

Best Practices for Teaching Writing in STEM Disciplines

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STEM Departments/ Majors at SJSU

- Biology
- Chemistry
- Computer Science
- Environmental Studies
- Geography
- Geology
- Health Science and Recreation
- Mathematics and Statistics
- Meteorology and Climate Science
- Nursing
- Nutrition, Food Science, and Packaging
- Physics and Astronomy
- Psychology
- Technology
- Aerospace Engineering
- Biomedical, Chemical, and Materials Engineering
- Civil and Environmental Engineering
- Computer Engineering
- Electrical Engineering
- General Engineering
- Industrial and Systems Engineering

Need for Specialized Writing Instruction in STEM Majors

- **Professional Writing**
 - Specific and diverse communication and standards
 - Specific purpose, recipients, and/or audiences
 - Standardized professional documents
- **Educational Writing**
 - Student demonstrates understanding and proficiency of theory and/or content (disciplinary literacy)
 - Identify and understand genre-specific form, style, and formatting (content literacy)
 - Meet broad university and specific departmental goals and requirements

General Challenges in Teaching Writing

- Large time commitment to grade
- Range of writing abilities and experience among students in a class varies tremendously
- ESL students may need specialized support
- Additional skills for writing have changed (e.g., information literacy) and may require collaborations with librarians, IT faculty, etc.
- Discrepancies between faculty and student expectations and/or understanding of the assignment
- Students develop low investment strategies
- Students often do not read comments on their papers, do not seek clarification

Challenges Specific to Teaching Writing in STEM

- Genre-specific writing is unique to each STEM field
- STEM faculty may want to teach content rather than writing
- STEM faculty may feel uncomfortable or unprepared to teach writing (compared to their STEM content)
- Lack of exposure to writing content and structure in STEM genres
- Pedagogical differences between English and science teachers
- Lack of exposure to multi-modal skills used in STEM writing

Differences Between Student and Practitioner Writing

Student	Practitioner
Write to demonstrate understanding of theory, concepts, and competence, AND clarity and purpose	Write for clarity and purpose
Often do not have exposure to genre-specific conventions and examples	Specific/specialized genre organization; documents are standardized for similar purpose
Complex and/or compound sentences with multiple ideas, vague or inaccurate information, confusing use of jargon and long sentences with sounding professional	Concise writing provides unambiguous and quick reading for clients with a specific purpose or outcome
Often use superlatives or absolutes; lack awareness between unambiguous writing and unintended liability/consequences	Precise and concise vocabulary

Researching Best Practices for Teaching Writing in STEM Majors

- **Goal:** provide information to support and enhance writing instruction and resources in STEM disciplines to prepare students to be competitive for STEM internships and jobs upon graduation.
- **Methods:**
 - **Literature survey:** research current approaches to teaching writing and improving student outcomes
 - **Data collection:** Qualtrics survey of STEM writing instructors (100W) to document current approaches and observations within SJSU
- **Results:** recommendations for improving student outcomes in STEM writing programs at SJSU at the university, department, and course levels

University- Scale Programs

Duke University

- The Duke Reader Project
- Collaboration between Writing Center and Alumni Affairs
- Pairs an alumni with a student for one assignment to read, offer advice, and talk about professional writing
- Four hours per student (small time investment)
- Benefits: improve ability to write for a specialized audience, more likely to seek input on future writing, more critical of their own writing

Samford University (Howard College of Arts and Sciences)

- Links writing and research opportunities; provides long-term goal of senior research project
- Writing requirements are scaffolded and developed over several years and classes
- Culmination of writing and research is a presentation at an annual university-wide Student Showcase
- Benefits: gain research experience, provide focus and purpose for writing, investment in clear communication

Department Programs

- Writing instruction is organized across multiple upper-division courses
- Two levels of consistent goals and objectives: 1) individual classes and 2) through the series of classes required for graduation
- Goals and objectives must be made clear to students; incorporate into course student learning outcomes, assignment instructions, and rubrics.
- Work with professionals to develop curriculum that prepares them for jobs in their fields
- Scaffold skills within and between classes for consistent exposure to curriculum
- Establish hierarchy of faculty and TAs to provide more instruction and feedback to students
- Use writing portfolios or samples (1st year vs graduating senior) to evaluate a student's and the department's progress

Individual Course

- Improve student writing process
- Teach self-identification of writing issues
- Instructor intervention (providing “developmental feedback”)
- Link feedback with revision
- Grammar support software
- Integrate content and writing (read and practice genre-specific format via embedded writing assignments)
- Clarify assignment directives and outcomes (research and writing as iterative/non-linear process)
- Genre-specific instruction (expectations for workplace genres, choosing effective words, document organization)
- Experiential learning (providing professional opportunities)
- Enhanced assessment strategies (revision, rubrics, multiple drafts, peer review)

Decrease the Amount of Time Needed for Teaching and Grading

- Divide teaching efforts between professors and teaching assistants (also provides more help for students)
- Completion/participation grades on some writing assignments (low investment, but more writing opportunities)
- Provide extensive comments and suggestions only on assignments that will be revised
- Use clear rubric to score papers
- Peer reviews and evaluations decreases time an instructor spends providing comments and grading
- Assign highly structured, short tasks rather than longer writing assignments

Summary of Qualtrics Survey of SJSU STEM Writing Instructors

- SJSU STEM writing instructors use most of the techniques found in the literature survey for improving writing in individual classes
- SJSU does not have a university-wide program like Duke's Reader Program
- 75% of respondents collaborate with other instructors within their departments to create a consistent and cohesive writing curriculum for their majors (meetings, shared documents, and metrics)
- No department reported a formalized writing program like a writing portfolio, comparison of 1st year to graduating seniors, or scaffolded skills or assignments
- A few departments have a formal research showcase (College of Science's Research Day, Environmental Studies Department's Poster Presentation)

Resources for Writing at SJSU

- Writing Across the Curriculum
- Writing Center
- Writing Fellows
- Subject Librarians
- Center for Faculty Development
- Peer Connections (tutoring and embedded tutors)