2013 Transportation Logistics

Mississippi Department of Education

Program CIP: 52.0203 – Transportation Logistics, Materials, and Supply Chain Management

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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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The Center for Logistics, Trade, and Transportation (CLTT), located in Hattiesburg and Gulfport MS, as part of the University of Southern Mississippi, is the result of an integrated effort of industry, government, and The University of Southern Mississippi. The CLTT provides a competitive advantage to industry and government agencies through its multidisciplinary activities in Logistics, Trade, and Transportation. Logistics, Trade, and Transportation encompass the movement of goods and people (logistics) through the most efficient means (intermodal transportation) to achieve economic development (trade).
https://www.usm.edu/logistics-trade-transportation/index

Additional curriculum materials were made possible through grant monies from the Mississippi State University's National Center for Intermodal Transportation for Economic Competitiveness (NCITEC). http://www.ncitec.msstate.edu/

Standards

Standards are superscripted in each unit and referenced in the appendices. Standards in the Transportation Logistics *Curriculum Framework and Supporting Materials* are based on the following:

American Society of Transportation and Logistics Standards

The Transportation Logistics Career Cluster Content Standards were developed by the American Society of Transportation and Logistics (AST&L) to serve as a guide for what students should know or be able to do through a study of logistics in grades 11–12 and 2-year postsecondary programs. The standards were extensively researched and reviewed by leaders in the logistics industry, secondary and postsecondary instructors, and university specialists. The standards can be accessed at http://www.astl.org.

Common Core State Standards Initiative

The Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy. Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved. States and territories of the United States as well as the District of Columbia that have adopted the Common Core State Standards in whole are exempt from this provision, and no attribution to the National Governors Association Center for Best Practices and Council of Chief State School Officers is required. Reprinted from http://www.corestandards.org/.

National Educational Technology Standards for Students

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21st Century Skills and Information and Communication Technologies Literacy Standards

In defining 21st-century learning, the Partnership for 21st Century Skills has embraced five content and skill areas that represent the essential knowledge for the 21st century: global awareness; civic engagement; financial, economic, and business literacy; learning skills that encompass problem-solving, critical-thinking, and self-directional skills; and information and communication technology (ICT) literacy.

Preface

Secondary career and technical education programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Mississippi Teacher Professional Resources

There are several resources for Mississippi teachers.

My PLC: An online registration for all professional-development sessions

To register for any session, teachers will need an account in the registration system, MyPLC, https://myplc.rcu.msstate.edu. To create an account, click on the link and navigate to the "Request a Guest ID" link. The ID should be the teacher's first initial and last name and the last four (4) digits of the social security number. Teachers should complete the entire form, which will then be sent to a secure server. Upon activation of the teacher's account, he or she will receive an e-mail with login instructions. The teacher may then browse for the available sessions and register for the desired courses.

Should you need additional instructions, please call 662.325.2510.

Blackboard/PACE site: An online resource

Preparation for Academic and Career Education (PACE) sites have been created for Mississippi career and technical educators to have one central location for obtaining information regarding their teaching practice and classrooms. Each of the 16 career clusters has an individual site. Within the appropriate PACE site, a career pathway that is currently taught in Mississippi schools will be located, along with information from the Mississippi Department of Education (MDE) state curriculum coordinator, the MDE student organization coordinator, and the Research and Curriculum Unit (RCU) curriculum specialist. As information that is relevant to an educator's particular course is available, this information will be posted to the PACE site.

To log in to Blackboard:

1. Visit http://rcu.blackboard.com.
2. Log in with your first initial, last name, and last four (4) digits of your social security number (e.g., ddorroh3456).
3. Input the password: rcu.
4. Should you need additional instructions, please call 662.325.2510.

Executive Summary

Pathway Description

Transportation Logistics is a pathway designed to introduce students to the broad field of supply chain management. The program includes instruction in the applied processes related to transportation logistics as well as introduces students to transportation practices and maintenance of facilities and equipment. Students in the pathway will participate in active learning exercises, including integral activities and supervised experiences that highlight key logistics concepts. Students who successfully complete the competencies in this pathway will possess fundamental knowledge and skills that can be used to secure entry-level employment or as a foundation for continuing their education. Industry standards are adapted from the publication Career Cluster Resources for Transportation Logistics, developed by the National Association of State Directors of Career and Technical Education.

Industry Certification

The Global Logistics Associate (GLA) certificate from the American Society for Transportation and Logistics (AST&L) is a national, industry-recognized certification for entry-level, high school graduates. All competencies and suggested performance indicators in the Transportation Logistics course are driven by the (AST&L) Content Standards. The standards can be found at http://www.astl.org.

Assessment

Students will be assessed using the American Society for Transportation and Logistics Global Logistics Associate (GLA) Certificate Exam. If there are questions regarding assessment of this program, please contact the instructional design specialist at the Research and Curriculum Unit at 662.325.2510.

Student Prerequisites

In order for students to be able to experience success in the Transportation Logistics program, the following student prerequisites are required:

1. C or higher in English (the previous year)
2. C or higher in Math (last course taken or the instructor can specify the math)
3. Instructor approval and a TABE Reading Score of eighth grade or higher

or

1. TABE Reading Score of eighth grade or higher
2. Instructor approval

or

1. Instructor approval

Applied Academic Credit

At this time, no applied academic credit is available for this pathway.

Teacher Licensure

The latest teacher licensure information can be found at http://www.mde.k12.ms.us/educator-licensure.

Professional Learning

If you have specific questions about the content of any of the training sessions provided, please contact the Research and Curriculum Unit at 662.325.2510, and ask for a professional-learning specialist.

Course Outlines

Option 1—Four 1-Carnegie-Unit Courses

This curriculum consists of four one-credit courses, which should be completed in the following sequence:

1. Transportation Logistics: Fundamentals of Transportation Logistics—Course Code: 997302
2. Transportation Logistics: Receiving and Stocking—Course Code: 997303
3. Transportation Logistics: Material Handling—Course Code: 997304
4. Transportation Logistics: Supply Chain Management—Course Code: 997305

Course Description: Transportation Logistics: Fundamentals of Transportation Logistics
This course provides a broad understanding of the Fundamentals of Transportation Logistics. The course includes the overview of the industry as well as the introductory materials to the transportation logistics profession.

Course Description: Transportation Logistics: Receiving and Stocking
This course covers the taking in and storage of materials found in any Transportation Logistics facility. All safety and broad concepts are continued in this course.

Course Description: Transportation Logistics: Material Handling
This course covers the handling of materials found in most Transportation Logistics facilities. New concepts of Intermodal Transportation as well as the physical and technical requirements are introduced with multiple activities to integrate the technology and higher-order thinking skills into the workplace.

