



BioSTEM Practicum

Primary Career Cluster:	Science, Technology, Engineering, and Mathematics (STEM)
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C21H10
Prerequisite(s):	<i>BioSTEM III</i> (C21H09)
Credit:	1
Grade Level:	11, 12
Focus Elective Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other <i>STEM</i> courses.
Program of Study (POS) Concentrator:	This course satisfies one out of two required courses that meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
Programs of Study and Sequence:	This is the fourth course in the <i>BioSTEM</i> program of study.
Aligned Student Organization(s):	SkillsUSA: http://www.tnskillsusa.com Technology Student Association (TSA): http://www.tntsa.org
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit https://tn.gov/education/topic/work-based-learning .
Promoted Student Industry Credentials:	Credentials are aligned with post-secondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html
Teacher Endorsement(s):	013, 014, 015, 016, 017, 018, 047, 070, 078, 081, 125, 126, 127, 128, 129, 157, 210, 211, 212, 213, 214, 230, 232, 233, 413, 414, 415, 416, 417, 418, 449, 470, 477, 519, 531, 595, 596, 700, 740, 760, 982
Required Teacher Certifications/Training:	Teachers who have never taught this course must attend training provided by the Department of Education.
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-stem.html Best for All Central: https://bestforall.tnedu.gov/

Course-At-A-Glance

There is no one way to create meaningful learning experiences for students. There are best practices available that data and students say impact long-term student learning. One of those best practices is to put student learning in context with their experiences.

Career and Technical Student Organizations (CTSOs) provide an opportunity for students to display their learning in the classroom and through regional, state, and/or national competition. Work-based Learning (WBL) consists of sustained and coordinated work-based activities that relate to the course content. These activities should occur at every level through a program of study. Below is a listing of possible CTSO connections and WBL activities for this course. This listing is intended to be an idea starter and not a comprehensive listing.

Using a Career and Technical Student Organization (CTSO) in Your Classroom

Putting the classroom learning into real life experiences is often what creates a meaningful learning experience for students, one that lasts beyond the exam and course. CTSOs are a great resource to create this type of learning for your students. They are also a great resource to showcase your students learning through regional, state, and national competitions. Possible connections for this course include the following. This is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management
- Participate in contests that highlight job skill demonstration; interviewing skills; community service activities, extemporaneous speaking, and job interview
- Participate in leadership activities such as National Leadership and Skills Conference, National Week of Service, 21st Century Skills

For more ideas and information, visit Tennessee SkillsUSA at <http://www.tnskillsusa.com> and Technology Student Association (TSA): <http://www.tntsa.org>

Using Work-based Learning in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1-6** | Partner students with an industry mentor who can provide career guidance.
- **Standards 7-10** | Ask an industry rep to discuss professional ethics in BioSTEM.
- **Standards 11-14** | Internship.
- **Standards 15-16** | Create a portfolio to be evaluated by industry representatives.

For more ideas and information, visit <https://www.tn.gov/education/career-and-technical-education/work-based-learning.html>.

Course Description

BioSTEM Practicum is the fourth course in the STEM cluster for students interested in learning more about careers in science, technology, engineering and mathematics with emphasis in Biotechnology. This course provides opportunity for students to use skills and content learned during the first three courses in a real-world university or industry lab setting. Upon completion of this course, proficient students are able to identify, explain, and execute lab-based research utilizing the scientific inquiry processes. They will conduct research to develop meaningful questions, define simple problem scenarios and scientific investigations, develop fundamental design solutions, conduct basic mathematical modeling and data analysis, and effectively communicate solutions and scientific explanations to others. Students also will gain knowledge in how a biotechnology business works.

Note: For clarity, some standards include example applications to science, technology, engineering, and mathematics. Teachers are encouraged to align instruction to one or more of these areas, depending on area of expertise and student interest.

Program of Study Application

This is the fourth course in the BioSTEM program of study. For more information on the benefits and requirements of implementing this program in full, please visit the STEM website at <https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-stem.html>.

Course Standards

- 1) A student will have a Personalized Learning Plan that identifies their long-term goals, demonstrates how the Work-Based Learning (WBL) experience aligns with their elective focus and/or high school plan of study, addresses how the student plans to meet and demonstrate the course standards, and addresses employability skill attainment in the following areas:
 - a. Application of academic and technical knowledge and skills (embedded in course standards)
 - b. Career knowledge and navigation skills
 - c. 21st Century learning and innovation skills
 - d. Personal and social skills

BioSTEM Career Planning

- 2) Research a company or organization that utilizes BioSTEM applications or specializes in BioSTEM solutions. Companies could range from large biotech developers, to niche organizations that retain specialists on staff to serve their particular clients' needs. For the chosen company, cite specific textual evidence from the company's literature, as well as press coverage (if available) to summarize:
 - a. The mission and history of the organization
 - b. Headquarters and organizational structure
 - c. Products or services provided
 - d. Credentials required for employment and how they are obtained and maintained
 - e. Policies and procedures
 - f. Reports, newsletters, and other documents published by the organization
 - g. Website and contact information

