



Going Out on a Limb: Using Poetry to Reinforce Civil Engineering Concepts

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This paper presents the results of a personal introspection on the subject of intentionally taking oneself out of a comfort-zone in the classroom with the goal of continuous teaching improvement. Specifically, this paper discusses one civil engineering educator's implementation of reading engineering poetry in the classroom throughout a course to both reinforce learned concepts for his students and at the same time to go "out on a limb" beyond his comfort zone in an effort to capture and channel feelings of excitement and apprehension.

The hypothesis associated with this study is that by intentionally taking one's self out of a comfort zone in front of students, the instructor will ultimately be more comfortable in the classroom. Secondly, it is also suggested that the students associated with the course appreciated and respected the instructor's attempt at using a non-traditional method of engineering instruction. Finally, an attempt will be made to determine if the use of poetry actually assisted students with reinforcement of learned civil engineering concepts.

It is anticipated that this paper will be of interest to any civil engineering educator with the willingness to go out on a limb.

Background

This manuscript presents the result of a personal introspection on the subject of intentionally taking myself out a comfort-zone in the class. In doing so, I was taking a risk or going out on a limb in an attempt to improve my teaching. It is my contention that by pushing myself beyond my comfort zone, I ultimately become more comfortable in the classroom.

The impetus behind this process was the direct result of participation in the American Society of Civil Engineer's (ASCE) Excellence in Civil Engineering Education (ExCEED) teaching workshop. The ExCEED Teaching Workshop is a six-day practicum that provides engineering educators with an opportunity to improve their teaching abilities. The workshop focuses on basic skills and includes seminars addressing principles of effective teaching and learning, learning styles, communication skills, learning objectives, class organization, course organization, development of interpersonal rapport with students, teaching with technology, and classroom assessment techniques. To-date over 600 individuals from more than 200 different academic institutions have attended the ExCEED program.^[1-3] Over each of the past five years, I have served as an Assistant Mentor, Mentor, and/or Instructor during the workshop.

During the ExCEED teaching workshop, a series of demonstration classes are provided by the instructors for the participants. Instructors are hand-selected to deliver an example class in a manner that embodies the principles associated with the workshop. For many years, one of those demonstration classes has been delivered by Dr. Al Estes, Professor and Head of the Architectural Engineering Department at California Polytechnic State University, San Luis Obispo (Cal Poly). At the conclusion of what is perennially an exemplary demonstration class, Al will sing a song to his audience/students. Al would not describe himself, nor would he likely be described by observes, as a "great" singer.

Engaging Al in subsequent conversations, I pushed him to explain why he sings to his ExCEED demonstration class. I discovered that the intent was not to become a better singer. Rather, the response was simply that he found the prospect of singing in front a group of students to be one of the most terrifying things he could conceive of doing (Estes). However, by forcing himself to do something uncomfortable, it provided him with confidence in other aspects of teaching (Estes). In fact, during the ExCEED program, all participants are strongly encouraged to step outside of their normal comfort zone and to implement something new during the series of three practices classes they deliver. Most commonly this includes the use of a new questioning style or the incorporation of a physical demonstration, rather than singing a song. Reportedly, Al Estes also sings to his students at Cal Poly at least once a semester.

Al Estes was formerly the Division Director (equivalent to a Department Head) for the civil engineering program at the United States Military Academy (Academy). The Academy utilizes a large number of officers that serve a rotation of (typically) 3-years as part of the faculty. As a number of faculty members rotate out, each year a new group of instructors arrive and are trained in the theory and practice of effective teaching. Within the Department of Civil & Mechanical Engineering this training program consists of a 6-week long required workshop. A significant part of that training program is encouragement for instructors to lose their inhibitions and develop interpersonal rapport with students. While Al was serving as the Division Director during the early 2000s, he implemented a culminating event as part of the new instructor summer workshop that put to a test each instructor's willingness to step out on a limb. The event consisted of a surprise, mandatory karaoke performance in front of other members of the faculty. The tradition of this culminating event has continued to today. In the past few years the tradition has morphed such that all members of the summer workshop must now participate in a Rock Band® performance (singing and playing an instrument).

