

Communicating your Science: The Dual Poster Project

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Teacher Education

Texas Woman's University





Texas Woman's University

- Largest public university primarily for women in the United States
- Approximately 15,100 students at three campuses: Denton, Dallas and Houston
- Approximately 36% graduate and 64% undergraduate student populations
- Has nationally ranked programs in Nursing and Health Sciences
- Ranked in Top 15 universities in the nation for diverse student body (~45% white)
- **Requires all students to take at least six credits of laboratory science courses**



Texas Woman's University

STUDENT FACTS

| | |
|-------------------|---------|
| Female | 88% |
| Average Age | 29 yrs. |
| Average Age of UG | 26 yrs. |
| UG > 25 years | 39% |



Texas Woman's University

STUDENT FACTS

| | |
|---------------------|--------|
| Total Minority | 54% |
| African American | 21% |
| Hispanic | 18% |
| Undergraduate | 62% |
| Graduate | 38% |
| Full-time/Part-time | 58/42% |

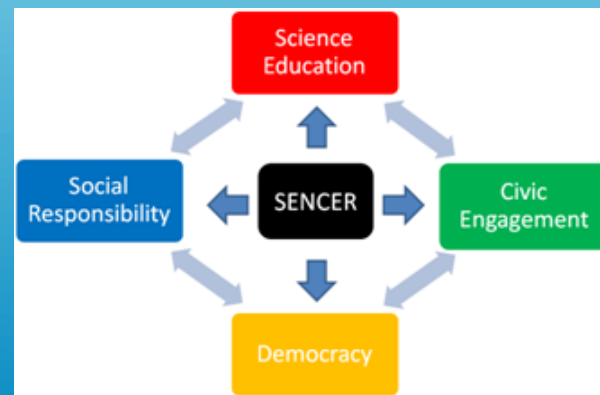
TWU is SCI-Southwest

Co-Directors

- > Richard D. Sheardy, Chair, Chemistry & Biochemistry
- > Cynthia Maguire, Sr. Lecturer Chemistry & Biochemistry

Areas of Focus & Expertise

- > Environmental Sustainability
- > Science Teacher Preparation
- > Undergraduate Research



The Beginning of Dual Posters

- Garon Smith's Dual Poster Presentation at the NCSCE Washington D.C. Symposium in spring 2010
- Desire to help students communicate science beyond disciplinary specialists
- He brought two groups of students who had just presented at NCUR.
- Huge potential but challenges with consistency

Project Design: Phase I

With consent of their faculty mentors, science students performing research at Texas Woman's University were solicited to participate in a pilot project. One chemistry and one biology student (both masters level) developed public versions of their technical research. These dual pairs were completed during March 2011.

2010-2011

- ◉ Le Shepard (Psychology 2011) and Nicole Wallis (Teacher Ed 2012) created a handbook to guide student researchers
- ◉ We tried to recruit students with existing technical posters, but...
- ◉ Had to recruit faculty mentors first!
- ◉ Finished two poster pairs and surveyed undergraduate students to measure responses to each pair

The Process

- ◉ List all words in your title that may not be understood by a general audience, followed by more common synonyms or a brief explanation
- ◉ What is the purpose of your work? What impact could it have on the general public?
- ◉ Create a new title considering your answers above.
- ◉ Share your new title with someone unfamiliar with your work. What is their response? Do they have a basic idea what your research is about?

(repeat for other parts)

Some Samples

Technical title:

Microscopic Studies of the Mutualistic Relationship between
the Sunflower and the Honey Bee



Public title:

Understanding the relationship
between honeybees and sunflowers

Poster Authors:

Jennie Wojtaszek and Camelia Maier

A Spectroscopic and Calorimetric Investigation of the Human Telomere DNA Sequence

We are investigating the effects of sequence context and environment on the human telomere sequence (TTAGGG)₄. Our questions include: 1) How does the sequence of the first three bases of the repeat influence the structure and stability of the quadruplex?; 2) How does the number of repeats influence the structure and stability of the quadruplex?; and 3) How does the nature of the counter ion and its concentration influence the structure and stability of the quadruplex? To address the first question, we are studying all permutations of (XXXGGG)₄ where X = T or A. For the second question, we are investigating (TTAGGG)_x where x = 1, 2, 4, or 8. Finally, we are investigating the influence of K⁺ and/or Na⁺ on the structure and stability of all oligomers in our library. Initial results from circular dichroism studies suggest all oligomers form quadruplexes whose molecularities and structures depend upon the sequence context, number of repeats, and which counter ion is present. We have recently initiated calorimetric studies of these sequences under different counter ion environments to assess their stabilities. We will present a progress report of this project.