- 3) Analyze the requirements and qualifications for various BioSTEM job postings identified from specific company websites or online metasearch engines. Gather information from multiple sources, such as sample resumes, interviews with professionals, and job boards, to determine effective strategies for realizing career goals. Create a personal resume modeled after elements based on the findings above, then complete an authentic job application as part of a career search or work-based learning experience.
- 4) Search for BioSTEM resumes retrieved from the websites of institutions, organizations, or professional networks. Discuss what is typically included in the resumes of BioSTEM professionals, compare and contrast several examples, and create a personal resume modeled after elements identified in the search.
- 5) Conduct a job search and simulate the experience by researching local employment options. In preparation for a future career in BioSTEM, complete an authentic job application form and compose a cover letter following guidelines specified in the vacancy announcement.
- 6) Participate in a mock interview. Prior to the interview, prepare a artifact that includes the following: tips on dress and grooming, most commonly asked interview questions, appropriate conduct during an interview, and recommended follow-up procedures. Upon completion of the interview, write a thank you letter to the interviewer in a written or email format.

Professional Ethics and Legal Responsibilities

- 7) Investigate current issues surrounding BioSTEM and its applications. Explore a range of arguments concerning privacy rights as they relate to the mining of personal data; determine when it is ethical and legal to collect data for profit versus for not-for-profit purposes. Advance an original argument that debates the pros and cons and summarizes the potential ramifications for clients, the public, and one's own personal reputation, drawing on evidence gathered from news media, company policies, and state and federal laws.
- 8) Research a case study involving an ethical issue related to intellectual property rights. Examine a variety of perspectives surrounding the issue, then develop an original analysis explaining the impact of the issue on those involved, using persuasive language and citing evidence from the research. Potential issues include copyright infringement, piracy, plagiarism, creative commons, and the state/federal laws that govern them.

Safety

- 9) Accurately read and interpret safety rules, including but not limited to rules published by the National Science Teachers Association (NSTA), rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between the rules and explain why certain rules apply.

- 10) Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment. Incorporate safety procedures and complete safety test with 100 percent accuracy.

Transferring Course Concepts to Practicum

- 11) Apply skills and knowledge from previous courses in an authentic work-based learning internship, job shadow, or classroom-based project. Where appropriate, develop, practice, and demonstrate skills outlined in previous courses.
- 12) Define a discreet question and execute a research project to answer that question. Document all lab work in a lab notebook. Communicate results of project by a written paper or poster.
- 13) Continually update a lab notebook to document skills learned during the practicum and draw connections between the experience and previous course content.
- 14) Create and continually update a personal journal to document skills learned during the practicum and draw connections between the experience and previous course content by reflecting on:
 - a. Tasks accomplished and activities implemented
 - b. Positive and negative aspects of the experience
 - c. How challenges were addressed
 - d. Team participation in a learning environment
 - e. Comparisons and contrasts between classroom and work environments
 - f. Interactions with colleagues and supervisors
 - g. Personal career development
 - h. Personal satisfaction

Capstone Project

- 15) Using the scientific method, design a BioSTEM research project or experiment to investigate BioSTEM applications in healthcare, the food industry, the environment, agriculture, forensics, or related fields. Upon completion of the project, develop a technology-enhanced presentation showcasing highlights, challenges, and lessons learned from the experience. The presentation should be delivered orally, but supported by relevant graphic illustrations, such as diagrams, drawings, and models of project findings, and/or physical artifacts that represent the outcome of the project (i.e., a prototype or 3-D model). Prepare the presentation in a format that could be presented to both a technical and a non-technical audience, as well as for a career and technical student organization (CTSO) competitive event.
 - a. Research to determine the task or topic
 - b. Exploration of the task or topic
 - c. Literature review
 - d. Collection and evaluation of sources

- e. Thesis/hypothesis proposal and annotated bibliography
 - f. Revision and final draft of thesis/hypothesis
 - g. Outline/plan of action for paper or experiment
 - h. Data collection/development of research ideas and narratives
 - i. Submission of first draft of paper/lab report
 - j. Feedback, revision, and submission of final draft
 - k. Reflection and evaluation
- 16) Create a portfolio, or similar collection of work, that illustrates mastery of skills and knowledge outlined in the previous courses and applied in the practicum. The portfolio should reflect thoughtful assessment and evaluation of the progression of work involving the application of steps of the scientific method (depending on the nature of the work-based learning project). The following documents will reside in the career portfolio:
- a. Career and professional development plan
 - b. Resume
 - c. List of responsibilities undertaken through the course
 - d. Examples of visual materials developed and used during the course (such as graphics, drawings, models, presentation slides, videos, and demonstrations)
 - e. Description of technology used, with examples if appropriate
 - f. Periodic journal entries reflecting on tasks and activities
 - g. Feedback from instructor and/or supervisor based on observations

Standards Alignment Notes

*References to other standards include:

- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
 - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.