Course Description: Transportation Logistics: Supply Chain Management
This course integrates most Transportation Logistics concepts into what the industry is all about. The technology, the impact, and all the principles of receiving, storing, tracking, managing, and shipping goods are all used to satisfy this course.

Course Name Transportation Logistics: Fundamentals of Transportation Logistics**—Course Code: 997302**

Unit	Unit Name	Hours
1	Orientation, Advanced Leadership, and Employability Skills	10
2	Environmental Safety and Health	15
3	Overview of Supply Chain Management, Transportation, and Distribution	15
4	Basic Material-Handling Equipment and Technology	35
5	Procurement and Inventory Management	30
Total		105

Course Name Transportation Logistics: Receiving and Stocking**—Course Code: 997303**

Unit	Unit Name	Hours
6	Receiving, Stocking, and Put-away Procedures	50
7	Order Selection and Packing Procedures	55
Total		105

Course Name Transportation Logistics: Material Handling**—Course Code: 997304**

Unit	Unit Name	Hours
8	Environmental Safety & Health and Year 1 Review	35
9	Introduction to Intermodal Transportation	35
10	Advanced Material-Handling Equipment and Technology	35
Total		105

Course Name Transportation Logistics: Supply Chain Management**—Course Code: 997305**

Unit	Unit Name	Hours
11	Managing Distribution Center and Warehouse Facilities	40
12	Logistics and Supply Chain Management	65
Total		105

Option 2—Two 2-Carnegie-Unit Courses

This curriculum consists of two two-credit courses, which should be completed in the following sequence:

1. Transportation Logistics I —Course Code: 997300
2. Transportation Logistics II—Course Code: 997301

Course Description: Transportation Logistics I
This course provides a broad understanding of the Fundamentals of Transportation Logistics. The course includes the overview of the industry as well as the introductory materials to the transportation logistics profession. This course also covers the taking in and storage of materials found in any Transportation Logistics facility. All safety and broad concepts are continued in this course.

Course Description: Transportation Logistics II
This course covers the handling of materials found in most Transportation Logistics facilities. New concepts of Intermodal Transportation as well as the physical and technical requirements are introduced with multiple activities to integrate the technology and higher-order thinking skills into the workplace. This course also integrates most Transportation Logistics concepts into what the industry is all about. The technology, the impact, and all the principles of receiving, storing, tracking, managing, and shipping goods are all used to satisfy this course.

Course Name Transportation Logistics I **—Course Code: 997300**

Unit	Unit Name	Hours
1	Orientation, Advanced Leadership, and Employability Skills	10
2	Environmental Safety and Health	15
3	Overview of Supply Chain Management, Transportation, and Distribution	15
4	Basic Material-Handling Equipment and Technology	35
5	Procurement and Inventory Management	30
6	Receiving, Stocking, and Put-away Procedures	50
7	Order Selection and Packing Procedures	55
Total		210

Course Name Transportation Logistics II**—Course Code: 997301**

Unit	Unit Name	Hours
8	Environmental Safety & Health and Year 1 Review	35
9	Introduction to Intermodal Transportation	35
10	Advanced Material-Handling Equipment and Technology	35
11	Managing Distribution Center and Warehouse Facilities	40
12	Logistics and Supply Chain Management	65
Total		210

Research Synopsis

Introduction

The Transportation Logistics Cluster covers the broad field of occupations related to the transportation of goods and services. Projections for the year 2020 indicate that occupations within this area will be in high demand and well paying. In fact, jobs within the Transportation Logistics Cluster are expected to increase 11% in the Mississippi region and 10% nationally, which is above-average growth in comparison to other jobs in the United States (EMSI, 2011). Some occupations in Transportation Logistics require a bachelor's degree, and job prospects will be best for those with job experience and 4-year degrees.

Needs of the Future Workforce

Data for this synopsis were compiled from employment projections prepared by the Mississippi Department of Employment Security and the U. S. Department of Labor.

Description	2011 Jobs	2020 Jobs	Change	% Change	2011 Average Earnings	2011 Establishments
Regional Total	52,770	58,396	5,626	11%	$44,937	2,490
National Total	5,750,903	6,321,177	570,274	10%	$51,894	234,250

Source: EMSI Complete Employment - 2011.4

Perkins IV Requirements

The Transportation Logistics curriculum meets Perkins IV requirements of high-skill, high-wage, and/or high-demand occupations by introducing students to and preparing them for supply-chain occupations. It also offers students a program of study, including secondary, postsecondary, and Institutions of Higher Learning (IHL) courses, that will prepare them for occupations in these fields. Additionally, the Transportation Logistics curriculum is integrated with academic Common Core Standards. Lastly, this curriculum focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Curriculum Content

Summary of Standards

The standards to be included in the Transportation Logistics curriculum are the American Society for Transportation and Logistics, Common Core Standards, 21st Century Skills, and the National Educational Technology Standards (NETS) for Students. Mastery of these standards will result in highly skilled, well-rounded students who are prepared to enter a postsecondary academic or career and technical program of study. They will also be prepared to compete academically at a national level, as the Common Core Standards are designed to prepare students for success in community colleges, IHLs, and the workforce.

Academic Infusion

The Transportation Logistics curriculum is aligned with the Common Core Standards. The curriculum provides multiple opportunities to enhance and reinforce these academic skills. Since students will be required to communicate effectively in the classroom as well as in the workforce, there are several writing-focused activities included throughout the curriculum. Students will also learn to preform calculations and to use strategic and critical thinking skills to solve real-world problems.

Transition to Postsecondary Education

The following articulation plan is in place for the Transportation Logistics Pathway.

Statewide Guidelines on Articulated Credit

Eligibility

- To be eligible for articulated credit, a student must do the following:
    - Complete the articulated Secondary Career and Technical Program.
    - Score 80% or higher on the Mississippi Career Planning and Assessment System (MS CPAS2) in his or her secondary program of study.

- To be awarded articulated credit, a student must do the following:
    - Complete application for articulated credit at the community or junior college.
    - Enroll in the community or junior college within 18 months of graduation.
    - Successfully complete 12 non-developmental career/technical or academic credit hours in the corresponding articulated postsecondary career-technical program of study.

How MS CPAS2 Will Be Documented

- The Research and Curriculum Unit of Mississippi State University will provide the Mississippi Community College Board (MCCB) with a list of all secondary career and technical education (CTE) students scoring at or above the 80th percentile for the articulated programs.
- The MCCB will forward the list of students eligible for articulated credit to the colleges.

Transcripting of Articulated Credit

- Students must complete 12 non-developmental career/technical or academic credit hours in the articulated postsecondary career-technical program of study before the articulated credit is transcripted.
- No grade will be given on the transcript for articulated courses; only hours granted will be transcripted (thus resulting in no change in quality points).