I personally participated in the new instructor summer workshop at the Academy and was terrified by the prospect of singing karaoke in front of my peers. However, upon completion, the sense of confidence was notable. If I could sing (very poorly) in front of the people I work with on a daily basis, I was certainly capable of trying new techniques and methods in my classroom instruction. Indeed, I have taken more risks and tried more new things during the past 3-1/2-years of teaching at the Academy than I would have ever thought possible.

One of those teaching risks that I opted to try was the use of poetry in my engineering classroom. Specifically, during the spring academic term, I am responsible for teaching the Introduction to Soil Mechanics and Foundation Design course coded as CE371. At multiple points throughout the semester I conclude a lesson by reading geo-poetry to my students. Always the poetry relates specifically to concepts covered during that lesson or prior series of lessons. Students are not assessed on their ability to interpret poetry as part of the course grade and they are not asked to compose or read poetry. During the first reading of the semester, I openly admit to my students that the thought of reading poetry to them scares me and that I am voluntarily choosing to do so in an effort to 1.) reinforce the geotechnical engineering concepts they are learning, and 2.) to force myself out on a limb.

The geo-poetry I read to my students is written by Mary Nodine, a geotechnical engineer employed by GEI Consultants, Inc. of Woburn, Massachusetts. For many years, Mary has published her geo-poetry in *Geo-Strata Magazine*®, a publication of ASCE's Geo-Institute. The focus of her poems cover many of the significant aspects of geotechnical engineering that are discussed in CE371. I corresponded with Mary to inquire if she was comfortable with the idea of her poetry being used in a classroom setting. She not only enthusiastically agreed to the idea, but also provided several unpublished poems for my use. An example of Mary's geo-poetry, as read in the CE371 course, is included in Appendix A of this manuscript. During the term, approximately 10 different poems are read to the class at times when they closely relate to the lesson content.

While I was certain that going out on a limb by reading poetry to my students was having a positive impact on my own confidence in the classroom, I began to wonder what impact it was having on my students. Was the effort really a good reinforcement of their learning or was this a frivolous activity? Did my students actually appreciate the poetry? Did my student respect me for my willingness to take a risk?

Thus, the first hypothesis associated with this study is that by intentionally taking one's self out of a comfort zone in front of students, an instructor will ultimately be more comfortable in the classroom. Secondly, it is also suggested that the students associated with the course appreciate and respect the instructor's attempt at using a non-traditional method of engineering instruction. Finally, an attempt will be made to determine if the use of poetry actually assisted with student reinforcement of learned civil engineering concepts. The initial hypothesis will be addressed through self-reflection. The second and third hypothesis will be explored through analysis of student-reported survey data.

It should be noted that this study implements non-traditional, but formally accepted research methods, including the use of reflective analysis. The intent of a reflective analysis is not to definitively prove or disprove a formal hypothesis, but rather to offer discourse that could generate more structured investigation. In addition, the survey data collected does not include the use of a control group. Thus, the reported survey results are only intended to represent the characteristics of a single population. Accordingly, a series of summary findings will be provided, but a statement of research conclusions would not be appropriate.

Literature Review

Many educators, with a range of years of experience, have equated their classroom teaching activities to acting.^[4-9] For example, Wankat & Oreovicz^[9] discuss preparation for a performance in the classroom. They make vivid comparisons between stage directions and lecture notes, between a dress rehearsal and classroom preparation, between voice projection in a theatre and voice projection in a classroom, and the list goes on. Lowman^[5] also draws similar parallels. In fact Lowman makes the statement that, "college classrooms are fundamentally dramatic arenas in which the teacher is the focal point, like the actor or orator on stage." In his journal article titled "The Teacher as Actor," Harris^[10] explores speech, pantomime, and characterization and shows how these traditional acting concepts are applicable to college teaching.

Continuing that metaphor further, the renowned actress prepares for a scene by studying her lines, considering her audience’s perspective, and channeling the director’s vision, while the engineering instructor prepares for a lesson by studying her class notes, considering her student’s prior understanding of course content, and channeling the department’s and/or ABET, Inc.’s expectations on what must be taught. Actors often describe a mixture of excitement and apprehension as they take to the stage. Similarly, teachers compelled by an internal desire to provide the best possible learning experience for their students, will also acknowledge a similar mixture of excitement and apprehension as they enter a classroom. It is when actors and teachers alike have the ability to channel that excitement and overcome their apprehension, that they have the potential to deliver a “great performance.”

