

STEM/STEAM Standards Framework for Grades K-5

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Course Code:	G25X42
Prerequisite(s):	None
Grade Level:	K-5
Teacher Endorsement(s):	001, 002, 073, 074, 101, 120, 173, 198, 400, 401, 402, 403, 440, 466, 467, 468, 497, 499
Required Teacher Certifications/Training:	None

Course Description

STEM/STEAM Standards of Practice Framework for grades K-5 is a foundational course experience providing students the opportunity to deepen their understanding of the content connections that exist between science, technology, engineering, and mathematics (STEM). This introductory K-5 course helps younger students begin developing introductory skills and a foundational knowledge base important to subsequent STEM fields that may include art integration. This course engages students in career awareness to explore STEM career fields and occupations. It is important to note that this course may be implemented flexibly to meet individual district needs within the K-5 grade band. This course is also intentionally designed to and align with the attributes in the Tennessee STEM Innovation Network's STEM and STEAM Designation rubric. The course standards meet the rigor and alignment when incorporating Tennessee State Standards and are designed to pave a path for schools interested in earning designation. To access the STEM and STE(A)M School Designation Rubric for cross-reference [click here](#).

Course Standards

Infrastructure

These standards are designed to engage students with specific skills and strategies needed to effectively utilize time, tools, and space for STEM learning and problem-solving.

- 1) Develop collaboration skills in problem solving in order to construct explanations, design solutions, or achieve common goals
- 2) Interact with peers, experts, and others to gather information for problem solving
- 3) Use space and materials (floor, desk, chart paper, etc.) to support the problem-solving process
- 4) Create a timeline for project completion (idea to completed project)
- 5) Use technology in a responsible and ethical manner
- 6) Use appropriate safety procedures for conducting STEM investigations

Proficient students are able to:

Grade: K-2	Grade: 3-5
<ul style="list-style-type: none"> • work in a collaborative group with defined roles • identify information gathering strategies to aid in the problem-solving process • implement flexible seating arrangements to work collaboratively to support problem-solving • work through a project sequence provided by the teacher • explore internet safety • explore safety standards in STEM career fields 	<ul style="list-style-type: none"> • form and work in collaborative groups with defined roles • create a journal/blog/record of information gathered for the problem-solving process • create multiple seating arrangements to support problem-solving • create a project schedule with peers • explore internet safety and the use of media to support problem-solving • identify safety standards in STEM career fields and implement them in a STEM project

Curriculum and Instruction

These standards are designed to engage students in multiple subject areas and standards while demonstrating students ability to use the design process to form a solution to a problem.

- 1) Investigate real-world problems or challenges requiring the synthesis of multiple sources of information
- 2) Use content-specific and precise vocabulary when communicating ideas related to STEM content
- 3) Engage in investigations through science and engineering practices to identify and define global issues, challenges, and real-world problems
- 4) Use models of the engineering design process to develop solutions to problems
- 5) Evaluate the criteria and constraints for a successful solution to a problem or challenge
- 6) Evaluate and compare multiple design solutions and select the most optimal design
- 7) Integrate the arts (music, visual art, literature, and dance) in problem-solving and product design

Proficient students are able to:

Grade: K-2	Grade: 3-5
<ul style="list-style-type: none"> • make connections between content and real life • draw pictures to demonstrate the problem or verbally explain the solution using content-specific vocabulary 	<ul style="list-style-type: none"> • analyze connections between content and real life • create digital, paper, or verbal presentations to demonstrate the

<ul style="list-style-type: none"> • pose/ask questions about global issues, social problems, or challenges • identify the steps of the engineering design process • compare multiple prototypes to determine optimal design features • compare products to identify the importance of the arts in adding aesthetics/beauty to product design 	<p>solution to the problem using content-specific vocabulary</p> <ul style="list-style-type: none"> • create research questions about global issues, social problems, or challenges • identify steps of the engineering design process to revisit as the problem is revised • create multiple prototypes to identify optimal design features • create a commercial to explain the benefits of a new product
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Achievement

These standards are designed to equip students with specific skills and strategies needed for analyzing academic progress, making interdisciplinary connections, project and self-evaluation, and goal setting.

