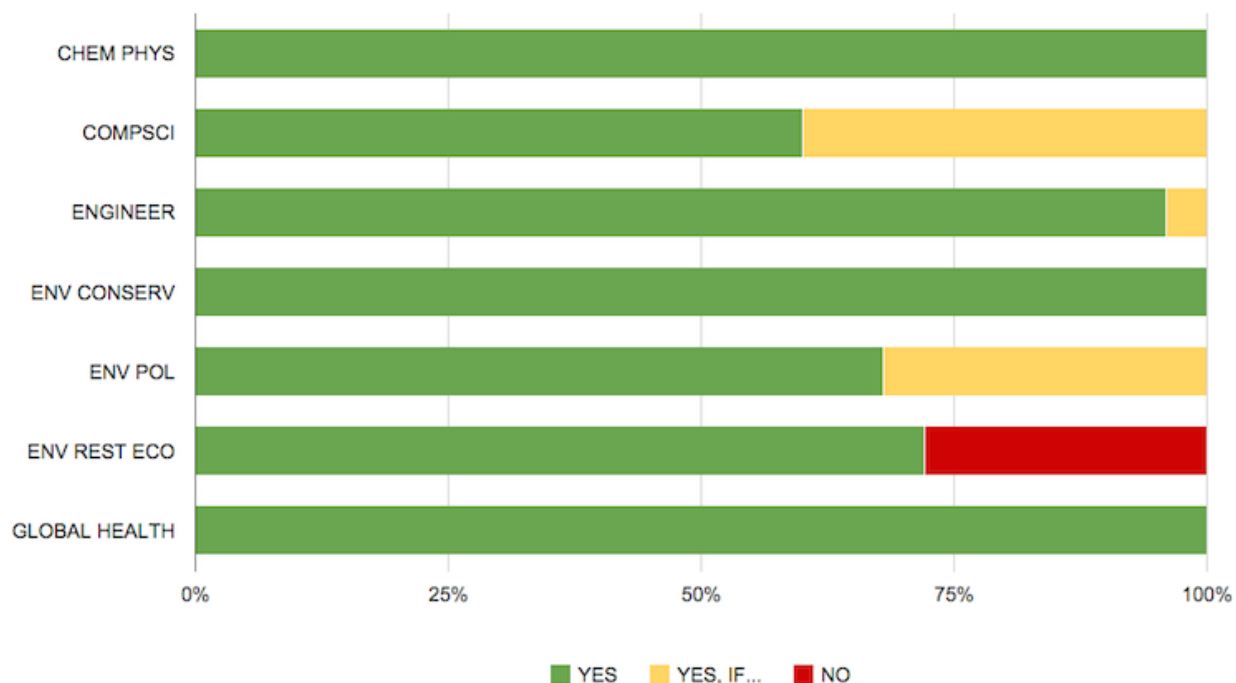


Figure 4 shows the results for this prompt for the most recent year. Courses with co-authored papers are COMPSCI, ENGINEER, ENV REST ECO and GLOBAL HEALTH. Note that the course with the lowest proportion of "yes" responses is the computer science course—still under the required participation/one-reader-per-team model. In 2011 (Figure 3) participation in the engineering course was required and each *group* had one reader. In 2013 it was optional and students were assigned their own readers. (Note: 19 of 25 students opted in.)

Figure 4. Student Responses to the Prompt: "If you had the opportunity to participate in the Reader Project again, would you?" Past year results (Spring 2012-Fall 2013)



**Student Assessment of Readers and Interactions**

Beginning in 2011, the student survey asked, "Was your reader engaged and responsive?" (Table 4). Slightly over half of students responded "yes" in the first year of the study, increasing to about 75% in the following two years. Students' overall assessment of their experience was associated with their responses on this question: 77% of students who responded "yes" indicated that they would participate again if offered the chance, vs. 33% who answered "somewhat." (Very few responded "not at all.")

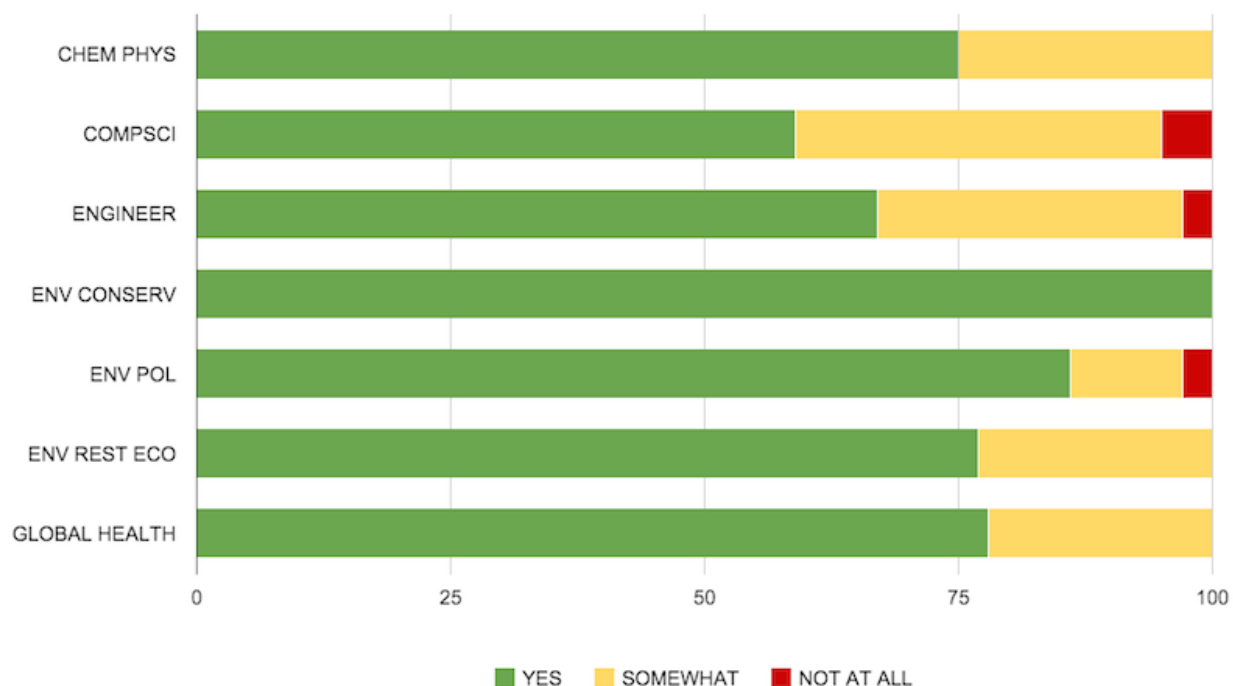
**Table 4. Student Response to "Was your reader engaged and responsive?"**

RESPONSE	2011-2012	2012-2013	FALL 2013
No	9%	1%	3.1%
Somewhat	36%	25%	21.5%
Yes	55%	73%	75.4%

If student reports of reader enthusiasm are accurate, this may well reflect the readers' perception of their *student's* commitment to VER process. Increases in reported reader enthusiasm, then, might be indirectly influenced by improvements in the matching process and measures to improve student follow-through and accountability. Figure 5 shows responses to this prompt from our last full year of data collection, by course. The computer science course again gives the most negative responses, with

about 40% of respondents indicating a less-than-ideal perception of reader engagement. Notably, this was the only course that year in which students both coauthored papers and had a single reader per team.