What then could be said for the engineering instructor that has become “comfortable” in the classroom after a number of years delivering a particular subject? Presumably, that instructor still cares about his or her students and is motivated to deliver a great lesson, but with increasing experience comes a potential loss of excitement and apprehension that actors and instructors can so effectively channel.

In his book, “The Courage to Teach,” Palmer^[11] states,

“Many of us become teachers for reasons of the heart, animated by a passion for some subject and for helping people learn. But many of us lose heart as the years of teaching go by. How can we take heart in teaching once more so that we can, as good teachers always do, give heart to our students?”

In his seminal work titled “Mastering the Techniques of Teaching,” Lowman^[5] introduces a two-dimensional model for effective college teaching. His model can be presented in table-format that describes the characteristics of college teachers. The three-by-three table presents nine different conditions ranging from the “inadequate” college teacher to the “complete exemplar.” (See Figure 1). The two dimensions, or axis, on this scale are Intellectual Excitement and

		Interpersonal Rapport		
		Low	Moderate	High
Intellectual Excitement	High	6. Intellectual Authority	8. Exemplary Lecturer	9. Complete Exemplar
	Moderate	3. Adequate	5. Competent	7. Exemplary Facilitator
	Low	1. Inadequate	2. Marginal	4. Socratic

Figure 1. Two-Dimensional Model of Effective Teaching (adapted from Lowman, 1995)

Interpersonal Rapport. Lowman suggests that gains on the Interpersonal Rapport dimension can be made by stimulating positive emotion in our students. He specifically states “the ability to stimulate strong positive emotions in students separates the competent from the outstanding teacher.” Such positive emotions greatly influence a student’s motivation to learn and succeed.

The natural response is to then ask, what can an engineering instructor do to generate positive emotions in his or her students, while maintain an appropriate level of decorum in the classroom? Going out on a limb in an engineering classroom environment can consist of introduction of a variety of different elements. For some it may be the use of poetry in non-traditional settings or the incorporation of music (instrumental or singing) to underscore an important concept. For others it might consist of the use of drama and/or demonstrations. Each of these elements would require most engineering instructors to stretch beyond their comfort zone and many cases “act” in a manner they are not familiar with.

Writings by Estes^[12], Hanus & Estes^[13], Tauber & Mester^[8], Waters^[14], Conniff et al.^[15], Welch & Klosky^[16], Klosky & Vander Schaff^[17, 18] all discuss the value of drama in the engineering classroom. However, Hanus and Estes note that well-executed drama requires “extensive preparation and additional preparation by the instructor.” Conniff et al, go further to state that “without proper preparation, dramatic presentations can waste class time.”

The use of demonstrations (ideally, delivered with drama) to reinforce engineering concepts has also been widely reviewed. For examples specific to civil engineering see the work of Cooke^[19] for discussion of geotechnical engineering demos, the works of Conniff et al.^[15], Welch & Klosky^[16], Klosky & Vander Schaff^[17, 18] for engineering mechanics demos, and the work of Kresta^[20] for discussion of fluid mechanics demos.

No specific literature pertaining to the instructor’s use of poetry in an engineering classroom could be located. However, literature by Gunn^[21] and Millan^[22] discuss the incorporation of student written poetry in engineering courses. Millan even notes that “students relinquish stereotypes about engineers when they see their engineering professors endorse poetry.”

Kaplan, McGuire, and Kaplan^[23] do not discuss the specific incorporation of music in the engineering classroom, but they do provide a detailed correlation between music and engineering concepts. Gunn^[24] advocates for the general incorporation of art projects in engineering courses to help students develop a better appreciation for the aesthetic aspects of their engineering creations.

Methods

The method used to consider the first research question presented in this paper consisted of routine self-assessment and reflective writing. Most formally, at the end of each academic term, I take the time to write an essay about the past semester; what was a success and what do I need to continue to work on. Those essays then become part of my teaching portfolio. Each essay was subsequently reviewed for evidence in support of this study.