Unusual DNA Structures and their Potential Role in New Cancer Therapies

The human telomere is a DNA sequence located at the end of all chromosomes in human cells and its unique structure is associated with the onset of cancer and aging. To better understand the relationship between this unusual structure and its role in cancer, we have utilized several different techniques to study how slight changes within the sequence can affect the resulting structure. With every modification made thus far, we have found that each sequence folds into a different structure. Gaining a firm understanding of the different types of structures formed by the human telomere can provide important information for the development of new cancer therapies.

Poster authors:

Brenna A. Tucker, Sam G. Gabriel, C. Antonacci, and Richard D. Sheardy

Let's Practice!

Take five minutes to rewrite this title in common language...

An Investigation of Pharmaceutical
Properties of *Cannabis* via
Spectrophotometric Methods

Faculty Mentor approval



- Is poster still presentation worthy?
- Is the science still accurate?
- Does this represent your department well?

Benefits of Dual Posters

- Easier for general audiences to understand (and the more complex the material, the more successful the dual version appears to be)
- Help students focus on why their work is important and what it will be used for
- Valuable teaching tool (*Do your students really understand what they're doing?*)
- Valuable recruitment tool for the institution (Arrange display of dual pairs during an open house when prospective students (and their parents) visit your campus.)

Lessons Learned in Phase 1

- ⦿ There's something more going on here.
- ⦿ I am not an expert in this!
- ⦿ Find someone who knows more than I do to help.

What's going on???

“What do we mean by “invisible learning?” We use this phrase to mean at least two things.

First, it points us to ...“intermediate processes,” the steps in the learning process that are often invisible but critical to development.

[Second] All too often in education, we are focused only on final products: the final exam, the grade, the perfect research paper, mastery of a subject. But how do we get students from here to there? What are the intermediate stages that help students develop the skills and habits of master learners in our disciplines? What kinds of scaffolding enable students to move forward, step by step? How do we, as educators, **recognize and support the slow process of progressively deepening students' abilities to think like historians and scholars?**”

Bass & Eynons, 2009

Why Expertise is Important:

- It provides insights into the nature of thinking and problem solving.
- Once acquired, it affects what people notice, how they organize thoughts and ideas; and how they interpret information about the world around them.

“Provide the novice with learning experiences which specifically enhance abilities to recognize meaningful patterns of info”.

(Simon, 1980)

Five key principles of experts' knowledge

- Experts notice features and meaningful patterns.
Novices do not.

Five key principles of experts' knowledge

- Experts have acquired a significant amount of content knowledge that is organized in ways that reflect deep understanding of the targeted subject.

Novices do not.

Five key principles of experts' knowledge

- ⦿ Experts' knowledge cannot be reduced to sets of isolated facts; novices can. Instead experts organize knowledge around core concepts or big ideas that guide their thinking. Novices need such hooks.
- ⦿ Experts can retrieve important aspects of knowledge with seemingly very little attention/effort; novices cannot.

Five key principles of experts' knowledge

- *Though experts know their disciplines thoroughly, this does not guarantee that they are able to teach others. Experts must watch that they do not forget what is easy and what is difficult for students.*

Phase II

- Since 2011, by consulting scholars in the Scholarship of Teaching and Learning (SoTL) community, Maguire has pursued experimental design of a broader project in phase two involving multiple institutions and disciplines in further study.

Implementing Phase II

- Beginning in 2013-14, phase two will be implemented. This will involve collecting qualitative data from students and their research mentors while they are writing a “technical” and “public” poster pair.

Future Research Questions

- ❖ What effect does preparing a public poster have on the student researcher?
- ❖ How do students learn to “translate” scientific findings for a general audience?
- ❖ Does translating technical scientific findings for a general audience lead to deeper scientific understanding on the part of students? *and*
- ❖ What is the impact on participating faculty mentors?

Each of these questions is addressable using generally accepted concepts and methods in the SoTL research community.

Phase II project design

The authors plan to proceed by coding qualitative data obtained from

- ❖ written journals kept during development of dual posters and
- ❖ oral interviews with student researchers and their mentors.



Translating Your Science: the Dual Poster Concept

Cynthia Maguire, M.S., M.S.*

Abstract

Many scientists do important work that could have a profound impact on their own field as well as others, but then struggle to communicate their results. Part of the challenge is that each discipline, and specialty within it, has jargon that is often not understood by the general public or others in complementary fields of research.

