



The *PRAXIS*® Study Companion

STEM for the Elementary Grades (5036)



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STEM for the Elementary Grades (5036)

Test at a Glance

The *Praxis*® STEM for the Elementary Grades test is designed to measure knowledge and competencies that are important for safe and effective beginning practice as an elementary STEM teacher.

Test Name	STEM for the Elementary Grades		
Test Code	5036		
Time	90 minutes		
Number of Questions	75 selected-response and numeric-entry questions		
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices; questions where you enter a numeric answer in a box; and other types of questions. You can review the possible question types in Understanding Question Types.		
Test Delivery	Computer Delivered		
	Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
	I. The Nature and Practices of the STEM Disciplines	24	32%
	II. Computer Science for STEM	21	28%
	III. STEM Pedagogy	30	40%

About The Test

Elementary STEM teachers support students' learning of science, technology, engineering, and mathematics in an integrated way by emphasizing the use of standard practices in the disciplines to develop design solutions and answer questions. Elementary STEM teachers have an understanding of computer science and technology that is relevant to the role and have the pedagogical knowledge needed to create a safe and effective learning environment for all elementary students. Test takers typically have experience teaching in the elementary or secondary grades and have completed appropriate coursework in the STEM disciplines or computer science.

The assessment is designed and developed through work with practicing teachers and teacher educators to reflect state and national standards for the preparation of elementary STEM teachers. These include the Standards for Technological and Engineering Literacy (2020) by the International Technology and Engineering Educators Association (ITEEA), the K-12 Computer Science Standards (2017) by the Computer Science Teachers Association (CSTA), the Standards for Educators (2017) by the International Society for Technology in Education (ISTE), and the Next Generation Science Standards (2013) by the National Science Teachers Association (NSTA).

This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Note: The use of “e.g.” to start a list of examples implies that only a few examples are offered and the list is not exhaustive, whereas the use of “i.e.” to start a list of examples implies that the given list of examples is complete.

Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. We do **not** provide answers for the discussion questions but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test’s subject matter. You may want to discuss these questions with a teacher or mentor.

I. The Nature and Practices of the STEM Disciplines

A. Interrelationships Among the STEM Disciplines and Their Practices

1. Understands the nature of individual STEM disciplines and their interdependence
 - a. Identifies, describes, and compares the goals and objectives of the individual STEM disciplines
 - b. Identifies the nature and different aspects of a given question or problem (e.g., scientific, engineering, computational)
 - c. Identifies and describes how the STEM disciplines are used in combination in the development of solutions to problems
2. Knows how to apply the practices of the STEM disciplines
 - a. Asks, identifies, defines, and makes sense of questions and problems (e.g., identifies criteria and constraints [such as material, time, space, and cost] in engineering problems)
 - b. Evaluates a variety of resources to inform a solution
 - c. Identifies and evaluates one or more potential answers to a question or one or more potential solutions to a problem
 - d. Identifies and describes the use of tools appropriate for measurement, data collection, representation and analysis of data, and problem-solving

- e. Identifies ways to collect data and uses mathematical reasoning and computational thinking when evaluating potential solutions
- f. Identifies viable arguments and critiques the reasoning of others regarding a proposed plan with viable justifications
- g. Describes how to plan investigations (e.g., experiments, observational investigations)
- h. Identifies and uses models (e.g., conceptual, physical, mathematical, computational) for representation, simulation, and testing and recognizes the limitations of models
- i. Evaluates explanations and design solutions (e.g., explanations, prototypes, algorithms, equations)
- j. Appropriately collects, analyzes, and interprets data (qualitative, quantitative) and patterns in data
- k. Evaluates, compares, and improves solutions to meet the criteria and constraints (e.g., identifies and evaluates strengths and weaknesses of proposed solutions, recognizes that there may be no perfect solution)
- l. Represents and communicates solutions and ideas with supporting evidence and appropriate STEM vocabulary