The second and third point of inquiry in this study were addressed through administration of a survey. The online survey creation and administration website SurveyMonkey® was used in support of this process. The custom survey utilized for this study consisted of 9 items. Each item provided both a multiple choice response and an open field for response elaboration. An email was sent during the semester subsequent to completion of the course to invite students to participate in the survey. A single, follow-up reminder email was sent approximately one-week

later. The email messages provided a brief description of the study and advised the students that all data would be collected anonymously (survey responses did not collect identify information). No incentive was provided for students to complete the survey. The nature of the survey questions did not require extensive analysis or manipulation of the data. A copy of the survey is included in Appendix B of this manuscript.

Results

Throughout the three different academic terms in-which I have read geo-poetry to my CE371 classes, I found myself increasingly more comfortable with my routine, day-to-day responsibilities in the classroom. My interpersonal rapport with my students, while initially good, became great during each term. I have had students who now, a year or two after completing the course, still like to engage me in conversation about geo-poetry. The teaching portfolio essays, referenced previously, indicate that I was having fun and while I felt uncomfortable reading the poetry, I was notably very confident in the other aspects of my teaching. Perhaps the most significant measure of my post-poetry confidence is the frequency with which I share this experience with my peers and indeed my interest in writing this conference paper.

A total of 35 students were enrolled in my two sections of the Spring 2012 administration of CE371. Of those 35 students, 3 graduated from the Academy and 1 was no longer enrolled. Only students that remained in the program received the invitation to participate in the study by completing the survey. A total of 29 of 31 students responded to the survey. This 94% response rate is considered significant.

The collected data indicates that 28 of 29 respondents recall the use of geo-poetry in CE371. Notably, the only respondent to respond with a “No” to the question on recalling the use of geo-poetry, subsequently responded with great detail to another question, suggesting that he/she did in fact recall that poetry was used in the class.

When asked if the students had ever attended another engineering class wherein the instructor read poetry, a surprising 24% of the respondents said “Yes.” However, the open-field text responses revealed that within the prior two days of issuing the survey another instructor in my department had started his course by reading a verse from a Walt Whitman poem. This singular event was the only other reported instance of the use of poetry in an engineering course per the collected data.

Only 59% of the respondents felt that hearing poetry related to the topic assisted with their ability to understand the material. Some of the open-field text responses from students that provide a “Yes” were:

- “...it helped with memorization”
- “It wasn’t like anything I had done before so I was able to associate the material with something abstract, which helped me remember it”
- “Rhyming stuff together helps me remembering it”
- “It forced you to know what things meant in order to understand the poetry”

- “In order to understand the poetry you just heard, you had to analyze the material you had learned in the class”
- “It painted a more artistic image of the concepts”
- “Some of the poems involved puns and plays on words, which requires a deep level of understanding”

Students that provided a “No” response to the idea that poetry helped them understand the material, provided these responses:

- “Not really but it was kind of cool to hear words related to soils in the statements of poetry”
- “But it may have helped me in the retention of it”
- “It was hilarious to hear the puns that were implemented into the poetry, but my overall understanding of the material did not actually [increase]”
- “It was a good way to allow the class to relax a bit but I did not learn or better understand the material from the poetry”
- “I solely think it was an entertaining way of ending class”

These comments suggest that while poetry may not have assisted all students with reinforcement of learned concepts, it still may have had merit; if nothing else than a way to end the class on a positive and humorous note.

Similarly, 62% of the respondents believe that the poetry stimulated their interest in the course. Some of those respondents offered the following open-field text:

- “Yes, it did because it gave us some relief from the rigorous course schedule and provided some comic insight into the field of geotechnical engineering”
- “I thought it was funny and therefore fun to look forward to the poetry”

Perhaps the most unexpected, but telling open-field text response was:

- “My thought process was if people are nerdy and passionate enough about this field to write poetry, then maybe this is something worth looking into”

Among those that provided a “No” response, most suggested that they were already interested in the course and the use of poetry did not further stimulate that interest.