Figure 5. Student Responses to the Prompt: "Was your reader engaged and responsive?" (Spring 2012-Fall 2013)

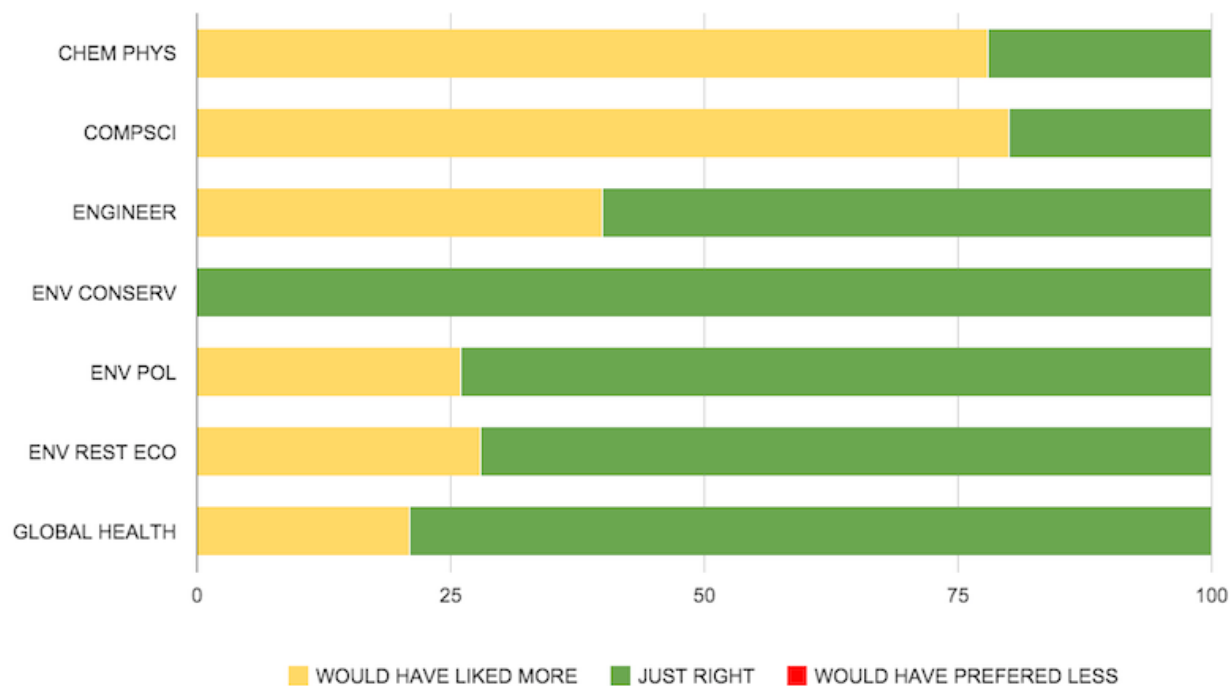


Students were also asked about the *quantity* of their interaction with readers. In response to the prompt, "What are your thoughts about the amount of interaction you had with your reader?" 67% of students reported that this was "just right," while 29% "would have liked more." Only 4% (8 students) "would have preferred less." These results were fairly stable over time, suggesting that we are generally planning the right amount of interaction between students and readers—with the assumption that it is better to leave participants wanting more interaction than to expect them to interact more than they would like.

Figure 6 shows student responses to this question over the last full year of data collection by course. While students in most courses were generally satisfied with the amount of interaction they had with readers, the exceptions are interesting. 80% of students in the computer science course wanted more interaction. Given the relatively low rate of student satisfaction described above, these data suggest at least one possible reason: in student teams with a single reader, students may have too little interaction with the reader. Yet the responses were quite similar for the physical chemistry course for which students reported favorably on their experience with VER. Student desire for more interaction might imply that these students would have liked yet more of what they felt was a good thing.



Figure 6. Student Responses to the Prompt: "What are your thoughts about the amount of interaction you had with your reader?" (Spring 2012-Fall 2013)



Starting in fall 2012 we began asking students about the quality of the reader match with the prompt, "Considering your reader's background and experience, how good a fit was this reader for giving feedback as a member of the target audience for the assignment(s)?" Of 139 responses, 62% felt their reader was a "good" fit, 30% a "satisfactory" fit, and the remaining 8% "not a good fit." Examining these data across time suggests that improvements in soliciting and matching procedures have improved reader fit: In 2012/13, 47% of students rated their reader's fit as good, 39% as satisfactory, and 15% as not good, whereas for the last semester of this study, the ratings were 80% good and 20% satisfactory, with no students reporting poor fits.

### Problems and Challenges

Students were asked about challenges they faced as a VER participant in two ways: via an open-ended prompt about whether they encountered any problems and a question asking specifically about conflicting feedback they received from their VE reader and their instructor or teaching assistant. The proportion of students reporting some type of problem was highest the first year of the study at 24.1%. The proportion has since decreased: 21.3% for the '12/'13 year, down to 13.9% for the most recent term.

On the open-ended prompt, the most common themes were a lack of reader engagement and not getting feedback from the reader quickly enough to meet the timeline of the assignment. One student, for example, commented that her reader "was most often busy and the response time too slow to be valuable in doing drafts of a report for a college class." The pacing of student writing tasks, combined with the multiple assignment deadlines and exams students must juggle, does pose a challenge for VER. This may be why assessment data are more positive for courses with a single large writing project than for multiple shorter assignments. A number of students also commented on reader fit,

noting that their reader had insufficient subject-matter expertise or didn't know enough about the genre of the assignment.

In response to the prompt, "If you received feedback both from your reader and your instructor (or T.A.), did you ever receive conflicting feedback?" 24% students answered in the affirmative. Those students were then asked how they dealt with the conflict. The majority (56%) reported that they deferred to the instructor or teaching assistant:

I inevitably had to default to the feedback of my TA. She is the person who grades my assignments and thus I need to follow her instructions and improvements.

It was mostly feedback from the reader that didn't take into consideration small quirks required by the instructor for the paper, so the instructor's wants won out always.

The TA grades my paper, so I took his advice. But I know that in real life that my writing will be different and make more sense than the stuff we do for grades in this class, so hearing my reader's advice is good for when I do actual writing in real life.

Those who deferred to their reader (14%) generally noted the reader's greater experience, particularly in comparison to the teaching assistant:

Our writing assignments were policy memos about impact assessing and recommended policy action. My reader is a professional working in environmental impact analysis and regulation, while my TA was a student in environmental finance. So, I deferred to my reader because her feedback was more informed and pointed.

I used the feedback from my reader, as she was an expert in the field that my memo addressed.

As my reader was an expert in her field, I trusted her feedback over that of the TAs, who are essentially my peers.

The remaining 25% attempted to synthesize input from both sources:

Most of these conflicts were related to personal opinion, so I just went with the feedback I was most comfortable with.

It really dealt with the topics of the writing project and how I as a student should go about writing them. [My reader] ...was giving advice more as if in a real world situation whereas the TA talked mostly about grading and grading policies which differed in terms of content and style.

I tried to incorporate both types of feedback in a way that would satisfy both the professor and the reader.

## Reader Perspectives

Because qualified and willing volunteers are the essential element in VER, I focused data gathering for readers on questions that would provide insight on their motivations for participating, their approaches to providing feedback, and their likelihood of participating again. In response to the

question "Why did you participate in the Reader Project?" common responses related to three themes: the desire to interact with Duke students, the opportunity to give back to the institution, and the importance of writing in the field (Figure 7).

Figure 7. Wordcloud Representation of Reader Responses to the Prompt: "Why did you participate in the Reader Project?"



Table 5 shows the ways in which readers provided feedback and the proportion of readers who used each. Readers were asked to select all of the modes they used. Email was the most common, followed by Word "comments" and then "track changes." Since most readers do not reside near the university, it is not surprising that only 15% of readers met with their students in person.

Table 5. Modes of Feedback Used by Readers

ANSWER	%
Comments typed in an email	68%
"Insert Comment" feature of Word	58%
"Track Changes" feature of Word	55%
Webcam	22%
Face to Face	15%
Phone	13%
Other	6%
Social Media	1%

### Reader Feedback

To understand the kinds of feedback readers provide for students, we began collecting feedback samples in the second year of the study. Collecting such data is challenging for a number of reasons: The variety of response modes (email comments separate from the student text, comments made

within documents, and those made orally in person, or by phone or webcam), participants reluctance to share these data, and because IRB protocol requires securing both student and reader permissions for each document. While I have not analyzed the data collected to date, I have worked with instructors to select model responses from those submitted for their courses to use in future reader training. A sample of these models is presented in Appendix C.

Readers were asked whether the type of feedback they gave changed during the semester, to which 35% responded affirmatively. Comments tended to remark on changes made either as a result of better understanding the role of the VE reader and the educational context or recognizing that student needs changed as the work developed:

I pulled back from editor mode to more like a senior engineer reviewing the work of a less experienced engineer.

It became more generalized and less direct which gave the students a chance to think for themselves.

From helping her brainstorm on sources for information and perspectives to the best way to organize your arguments and information in the paper.

We started out just talking about ideas, and gradually became more targeted.

The first set of feedback was a little more generic about organization, purpose, and clarity. The second feedback spent more time discussing specific points.

The first draft was much more basic, pointing out the initial issues about organization and the content working together. The second draft was more about asking questions about the subject and content that I would have anticipated the intended reader to ask.