Time Limit

- MS-CPAS2 scores will be accepted to demonstrate competencies for up to 18 months after high school graduation.

Cost

- No costs will be assessed on hours earned through articulated credit.
- Articulation credit from Secondary to the Postsecondary will be awarded beginning upon implementation of this curriculum by the college. Courses to be articulated are listed in the chart below with the stipulation of passing the MS-CPAS2 according to MCCB guidelines.

Articulated Secondary Program	Community College Program	Articulated Postsecondary Course
Business Management – Program CIP: 52.0801 – Management/Marketing I 52.0204 – Management/Marketing II	Logistics Technology (Program CIP: 52.0203 – Logistics and Materials Management)	LGT 1213 – Transportation and Distribution

Best Practices

Experiential Learning

Experiential Learning is an important aspect of the Transportation Logistics program. Projects are recommended in a variety of situations to reinforce and compliment classroom theory and content. The experiential learning project may be an entrepreneurship, placement, research/experimentation, and/or exploratory investigation.

Innovative Instructional Technologies

Recognizing that today's students are digital learners, the classroom should be equipped with tools that will teach them in the way they need to learn. The Transportation Logistics teacher's goal should be to include teaching strategies that incorporate current technology. It is suggested that each classroom house a set of desktop computers for students and one laptop for the teacher. To make use of the latest online communication tools such as wikis, blogs, and podcasts, the classroom teacher is encouraged to use a learning management system, such as the Transportation Logistics Teacher Blackboard Content Management System, which introduces students to education in an online environment and places the responsibility of learning on the student.

Differentiated Instruction

Students learn in a variety of ways. Some are visual learners, needing only to read information and study it to succeed. Others are auditory learners, thriving best when information is read aloud to them. Still others are tactile learners, needing to participate actively in their learning experiences. Add the student's background, emotional health, and circumstances, and a very unique learner emerges. To accommodate this, the Transportation Logistics curriculum is written to include several instructional methods by using the Understanding by Design (UbD) approach. This method of instructional design leads students to a deeper understanding of course material and provides multiple opportunities for students to succeed in different ways. Many activities are graded by rubrics that allow students to choose the type of product they will produce. By providing various teaching and assessment strategies, students with various learning styles can succeed.

Career and Technical Education Student Organizations

Teachers should investigate opportunities to sponsor a student organization. There are several available in Mississippi that will foster the types of learning expected from the Transportation Logistics curriculum. SkillsUSA is the student organization for Transportation Logistics and it provides students with growth opportunities and competitive events. It also opens the doors to the world of transportation logistics and scholarships opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, several opportunities for group work are incorporated into the Transportation Logistics curriculum. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Transportation

Logistics curriculum provides opportunities for students to work together and help one another to complete complex tasks.

Conclusions

The Transportation Logistics curriculum is one of Mississippi's most comprehensive. Students that complete the requirements will be well equipped for a variety of endeavors. Instructors are urged to encourage Transportation Logistics students to pursue further educational opportunities at community colleges and universities in Mississippi.

Professional Organizations

American Society of Transportation and Logistics (AST&L) *www.astl.org*

APICS American Production and Inventory Control Society *www.apics.org*

B.R.I.D.G.E. - Mississippi Transportation Logistics Education rcu.blackboard.com

Council of Supply Chain Management Professionals (CSCMP) *www.cscmp.org*

Manufacturing Skill Standards Council www.msscusa.org

Delta Nu Alpha *www.deltanualpha.org*

International Warehouse Logistics Association (IWLA) *www.iwla.com*

Material Handling Industry of America *www.mhia.org/*

Mississippi ACTE www.mississippiacte.com/

National Academy Foundation

Safety Council & Coaching Systems www.osha.gov

Supply Chain Council (SCC) *www.supply-chain.org*

The International Society of Logistics (SOLE) *www.sole.org*

Using This Document and the Blackboard Site

Suggested Time on Task
This section indicates an estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie-unit credit. The curriculum framework should account for approximately 75–80% of the time in the course.

Competencies and Suggested Performance Indicators
A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested performance indicators represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

Suggested Teaching Strategies (Found on the Blackboard site)
This section of each unit indicates research-based strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies that reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.

Suggested Assessment Strategies (Found on the Blackboard site)
This section indicates research-based strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

Integrated Academic Topics, 21st Century Skills and Information and Communication Technology Literacy Standards, ACT College Readiness Standards, and Technology Standards for Students
This section identifies related academic topics as required in the Subject Area Testing Program (SATP) in Algebra I, Biology I, English II, and U.S. History from 1877, which are integrated into the content of the unit. Research-based teaching strategies also incorporate ACT College Readiness standards. This section also identifies the 21st Century Skills and Information and Communication Technology Literacy skills. In addition, national technology standards for students associated with the competencies and suggested objectives for the unit are also identified.

References
A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested, and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Unit 1: Orientation, Advanced Leadership, and Employability Skills

Competencies and Suggested Performance Indicators
1. Review local program and career and technical center policies and procedures. DOK 1, WE a. Describe local program and career and technical center policies and procedures, including dress code, attendance, academic requirements, discipline, and transportation regulations. b. Describe local school rules found in the student handbook. c. Describe laboratory and facilities associated with the program.
2. Describe employment opportunities and responsibilities. DOK 1, WE a. Describe employment opportunities, including potential earnings, employee benefits, job availability, places of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities.
3. Explore leadership skills and personal development opportunities provided students by student organizations, including SkillsUSA. DOK 1, WE a. Demonstrate effective teambuilding and leadership skills. b. Practice appropriate work ethics.
4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. DOK 1, WE a. Performance indicators are reflected in the competency.

Scenario

Scenario 1

Create a Cover Letter and Résumé

Students should create a cover letter to accompany an application for the position listed below. Students may use their own names but should make up personal contact information for their letters. They may also use their personal school, church, or volunteer experiences for the cover letter and résumé, but they should utilize the experience listed below. The type of cover letter is left to the discretion of the instructor.

Students should then create a résumé that coordinates with the cover letter, using the same information. Either a functional résumé format may be used, or dates and additional information may be added to create a chronological résumé.

Use the following company information and position:

Job Title: Shipping Department Supervisor
Manager: John Prior
Company: ABC Logistics, Inc.
123 James Street
Akron, OH 12345
Background:
The job was listed on the Monster.com Web site. ABC Logistics is looking to fill a recently vacated shipping department supervisor position. The company ships 500 orders per day and operates a 50,000-square-foot warehouse with 2,500 SKUs and a shipping department staff of three people.