B. STEM and Society

- 1. Understands impacts of technology on society
 - a. Identifies ways that technology helps with everyday tasks (e.g., at home, in the community, in the larger world)
 - b. Identifies examples of helpful and harmful effects of technology
 - c. Identifies examples of how certain aspects of people's daily lives would be different without given technologies
 - d. Identifies and describes the impact that a solution has on a user and/or on the community
- 2. Understands relationships between changes in technology and changes in society
 - a. Identifies connections between technology and human experiences and identifies examples of how technology has influenced the way people live and work throughout history
 - b. Identifies ways in which the natural world can contribute to the human-made world to foster innovation
 - c. Identifies examples of how technologies are developed or adapted when individual or societal needs and wants change

Discussion Questions: The Nature and Practices of the STEM Disciplines

- Recognize the importance of the following standards in elementary STEM education: the Standards for Technological and Engineering Literacy (2020) by the International Technology and Engineering Educators Association (ITEEA), the Next Generation Science Standards (2013) by the National Science Teaching Association (NSTA), and the K-12 Computer Science Standards (2017) by the Computer Science Teachers Association (CSTA).
- Identify definitions of technology and technological literacy.
- Identify the process (e.g., computational thinking, the scientific method, the engineering design process) that is the primary focus of a question, problem, or task.
- Identify similarities and differences between steps in the engineering design process and either the mathematical practices or steps in the scientific method.
- Identify actions that occur at the different steps in the engineering design process, the primary purpose of each step, and the general sequence in which the steps are followed (e.g., defining a problem, researching the problem, brainstorming possible solutions, establishing criteria and constraints, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating, refining the design, creating the solution, communicating results).
- Identify definitions and examples of terms related to the design process (e.g., criteria, constraints, trade-offs, optimization, invention, innovation, technology transfer).
- Identify definitions of brainstorming and research and the purpose of each.
- Recognize that there can be multiple solutions to design problems.
- Identify appropriate measurement tools for a task (e.g., a meterstick, a kitchen scale).
- Identify appropriate steps and task designs when planning scientific investigations.
- Identify the purposes of different types of models and prototypes (e.g., functional prototype, mock-up, computer model) and the benefits and risks of using models and prototypes.
- Identify examples of artificial intelligence and ergonomics.
- Identify examples of and effects of renewable and nonrenewable energy sources.

- Identify reasons for and effects of important technological developments (e.g., the clock, water purification, the assembly line, cell phones, wireless technology, CFL and LED lightbulbs).
- Identify examples of helpful and harmful effects of technology (e.g., automation, chlorofluorocarbons, lead, social networking).
- Identify examples of how societal forces can affect the creation, development, or expansion of technology (e.g., automobile production, nuclear energy).

II. Computer Science for STEM

A. Data, Algorithms, and Programming

1. Understands collection, presentation, analysis, and interpretation of data
 - a. Selects software and applications that collect data and identifies how to present collected data in various formats using technology
 - b. Identifies and describes patterns and makes predictions using data visualizations (e.g., charts, graphs)
 - c. Uses data to highlight or propose cause-and-effect relationships, predict outcomes and correlation, or communicate an idea using digital systems
2. Understands algorithms and other programming concepts
 - a. Models everyday processes by identifying, creating, and following sets of step-by-step instructions (algorithms) and compares and refines multiple algorithms for the same task
 - b. Selects and uses programs that include control structures (e.g., sequences, events, loops, conditionals) to express ideas or address a problem
 - c. Demonstrates how breaking down a problem into steps or smaller manageable subproblems can help in creating a precise sequence of instructions to solve the problem
 - d. Modifies, remixes, or incorporates portions of an existing program to develop something new or add more advanced features
 - e. Interprets plans that describe a program's sequence of events, goals, and expected outcomes
 - f. Identifies and fixes (debugs) errors in an algorithm or program that includes sequences, simple loops, and simple branching to ensure that it runs as intended
 - g. Demonstrates how to take on varying roles when collaborating during the design, implementation, and review stages of program development

- h. Communicates, using discipline/content-specific terminology, steps taken and choices made during the iterative process of program development, using code comments, presentations, and demonstrations