Readers were also asked what, if anything, they learned in the process of being a reader. Interestingly, many of the responses were in line with current best practices in teaching writing. (How much of this was learned from the experience itself or from reading the materials we provided to guide them in giving feedback is not clear.) Many commented on the importance of not appropriating the student's text or doing their work for them:

Leaving work in students' hands.

I have learned how to suggest changes without making the changes. It was definitely different as all of my previous editing experience has been making changes. It was also challenging to suggest changes in a way that suggests learning.

I've learned how to comment by giving suggestions, rather than telling the student what to change. It is the student's paper, and therefore his or her decision to accept or reject any of my comments or suggestions.

It is in the best interests of the students to give them less direct feedback—they learn more and think for themselves.

Try not to give students answers but ask questions.

Others commented on the importance of including positive comments and having an encouraging attitude:

... to give positive feedback as well as critical feedback.

Feedback should always be constructive and never negative.

Importance of giving positive feedback along with critical feedback.

The best results and experiences have come from remaining positive, encouraging, and if there are issues to address, be sure to be clear and focused if you have specific concerns.

Students are used to criticism, but I'm not sure they are used to the idea that it is always intended to make the product better. In other words, this reader needs to make clear that their comments are in the spirit of business / enterprise collaborative writing - it's not about critiquing the performance, but rather about improving the performance.

One has to be very careful not to do any of the student's actual research, but to suggest areas where he or she might find relevant material, new material, challenging perspectives. In face to face (via web cam in my case), I always find asking questions produces more interest and follow up work from the student. I often disagree with a student's assumptions or conclusions, but I see my job as helping the student present his or her thesis or analysis as effectively as possible. Often I find I have learned something new along the way as I read and listen.

A number of readers mentioned keeping comments focused:

I'm used to giving feedback to younger professionals, but I found that with college students without real world experience you have to be a little more targeted.

Be specific about what you're trying to help them achieve. It's more than "good writing"; it's about developing a tight package about a problem and describing the issues succinctly.

I think giving too many comments can be overwhelming. Focusing on a few critical points can be more effective.

Finally, many readers gave responses that are interesting for the level of engagement they show for the VER process:

I think I have a pretty cut-to-the-bone, possibly harsh style with my colleagues as we turn around materials very urgently at times and also we tend to write comments rather than talk. We work from various parts of the country so are not in the same offices. I do not think that style would have been productive with a student. I certainly gave my opinion, but the chance to talk rather than just mark up a paper was very helpful. At the same time, it allowed me a chance to reflect on what my well-informed but generally gut reactions to policy writing are based on. I could explain them, with this reflection, and also discern what was actually a personal preference.



I've learned to really pay attention to how the student is reacting to the conversation to understand how/if feedback is being understood or valued. I've participated for several years and each student is different.

How to separate comments on content from those on delivery. It seems to be easier to assimilate the information when compartmentalized this way.

Don't assume that what seems obvious to you is obvious to others.

Sometimes it is necessary to correct/provide feedback for a student for the same thing in multiple situations/multiple times—can't just use one example and expect the student to recognize and change similar situations, but if you point out the same thing two or three times then they might recognize it themselves in the fourth time. This isn't because students are slow or don't understand, it's because the feedback and material is new to them. I think that professionals with a lot of experience in a certain field or skill have a tendency to forget that at one point we had to learn that material, skill, way of doing things—it isn't completely intuitive or natural. Working to teach a student through feedback on a piece of writing provided a valuable experience which I think will help me work with junior staff and new employees in the future.

### ***Challenges and Satisfaction***

Readers were also asked about the challenges they faced in providing feedback, the amount of interaction they had with students, and whether they would participate again. As shown in [Figure 8](#), a slight majority of respondents indicated no difficulties in providing feedback. Of those who reported challenges, the most common response was refraining from correcting students' work (30%).

*Figure 8. Responses to "What were the challenges in responding to student writing?" Results in percentages. 2011-2012.*

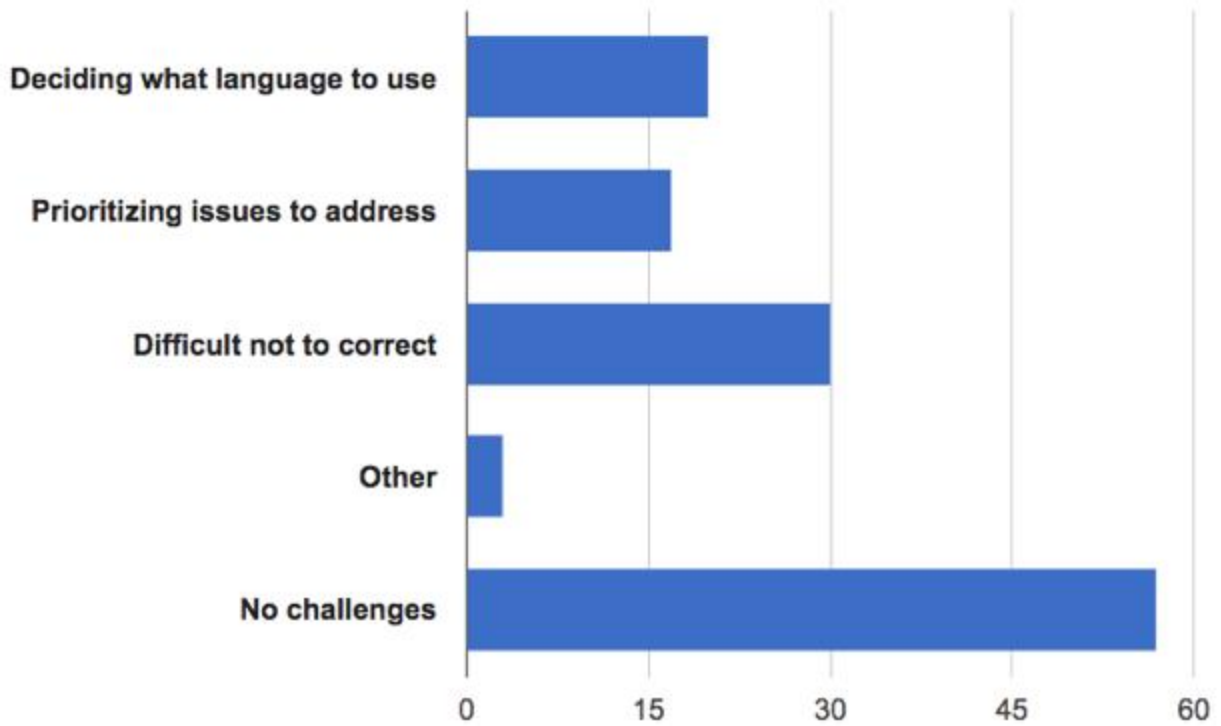


Table 6 shows how readers felt about the amount of interaction they had with students—overall and as a function of team vs. group projects.

**Table 6: Reader Preferences for Student Interaction (Collaboratively vs. Individually Authored Papers)**

Amount of Interaction?	Total	Collaboratively Authored	Individually Authored
Prefer More	45%	60%	33%
About Right	55%	40%	67%
Prefer Less	0	0	0

Overall, readers were almost evenly split between those who thought the amount of interaction as "about right" and those who wanted more. Breaking these data down by type of authorship suggest that readers tended to be less satisfied with the amount of interaction for collaborative writing projects than for individually authored papers, consistent with results for students. For team-based writing projects, most readers (60%) would have preferred more interaction, whereas for solo-authored papers most readers (67%) felt the amount of interaction was about right. No respondents indicated that they had too much interaction. For the team projects it was theoretically possible for readers to have *more* opportunities to interact with students, since each reader was matched with three to five students (depending on the course). These data suggest, however, that the dynamics of one-reader-multiple-student matching were less favorable than the one-to-one matching in the solo-authored contexts.

A crucial matter for sustaining VER is whether readers will volunteer repeatedly—both because of the need for a sufficient number of readers but also because repeaters bring the benefit of prior VER experience (which includes the kinds of things readers reported learning from their experience discussed above). When asked whether they would be interested in participating again, 79% of 113 respondents chose "Yes, as soon as possible," while 19% responded "Yes, but not next semester." Only 2 readers indicated that they did not want to participate again. In fact, over one third of readers taking the survey indicated they had been a reader at least one time before.

