Department of Education | College, Career and Technical Education

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STEM IV: STEM Practicum

Primary Career Cluster:	Science, Technology, Engineering, and Mathematics (STEM)
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C21H18
Prerequisite(s):	*STEM III: STEM in Context* (C21H17)
Credit:	1
Grade Level:	12
Focus Elective Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other *STEM* 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 *STEM Education* 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 who hold an active WBL certificate may offer placement for credit when the requirements of the state board's WBL Framework and the Department's WBL Policy Guide are met. For information, visit https://www.tn.gov/education/career-and-technical-education/work-based-learning.html.
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 the 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/

Approved April 10, 2015; Amended January 25, 2018

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 1-2**| Invite an OSHA rep to discuss occupational hazards.
- **Standards 3-6**| Provide students an industry mentor to discuss career preparation and employment.
- **Standards 7** | Invite a local scientist to discuss scientific foundations.
- **Standards 8-12** | Internship with portfolio evaluation by an industry professional.

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

Course Description

STEM IV: STEM Practicum is a capstone course intended to provide students with the opportunity to apply the skills and knowledge learned in previous *STEM Education* courses within a professional, working environment. In addition to developing an understanding of the professional and ethical issues encountered by STEM professionals in the workplace, students learn to refine their skills in problem solving, research, communication, data analysis, teamwork, and project management. The course is highly customizable to meet local system needs: instruction may be delivered through school laboratory training or through work-based learning arrangements such as internships, cooperative education, service learning, mentoring, and job shadowing. Upon completion of this course, proficient students will be prepared for postsecondary study in a STEM field.

Note: Mastery of the following standards should be attained while completing a STEM project in a practicum setting. The project should follow the scientific inquiry or engineering design process learned in previous courses.

Work-Based Learning Framework

Practicum activities may take the form of work-based learning (WBL) opportunities (such as internships, cooperative education, service learning, and job shadowing) or industry-driven project-based learning. These experiences must comply with the Work-Based Learning Framework guidelines established in SBE High School Policy 2.103. As such, this course must be taught by a teacher with an active WBL Certificate issued by the Tennessee Department of Education and follow policies outlined in the Work-Based Learning Policy Guide available online at https://www.tn.gov/education/career-and-technical-education/work-based-learning.html. The Tennessee Department of Education provides a Personalized Learning Plan template to ensure compliance with the Work-Based Learning Framework, state and federal Child Labor Law, and Tennessee Department of Education policies, which must be used for students participating in WBL opportunities.

Program of Study Application

This is the fourth course in the *STEM Education* 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 Requirements

This capstone course aligns with the requirements of the Work-Based Learning Framework (established in Tennessee State Board High School Policy), with the Tennessee Department of Education's Work-Based Learning Policy Guide, and with state and federal Child Labor Law. As such, the following components are course requirements:

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

Safety

1) 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.

2) 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.

STEM Employment Research and Preparation

3) Research and select a company or organization for a work-based learning project in a STEM area of choice. Cite specific textual evidence from the organization's literature as well as independent news articles 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

4) Search for the resumes and curricula vitae (CVs) of scientists, engineers, and researchers retrieved from the websites of institutions, organizations, or professional networks. Discuss what is typically included in the resumes and CVs of STEM professionals, compare and contrast several examples, and create a personal resume or curriculum vitae 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 STEM, 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 paper 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.

Ethics

7) Collect codes of ethics from various professions related to the STEM area of choice, such as the National Society of Professional Engineers (NSPE) Code of Ethics for Engineers and the American Society for Clinical Laboratory Science (ASCL) Code of Ethics. Participate in a class discussion on the significance of following ethical standards in the STEM fields. Synthesize principles from the codes investigated to create a personal code of ethics related to a STEM area of choice.

Transferring Course Concepts to Practicum

8) 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 from previous courses.

9) Create and continually update a personal journal to document 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

Portfolio

10) 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 inquiry or the engineering design process (depending on the nature of the work-based learning project). The following documents will reside in the career portfolio:
    a. Personal code of ethics
    b. Career and professional development plan
    c. Resume or Curriculum Vitae
    d. List of responsibilities undertaken through the course
    e. Examples of visual materials developed and used during the course (such as graphics, drawings, models, presentation slides, videos, and demonstrations)
    f. Description of technology used, with examples if appropriate
    g. Periodic journal entries reflecting on tasks and activities
    h. Feedback from instructor and/or supervisor based on observations

Communication of Project Results

11) Apply all steps of the scientific inquiry or the engineering design process (depending on the nature of the project) to successfully generate a hypothesis or prototype, collect the relevant

data, perform the necessary tests, interpret the results, make modifications to models or prototypes, and communicate results over the course of the project's duration. Produce a technical report documenting the findings of the project and justifying the final conclusions based on evidence obtained.

12) Upon completion of the practicum, 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.

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.