Job Description:
The shipping supervisor will be responsible for all aspects of packing and shipping operations, maintaining supply inventories, scheduling pick ups, and overseeing all manner of activities usually associated with a small-to-mid-sized shipping department. The candidate may have to fill in for the receiving supervisor occasionally and must be willing to perform all duties necessary to fulfill daily shipping quotas.

Ability to operate powered warehouse equipment is a plus but is not required. Most products are shipped via FedEx or UPS in small to mid-sized boxes. Freight shipping is rare. ABC Company is an e-commerce order fulfillment company. Candidate must have at least one year of shipping or general warehouse experience and show an aptitude for leadership. Must be punctual, a fast learner and have a desire to produce quality work while under pressure.

Use the following professional experience when applying for the position:

- 2-years experience in warehouse operations at a small company (shipped 100 orders per day), worked part time during the school year and full time during summers

- Performed all duties associated with a general warehouse worker, including shipping, receiving, and inventory management
- Familiar with most common nonpowered warehouse equipment
- Working knowledge of barcode printers and readers
- Proficient with Microsoft Excel and Word

Instructor may choose to elaborate more on the experience and skills

Scenario 2

Mock Interviews

This task can be extremely fun and educational. It involves small groups in which each person plays a specified role during interview situations.

- Divide the class into groups of four, where possible
- Allow each group to sit in a circle
- Students should have their completed cover letters and résumés from Task 1
- Have each student pass his or her cover letter and résumé to the person seated to the left
- Choose a person to be the first interviewee
- The person to the left of the selected interviewee should be holding the interviewee's resume and will act as the warehouse manager (position to which the shipping supervisor will report)
- The other students in each group will serve as the vice president of operations, human resources (HR) manager, and director of materials, respectively (modify the positions depending on number of group members)
- The HR manager will begin the interview process by asking some general questions about education, hobbies, etc.
- The Warehouse Supervisor should be studying the résumé quickly while the HR manager is asking a few questions
- The Warehouse Supervisor will conduct the technical interview and will ask questions based on the résumé
- The other members in each group will ask soft skills-related questions, try to gain general information, and ask follow-up questions based on the interviewee's responses but will never look at the actual résumé
- Once every group has completed the first interview round, then the people who initially played the warehouse managers will become the new interviewees, and the other group members' roles will shift accordingly

The instructor should interject as needed to keep the interviews moving at a realistic pace and with reasonable lines of questioning. The students should have fun and feel a sense of accomplishment about the task once it is completed. Be sure to monitor for illegal or unethical questions and explain these issues to each group as they arise.

Once the interviews are concluded, conduct a group question and answer session about the use of soft skills during the interviews both from the interviewers' and interviewees' perspectives.

*As an add-on activity, consider having the students create multiple types of cover letters and add or remove some of the provided company information or assigned skills

*As an additional task that will be ongoing throughout the duration of the course, have students create real résumés using their own information and experiences and updating them each semester with new skills or certifications obtained through the course work and any projects they complete.

Attachments for Scenario

None

Unit 2: Environmental Safety and Health

Competencies and Suggested Performance Indicators
1. Identify and describe the basics of safety in a distribution facility. DOK 1, SA a. Identify and discuss common causes of accidents and injuries in a distribution facility. b. Identify, define, and incorporate safety and ergonomics into all activities. c. Identify and demonstrate the proper use of personal protective devices. d. Identify and demonstrate proper lifting techniques. e. Identify types and understand appropriate uses of fire extinguishers. f. Identify safety symbols and explain how to effectively handle associated hazardous materials. g. Define the role of OSHA in the workplace. h. Explain right-to-know laws. i. Explain Material Safety Data Sheets (MSDS) and interpret meaning.

Scenario

Scenario 1

Proper Lifting Techniques

Have students build 20 empty boxes, preferably of various sizes, and write different weights (less than 55 pounds) on each box with a marker.

Place the boxes either on a shelf or on the floor. Split the class into groups of two students. Have each group demonstrate for the other groups the proper lifting and motion techniques to move the boxes from the current location to an alternate location. Students must take care not to move too much weight at once or violate any other safety rules during their turn or they will be required to take another turn after all the other groups have had attempted the exercise at least once. Allow the other students to participate in the judging, but the instructor has the final word on safety violations.

This competitive activity will reinforce the need for proper lifting techniques through a group effort.

Scenario 2

OSHA Visits

This activity is intended to be performed in a warehouse. Otherwise, use a best-effort approach given the available resources.

Divide the students into pairs for an "OSHA inspection scenario." The instructor presets potential OSHA safety issues in the warehouse. Use empty boxes, water to represent spills, etc. Set up issues that are relevant to the lessons introduced during Unit 2.

Inform the students that they are going to be OSHA inspectors responding to complaints regarding the work environment, and they are to log each issue they discover on a checklist provided by the instructor. They should take notes of the violations because they will have to defend their decisions later. The students should properly quarantine the issue, take corrective action to isolate the problem, or otherwise minimize the risk until it can be addressed with the warehouse manager.

Consider inviting a separate participant to act as the warehouse manager and have each group walk the manager to the violations and explain why they are potential safety hazards. They must be concise in their explanations and demonstrate being able to navigate the disgruntled objections from the manager, who will be arguing against any violations in order to avoid potential fines. The instructor will judge the work. If an alternate manager is not available, then have the instructor act as the warehouse manager.

Repeat this process with each group after resetting the warehouse environment.

If the class size is large, then consider using larger groups of inspectors, have them split up to find violations, and meet back together to review.

Attachments for Scenario

None

Unit 3: Overview of Supply Chain Management, Transportation, and Distribution

Competencies and Suggested Performance Indicators

1. Develop an understanding of the relationship between supply and demand, transportation, and distribution. DOK 2, SC, TM
   a. Define supply chain management and identify the basic supply chain components as identified by APICS.
   b. Create typical product flow chart from raw material supplier through consumer and explain the role of each step.
   c. Explain the theory of supply and demand and how it affects a supply chain.
   d. Identify how logistics and transportation fit within a supply chain.
   e. Explain strategic, tactical, and operational processes within an organization's use of a supply chain.
   f. Examine the history of transportation and explain the similarities and differences in past and present modes.
   g. Define the concept of KanBan.
   h. Discuss the basic modes of transportation.
   i. Expand the basic modes of transportation through detailed examples of each.
   j. Identify and explain selection factors and criteria used in choosing a transport mode.
   k. Define distribution and explain how it fits in a supply chain.
   l. Describe the importance of distribution as a component in the marketing mix (product, price, promotion, and placement).
   m. Explain how channels are used in a distribution system.
   n. Name the types of distribution and provide examples of each: Intensive, Selective, and Exclusive.
   o. Discuss the role of a distribution center.