While formal assessment offers important data on the experiences of volunteers, readers occasionally communicate with the program informally by email. While these data are anecdotal, they provide insight into the motivations of some readers. Here are two excerpts from unsolicited notes describing the reader's interest in participating:

As an engineering manager, I have had the opportunity to recruit and develop many bright young engineers over the past couple decades. It seems that only a very small fraction have the writing skills to communicate their ideas in an organized, coherent fashion.

Oftentimes, engineers seem to think that the calculations are all they need to be good at. My response has always been that it doesn't matter how good your idea is if you can't communicate it, and that much of the time, the people deciding whether to approve a project expenditure only understand the text, not the technical data.

## Instructor Perspectives

My research on VER to date has focused primarily on students and secondarily on readers. Nonetheless, we have collected a limited amount of data from instructors. These data suggest that for some participating instructors, their involvement in VER has influenced their teaching in ways we would consider positive from a WID perspective:

It has helped me to think about how to structure the assignments so that they are not merely outputs, but... part of a process.

I am using additional interim deadlines and assignments for the students. I have utilized more class time for writing workshops, including peer and model editing..

Previous semesters, we have left documentation tasks until near the end of the semester. Being part of the Reader Project has facilitated our more effectively integrating documentation issues into the core of the course.

These responses suggest that aside from the direct benefits of students interacting with readers, VER may result in enhancements to the writing pedagogy of the course more broadly. Finally, one instructor offered a comment on the value of VER that aligns well with the broad aims of the approach:

Without a doubt, [my students'] writing has improved dramatically [...] through their interactions with their reader. This is not because of feedback on sentence structure and grammar, but because of the real-life experience these readers bring with them. [...] As a result of their interactions with their readers (e.g., via e-mail or Skype), their papers have been transformed from just another term paper into a "living document" that has real meaning beyond the classroom. These students are no longer just writing for the "professor", but know that there is a larger audience out there that may find their research and ideas of value.

While such comments have limited value as evidence of the effectiveness of VER, they do suggest that faculty can understand what VER offers and value the experience for their students. The other and perhaps most telling data regarding instructors is indirect: Of the ten courses involved in this study, instructors of all but one—the computer science course—have asked to continue VER in their courses after the study.

## Lessons From Research and Practice

My research to date suggests that VER can indeed be an effective tool for STEM writing projects. But it is also clear that a number of factors may affect the success fo VER. Here I present my current thinking on issues that appear to play a role in the success of VER and how VER can best be implemented.

### Will sufficient numbers of qualified readers volunteer?

One of the most rewarding aspects of directing the Reader Project has been seeing the variety and caliber of volunteers. When I first experimented with VER in my own health-science-oriented first-year writing courses in 2006, I expected that if were I fortunate enough to get many volunteers, they would be primarily younger professionals with limited experience. I found the opposite. Most of

those who volunteered had considerable experience and some were at the top of their fields. In fact, readers for this course over two semesters included the directors of the Duke Diet and Fitness Center and the Rice Diet Center, both nationally renowned experts. This trend has continued. To provide a sense of the caliber of professionals who are willing to share their expertise with students in this way, I provide a sample of reader biographies in Appendix D.

### **Should student participation be required or optional?**

One of the earliest questions I faced in implementing VER was whether student participation could be required. Some instructors have had initially a strong preference that all their students participate—either because they wanted all of their students to get the benefits or because they wanted to avoid the complications resulting from partial participation. While sympathetic to these concerns, I preferred from the outset to make participation optional. For one reason, I was not certain we would be able to solicit enough qualified volunteers to make good matches for every student. I have also found that while our volunteers have been remarkably reliable overall, it occasionally happens that readers don't work out, either because personal issues arise and they have to withdraw or, more commonly, because they take too long to respond to their student's work.

One of the clearest lessons from our ongoing assessment of the Duke Reader Project is that when students are required to participate, rates of student follow-through decrease markedly. In fact, changing student participation from required to voluntary has consistently improved outcomes according to our data. Three of the ten courses in this study began with students being required to participate, one of which—engineering—transitioned to optional after the first term. Of the two remaining, the computer science course consistently returned the weakest assessment results while physical chemistry has been strong. The computer science course enrolls nearly 20 students, has many moving parts (including external, real-world clients) and requires students to write in teams. The physical chemistry course has had unusually low student enrollment during the two semesters of this study with only 3-5 students per term (corresponding to a general dip in departmental enrollments). The chemistry instructor is also extremely engaged and committed to VER, to the extent of soliciting readers for his students himself—largely from his network of former graduate students. Every student in his course reported positively on the experience. Evidence from this study, together with informal assessment of many other VER courses has convinced me that requiring students to participate is unlikely to be effective except in unusual circumstances.

### **How much specialized knowledge should readers have?**

While most Reader Project assignments have been targeted to specialist readers, some have been specifically intended for non-specialists. When I started the Reader Project I assumed that we should choose volunteers who were the best fit as members of the target audience for each assignment. For non-specialist assignments this meant matching students with readers who were *interested* in the subject (either personally or professionally) but did not have expertise in the field. Assessment data has complicated this idea: it seems that in spite of the potential merits of the more "authentic" reading non-specialists might provide, students are more likely to fully engage with readers who are experts in their topic area. Readers with topical expertise can provide more input on the substance of the work—questioning content, suggesting resources, and so on. For students interested in a career related to the topic or discipline, these readers may be more interesting to interact with and may also provide potential networking opportunities. In these cases, getting feedback from both a VE reader and a tutor might be fruitful—the reader providing the insider textual and content knowledge and motivation and the tutor responding through the lens of the non-specialist.

In other cases, it may be advantageous for readers to have genre knowledge but not content knowledge. For example, students in the environmental science course *Conserving the Variety of Life* are assigned to write (and then video themselves delivering) a 5-minute congressional testimony on a species conservation case of current interest. The target audience for this assignment would include people familiar with the rhetorical context of congressional testimony but not necessarily expert in species conservation. In the most recent term of this course, one reader had experience giving just this sort of testimony on an environmental issue, another served as a staffer on a congressional committee, and yet another was the past chair of the House Republican Caucus. I assume that all of these readers could be good VE Readers for this course.

### How should readers and students be matched?

When we began matching students and readers in 2007, we solicited readers broadly to join a volunteer pool, using a detailed survey to collect information about education and work history, personal interests, and so on. We then used these data to select readers as needed for each course. This approach, however, had its drawbacks. First, and perhaps most important, having readers sign up to volunteer for the *program* doesn't guarantee they will be available for any given term. This meant we had to check in with the volunteers we selected and find replacements for some, adding extra labor and delaying the match process. Second, this approach required our personnel to make the judgments as to which readers would be the best fit for each course. Given the range of topics, genres, and fields, this was impractical at best. Now, before the start of each semester, we present the list of upcoming courses to readers in our pool and then let *them* decide when they want to volunteer and which courses they are suited for.

Also, when we began the Reader Project we didn't involve the instructors in the match process, trying to minimize what we asked of them so as not to discourage them from trying VER in their courses. We now know that most instructors are happy to provide input in selecting readers for their courses, and this input clearly results in better matches. Instructors often notice relevant aspects of a reader's background that VER personnel miss, especially for independent research projects since instructors know the particular topic of each student's paper. Here are two such examples as described by the instructor of the course *Environment and Conflict*:

[O]ne of the students this year was writing about the marshlands shared between Iraq and Iran and the potential conflicts over water that could erupt as Iraq moves forward with its reconstruction efforts. This student [was] paired with a Duke alumnus [in the service] stationed in Iraq. Another student was interested in the relationship between conservation of sea turtles and the narcotics trade in Mexico. She was paired with a Duke alumnus who is one of the world's leading experts on the protection of sea turtles along the Mexican coastline.

In our current practice, once a roster of potential readers for a given course offering has been identified, we ask instructors to help in making the final selections for their students.

We have also learned that readers occasionally volunteer themselves for courses that interest them but for which they do not possess the necessary background. When readers volunteer themselves for a specific course, we now ask them to briefly explain their interest and fit for that course—information which usefully supplements the general biographic data we collect for each volunteer. Overall, then, we have found it best to let readers propose themselves for courses each term and then select among those readers based on available information with input from instructors.