B. Computing Technology and Society

1. Understands computing devices and their components, the relationship between hardware and software, and basic techniques of troubleshooting
 - a. Selects and identifies how to operate appropriate software to perform a task
 - b. Identifies and describes, using appropriate terminology, the function of common hardware and how hardware and software work together as a system to accomplish tasks
 - c. Describes, using accurate terminology, and demonstrates how to troubleshoot simple hardware and software problems (e.g., screen is frozen, log-in issues)
2. Understands fundamental concepts related to protecting digital information on the Internet
 - a. Describes what passwords are, why we use them, and why strong passwords are used to protect devices and information
 - b. Describes how to protect personal and digital information on the Internet and why it is important to do so
3. Understands positive and negative impacts of computing technology
 - a. Describes the impact computer science has had on other STEM disciplines, as well as various career fields in and out of the technology sector
4. Understands issues of computing technology related to safety, law, and ethics
 - a. Identifies ways to improve the accessibility and usability of technology products for the diverse needs and wants of users
 - b. Demonstrates how to work respectfully and responsibly with others online and describes the role of seeking out diverse perspectives in improving computational artifacts (e.g., programs, Web pages)
 - c. Recognizes intellectual property rights when using the ideas and creations of others and gives appropriate attribution when creating, remixing, or adapting programs
 - d. Describes public domain and Creative Commons media and the issues that arise from copying or using material created by others without permission
 - e. Describes how to keep log-in information private and the importance of logging out of devices appropriately

Discussion Questions: Computer Science for STEM

- Identify appropriate applications of computer simulations and ways to make computer simulations more efficient.
- Identify purposes and uses of different file formats (e.g., CSV, HTML, JPEG, PNG, PDF).
- Apply different methods to sort, filter, manipulate, and analyze data in spreadsheets.
- Identify whether data show a positive or negative association, and classify data sets as linear or nonlinear.
- Identify the purposes or results of algorithms (e.g., comparing numbers, listing integers, drawing polygons), including algorithms that use loops and conditionals.
- Identify steps to complete algorithms (e.g., moving a point to a certain location on the coordinate plane).
- Identify errors in algorithms and how to fix them (e.g., an algorithm that does not draw the intended polygon, an algorithm that does not draw the intended design on a grid).
- Identify examples of syntax errors.
- Identify the best set of inputs to use when testing an algorithm that returns numeric values.
- Identify different roles for students to take on during collaborative computing tasks (i.e., facilitator, notetaker, computer operator, program tester) and examples of those roles.
- Identify the purposes of code comments.
- Identify definitions of a browser, a network, a router, a server, and an operating system and descriptions of how they work.
- Identify descriptions of hardware acronyms (e.g., CPU, LCD, RAM, ROM, USB).
- Identify examples of input devices (e.g., a keyboard, a scanner) and output devices (e.g., a printer, a speaker).
- Identify ways to troubleshoot simple hardware and software problems (e.g., log-in issues, computer audio issues).
- Identify ways to protect personal information on computers, prevent cyberattacks from occurring, and end cyberattacks while they are occurring.
- Identify definitions and examples of hacking, phishing, and two-factor authentication.
- Identify effects of cybercrime.
- Identify benefits and risks of cloud-based storage.
- Identify the purposes of browser cookies and content-filtering applications.
- Identify factors that contribute to the digital divide.
- Recognize the relationship between traffic flow on a network and network bandwidth.
- Identify accessibility features that are most appropriate for people who have disabilities (e.g., people who are deaf or hard of hearing, people who are blind or visually impaired).