Scenario

Overview of Supply Chain Management, Transportation, and Distribution

Scenario 1

Supply Chain

This is an individual task. The instructor will need to obtain blank copies of a Bubble Map from Thinking Maps, Inc.

Pass out one Bubble Map to each student.

Have the students choose a common item and list it in the center of the Bubble Map.

Next, have them develop a supply chain around that item using the remaining circles.

During the process, have the students insert arrows to show the path of the supply chain. They may use as many of the circles as they deem necessary to explain how their chosen products came to be.

Also, in the margins of their papers, have the students list some possible Tier 2 supplier items (i.e., if they chose a car, then the Tier 1 supplier to a distributor might be the auto manufacturer and the Tier 2 supplier might provide tires to the auto manufacturer or could be the raw material rubber supplier) that may be necessary to generate the selected product. This aspect of the exercise may be carried as far as the instructor chooses.

Have each student explain his or her selection and process to the class.

To enhance the exercise with a more real-world approach to the task, consider taking the students on a mini field trip around the school grounds and have them choose items for their Bubble Maps from any of the examples they come across while on tour. Have them fill in their Bubble Maps as they progress around the grounds. Talk to them about items they may run across while walking and how the supply chain was utilized in order for the identified items to be visible on the school's property. For example, a school bus, automobile, playground equipment, air conditioner, basketball goal, etc. could all be used as targets for which to develop a supply chain process. Students should place their chosen items in the center of the Bubble Map and work backward from consumer to raw material supplier. Talk about Tier 1 and 2 suppliers and how the Bubble Map could grow exponentially.

Scenario 2

Transportation

This is an individual task. The instructor will need to obtain blank copies of a Brace Map from Thinking Maps, Inc.

Pass out one Brace Map to each student.

Have the students write in “transportation” on the far left.

Have the students list three to four basic modes of transportation (air, water, ground, pipeline, space, etc.) in the next relationship level.

Next, have the students break those levels down even further, being sure to keep them categorized properly in the relationship order (i.e., ground may break down into railroad and highway or into train and truck).

(This task may be performed multiple ways utilizing the Brace Map, either with transportation in general or a particular mode of transportation being the starting point.)

Scenario 3

Distribution

This task is small group-oriented.

Divide the students into pairs, with an attempt to avoid partners who already know each other well. Provide the following list of instructions. Allow elaboration by the students where possible. Make sure they take into consideration the possible difficulties with distributing into markets such as China and have them discuss the possibilities of direct and indirect channels. Reinforce the marketing mix just before presenting them with the task (product, price, promotion, placement).

- You and your partner own a video system development company.
- Your company has developed a new video game system called the “XYZ Box.”
- You have produced 100,000 systems that come packaged with three games each.
- You wish to sell your product internationally as well as in the U.S.
- Choose five ways to promote your product and develop a plan, including a distribution channel for each country.
- You have set a goal for the following sales:
  - 10,000 units in Germany
  - 10,000 units in Japan
  - 50,000 units in the U.S. including Alaska and Hawaii
  - 25,000 units in Canada
  - 5, 000 units in China
- You can decide to distribute some or all of the items yourself, and you may decide to perform direct sales to consumers for all or part of the units, but you must have a sound plan in place.
- Present your group plan.

Attachments for Scenario

None

Unit 4: Basic Material-Handling Equipment and Technology

Competencies and Suggested Performance Indicators

1. Discuss the various types of basic material-handling equipment and technology. DOK 2, WE, WM, CS, SA
   a. Identify the types of hand-operated pieces of warehouse equipment.
   b. Demonstrate the safe operation of hand-operated warehouse equipment.
   c. Identify the various types and characteristics of powered industrial trucks
   d. Demonstrate inspection procedures for powered industrial trucks.
   e. Demonstrate the safe operation of various types of powered industrial trucks. Complete certification tests on selected powered industrial trucks.
   f. Identify and discuss the various types of forklift accessories.
   g. Identify and discuss steps for refueling and or recharging forklifts.
   h. Identify and discuss the various types of overhead handling equipment.
   i. Identify and discuss types of conveyor systems.
   j. Identify and discuss various types of automated material-handling equipment.
   k. Identify and discuss Warehouse Management System (WMS) software.

Scenario

Equipment Handling

These activities involve the use of physical equipment that may or may not be available in each facility. If recommended equipment is not available, then substitute equipment may be used to enforce the same lesson.

Scenario 1

Hand-Operated Equipment

Start with the smaller equipment and work up to the powered equipment in Scenario 2. These tasks may be performed throughout the unit review with special emphasis being placed on "safety, choosing the right equipment for the right job, and proper operation of the equipment."

- Divide the class into small groups (preferably two to three people).
- Create a series of inventory-movement opportunities.
    - Fill a pallet with empty boxes and attach a label representing 200 pounds for the load.
    - Fill a shelf location with empty boxes labeled with various weights not to exceed the shelf capacity.
    - Create a pile of empty boxes labeled with various weights in a staging area on the warehouse floor.
    - Have the students pick the best material-handling equipment for each of the following jobs and execute them using the selected equipment:
        - Move the shelved boxes to the shipping area in the most efficient manner possible, being careful not to exceed load capacity on the equipment selected.
        - Stack the moved inventory onto an empty pallet to prepare for shipping.
        - Select a piece of equipment and move the staged inventory (that could be sitting directly on a floor or a pallet) to the now-open location or additional locations depending on size and weight of the boxes.
        - Remove the receiving area merchandise from the pallet and transfer it to the staging area for inspection with another selected piece of equipment, being careful not to stack the heavier boxes on top of lighter ones.
        - Repeat the process using various types of equipment that would work well with the task.
        - Have other students observe each group in order to attempt improving the process of the previous groups through equipment selection, route movement, group effort, or other means.
    - Have each group explain and qualify their selection of equipment based on Unit 4 competencies.

Scenario 2

Powered Equipment

Choose a powered lift truck that is available and create tags representing each of the items on a checklist of inspections to be performed on the piece of equipment. Have each student place the tags on each area to be checked while naming the procedure for verification. This activity will reinforce the location of each checked procedure.

Later in the unit, have the students review the same checklist without the use of the identification tags. Have them point to or touch each item of inspection and explain the reason for performing the check. The instructor should have a checklist for verifying the accuracy of the students' responses, making notes as necessary and providing feedback to the students after they complete their explanations.

Scenario 3

WMS or Data-Tracking Technology

This task involves the use of more sophisticated and costly electronic equipment used for inventory tracking functions. A simulation program may be substituted for an actual working Warehouse Management System (WMS) as long as the task reinforces the competency and visual aids are introduced to the student.