- 1) Analyze interdisciplinary connections that exist within the STEM disciplines as appropriate to the grade level to answer complex questions and to investigate/develop solutions to real-world problems
- 2) Engage in self-evaluation, goal setting, and peer feedback opportunities
- 3) Engage in critical reading and communicating of technical information
- 4) Develop claims and use evidence to form arguments
- 5) Employ the arts to increase innovation, product visibility, and topic awareness

Proficient students are able to:

Grade: K-2	Grade: 3-5
<ul style="list-style-type: none"> • identify the connections between science, technology, engineering, and mathematics disciplines and other disciplines • identify goals for the outcome of a project or exercise • use picture rubrics to self-identify progress • develop strategies used to monitor understanding before, during, and after reading, viewing, or listening to informational text • differentiate between facts and opinion within a specific source 	<ul style="list-style-type: none"> • explain connections between science, technology, engineering, and mathematics disciplines and other disciplines • set goals for the outcome of a project or exercise • use rubrics to self-identify and peer identify groups progress • summarize an informational text, either orally or in writing, including the main ideas and significant supporting information from across the text • differentiate facts from opinion(s) within multiple sources

<ul style="list-style-type: none"> • use mnemonic devices to increase content understanding 	<ul style="list-style-type: none"> • create mnemonic devices to increase content understanding
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Community Partnerships

These standards are designed to equip students with an understanding of STEM careers and occupations through engagement in direct experiences with STEM professionals.

- 1) Identify community challenges and apply STEM content and practices to construct creative and innovative responses and solutions to real-world problems or challenges that exist in different STEM fields
- 2) Connect with community or business partners to allow opportunities for virtual experiences, field trips, and feedback on projects/problems
- 3) Explore career opportunities and occupations that exist in a variety of STEM fields
- 4) Explore how technology is integrated into different career fields and occupations
- 5) Identify the relationships between scientists, engineers, mathematicians, etc. and the nature of those career pathways
- 6) Identify, analyze, and perform a science, technology, engineering, and mathematics specific subject matter expert role
- 7) Identify how professions in the arts increase innovation and creative problem-solving strategies

Proficient students are able to:

Grade: K-2	Grade: 3-5
<ul style="list-style-type: none"> • identify a problem in the local community and how STEM professionals help solve them • participate in career exploration through fairs, guest speakers, tours, and other experiences • identify ways STEM fields use technology to solve real world problems • identify specific behaviors and knowledge needed by many STEM professionals to perform their job(s) • role play community STEM professionals • identify how artists are important in video game and multimedia production 	<ul style="list-style-type: none"> • investigate a problem in the local community and identify STEM professionals who help solve them • participate in career exploration through fairs, guest speakers, tours, and other experiences • create and write interview questions for STEM professionals to determine how they use technology to solve real world problems • research several engineering careers in order to understand the career knowledge and behavioral expectations from a variety of engineering professions • perform the role of a STEM professional to accomplish STEM team goals • research video gaming companies and the various roles of software developers

Standards Alignment Notes

The STEM/STEAM Standards of Practice Framework for Grades K-5 are supported by the: Standards for Mathematical Practices, the Science and Engineering Practices, the K-12 Computer Science Framework, Fine Arts, and the P21: Partnership for 21st Century Skills Framework for 21st Century Learning.

Teachers are encouraged to align instruction to these areas to support the processes and proficiencies of student learning to enhance to the connection between the science, technology, engineering, and mathematics content.

- Standards for Mathematical Practices
 - https://www.tn.gov/content/dam/tn/education/standards/math/std_math_standards_mathematical_practice.pdf
- Science and Engineering Practices
 - https://www.tn.gov/content/dam/tn/education/standards/sci/sci_standards_reference.pdf
- K-12 Computer Science Framework
 - <https://k12cs.org/navigating-the-practices/>
- Fine Arts Standards
 - <https://www.tn.gov/education/instruction/academic-standards/arts-education.html>

Professional Development Recommendations

Teachers are encouraged to participate in professional development that addresses integrated content, community/industry partnerships, connections with postsecondary education, pedagogy, art and design opportunities, and digital learning to develop project-based learning (PBLs) activities that are custom designed to provide relevant learning by providing opportunities to research challenges within the community.

STEM/STE(A)M-specific professional learning that incorporates the following:

- project/problem/place-based learning
- engineering design process
- integrated instruction
- investigative research-based practices
- collaborative planning practices
- connect with local business or community partners
- improve the STEM/STE(A)M-focused content knowledge (advanced academics, agriculture, architecture, art, biotechnology, computer programming, cybersecurity, digital art, energy, engineering, food science and nutrition, forensic science, healthcare science, and/or information technology)
- Visit www.tsin.org to access multiple resources and professional development to expand STEM opportunities.