- Apply concepts of copyright, fair use, and public domain to various situations.
 - Identify activities allowed or prohibited under the terms of different Creative Commons licenses (e.g., Attribution-NoDerivs, Attribution-NonCommercial-ShareAlike).
- d. Identifies ways to facilitate students' engagement in productive struggle in STEM education (e.g., the importance of learning from failure, perseverance, adaptability, cooperation, organization, responsibility)

2. Knows how to facilitate equitable access to high-quality instruction for each and every student

III. STEM Pedagogy

A. Students and Learning

1. Knows how to create opportunities for successful learning experiences and outcomes for each and every student
 - a. Identifies ways to organize and deliver STEM instruction using research-based strategies that are developmentally appropriate and responsive to individual students, building on cultural and linguistic differences
 - b. Uses instructional formats (e.g., whole group, small group, partner, individual) skillfully and flexibly in support of STEM learning goals and in consideration of various settings
 - c. Identifies ways to encourage the development of soft skills such as critical thinking, communication, collaboration, and creativity in the STEM classroom
2. Knows how to facilitate equitable access to high-quality instruction for each and every student
 - a. Identifies ways to draw on students' strengths to create inclusive social-learning contexts that engage and build collaboration skills among students in discussions, explorations, and investigations in order to motivate and extend STEM learning opportunities that connect to students' lived experiences
 - b. Identifies ways to support the equitable learning of STEM content by embracing and purposefully incorporating diversities of the classroom and school—cultural, racial, ethnic, ability, linguistic, gender, socioeconomic, developmental, and so forth—and uses this knowledge to motivate and extend learning opportunities in STEM education
 - c. Identifies ways to cultivate positive diverse identities and promote positive dispositions toward all the STEM disciplines, including computer science learning

- d. Identifies examples of the roles of power, privilege, and oppression in the history of STEM education and evaluates existing and proposed educational systems that produce inequitable learning experiences and outcomes for students
 - e. Identifies ways to advocate for the rights and needs of students to secure resources and promote academic advancement in STEM education
 - f. Demonstrates knowledge of educational structures and policies that affect equitable access to quality STEM instruction
- e. Selects and uses a variety of assessment methods—formal and informal, formative and summative—to monitor and evaluate both student STEM learning and instructional effectiveness
 - f. Selects authentic STEM instruction that helps students make connections between STEM and other content areas, careers, and everyday life

2. Understands how to grow professionally as a STEM teacher
 - a. Identifies ways to promote STEM education internally and externally (e.g., to the community, to school staff, to students)
 - b. Identifies ways to collaborate with other school staff to design, implement, evaluate, and improve instruction that integrates knowledge and skills from other core academic subject areas into STEM instruction
 - c. Identifies ways to use self-reflection to keep STEM teaching relevant to students and to remain innovative and up-to-date with new practices, technology, and strategies
 - d. Identifies ways to use professional development (e.g., formal instruction, in-service activities, professional association meetings) to facilitate personal professional growth

B. Curriculum, Assessment, and Professional Development

1. Understands equitable curriculum and assessment practices in the STEM classroom
 - a. Recognizes characteristics of engineering design and identifies design challenges that require students to use the engineering design process
 - b. Identifies ways to adapt and implement a research-based STEM curriculum
 - c. Identifies ways to design and implement STEM instruction that allow students to emphasize problem solving and to develop STEM literacy
 - d. Identifies ways to use appropriate instructional technology equipment, materials, processes, and tools to enhance STEM teaching and to actively engage students in learning

Discussion Questions: STEM Pedagogy

- Identify actions that are appropriate to a teacher's instructional objective and to students' profiles (e.g., students' strengths or weaknesses, students' ages).
- Identify best practices for using STEM challenges with different cohorts of students.
- Identify strategies that keep students engaged in classroom activities.
- Identify the purposes, affordances, and limitations of different grouping strategies (e.g., flexible groups, cooperative learning groups, whole-class instruction).
- Identify ways to help students develop the communication and collaboration skills they need to work in small groups.
- Identify actions (e.g., teacher responses, choosing which tasks to assign) that promote students' engagement in productive struggle.
- Identify practices that engage students (e.g., students with special needs, English learners, students of color, gifted students), meet their needs, and support equitable STEM instruction.
- Identify barriers that prevent equal access to STEM instruction and resources and identify actions that can be taken to address the barriers.
- Identify strategies for self-reflection, setting and meeting goals, and providing effective and meaningful feedback to students.
- Identify steps and activities that are appropriate for the design process as it is used in elementary STEM classrooms.
- Recognize that meeting standards and educational objectives in the context of problem-solving is the primary consideration when designing STEM instruction or instituting new STEM curricula or programs.
- Identify appropriate strategies for teaching elementary students how to safely use materials in the STEM classroom.
- Identify a set of tools that is appropriate for students to use to complete a given STEM challenge.
- Identify the purposes of rubrics, student portfolios, and formative assessments.
- Identify strategies to partner with stakeholders (e.g., school staff, students' parents and guardians, community members) to promote elementary STEM programs.
- Identify strategies for growing professionally as a STEM educator (e.g., reading journal articles, attending conferences).
- Identify the purposes of continuing education and membership in professional associations.