We are early in the process of learning how we learn a discipline, and how learning in one discipline varies from learning in another (Middendorf and Pace, 2004). Mental skills needed for undergraduate success are not generally explicitly taught. By guiding students through the steps essential to acquiring the needed communication skills, we can make invisible learning visible as we guide their metamorphosis from novice to professional scientist (Bass and Eynon, 2009).

By learning to reduce jargon and describe highly complex ideas so that most well-educated people can understand, researchers will be better equipped to share the significance of their work with those in other disciplines, and better able to inform policymakers about their science.

Project Design: Phase One

With consent of their faculty mentors, science students performing research at Texas Woman's University were solicited to participate in a pilot project. One chemistry and one biology student (both masters level) developed public versions of their technical research posters using a handbook developed by Shepard and Wallis (2011) to guide the process of replacing jargon with commonly understood language. These dual pairs were completed during March 2011.

Since then, by consulting scholars in the Scholarship of Teaching and Learning (SoTL) community, Maguire has pursued experimental design of a broader project in Phase Two involving multiple institutions and disciplines in further study.

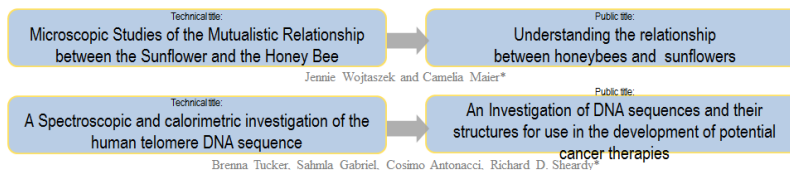
Future Research

Beginning in 2013-14, Phase Two will be implemented. This will involve collecting qualitative data from students and their research mentors while they are writing a "technical" and "public" poster pair. Questions to pursue in future research include:

- What effect does preparing a public poster have on the student researcher?
- How do students learn to "translate" scientific findings for a general audience?
- Does translating technical scientific findings for a general audience lead to deeper scientific understanding on the part of students? and
- What is the impact on participating faculty mentors?

Each of these questions is addressable using generally accepted concepts and methods in the SoTL research community. The author plans to proceed by coding qualitative data obtained from written journals kept during development of dual posters and during oral interviews with student researchers and their mentors (Maguire, et al 2012). Potential collaborators for Phase Two should contact Cynthia Maguire at Cmaguire@twu.edu.

Pilot Project Data



Pilot Survey Results

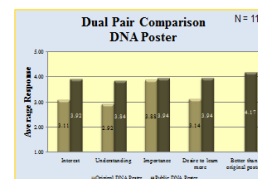
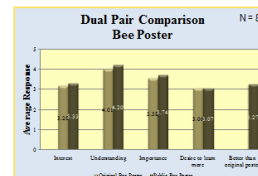
To measure responses to viewing poster pairs, the posters were shown—first technical, then public—to undergraduate students in a core science course during June, 2011. They were asked to rate their agreement with the following statements.

- I am interested in this poster.
- I understand what this poster is about.
- I think this research is important.
- I want to learn more about this topic.
- A fifth statement added after viewing the public poster asked viewers to rate agreement with whether they thought the public version was "better than the technical poster?"

Responses were (5) Strongly agree, (4) Somewhat agree, (3) Neutral, (2) Somewhat disagree and (1) Strongly disagree.

The least technical topic (relation between honeybees and sunflowers) showed a small increase (<5% change) in level of interest, comprehension, opinion of importance of the research, or desire to learn more about the topic. A more technical topic (structural changes in telomeres of human DNA) revealed greater changes (ranging from 20 to 31% increases for the same scales), favoring the dual version of this pair.

When asked their preference, 80% of respondents preferred the public DNA poster while only 43% preferred the public Bee poster (Maguire, et al 2012).



Why get involved?

Among the advantages identified are:

- The student adds a publication to her/his resume.
- Participating in this process helps students focus on why their work is important & what it is used for.
- Preparing a public poster is a valuable teaching tool. (*Do your students really understand their research?*)
- Public versions are easier for general audiences to understand (and *the more complex the material, the more successful the public version seems to be*).
- Using the dual pair can create a significant recruitment tool. (Arrange a display of dual pairs during an open house when prospective students and their parents visit your campus.)

(Maguire, et al 2012)

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Bass, R. and Eynon, B. Academic Commons, 2009, <http://www.academiccommons.org/commons/essay/capturing-visible-evidence-invisible-learning> (accessed March 2012).

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The Sales Pitch!

Potential collaborators for phase two should contact Cynthia Maguire at

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Karen Dunlap at

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Science References

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That's All Folks!

Questions?