Students were asked to evaluate if I appeared less comfortable, equally as comfortable or more comfortable reading geo-poetry as I did teaching the other portions of the class. The data revealed that 31% of the respondents felt I looked less comfortable, 62% felt I looked equally comfortable, and 7% felt I looked more comfortable. It is surprising to see the number that felt I looked equally or more comfortable reading the poetry. I can confirm, without hesitation, that I was not. A handful of respondents offered these open-field text comments:

- “You could tell Dr. Barry was trying something new, and he knew that it was amusing for everyone in the class”
- “I thought he did a very good job reading poetry and making light of himself in front of the class, he was obviously less comfortable, however, I think he really enjoyed it too”

An overwhelming 93% of the respondents indicated that they enjoyed the attempt to read poetry in the engineering classroom. Some of the related open-field text responses were:

- “Highlight of the day”
- “Anytime you break up the class, it’s cool”

- “It was something different and entertaining”
- “It was fun and it brought us together a little as a class, a shared experience if you will”

When asked if the use of poetry increased their respect for me as an instructor, 86% replied with a “Yes.” Again, some of the open-field text response were:

- “Yes, it takes courage to get up in front of a bunch of Type A/military college age students and read poetry”
- “He was willing to stick his neck out and look silly, so I was more willing to be creative in his class when answering questions...”
- “I respected that he was willing to step out of his comfort zone in order to be a better teacher”
- “I would like to see an engineering teacher from another school read poetry...”
- Reading poetry = an attempt to level oneself down from a confident teacher figure to that of a not so confident/struggling student to build a common bond”

Finally, when asked if the use of geo-poetry should be sustained in the CE371 course, 86% of the respondents replied with a “Yes.”

Summary Findings

It is difficult to quantify an instructor’s comfort level in a classroom. The reflective essays reviewed for this study appear to document a teacher who was not comfortable at the time of reading poetry to his students, but was ultimately more confident in his teaching. There is no question that while my confidence in the classroom was not lacking initially, I am now more open to the idea of trying non-traditional teaching techniques.

The survey results clearly indicate that my students appreciated and respected my attempt to step outside of my traditional comfort zone. A small percentage of students failed to see the relevance of poetry to their engineering studies. Similar results were reported in Millan’s^[22] study of engineering students writing poetry. The students in my CE371 classes found my willingness to read them poetry rather humorous. Self-deprecating humor always seems to be well received. However, I also found that they looked forward to the sporadic events throughout the academic term; often arriving to class eager to know if there would be any geo-poetry that day.

The use of poetry also appeared to be an effective mechanism whereby the class has the opportunity to review and discuss recently learned concepts. The majority of students self-reported that their understanding of the course concepts (59%) and interest in the course (62%) was increased as a result of incorporating geo-poetry. However, these are only self-reported results and no quantitative measure of increased understanding or long-term retention was performed as part of this study.

Palmer^[11] notes that “teaching is a daily exercise in vulnerability.” As teachers, we open ourselves up every time we walk into a classroom. However, it is up to us to determine how far out on a limb we are willing to venture during any given lesson. When appropriate consideration

is given to the positive emotions we can generate in our students, the risks we take can pay dividends.

Other educators with an interest in attempting to stimulate positive emotions in their students and possessing a willingness to step out on a limb might consider incorporating a new demonstration, singing a song, or even reading poetry to your students. As noted previously, there is a large amount of published information about great demonstrations of engineering concepts covering a wide range of topics. While I am not in a position to suggest a song for you to sing, it is worth noting that engineering poetry does exist beyond the realm of geotechnical engineering. For example, Oliver Wendell Holmes^[25] provides a humorous look at engineering design in his poem “The Deacon’s Masterpiece,” also known as “The Wonderful One-Hoss Shay.” In the poem “Passage to India” Walt Whitman^[26] encourages the reader to celebrate “the strong light works of engineers...” Most recently, licensed engineer Clayton Grow published a book titled “Poetry for Engineers or Engineering for Poetry” which contains an extensive number of original poems covering a large spectrum of engineering^[27].