If a WMS-type system is running in the warehouse, then this task should be introduced through each of the basic functions of the warehouse: receiving, put-away, movement, picking, and shipping. Additional tasks for cycle counting or physical inventory could be included as well. If the educational warehouse is providing a live service, then those functions should suffice as the WMS tasks on a daily or weekly basis. If a WMS is not available but Microsoft Access is, then consider developing a basic inventory management program or enlist the assistance of the IT department to help set up a basic database using forms, macros, and queries inherent to that software.

You may also consider downloading a demo version of a WMS provided it has enough functionality to represent the competency.

If a barcode printer is available, have each student remove all media from the printer, reset all tension settings, and perform a visual inspection, replace all media, properly adjust tension settings, and perform a calibration test.

Attachments for Scenario

None

Unit 5: Procurement and Inventory Management

Competencies and Suggested Performance Indicators
1. Identify and describe the fundamental concepts of inventory management. DOK1, SC, WM a. Explain various types of inventory. b. Distinguish physical characteristics of inventory. c. Describe the buying process. d. Develop various buying/purchasing policies. e. Locate and review various purchasing documentation. f. Identify and discuss various inventory control systems. g. Explain use of inventory storage systems. h. Demonstrate the procedures for correct rotation of stock. i. Complete physical stock counts. j. Calculate gross and net stock. k. Explain inventory shrinkage. l. Process returns of inventory to vendors. m. Discuss inventory management procedures.

Scenario

Procurement and Inventory Management

Scenario 1

Purchasing

The following tasks should be performed while conforming to buying/purchasing policies established within the Unit.

Instructor should create or download a manual purchase requisition and have each student complete the requisition for a defined number of items. If the Internet is available, have the students research potential suppliers for the defined products and use factors such as cost, shipping, location, and other competencies to be enforced in the selection process.

The instructor should either approve each purchase requisition or reject it with qualifications and have the student repeat the process, making the necessary corrections. Once a successful purchase requisition has been created, then proceed to the next step.

The instructor should create or download a purchase order template. Each student should take the information from the approved manual purchase requisition and transfer it to the electronic purchase order. Pair students together and have them check one another's documents.

Have each student create an order-confirmation form based on his or her purchase orders. The instructor will provide a template or sample.

Have each student prepare an advanced shipping notice (ASN) for each purchase order based on a template or sample provided by the instructor. This information will be used later for the receiving-process activity in Unit 6.

Scenario 2

Inventory Control Systems/Physical Stock Counts/Shrinkage

Performing a physical stock count using barcode equipment can effectively demonstrate competencies in each of the identified areas for Scenario 2.

This task requires that items be identified with barcodes on each unit, that case lots are identified with SKU and QTY, or that the part number should be provided on the shelf. Man down labels may be necessary for upper rack storage, or large signage may be used to identify part numbers on inventory located in upper-level racking. Location barcodes should also be used in case the application requires the scanning of a location code.

Students should be divided into small groups and assigned at least one barcode reader per group or as necessary depending on equipment availability. Barcode readers should be loaded with a simple counting program or WMS physical count program client. One student from each group

should also be assigned a clipboard to manually record the count as a redundancy check at least until the students become confident scanning barcodes. If an actual count program cannot be obtained, the manual count results may be used, but have the students practice scanning the barcodes on the products.

The instructor should assign each group a separate series of locations to count. Each group should complete the assigned count area within the specified time, taking care to follow all safety procedures and material-handling policies.

Upon completion, the groups should report their numbers back to the instructor, who will record the results in a log. Then, each group will swap locations with another group and perform another physical count to compare to the previous group's finding. This second count will then be recorded and compared with each of the first counts in order to determine discrepancies. At the completion of both counts, the groups will meet and discuss why there were differences in inventory counts (if any) and what may have happened to cause the discrepancies. They should then discuss a solution to arrive at the accurate count.

In order to create a more difficult count, the instructor may choose to write quantities on boxes and use random numbers not divisible by 10 to increase the likelihood of a miscount and thereby further validate the need for accuracy.

Attachments for Scenario

None

Unit 6: Receiving, Stocking, and Put-away Procedures

Competencies and Suggested Performance Indicators
1. Discuss procedures regarding receiving, stocking, and processing. DOK 2, WM, CS a. Identify and discuss the steps involved in receiving shipments. b. Develop procedures for unloading shipments. c. Develop the process for checking merchandise for damage. d. Complete inventory transactions. e. Reconcile inventory discrepancies against receiving documents. f. Update inventory control system records with received product. g. Process refused shipments. h. Identify storage locations requiring replenishments. i. Perform replenishment operations and put-away of merchandise in designated locations. j. Execute inventory transactions to update the Warehouse Management System (WMS).

Scenario

Receiving, Stocking and Put-away Procedures

Use the Unit 4 competencies for material-handling equipment to properly select the right equipment for each of the following Scenarios. Reinforce those competencies when evaluating student performances in this unit.

Scenario 1

Receiving Items into Staging Area

The instructor should create packing slips to represent the advanced shipping notices (ASNs) previously generated by each group in Unit 5. These should be the items from the purchase orders that were created in that section as well.

Prepare the receiving area with the appropriate number of boxes from the ASNs. Divide the students into small groups or pairs. When issuing the assignment, it is not necessary that the groups be the same as in previous units; instead, the instructor may randomly assign the receipt orders to the groups without regard to previous tasks. Create floor storage areas designated as "staging." Staging may be separated into areas for "incoming inspection" for received goods, shipping, returns, and/or available locations, etc. Be sure to locate these areas far enough away from path areas and shipping/receiving docks.

The student groups should each receive (move) the items to the appropriate inspection staging areas and verify them against the order (packing slip) to ensure the order is complete. They should separate any boxes that are damaged (this may be simulated by the instructor) in order to further inspect the merchandise at a later point. Groups should note any discrepancy in what was ordered and what was received. Notice should be placed on the packing slip, and the group should make a recommendation on what to do to resolve the shortage or overage.

If barcode readers are available, have the groups receive the items through scanning. If an application is not available, then students may simply practice the process of scanning without updating any application.

If an inventory system is in place, have the groups update the system with the scanned data or manually enter the receipt to update the inventory as being stored in the staging location.

Extra: Consider adding an extra item that is identified on the container as a specific chemical (i.e., chlorine) that was delivered in error and not on the packing slip. Have the students deal with the package through isolation, simulated contact with the vendor, and re-staging the item for return.

Scenario 2

Create a lower-level picking location and an upper-level bulk storage location on the shelves, if not already in place. Divide the students into small groups or pairs. Using items stored in the staging area from Scenario 1, have the students perform an inventory move to place half of the staged inventory into the bulk storage location and the other half into picking locations. Multiple locations may be created to advance the task.