STEM for the Elementary Grades (5036) Sample Test Questions

Sample Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: The test consists of a variety of selected-response questions, where you select one or more answer choices, and questions where you enter a numeric answer in a box.

1. Which of the following steps in the design process is most closely associated with the step of asking a question in the scientific method?
 - (A) Brainstorming possible solutions
 - (B) Creating a model or prototype
 - (C) Defining the problem
 - (D) Selecting an approach

2. Students are working together in groups to use the design process to develop a boat powered by a rubber band.

Which of the following student activities occurs at the step in the design process in which a solution is chosen?

 - (A) Students gather materials and tools and construct a model boat.
 - (B) Students place the boat in the water, record data, and evaluate the effectiveness of the design.
 - (C) Students compare their ideas to the stated criteria and decide on a design that best fits their goals.
 - (D) Students sketch their own ideas about ways to build the boat and configure the rubber-band power source and then discuss those ideas in the group.

3. Which of the following statements describes a risk inherent in using a prototype in the design process?
 - (A) A prototype may be easily discarded.
 - (B) An early prototype may be of low fidelity.
 - (C) The prototyping environment discourages commitment to a particular design.
 - (D) The prototype will validate whether the product meets a target user's requirements.

4. Which of the following is generally the final step in the design process?
 - (A) Communicating results
 - (B) Creating the solution
 - (C) Developing a design proposal
 - (D) Testing and evaluating

5. An elementary STEM teacher is discussing aspects of life cycle management (LCM) with students.

Life cycle management is used to evaluate how a product at each stage of its life cycle will affect the economy, the environment, and which of the following?

 - (A) Businesses
 - (B) Governments
 - (C) Schools
 - (D) Societies

6. Energy resources such as geothermal power, hydropower, solar energy, and wind energy are best categorized as which of the following?
 - (A) Nonorganic resources
 - (B) Nonrenewable resources
 - (C) Renewable resources
 - (D) Recyclable resources

7. A spreadsheet has one row for each of the 50 states in the United States. The row for each state contains the name of the state and the total area of the state to the nearest square kilometer, as shown in the following incomplete table.

State	Total Area (in square kilometers)
Iowa	145,746
Kansas	213,100
Kentucky	104,656
Louisiana	135,659

Which of the following is the best method to list only those states with a total area greater than 200,000 square kilometers?

- (A) Sorting the data on the total area column
 - (B) Summing the entries in the total area column
 - (C) Applying a filter rule to the entries in the total area column
 - (D) Creating a histogram that groups the states by their total areas
8. An algorithm was created to move a robot one time in the pattern of an equilateral triangle, ending in the same position and orientation in which it started. However, the algorithm contained an error in one of the steps, which prevented the robot from moving as intended. The five steps in the algorithm, including the error, are as follows.

Step 1: Start.

Step 2: Move forward 5 inches.

Step 3: Turn right 120 degrees.

Step 4: Repeat steps 2 and 3 three times.

Step 5: Stop.

Of the following, which is the best way to fix the algorithm so the robot will move as intended?

- (A) Revise step 2 to "Move forward 3 inches."
- (B) Revise step 3 to "Turn left 120 degrees."
- (C) Revise step 3 to "Turn right 60 degrees."
- (D) Revise step 4 to "Repeat steps 2 and 3 two times."