Whatever method you choose to step out on a limb, I encourage you to embrace the discomfort and realize the process will make you a more confident teacher. In addition, it just might increase the interpersonal rapport you have with you students and assist your students with their learning process. However, it is important to keep in mind that the teacher must walk a thin line when attempting to lose one’s inhibitions in the classroom so as to avoid losing the respect of his/her students.

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Appendix A

Tare #23: The Value of a Moisture Content by Mary C. Nodine, P.E.
(reproduced with permission)

One evening in the cabinet
Sieve #10 woke with a start
To quiet sobs – “Come here,” he said.
Let’s have a heart-to-heart.”

Tare 23 rolled over –
A small ceramic dish.
He’d been distraught all afternoon
Since he glimpsed the lab’s price list.

“I thought I was important,” he said,
“Toiling every day
In that inferno of an oven,
Drying endless globs of clay.

But my test cost (sob!) twelve dollars!
Honestly, what’s the point?
Compared to a hydrometer,
I’m peanuts to this joint.

Never mind that old triaxial cell
Whose drained test cost a grand.
A Proctor hammer’s worth trumps mine
And it just pounds on sand!”

The sieve sighed through his wire mesh.
“You have a lot to learn.

A moisture content test, you know,
Is not performed alone.

With grains sizes and limits
It tells load about a site,
If the engineers use judgment
To correlate things right.

And when the jobs get bigger
We rely upon you still,
For consol test with no moisture data
Would just be pointless drills.

Without you there would be no dams!
No piers or slurry walls.
Your impact runs the gamut
From pipelines to shopping malls.”

The tare gave one last snuffle
As he pondered his address.
“I guess I’m more important
Than the listed price suggests.”

The he drew his rum up taller
And exclaimed with renewed zeal,
“I hope those clients realize
That I’m one heck of a deal!”

Appendix B

SurveyMonkey® Administered Survey

CE371 Geotechnical Poetry

Thank you for your willingness to take this survey. It should only require a few minutes to complete. Your responses are greatly valued. Your responses are also anonymous.

You have been asked to complete this survey because you were enrolled in one of Dr. Barry's sections of CE371 (soil mechanics) during the spring term.

There are a total of 8 questions in this survey. When given the option to elaborate on your response, please do so.

Next

CE371 Geotechnical Poetry

1. Do you recall Dr. Barry occasionally reading poetry in class related to geotechnical engineering?

- Yes
 No

Prev

Next

CE371 Geotechnical Poetry

2. Have you ever attended another engineering class wherein the instructor read poetry?

- Yes
 No

If YES, please specify the course.

Prev

Next

CE371 Geotechnical Poetry

3. Do you feel that hearing poetry related to the topic you were studying assisted with your ability to understand the material?

- Yes
 No

Please provide a short explanation for your response.

Prev

Next

CE371 Geotechnical Poetry

4. Did hearing Dr. Barry read poetry about course topics stimulate your interest in the course?

- Yes
 No

Please elaborate on your response.

Prev

Next

CE371 Geotechnical Poetry

5. One reason that Dr. Barry chose to read poetry in the classroom was to intentionally take himself out of his comfort zone.

Relative to Dr. Barry's normal classroom presence, which of the following statements is appropriate:

- Dr. Barry appeared less comfortable reading poetry than he normally does in class.
 Dr. Barry appeared more comfortable reading poetry than he normally does in class.
 Dr. Barry appeared equally comfortable reading poetry as he normally does in class.

Please elaborate on your response.

Prev

Next

CE371 Geotechnical Poetry

6. Did you enjoy Dr. Barry's attempt to read poetry in the classroom?

- Yes
 No

Please elaborate on your response.

Prev

Next

CE371 Geotechnical Poetry



7. Did Dr. Barry's attempt to use a non-traditional method of engineering instruction (poetry) increase your respect for him as an instructor?

- Yes
- No

Please elaborate on your response.

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8. Should Dr. Barry continue to use poetry in the CE371 (soil mechanics) course?

- Yes
- No

Other (please specify)

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9. Please feel free to use the space below to provide any additional thoughts/comments you might have related to Dr. Barry's use of poetry in CE371 (soil mechanics).

Thank you for taking the time to complete this survey.

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