Utilize inventory management equipment and applications, if possible, or manually process the move through paperwork. Update the inventory system upon completion to ensure inventory accuracy. Direct the students on quantities to move to each location or have a preset stock quantity for the picking location; the students should also replenish accordingly. This may also be an opportunity to reinforce re-order points and stock-outage issues.

Attachments for Scenario

None

Unit 7: Order Selection and Packing Procedures

Competencies and Suggested Performance Indicators
1. Demonstrate an understanding of packing procedures. DOK 2, WM a. Identify units of measure. b. Use tables of weights and measurements. c. Weigh and record items using a scale. d. Develop procedures for selection of customer orders. e. Complete the physical order-picking process using material-handling equipment. f. Complete order-selection documentation. g. Complete backorders or shortages. h. Identify and discuss types of boxes and packing materials used in shipping. i. Develop proper packing procedures. j. Develop package documentation and labeling procedures. k. Complete and include a packing list. l. Complete packing of case shipments. m. Identify pallet designs and patterns. n. Identify quantity pack numbers. o. Complete packing of pallet shipments. p. Palletize and shrink-wrap shipments.

Scenario

Order Selection and Packing Procedures

Use the Unit 4 competencies for material-handling equipment to properly select the right equipment for each of the following scenarios. Reinforce those competencies when evaluating student performances in this unit. Also utilize barcode readers and printers where possible, as well as WMS applications.

Scenario 1

Order Picking/Shortages

Depending on class size, select one or two students who will provide assistance as "shipping supervisors." Each supervisor will manage half of the class, and each half will be split into small groups or pairs. Utilize student supervisors to help create customer orders and/or pick tickets in the software or manually, and assign them to their designated groups.

Pick tickets should contain all necessary information to allow for picking and shipping an order. They should also identify the location where each item is stored in sufficient quantity to be efficiently picked. As long as the suggested pick location is identified, an order may be substituted for an actual pick ticket. Or, if an additional lesson is desired, then demonstrate the difference between "directed" or "undirected" picking during this task.

The pick tickets should guide the groups to the appropriate locations to pick products. Each group must deal with any out-of-stock items by working with the shipping supervisor to locate alternate sources for the product, either through bulk storage locations or from any items that may be stored in staging areas. Enforce the use of "best practices" when selecting alternate locations for picking, or have the pickers perform a move to the appropriate picking location. Should the suggested picking location be empty or not contain enough product to fulfill the order, then the student supervisor should execute an inventory-adjustment transaction, either through the barcode readers or manually from the system. At the very least, an Excel spreadsheet should have been created and accurate inventory numbers should have been previously entered. Make adjustments accordingly.

Since there are several ways to handle an item being out of stock in the picking location but in stock elsewhere, it is at the discretion of the instructor to determine the method of choice. Or, additional time may be spent on the task to perform each available method.

Where possible, the student supervisors should be allowed to make decisions, but immediate feedback should be provided to help guide them toward an appropriate solution. Be sure not to allow delay of the "order fulfillment" task at hand by allowing the student supervisor to dwell on uncertainty.

Other competencies may be reinforced if time permits, such as splitting the orders into picking case lots and "eaches." If your facility is an operational warehouse, consider changing this task

to be a little different than your daily pick operations. If the standard pick is for cases, adapt this task to pick single items, so packaging competencies may be stressed.

The task may be performed simultaneously in groups or one at a time, depending on the availability of supplies and equipment. Take care to enforce safety rules throughout the task and record any equipment use violations.

Scenario 2

Order Packing/Shipping Preparation

This task involves packing individual items for shipment, utilizing proper packaging materials, selecting proper box sizes, and efficiently and effectively packing complete orders for shipment using single box shipments and multi-box shipments.

The students should be split into small groups or pairs. The instructor should prepare a table or staging area with a wide variety of single items secured from around the facility or through donations. Notify each group that they are to package up all of the items in their designated area, using the best methods available to them in order to ensure that the items arrive undamaged but without spending too much money on packaging material. Now would be a good time to reinforce the idea of keeping expenses low by using only what is necessary. This includes the use of cartons and sealing tape.

Have the class split the shipments into multiple boxes and then try to combine the shipment into a single box. Evaluate the amount of packing materials needed along with the risk of damage involved with each method. Discuss other advantages and disadvantages, such as cost and time.

Have the groups select a lead clerk, who will create a packing slip from a sample for their shipments. Enclose the packing slip either in the box or attach it using a clear “packing list enclosed” envelope.

Have pre-printed sample labels created for shipping labels. If possible, utilize a barcode label printer using standard 4 in. x6 in. labels. Otherwise, use either a shipping envelope or tape the shipping information to the cartons. Be sure students address the issues of multiple packages per shipping address, if applicable.

Attachments for Scenario

None

Unit 8: Environmental Safety and Health and Year 1 Review

Competencies and Suggested Performance Indicators
1. Identify and describe procedures for various shipment types. DOK 1, WE, SC, TM, WM, CS, SA a. Identify terms used in routing/shipping. b. Complete shipments for small-package carriers. c. Prepare a bill of lading. d. Recognize other types of transportation documents. e. Determine types of loads. f. Describe methods for securing loads. g. Identify terms used in international shipping. h. Identify modes of transportation. i. Identify procedures for outbound modes of transportation. j. Identify procedures for international shipments. k. Identify procedures for shipments of hazardous materials.

Scenario

Environmental Safety and Health and Year 1 Review

Scenario 1

Have each student prepare a bill of lading for a truckload of dry dog food being shipped from a manufacturer's warehouse to a chain store distribution center. The students should use 30 lb bags of dog food as a basis to fill the entire trailer, taking into consideration weight limits and destination. Pick multiple destinations for loads so the students cannot copy one another's work. Acme Pet Food is the shipper and the loads are going to a variety of distribution centers.

Scenario 2

Multiple Shipments

Split the students into small groups or pairs and have them select the appropriate carrier and prepare all associated documents to perform the following actions:

- Ship a laser printer weighing 25 lb from a local distribution center to and individual located in an apartment in Little Rock, AR. The printer should arrive at its destination within 3 days of shipment.
- Ship one pallet of AA-battery packs weighing 200 lb from a local distribution center to a toy manufacturer located in Phoenix, AZ. The pallet should arrive within 2 weeks.
- Prepare documents for one love seat to be picked up by a customer at a local warehouse.
- Ship one case of digital cameras (12 total) from a local distribution center to a camera store in Toronto, Canada. Total weight is 8 pounds and the case dimension is 18"x12"x12".