## Can VER work for team projects?

Unlike courses in the humanities and interpretive social sciences, writing assignments in STEM often involve collaborative writing. Using VER for group projects involves additional considerations of student-reader matching. The two obvious matching options are one reader per group or one reader per student. Each has its theoretical advantages. Those acquainted with undergraduate student writing in STEM are aware that, unless required to do otherwise, teams will often distribute the labor of various tasks such that only one or two members end up doing most of the writing and editing. If each team has a single reader, most students in this scenario would have little if any substantive interaction with their reader, and thus get no benefit.<sup>[5]</sup> One reader per team also introduces scheduling complications that pose a serious threat to the success of the project. To date, we have tried the one-reader-per-group model five times and each has resulted in weaker assessment data from both students and readers. On the other hand, pairing a single reader with each team requires far fewer qualified readers and less administrative labor in making matches and following up with volunteers. Having a reader for each student, however, is more likely to sponsor meaningful relationships. As described above, data from this study suggest this as the better option. Students matched one-on-one with readers have tended to be more engaged and responsible partners.

For coauthored papers, one reader per student means multiple readers per group, and this does make incorporating reader feedback more complicated for students. As novice writers, students often see these complications as problematic—especially if they have learned to succeed at school writing tasks by interpreting teacher feedback as a comprehensive set of instructions to be executed in exchange for a higher grade. But there is reason to believe that the choices forced on students through multiple, personalized readings is valuable for students growth as writers. Robert Probst (1989) puts the point this way:

Regardless of personal ambition, ... the writer must have integrity, which means not unthinkingly accepting the judgments of others. Nor does it mean rejecting them out of hand. Rather, the writer must assimilate these judgments and use them in making her own judgments. The responses we make to writers at all stages of their development must encourage them to begin to take that responsibility. (p. 76)

Exposing students to multiple readings of their coauthored texts may turn out to be an additional advantage of the one-reader-per-student arrangement for team projects.

## Can VER be a useful faculty development tool?

From a faculty development perspective, it's fortuitous that implementing VER requires that instructors integrate it into the fabric of their courses and adopt accepted best practices in WID: a required revision process, an explicit rhetorical context, and feedback that focuses on the intentions of the author within that context. In order to secure the benefits of VER for their students—which are especially apparent to faculty in STEM—instructors must participate in what for many of them are their first collaborations with the writing program. Of the ten instructors participating in this study, only four had prior interactions with our writing program. As of this writing, I have worked with nearly fifty instructors to include courses in the Duke Reader Project; the great majority had no prior contact with our writing program or, to my knowledge, other formal training in writing pedagogy.



## Is there a role for writing centers in VER courses?

In "Rethinking the WAC/Writing Center Connection," Michael Pemberton (1995) asks "What benefits can the writing center and its tutors provide in conferences that would not be more fully realized in meetings with professors or *other experts in the field* [my emphasis]?" (373) Although addressing WID courses generally, Pemberton's question obtains here: Tutors may, in fact, serve a useful role as mediators for students, helping them interpret and decide how to act on VER feedback. Again, while Pemberton's essay predates VER, his insights are applicable: "[A]lthough writing center tutors may not be the best people to comment on papers produced for courses in WAC programs (in terms of their subject-area knowledge and familiarity with discipline-specific conventions), they may very well be the one quasi-authoritative source that students feel most comfortable with" (p. 374).

Serving as mediator could also benefit the tutors. The role reduces pressure on tutors to any pretense of insider knowledge they do not possess. Also, the opportunity to examine VER feedback along with the client educates the tutor about discursive norms in that field. I can easily imagine a professional tutor assigned to a VER course who, in reviewing many VER responses, develops rare and valuable insights that could be shared with the professor, future students in the course, other tutors. These insights might even be publication-worthy. Research into how tutors might be integrated into VER courses could reveal synergies between these two sources of support.

## Future Research

Like any research into a new area, this study raises more questions than it answers. I conclude with a list of those questions I feel are now ripe for investigation:

- If VER is best implemented with student participation being optional, what motivates students to sign up or dissuades them? Are there ways to encourage greater participation without resulting in lower student follow-through? Can participation be increased by giving students more information about experiences of prior participants?
- Does having a class participate in VER improve faculty teaching practices in other courses—through assignment design, attention to the writing process, or how they give feedback? Can examining examples of high-quality VER feedback on their own students' writing improve the feedback that faculty or teaching assistants give?
- What are the gains to be had by participating in VER more than once? Do the benefits diminish after the first experience (so that we should prioritize students who did not previously have the opportunity) or are multiple VER experiences more powerful than just one?
- Is it generally better to try to build a stable pool of readers for a particular course or to give readers a variety of experiences?
- How do students view/value their VER experience once they have a few years of professional experience of their own? Do students who participated in VER as students make particularly good readers after they have graduated?

## Appendix A - Course Information Form

### ABOUT THE COURSE

Instructor Name	
Course Name	Genomic Perspectives on Human Evolution
Course Number	BIO 554
When will this course usually be offered? (Fall, spring, varies, one-time course)	Fall

### ENROLLMENT

Expected Class Enrollment	20
Predicted enrollment breakdown (as percentages):	Freshmen: Sophomore: Junior: 30 Senior: 70
Is student participation in the RP required or voluntary?	Voluntary

### WRITING ASSIGNMENT(S)

Length of paper (range):	4 single-spaced pages
Will the first draft be completed all at once, or submitted in parts?	as a whole
Will papers be <i>individually written</i> or <i>coauthored</i> ?	Individually
Approximately when will students be starting the paper (or first of the papers) that will be part of this project? (Approximate date or number of weeks into term)	3 weeks into term

### THE MATCHING PROCESS

What type(s) of background or experience would be appropriate for readers to have?	Genetics and molecular biology, preferably with knowledge of anthropology or medicine
Do you want to be involved in the matching process? (Yes, No, unsure)	yes

<p>Would you be interested in helping us recruit any readers? (Yes, No, unsure) Some instructors have ideas for people they know who would be a good fit with their course. We're happy to invite them!</p>	<p>yes</p>
---	------------

### CONTEXT FOR STUDENT WRITING

This part is intended to help students and their Reader Project volunteers understand the rhetorical context for student writing: what kind of writing the students are doing, who would be expected to read it, and where and why a reader would normally encounter such writing.

1. **For the paper they will be writing while participating in the Reader Project, my students should imagine that their final product would be:**

<p><b>Published in a scholarly or professional periodical such as (list up to 3):</b> (e.g., American Economic Review, Family Practice News, Bioscience, William and Mary Quarterly, NASA Tech Briefs)</p>	
<p><b>Published in a venue for non-experts such as (list up to 3):</b> (e.g., The New York Times, The New Yorker, Newsweek, Scientific American, CDC public health brochure)</p>	
<p><b>A workplace document intended for...</b> (e.g., National Science Foundation, a project manager, the CEO, district attorney's office)</p>	<p>National Institutes of Health as a grant proposal to fund an original research project</p>
<p><b>Other</b></p>	

2. **Students should imagine that the primary readers of their work would be:**

<p><b>Experts working in fields such as (list up to 3):</b> (e.g., biochemistry, child psychology, civil engineering or architecture, any health sciences)</p>	<ol style="list-style-type: none"> <li>1. anthropology, esp. human ancestry and migration, genetics of trait variation</li> <li>2. medicine or public health, esp. the role of genetics in disease susceptibility</li> <li>3. human genetics / genomics (e.g., biochemistry, child psychology, any health sciences)</li> </ol>
<p><b>Professionally invested non-expert(s) such as...</b> (e.g., state senators, administrators, board members, members of allied fields)</p>	

<b>Lay readers with an interest in...</b> (e.g., science, contemporary politics, popular music, environmental concerns, art history)	
<b>Other:</b>	

3. **The form of writing is conventionally called a** e.g., journal article, book review essay, policy memo, grant proposal, op-ed, design report)

Grant proposal for research project

4. **In a couple of sentences, explain to students *why* a typical reader would read the kind of writing they will be doing:**

Readers of grant proposals are asked by federal and private agencies to help them evaluate the merit and feasibility of research projects that are being considered for funding. Readers are approached by these agencies based on their knowledge of the field, technical experience, and expertise in project management. From the reader's perspective, the motivation for participating is that proposals are often exciting and thought provoking, and provide a glimpse of where a field is heading in the coming years.