9. Which **TWO** of the following are best classified as input devices?
- (A) A keyboard
 - (B) A monitor
 - (C) A mouse
 - (D) A printer
 - (E) A speaker
10. Which **TWO** of the following are risks of cloud-based storage to businesses and organizations?
- (A) Less direct control of storage infrastructure
 - (B) Less long-term reliance on internal IT capabilities
 - (C) Greater flexibility to scale up or down
 - (D) Greater dependence on Internet connections
11. A piece of code is available under a Creative Commons Attribution-NonCommercial-ShareAlike license.
- Which of the following actions is legally permissible under the terms of the license?
- (A) Remixing, transforming, and building on the original code
 - (B) Receiving payment for one's own work based on the original code
 - (C) Licensing one's own work based on the original code under different terms
 - (D) Omitting an appropriate acknowledgment of the creator of the original code
12. Of the following, which is the most important reason for using team-based problem-solving instructional formats to deliver STEM content?
- (A) Teams are more likely to generate different and creative solutions than individuals are.
 - (B) The use of teams allows students with higher ability levels to assist students with lower ability levels.
 - (C) Projects completed by teams are easier for teachers to evaluate than projects completed by individuals.
 - (D) Fewer materials, tools, and equipment are needed when working in teams than when working as individuals.

13. In the first part of an introductory lesson on computer programming, an elementary STEM teacher introduces students to a block code as a whole class and then provides a segment of the block code that students will add to in the next part of the lesson. Since the block code is new to the students, the teacher wants the format of the next part of the lesson to maximize the development of students' ability to use the code while minimizing students' errors, frustration, and questions.

For the next part of the lesson, which of the following instructional formats best meets the teacher's goal?

- (A) Having student volunteers come up to the projected computer one at a time to add to the code
 - (B) Having students work on their own computers as individuals to add to the code
 - (C) Having many pairs of students share one computer per pair and work together to add to the code
 - (D) Having a few large groups of students share one computer per group and work together to add to the code
14. A group of students in an elementary STEM class designed a prototype for a STEM challenge. During the testing phase of the design process, the prototype failed.
- Which of the following actions is best for the students' teacher to take in response to this outcome?
- (A) Communicating to the students why the prototype failed and giving them directions on how to fix it
 - (B) Communicating to the students that their design is incorrect and that they should try to learn from this experience for the next challenge
 - (C) Encouraging the students to start the design process from the beginning again and create a completely new plan for the prototype
 - (D) Encouraging the students to evaluate their design, determine what did not work, and refine the prototype to satisfy the requirements of the challenge

15. Which of the following strategies would be most important for an elementary STEM teacher to employ to address inequitable STEM learning experiences and outcomes for students?
- (A) Applying for a grant to obtain more robots and 3-D printers for the school
 - (B) Proposing a new after-school STEM program for students who show interest
 - (C) Creating a hallway bulletin board that showcases children's parents who have careers related to STEM
 - (D) Evaluating the existing STEM program in the school to identify areas in which action is needed to advance opportunities for all students
16. A committee of elementary STEM teachers is meeting to begin the process of finding a software program to improve students' drawing and sketching skills.
- Which of the following steps should the committee take first in the process?
- (A) Conducting a survey to determine which software is used by the most districts
 - (B) Deciding what educational goals and objectives the software should meet
 - (C) Determining the amount of money available to obtain the software
 - (D) Obtaining approval from the school board for the purchase of software
17. One of the students in an elementary STEM teacher's class repeatedly announces loudly to the class, "This class is so boring. When are we ever going to use this in real life?"
- Which of the following actions is best for the teacher to take first to support the student as well as the rest of the class?
- (A) Having a class discussion to learn more about each student's interests outside of STEM and finding or creating challenges related to those interests
 - (B) Giving daily quizzes that spiral through content taught throughout the year and posting results on the class bulletin board to motivate students to study more
 - (C) Contacting students' parents or guardians to find out more about factors in students' lives and to remind families of the importance of STEM for future careers
 - (D) Having students fill out a weekly survey that requires them to reflect on their behavior in the class and to identify steps that they will take in areas in which improvement is needed

18. An elementary STEM teacher wants upper elementary students to share the projects they complete during the first half of the school year with the largest possible audience within the school.

