Technical Reading and Writing in STEM

STEM education provides students with STEM experiences (engineering design challenges or project/problem-based learning) that equip students with logical thought processes, technical reading and writing skills, and STEM Fluency skills (collaboration, creativity, communication, creative thinking, resilience, time management, adaptability, promptness, and innovation). The outcome of STEM Education is STEM literate students who are prepared to enter STEM careers. A STEM Literate student possesses the STEM Fluency skills, academic knowledge, and technical skills required for their career.

STEM careers require the skills of gathering, comprehending, evaluating, synthesizing, and reporting on information and ideas to conduct original research to answer questions or solve problems necessary for workforce readiness. Students need to be able to analyze and create a wide range of print and nonprint texts in various media forms. They need to be able to incorporate narrative elements effectively into arguments, informative, and explanatory texts and be able to write precise descriptions of the step-by-step procedures used in investigations or technical work. These literacy skills and understandings are not separate from STEM fields but are purposefully integrated within science standards and STEM experiences.

Technical Reading

Reading complex informational and technical texts with independence and confidence is critical to building knowledge and comprehension in STEM fields. When reading scientific and technical texts, the reader gains knowledge from challenging texts that often use complex diagrams and data to communicate information and illustrate concepts.

Technical Writing

In STEM fields, writing is a means of asserting and defending claims, communicating knowledge, and conveying information, and making concepts accessible. The author must carefully consider the audience, purpose, and task; word choice, information, structures, and formats are deliberately chosen. Technology is used strategically when creating, refining, and collaborating on writing. Skills involved in technical writing include gathering information, evaluating sources, citing material accurately, reporting findings from research/testing, and analyzing sources. Proficiency in these skills allows for clear and persuasive communication.

Examples of Technical Literature

- published scientific studies, case studies, and white papers
- technical reports, reviews, presentations, and engineering briefs
- datasheets, blueprints, code descriptions, Safety Data Sheets (SDS), and work statements
- end-user documentation: user manuals, handbooks, procedures, assembly guides, technical books, and code manuals
- technical marketing content: product descriptions and specifications, press releases, catalogs, proposals and pitches, brochures

Examples of Visual Elements within Technical Literature

Visual elements are used to represent objects, numbers, concepts, processes, data, and text. Examples include tables, graphs, charts, flow charts, Gant charts, schema, photographs, images, diagrams, maps, numbered lists, bulleted lists, CAD drawings, infographics, and sketches.

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In STEM fields, professional technical reading and writing skills are required daily.

Professional Technical Reading skills	Professional Technical Writing Skills
• Integrate and evaluate multiple sources of information presented in diverse formats and media • Evaluate the question or problem, hypotheses, data, analysis, and conclusions in a science, engineering, or technical text; corroborate or challenge conclusions with other information • Compare and contrast the information gained from investigations, engineering design processes, simulations, video, research, or multimedia sources with that gained from reading a text on the same topic • Cite specific evidence from the text to support analysis of science, engineering, and other technical texts • Identify the main ideas or conclusions of a technical text; summarize complex concepts, requirements, processes, or information • Follow a multistep procedure when carrying out scientific investigations or engineering design processes, taking measurements, or performing technical tasks; analyze the results based on explanations in the text • Analyze the structure and organization of a technical text, including how the major sections contribute to the whole and an understanding of the topic • Analyze diagrams, data, visuals, sketches, CAD drawings, and graphics in conjunction with text • Determine the meaning of key terms, symbols, and other discipline-specific words/phrases • Analyze the author's purpose in providing an explanation, describing a procedure or process, or discussing an investigation in a technical text	• Collect relevant information from multiple high-quality print and digital sources; evaluate the strengths and limitations of each source in relation to the specific audience, purpose, and task • Integrate information into written text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation • Draw evidence from informational texts to support research, analysis, and reflection • Write scientific arguments to support claims or persuasive engineering design proposals using valid reasoning, trade-offs, risk analysis, and relevant and sufficient evidence from various sources • Write informative and explanatory texts, including scientific procedures, engineering design processes, and code descriptions • Develop clear and coherent writing in which the development, organization, and style are appropriate to the audience, purpose, and task • Develop and strengthen writing by planning, revising, editing, rewriting, or trying a new approach • Use technology to produce, publish, and update writing products, for example, project boards and proposals, presentations, and professional research posters • Engage in short as well as more sustained research projects to answer a question or solve a problem • Develop diagrams and visuals in conjunction with text

Connections for Technical Reading and Writing in the Classroom

- **K-12 Scientific and Engineering Practices TEKS (Adopted 2021)**

Examples: communication through claim-evidence-reasoning, science investigations, prototyping, engineering design process, lab reports, assembly guides, research for projects or problems, STEM fluency skills

- **K-8 Technology Applications TEKS (Adopted 2022)**

Examples: computational thinking, code descriptions, transforming data, data visualizations, communicate and publish data, personal skills, research for projects or problems

- **High School Career Technical Education STEM Literacy Connections**

Examples: technology, engineering, manufacturing, health sciences, architecture, aerospace

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