## STUDENT-READER INTERACTIONS

by 6 Sep - Student deadline for sign up

By 11 Oct - Matches announced: Student contacts reader to set up Intro Meeting

by 23 Oct - Last day for introductory meeting with reader

*For the following interactions, dates are given for the latest dates; students and readers are welcome (and encouraged) to do these steps prior to these dates as schedules and student progress on project allows. Readers should aim to get written comments to students the day prior to the meetings so that students can look over their comments prior to the meeting.*

by 6 Nov - Student sends reader preliminary draft (same as due date for class)

by 13 Nov - Reader returns written comments to student

by 16 Nov - Student-reader meeting (real-time) to discuss second draft by 30 Nov - Student sends second draft to reader

by 6 Dec - Reader returns written comments to student (at least 1 day prior to meeting)

by 7 Dec - Student-reader meeting (real-time) to discuss second draft

on 12 Dec - Final draft due (six days later than the rest of the class); student sends final draft to reader

## Appendix B - Guidelines for Reader Feedback

### Guidelines for giving feedback

*Leave the work in the student's hands.* In general, editing tools such as "Track Changes" are good for collaborative writing but less-well suited to helping students become better writers, since students can be tempted to passively *accept* your suggested changes rather than deciding for themselves

which changes to make. Students will learn more if you can help them *recognize* where changes are needed, rather than doing the changing *for* them.

*Instead of telling the student what to do, describe your reactions to what you read.* Let the student know where you can follow the ideas and where you get lost; where you're engaged and where you're bored, confused, or frustrated; where you find an argument compelling and where you're skeptical. It's fine to do this without suggesting specific changes to address those issues; in fact, that's what we expect you to do most of the time. That said, there will be many occasions where students can benefit from your advice.

Give advice where it seems warranted, but try to do so in terms of principles students can apply in the future, rather than as only fixes to specific problems in their paper. For example, instead of this: "You should insert a sentence here that says...", try for something like this: "When I read this kind of paper, I want to see an explicit statement of the question or problem that will be addressed so I can understand where the paper is headed. Is that something you might do here?"

*Let students know what is working!* While you will want to let students know about difficulties you have trying to make sense of their drafts, you should also let them know what's good. These comments will encourage them to keep doing the things they're doing well. Even brief comments such as "This is clear" or "OK, I'm following you here" or "That's pretty convincing" give students valuable information.

*Respect and Privacy:* Many times the students are a bit nervous about sharing works-in-progress. Always keep your student's work private, and be kind as they learn this skill of receiving feedback before they have a finished product.

## Appendix C - Examples of Model Reader Feedback

### BIO 554: Genomic Perspectives on Human Evolution

**MAO-A and the evolution of human behavior: Comparisons of cognition and behavior across humans, chimpanzees, and ancient hominin species.**

Summary:  
 Fascination with the question of what makes us human has sparked the rapidly expanding field of research into uniquely human traits and genetic comparisons between *Homo sapiens* and our closest relatives. Features that distinguish humans and great ape relatives with respect to brain structure, cognition, and behavior are particularly popular topics of research. A recent study uncovered a fixed non-synonymous change in the MAOA gene, unique to humans within the clade of great apes. Yet the presence of this fixed mutation in ancient members of the genus *Homo* remain unexplored. Genetic information is now available for both Neanderthals and Denisovans, allowing for comparisons of specific coding regions between these species. Association of the MAOA gene with behavior and cognition presents new possibilities for the study of human evolution and divergence of the genus *Homo* from ape relatives. This study seeks to compare the genetic sequence of human MAOA with ancient DNA orthologs. Alignment will elucidate whether the human substitution is in fact a shared derived mutation of humans, Neanderthals, and Denisovans, or whether the selection for this mutation occurred after the time of the most recent common ancestor, therefore providing evidence for the comparison of human and ancient hominin behavior and cognition. This study will further explore the potential traits associated with the fixed amino acid substitution by creating genetic knock-in mice containing either the human, chimpanzee, Neanderthal, or Denisovan ortholog of the MAOA gene and analyzing phenotypic measurements. In humans, expression of the MAOA gene has been associated with aggression, antisocial behavior, impulsivity, and mild mental retardation. Therefore, cognitive tests involving learning, memory, and fear conditioning, and behavioral tests for stress response and social interactions will be conducted. Additionally, neurotransmitter levels in individual mice as well as the structure of neurons will be examined. Ultimately, differences in such phenotypic traits between knock in mice containing the ancestral gene and mice containing the humanized gene will offer new insight into the affect of this mutation on MAO-A protein function and unique behavioral traits of either humans or the genus *Homo* as an explanation for the positive selection acting on the MAOA gene.

Aims:  
 To determine by genomic alignment whether the fixed non-synonymous mutation in the human MAOA gene is also present in Neanderthal and Denisovan orthologs as well as whether additional variation exists between human, Neanderthal, and Denisovan MAOA sequences. Secondly, to create knock-in mice containing the human MAOA sequence, the chimpanzee MAOA sequence, as well as Neanderthal and/or Denisovan sequence, if determined to differ from both human and chimpanzee sequences. Phenotypic data will be gathered to understand unique traits with respect to behavior and cognition between the species.

Background:  
 The monoamine oxidase A gene, located on the X-chromosome, codes for the protein product, MAO-A, which is located in the outer mitochondrial membrane. Many tissues including the heart, kidney, liver, blood vessels and duodenum express MAO-A. The protein product functions as an enzyme in neurotransmitter degradation and catecholamine metabolism by catalyzing the deamination of norepinephrine, epinephrine, dopamine and

**Commented [A1]:** Do you mean entire genomes for Neanderthals and Denisovans? I think it would be helpful to establish where the genetic information at a higher level is coming from since you'll be comparing the human homo sapien MAOA gene to the Neanderthals and Denisovans.

**Commented [A2]:** I think you do a great job here laying out what this study will deliver/discover. I wonder if you would want to re-word "evidence for the comparison" because you can always compare the mutations. Do you mean comparable behavior and cognition?

**Commented [A3]:** What will neurotransmitter levels and the structure of neurons reveal?

**Commented [A4]:** Are you talking about variations amongst humans, Neanderthals, and Denisovan MAOA sequences or variations that are within each sequence?

**Commented [A5]:** Also the Neanderthal and/or Denisovan MAOA sequence, right?

**Commented [A6]:** I might just clarify the last part to say "if the Neanderthal and/or Denisovan sequence differ..."

**Commented [A7]:** I would try to link these two thoughts together since the phenotypic data will be coming from what you observe in those knock-in mice. I don't think it's clear though if you were just reading the aims section by itself without the background that the knock-in mice and phenotypic data are related. It might be something as simple as "phenotypic data from tests with the knock-in mice..."



serotonin (Shumay and Fowler 2010). Both MAOA and its most closely related gene, MAOB, are both known to affect behavioral traits (Gilad et al. 2002). Therefore, numerous studies have explored the potential association between variation in the MAOA gene and altered behaviors such as sleep disorders, addictive or antisocial behaviors, and cognitive development. A recent study by Reti et al. in 2011 suggests that the differences between low and high level expression of MAOA in individuals correlates to the incidence of aggression and antisocial personality disorder. Control of violent behavior and aggression is also associated with impulsivity. Preliminary research has suggested that individuals with certain MAOA haplotypes may demonstrate increased impulsive behaviors (Pavlov et al. 2011) and a decreased likelihood of evaluating future consequences for their actions (Daw and Guo 2011). A study in which transgenic mice with a deletion in the MAOA gene to produce MAO-A deficiency demonstrated that mice with the deletion showed an expected increase in neurotransmitter concentration. Moreover, juvenile mice demonstrated increased fearfulness and stress, while adult males had enhanced aggressive behavior (Cases et al. 1995). In addition to the reduced ability to control aggressive behavior, a study by Brunner et al. (1993) identified an X-linked rare nonsense mutation in the MAOA gene of several male subjects, which also results in mild mental retardation. This study resulted in the association of the MAOA gene...

The authors conclude that this mutation was selected to fixation by a recent instance of positive selection. All non-ape species for which a full gene sequence could be obtained also indicate neutral selection, and this conservation suggests the importance of this portion of the gene for protein function.

Now that sequences for ancient genomes of the Neanderthal and Denisovan species are available for genetic analysis, it will be useful to supplement data regarding sequence changes between chimpanzees and humans with comparison between humans and extinct hominin ancestors... Alignment of the human MAOA sequence with the Neanderthal and Denisovan sequences will determine whether the non-synonymous Glu151Lys substitution fixed in humans first appeared before the time of the most recent common ancestor. It may also reveal the presence or absence of additional non-conserved regions between the species. Thus far, studies have not been conducted to determine the consequence of the fixed human MAOA mutation. Andrés et al. speculate that this change in the sequence of the MAOA gene may correspond to functional changes to the protein product, resulting in...