Which of the following strategies is the best for the teacher to use for this purpose?

- (A) Holding a STEM fair where students display their projects and describe them to teachers and other students
 - (B) Designing a bulletin board with examples of students' work to display in the teachers' lounge
 - (C) Having the principal visit the STEM classroom to observe how the students work
 - (D) Inviting members of the community to partner with students to complete projects
19. Which of the following is likely the most effective way for an elementary STEM teacher to encourage school staff members to integrate STEM across the curriculum?
- (A) Printing copies of a research article that gives reasons why it is important to integrate STEM across the curriculum and putting a copy in each staff member's mailbox
 - (B) Using time allotted for staff professional development to share projects that students have been working on in class and discuss ways to integrate STEM across the curriculum
 - (C) Recording a video of students describing how their work in STEM class integrates with their work in other classes, posting the video on social media, and e-mailing a link to the post to all school staff members
 - (D) E-mailing all school staff members with a link to a professional development video that gives reasons why it is important to integrate STEM across the curriculum and a set of reflection questions for them to complete on their own time

Answers

1. Option (C) is correct. A scientist using the scientific method starts by asking a question and then develops one or more experiments to answer the question. An engineer using the design process starts by defining, or identifying, the problem and then develops a solution to the problem. Thus, the step of defining the problem in the design process is most closely associated with the step of asking a question in the scientific method.
2. Option (C) is correct. In the step in the design process in which a solution is chosen, the approach that best meets the requirements for the product is determined and any approaches that do not meet the requirements are rejected. Therefore, in this step, students would compare their ideas to the given criteria and decide which design best meets their goals. The activities in options (A), (B), and (D) occur at the steps in which a prototype is built, the design is tested, and solutions are brainstormed, respectively.
3. Option (B) is correct. Although early low-fidelity prototypes, such as drawings and storyboards, are quick and easy to create, they are very basic, they do not provide a clear idea of what works and what does not work during testing, and they have limited interactivity.
4. Option (A) is correct. The final step in the design process is to communicate results. Thorough documentation enables the final product to be created according to the specifications. Note that the steps given in the other options must be completed before results can be communicated.
5. Option (D) is correct. Life cycle management is used to understand and analyze life cycle stages of products and services; identify potential economic, environmental, and social risks and opportunities at each stage; and identify and develop ways to reduce the potential risks and take action on the potential opportunities.
6. Option (C) is correct. Renewable resources are natural resources that naturally replenish themselves rather quickly and as such can be used sustainably despite being consumed. Geothermal power, hydropower, solar energy, and wind energy all fit this description.
7. Option (C) is correct. Applying a filter rule will result in a list of only those states that meet the criterion of the filter. Note that the method in option (A) will list all 50 states, not just the states that meet the area criterion, and the methods in options (B) and (D) do not provide the data requested.
8. Option (D) is correct. After steps 2 and 3 are performed, one side of the equilateral triangle has been completed, so steps 2 and 3 need to be repeated only two more times to complete the equilateral triangle. If step 4 is revised from "Repeat steps 2 and 3 three times" to "Repeat steps 2 and 3 two times," the algorithm will move the robot in the pattern of an equilateral triangle one time, and the robot will stop in the same position and orientation in which it started.