The behavior of these knock-in mice will be observed, and it is expected that if differences with regard to behavior exist, they will manifest themselves in stress response, aggression, impulsivity versus more complex reasoning with respect to delayed reward, learning tasks and memory, as well as social interactions. Structure and function of the nervous system will also be assessed to examine potential areas of change between the species. Phenotypic data acquired from this experiment will provide novel information regarding the behavior and cognition of early hominins as well as the extent to which *Homo sapiens* have evolved with regard to behavioral and cognitive traits since the time of our most recent common ancestor with Neanderthals and Denisovans in addition to chimpanzees. Evolution of the MAOA gene provides promise for the discovery of additional explanations of uniquely human characteristics contained within cognitive abilities and human behavior.

#### Research Plan:

The initial step for this study is to obtain reliable DNA sequences of the MAOA gene for the Neanderthal and Denisovan genomes from existing databases. The Neanderthal consensus sequence produced using four genomes and the one complete genome for Denisovans will be used. Additionally, the four Neanderthal genomes will be analyzed to

Commented [A8]: I would remove the therefore; I think it flows better from the previous sentence without it.

Commented [A9]: I might try to make a transition from the previous sentence to the sentence following this one. At first reading it makes it seem a little random.

Commented [A10]: What does the expected increase in neurotransmitter concentration do?

Commented [A11]: I think this paragraph is great and very clearly laid out. I think you could make it stronger by having one sentence at the end to tie back to what positive selection in *Homo sapiens* for the MAOA gene means in light of other MAOA orthologs experiencing neutral selection.

Commented [A12]: This is a great sentence highlighting that there's a gap in research and you aim to address that.

Commented [A13]: These last two sentences are great! I think you do a great job neatly explaining what the impact of new information will mean.



## ENV 201: Integrating Environmental Science and Policy

### MEMORANDUM

TO: USAID Senior Malaria Advisor

FROM: XXX

DATE: October 10, 2012

SUBJECT: Evaluation and Recommendation on PMI Vector Management

### EXECUTIVE SUMMARY

Malaria deaths have begun to decrease since the implementation of the President's Malaria Initiative but reevaluation of processes is crucial to continued success. Vector management focuses on stopping the transmission of the disease and is critical in malaria control. Current vector management strategies include insecticide-treated mosquito nets, indoor residual spraying of insecticides, and artemisinin-based combination therapy. All of these measures can stop some amount of transmission, but the key is combining them effectively. Continued use of the current vector control strategies should be continued in areas where they are found to be effective. More research and development is needed as insect and parasite resistance to current methods increases. Resistance must be monitored closely in malarial areas to ensure that only effective treatments are used. Slowing the development of resistance will ensure a longer effectiveness of current treatment and prevention methods...

### OPTIONS

Reevaluation of the PMI vector management strategy is based on the effectiveness, cost, and environmental impacts seen currently. There is room for improvement in each of these fields but the main goal of the PMI, reducing the burden of malaria in sub-Saharan Africa, will be maintained. The current strategy of vector management has been evaluated and proposed options for the future are outlined below.

The first option is for the PMI to maintain their current vector management strategy. The number of malaria cases and deaths fell during the first seven years of the PMI which presents evidence for the success of the current program. Combining prevention and treatment restricts the ability of the malaria, ...

The second option is to make some minor changes to the vector management strategy, primarily where to focus the most effort and money. If the Stockholm Convention on Persistent Organic Pollutants sets a timeline for the phase out of DDT, changes will obviously have to be made. The relative benefits of other insecticides must be weighed...

The third proposed option is to entirely change the focus of the PMI's vector management strategy away from IRS and toward ITNs. ITNs may not be as effective however, since many homes may only have one and be unable to protect all family members. ITNs have other associated problems and will not work properly if ripped or not tucked under the bed ...

### RECOMMENDATIONS

I recommend that the PMI does not change its current vector management strategy at this time. The combined approach of prevention and treatment is reducing the number of malaria deaths and starting to push toward control and future elimination of the disease. IRS methods should not be abandoned because of concerns over the environmental impacts of insecticides. DDT is the only insecticide that is only used for health purposes and not agriculture (WHO 2006)...

Author

**Comment [1]:** Which processes are you referring to here?

Author

**Comment [2]:** These are three great points for the executive summary. I wonder if there is a way to highlight them more or distinguish them from the background information.

Author

**Comment [3]:** I'm not sure what formatting guidelines you were given but I think it would be useful to add additional subheadings to this section, to further differentiate and identify each option. For example, a sub-heading for Option 1 could read:

Option 1: Maintain the current vector management strategy.

If you use sub-headings like this to organize the memo, it makes it easier for readers to locate the information they want more quickly and efficiently.

Author

**Comment [4]:** I would recommend moving this sentence to the beginning of the paragraph. In a policy memo, the point of each paragraph should always be clear from the start and I think this would actually make a great first sentence.

Author

**Comment [5]:** The topic sentence in a memo like this should explicitly spell out the option that you are presenting. Instead of using vague language such as "make some minor changes", I would specify exactly where you are recommending that time and money be refocused. Then, you can follow up with the supporting information.

Author

**Comment [6]:** I found myself wondering why an initiative would change its focus to ITNs if they have all of the disadvantages that you discuss here. If there are any advantages to ITNs, I would explain them more explicitly to give a more balanced explanation of the option.

Author

**Comment [7]:** Did the assignment specify whether writing in first-person would be ok?

**COMP SCI 290: Mobile Apps: From Concept to Client****Tech Transfer Documentation**

To: [Students]

I think there is some good content in this document, but it needs some work. I'm happy to discuss my comments or to review another draft this week. Here are my thoughts:

The document starts "Server-side Query Script API". One line in and I'm lost. What is this document?

Who would use it? How is it organized?

I think the level of detail in the API documentation is good. I would combine the script descriptions/queries with the script responses so you just have one section for each script. Also, I would use the full XML response (provide a real life example) and change the font or somehow indicate it is different from regular text.

The general organization and flow is confusing. I would expect this type of document to start with the least technical information (how to use the app) and progress to the most technical (how to program against the API). Almost every client would want to know how to use the app, only a few clients would need to know how to install it or extend the APIs. Also, headers and a table of contents make it much easier to navigate and understand transitions in a document like this.

The executive summary is clear and well written; I would keep it towards the top of this document.

The reader guide talks about "user documentation that provides help and answers questions that may arise during the daily use of the software." I don't see that in your document though a bit can be inferred from the design section. It seems like this could be three or four tasks: logging in, selecting a shipment (barcode or typing), searching for shipments, updating damaged / missing details. I think this would be most effective with some short descriptions and then annotated screen shots.

I do see some information on how to setup the back end for the app. Here are the additional questions I have:

1. Any particular version of perl?
2. Any particular web server? Any web server configuration that is needed?
3. What directory do the files go in?



4. What is the structure of the mysql tables? Perhaps supply another file with a mysqldump of just the schema?
5. How do I tell the perl scripts how to communicate with the database?
6. How do I install the app on the phone?

Once the app is installed, here are some questions on how to maintain it:

1. How do I create a new user?
2. How do I reset a user's password?
3. How do I create a new lab?
4. How do I create a new shipment?
5. How do I link a user, lab and shipment together?

The mobile design document has a lot of good information for a developer. What happens if the user enters an invalid password? The diagram shows a Details1 and Search activity, though neither of those are discussed in detail, this is confusing. It also seems that Dave needs to add some information about the update Shipment function.

I think the possible extensions section is great, but I don't think the first two sentences add any value.

I would eliminate the sprint plan from this document since I don't think a customer would need to know the schedule

There are a few typos / awkward statements / grammatical issues. Rather than highlight the ones I've found, I would suggest that you all read aloud the document together. This sounds a little stupid, but it will take 10 minutes and by saying the words out loud it is much easier to catch those types of issues.

[Reader]

## Appendix D - Example Reader Biographies

### GLOBAL HEALTH

Conducts global mental health research focusing on populations affected by war-related trauma and chronic stressors of poverty, discrimination, and lack of access to healthcare and education. Assistant Professor of Psychiatry, Duke School of Medicine.

MHA Degree; director of a Psychiatric Institute for 12 years; grant writing experience for self esteem projects and healthy choice project.

I am a clinical psychologist who has an interest in the impact of global actions and policies on the health and welfare of populations. I have a particular interest in PTSD and the impact of war acts on

civilians (destruction, rape, wounding, displacement, loss of community and family) and how interventions can be systematically applied to reduce the devastated mental health of these victims.

I have worked at UNC Chapel Hill as a chaplain and thereby have hands on experience in counseling. Additionally, I provided HIV/AIDS counseling in Nairobi, Kenya.

I work for Triage Consulting Group, a finance healthcare consulting firm located in San Francisco. We complete reimbursement and revenue cycle review for facilities.

I am currently pursuing the International Clinical Research Fellowship through Harvard Medical School's Department of Global Health and Social Medicine. I am working in Haiti for Partners In Health/Zanmi Lasante, with focus on developing laboratory capacity and enteric disease surveillance. In Baltimore, MD, however, where I am a medical student at Johns Hopkins University School of Medicine, I work closely with the International Rescue Committee-Baltimore on a variety of refugee mental health issues and am currently beginning work on a case study in global mental health (PTSD in the DRC) to be published by Harvard Business Press.

I just graduated with my masters in public health from the Harvard School of Public Health (HSPH) and currently work for HSPH as a research assistant looking at health outcomes in Boston Public Housing.

I am a clinical psychologist by training who works in an academic setting. I have written successful grant proposals to the CDC and NIMH. My current research focuses on post traumatic stress disorder, trauma, bullying, and dating violence. My academic teaching is in the area of child advocacy and policy, with attention to abuse and neglect and its impact on children, families and communities.

Studied community health care in Nairobi, Kenya with the Duke Global Health Institute. Currently: Strategic Affiliations Manager at Keck Medical Center of USC; Previously: Program Development Intern at Relief International, Graduate Teaching and Research Assistant Positions at Duke Global Health Institute, Intern at World Health Organization

## **ENGINEERING**

I was a mechanical engineer and economics major at Duke and went on to work for Merrill Lynch in their Energy & Power group in investment banking for two years. I now work for a private equity firm that works with lots of entrepreneurs. I remember taking a similar class at Duke and would love to help current students.

I am also likely going to get back into the energy & power space so would love to help any groups with a focus in those areas.

I have been in engineering for 25 years. I have been in private consulting and have been here at Duke for the last 7-1/2 years. I am an architectural engineer by education but do most of my work with mechanical engineering.

I'm the Director of Ventures at Johns Hopkins and I work with faculty and student inventors focused on entrepreneurial projects. I have my BSE in BME and EE from Duke and a Masters in BME from UCSD.

I retired from a full-time career as an electronics designer in industrial controls, optical character recognition, aerospace computer design and medical device design, and hold 10 US patents. I have also served as consulting design engineer in my own sole proprietorship for 33 years.

I am a mechanical engineer. My background is in both design and investigation of building mechanical systems. After 13 years with an international architecture and engineering firm, I now work as a consultant providing forensic engineering services and expert witness testimony. As part of my work, I prepare a lot of presentations and reports geared to both technical and non-technical audiences.

I am a Duke engineering graduate, and, although I went in to marketing and general management quite quickly, I have always retained a love for engineering, particularly, innovation.

Background as an engineer. Currently facilitate with R&D pharmaceutical development teams to evaluate the business proposition of their program (ROI analysis) and prepare them for presentations to senior governance for money to execute their program.

Over 30 years in technical work as a systems engineer, developing new systems; additional experience as a Lean Six Sigma expert developing new and improved processes. With the Navy Reserves, I also supported a section in the Pentagon looking at technology trends and issues, looking 10-30 years into the future.

Assistant Director, Duke University Medical Center Engineering and Operations. I have done peer review for Department of Energy and also have mentored several students at the Nicholas School.

## **ENVIRONMENTAL SCIENCE AND POLICY**

I work in the environmental field, focusing on urban sustainability, and especially on energy, air quality and GHG emissions that cause climate change.

10+ years working as an environmental planner. Past 8 years, work as a Senior Planner for a land conservation agency in the San Francisco Bay Area. I work regularly in both the science and policy realms to advance sustainable land use planning, public land acquisition, and ecosystem restoration.

I am the Director of Wildlife Conservation for Audubon Florida, the state's oldest wildlife and wildlands conservation nonprofit. In this capacity, I supervise a staff of 9 in our coastal bird monitoring and management work, direct policy analysis and grassroots communications around public policy issues including wildlife, public lands acquisition and management, growth management, water and energy. I lobby our state legislature as well as local, state and federal agencies around these issues.

As an equity research analyst who follows renewable and clean energy companies, I have a very strong knowledge base in environmental policy, both in the U.S. and internationally.

I have over 15 years experiences in natural resource management and policy in CA. I've worked in environmental consulting, for the Nature Conservancy (in North Carolina), the state of California Resources Secretary and the US Fish and Wildlife Service. My experience most relevant to this class is with the State of California in the California Bay-Delta a highly political and controversial place dealing with complex issues of water allocation and conservation of a deteriorating ecosystem including state and federally endangered listed species.

My current post is as a coastal planner whereby I use the framework of ecosystem services as science support to integrating coastal and marine management policies, legislations, etc into national and regional coastal zone management plans and guidelines. I work and communicate with policy makers and scientists in Belize, the wider Caribbean region and the United States and on a regular basis to support my daily routine and larger strategic planning objectives. Reducing user-conflict and

competing interests for marine and coastal resources in Belize is a key component of my planning and management portfolio.

I currently work as an Air Quality Planner for the Houston-Galveston Area Council (the Council of Gov (COG) and Metro Planning Org (MPO)) for the Houston region. I work on projects related to alternative fuel transportation and air quality. We evaluate the potential environmental impacts of our air quality activities on a daily basis.

I'm a alumni, and 5th year adjunct professor (Energy Law and Regulation) in the LLM program at George Washington Law School - as well as a 26 year veteran of the legislative process as a counsel to the House Energy and Commerce Committee. I have expertise in energy and environmental issues - electricity, climate change, nuclear policy, and natural gas policy I serve on the Board of the Keystone Energy Board and have taught and participated in events at the Aspen Institute.

Nonprofit (NGO) work for environmental organizations, academic postgraduate research on atmospheric science and other environmental areas, currently employed as a consultant with a small air quality management and engineering firm in Atlanta where we do a wide variety of environmental work, focusing on permitting issues and regulatory analysis, though I do a great deal of other work here.

I am a policy analyst focused on state and federal climate and energy policy. I have worked on various aspects of energy and environmental policy including climate policy options under the Clean Air Act and new legislation, the intersection of electric utility regulation and environmental regulation, state-level regulation of shale gas extraction, public opinion of climate policy options, renewable energy and energy efficiency policy, and public opinion of climate policy options in the U.S.

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## Notes

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the Duke Alumni Association and the Jean T. and Heyward G. Pelham Foundation. This research was supported by the Division of Undergraduate Education of the National Science Foundation (DUE-1043674).

[2] Although the approach proposed here—having experts who are alumni and employees of the institution provide feedback for undergraduate writing projects—is novel, a related concept, the "Lay Reader Program," was developed for secondary school students in the late 1950's and early 1960's. In that program, members of the local community, usually "housewives" with degrees in English or related fields, were partnered with middle school or high school teachers and were paid to identify errors, make comments, and—occasionally—to grade student papers. The issue was the subject of considerable attention and some debate in English pedagogy scholarship in the early 1960's (Burke, 1960; Burke 1961; Ford, 1961; Rutgers Plan, 1961; Sauer, 1962). Lay Reader Programs existed in some fashion as recently as the late 1990's (Richard Bullock, personal correspondence).

[3] If the purpose of feedback is to help students develop mature writerly skills and sensibilities, peer feedback using computerized scoring systems (Topping, 1998; McLeod, 2009) such as CPR (Calibrated Peer Review, 2001) may be even less effective. The nature of the reviewing tasks means that students may have little internal motivation to take the reviewing process seriously and often find ways to game the system. A study of CPR practices found that feedback tended to be highly reductive and that the system indirectly encouraged practices not in line with current best practices of teaching writing (Reynolds & Moskovitz, 2008).

[4] For a discussion of feedback on student laboratory reports, see Moskovitz & Kellogg, 2005.

[5] This is precisely what happened with the first engineering course in the Duke Reader Project a couple of years before the current research began.

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