9. Options (A) and (C) are correct. An input device takes information from a user and delivers it to the computer. Option (A) is correct because a keyboard receives typed input from the user and sends the data to the computer. Option (C) is correct because a mouse receives motion input from the user, which allows control of the graphical user interface of the computer. Note that a monitor, a printer, and a speaker are examples of output devices.
10. Options (A) and (D) are correct. Risks involved in the shift of responsibilities to a cloud-based storage provider are the reduction in direct control of the storage and an increased dependence on Internet access, which is required to access the data in a cloud-based storage system. Options (B) and (C) are benefits of using cloud-based storage.
11. Option (A) is correct. The Creative Commons Attribution-NonCommercial-ShareAlike license allows others to copy and redistribute material as well as remix, adapt, and build on the material. However, the material may not be used for commercial purposes, any adaptations made to the material must be distributed under the same license as the original material, and appropriate credit must be given to the creator of the material.
12. Option (A) is correct. Working in teams when engaging in the design process gives all students the opportunity to participate in the problem-solving process and combine their ideas, which can lead to a wider variety of possible solutions.
13. Option (C) is correct. Pair programming gives students the opportunities to collaborate and practice that they need to build new skills. Note that the formats described in options (A) and (D) would limit students' hands-on experience with the code, and the format described in option (B) does not provide students with an opportunity to learn from others and thus provides less support when difficulties arise.
14. Option (D) is correct. It is important for students in STEM classes to be supported in persevering and learning from their mistakes when they are engaged in the design process. Note that the actions described in options (A), (B), and (C) do not give students an opportunity to discover on their own where improvements to the prototype need to be made.
15. Option (D) is correct. Evaluating the school's current STEM program would help target inequities in the school and is therefore the most likely strategy to lead to solutions to inequities of the strategies given.
16. Option (B) is correct. Effective curriculum development, which includes the selection of instructional materials, always begins with identifying sound educational goals, objectives, and standards.

17. Option (A) is correct. If the teacher can connect the content covered in the STEM class with the student's interests and life outside of school, the student is likely to find the content of the unit more engaging and meaningful. The action in option (B) is inappropriate because assessment results are posted publicly and the action would have a negative impact on the whole class. The action in option (C) skips what should be the first step of working with the student to find a productive solution. The action in option (D) addresses the behavior of the class overall rather than addressing the key concern of one student's actions and learning.
18. Option (A) is correct. A STEM fair promotes active engagement with a broad sector of the community in the school. Note that the scope of the strategies in options (B) and (C) is more limited than that in option (A), and the strategy in option (D) is not focused on the community in the school.
19. Option (B) is correct. Of the actions described, the action in option (B) is the only one that gives staff the opportunity to discuss ways to integrate STEM across the curriculum rather than considering it on their own. In addition, there are no privacy concerns with this approach, and staff members are more likely to be open to the experience if it takes place during time when they already have work responsibilities.

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from seeing them on other standardized tests you have taken. If not, familiarize yourself with them so that you won't have to spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions you will respond by selecting an oval to choose a single answer from a list of answer choices.

However, interactive question types may also ask you to respond doing the following:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text, or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question, you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essay questions and short-answer questions are types of questions that call for a constructed response.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. For such questions, you must support your position with specific reasons and examples from your own experience, observations, or reading.

Following are a few sample essay topics to review:

- *Brown v. Board of Education of Topeka*
 “We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other ‘tangible’ factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does.”
 - A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
 - B. What was the rationale given by the justices for their 1954 ruling?
- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*
 - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
 - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.
- *“Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people who need a job.”*
 - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and should not be filled with unnecessary information.
5. **Take notes on scratch paper so that you don't miss any details.** Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you intended to write. Do not leave sentences unfinished or omit clarifying information.

General Assistance For The Test

Praxis® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

ETS provides a free interactive practice test with each test registration. You can learn more [here](#).

Doing Your Best

Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your *Praxis* test and make the best use of your time. Learn more at [Strategy and Tips for Taking a *Praxis* Test](#).

Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at [Develop a Study Plan](#).

Helpful Links

[Ready to Register](#) – How to register and the information you need to know to do so.

[Disability Accommodations](#) – Testing accommodations are available for test takers who meet ETS requirements.

[PLNE Accommodations \(ESL\)](#) – If English is not your primary language, you may be eligible for extended testing time.

[What To Expect on Test Day](#) – Knowing what to expect on test day can make you feel more at ease.

[Getting Your Scores](#) – Find out where and when you will receive your test scores.

[State Requirements](#) – Learn which tests your state requires you to take.

[Other Praxis Tests](#) – Learn about other *Praxis* tests and how to prepare for them.

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