Scenario 3

Safety Placards

This task relies on the students having access to multiple DOT Hazmat truck placards identifying the types of hazards associated with each load. If the actual placards are not available, they may be found on various websites and printed on a color printer.

Have the students individually identify the proper safety DOT Hazmat placard that should be provided (if any) with each of the following full truckload shipments. Feel free to add more as necessary.
Truckload of propane tanks (empty)
Truckload of propane tanks (full)
Truckload of potato chips
Truckload of pesticides for weeds
Truckload of cases of quarts of automobile oil
Truckload of canned fruit

Truckload of cans of helium
Tanker truck filled with diesel
Create more as desired

Scenario 4

Divide the class into small groups.

The instructor should designate 10 different "ship to" addresses that include APO/FPO, PO boxes, home addresses, business addresses within the U.S., and business addresses abroad to include Canada and UK.

The instructor will select package sizes and product content for the students. Be sure to include at least one pallet load, as well as a truckload shipment.

Students will have to select the appropriate carriers and generate all paperwork required for each shipment.

Scenario 5

Hazardous material and terminology flash-card game. This game is intended to be head-to-head competition with another team, so the team sizes may vary depending on the facility and class size.

Divide the class into teams and create hazardous-materials display placards that include the symbol on one side and the definition or list of threats on the reverse.

Provide each team with a bell or some device for "buzzing in." This may be vocal or a light source or some other method for each team to announce being prepared to answer, etc. Have fun with it.

During the first round, the instructor will hold up a placard and the first team to "buzz in" will get a chance to identify the symbol. Each correct answer is worth five points. An incorrect answer removes five points. If an incorrect answer is declared, then the competing team gets a chance to provide the correct answer with no points removed for an incorrect response.

Play continues until all of the placards have been utilized.

The second round involves creating a list of words commonly associated with particular hazards, such as chlorine or matches, etc. The instructor should obtain or create "product" flash cards and identify them with the proper symbol on the reverse for reference.

Each team will maintain a separate set of hazard placards and will be charged with displaying the placard that best represents the product in question. If there is a combination of placards that represent a correct response, then all that apply must be displayed. It is up to the discretion of the

instructor to provide hints, give partial credit, or allow extra time. The students answering the question must also be able to announce the hazard associated with the placard.

Once all the cards have been utilized, the points should be tallied for a winning team.

Unit 9: Introduction to Intermodal Transportation

Competencies and Suggested Performance Indicators

1. Discuss the different aspects of intermodal transportation. DOK 1, SC, TM
   a. Recall and discuss the various modes of transportation.
   b. Identify attributes of intermodal selection through cost-benefit analyses.
   c. Determine a cost per container for various intermodal methods.
   d. Determine hurdles for each method of intermodal transport combinations.
   e. Prepare a layout of an intermodal facility and identify the major components.
   f. Identify potential hazards and delays for each mode of transport.
   g. Identify and explain various types of freight and intermodal consulting agencies such as freight brokers.
   h. Discuss various import/export rules and laws associated with domestic and international intermodal transport.
   i. Identify the various marine ports throughout the region.
   j. Identify the various intermodal rail/truck facilities throughout the region.
   k. Identify the capacity capabilities of the various transportation modes, including marine cargo ship types.
   l. Identify types of documentation necessary for domestic intermodal transport.
   m. Identify the types of documentation necessary for international intermodal transport.
   n. Explain the role of the federal Department of Transportation in the inspection process of intermodal transport for all modes of transport.

Scenario

Intermodal Transportation

Scenario 1

You will need a large white board with markers to perform this task.

Discuss the various modes of transportation used in an intermodal operation to help the students gain a mental picture of what is involved. You can elaborate to include multi-modal so the task can touch all modes of transport.

Divide the class into groups of five or fewer students and have them each draw a component of an intermodal operation. Allow the groups to openly discuss their plans and make as many changes and revisions as they need to be comfortable with their end products. The object is to accurately display the different modes and equipment used to offload the product/container at each point of transfer. They should use only pictures and no identifying words.

If there are enough white boards, have all groups participate at once. Otherwise, use what space you have available or erase each previous group's material to allow space for another group's presentation. Allow the students to be creative and have fun with this exercise. One way to enhance the task is to allow them to provide their visual interpretation of "the future of intermodal transportation."

Scenario 2

Divide the class into small groups of two to three students. Provide the groups with the following set of criteria and rules.

The student groups have been independently contracted to act as intermodal freight brokers for a company shipping containers of merchandise from Gulfport, MS to Chicago, IL. The groups must determine a cost per container to the customer and add a 25% markup to the total to make a profit.

- An intermodal transfer method of truck to train will be utilized.
- The initial haul will be via truck from Gulfport, MS to an intermodal facility in Memphis, TN.
- The containers will be placed on a train in Memphis destined for Chicago.
- We are only concerned with the cost of the truck from Gulfport to Memphis and the train to Chicago. The customer will make arrangements for its fleet to retrieve the containers from the intermodal facility in Chicago. The brokers are relieved of their responsibility once the merchandise arrives in Chicago.
- The containers must be delivered at the same time to Memphis and Chicago.
- There are four containers in the transfer.
- Each truck chassis can transport only one container.

- It is 365 miles from Gulfport to Memphis and the cost of diesel is $4.00 per gallon. Each truck gets 5 miles per gallon.
- The cost for each truck driver is $300 for the trip from Gulfport to Memphis. A backhaul order will pay for the return trips, so there is no cost for drivers or trucks returning to Gulfport from Memphis.
- There is a customer processing fee at the intermodal facility of $100. This is per customer, not per container. There is only one customer for the entire order.
- The cost to load the containers onto the train is $50 per container.
- The cost of the containers to be shipped is as follows:
    - First 2 containers are $200 each
    - Subsequent containers are $150 each
- The containers meet all weight restrictions and documentation requirements, so there are no fees or penalties.

The object of this activity is to determine the shipping cost per container of material being shipped via intermodal transportation from Gulf Port to Chicago using the previously defined route. For the sake of this project, only full containers will be shipped with no specified number or type of product. No hazardous materials will be included.

Determine the profit per container awarded to the brokerage group as well as the overall profit for the job.

Have the students determine what other items may need to be taken into consideration in the "real world" should they be working on a live project, including the following factors:

Cost of truck
Delays
Insurance
Variable cost of fuel
Taxes
Tolls
Weight restrictions
Etc.

Challenge the students to be creative and have them share their thoughts in a class discussion.

Attachments for Scenario

None

Unit 10: Advanced Material-Handling Equipment and Technology

Competencies and Suggested Performance Indicators
1. Develop an understanding of advanced handling equipment and technology. DOK 2, SC, WM, CS a. Identify and discuss the use of technological devices to facilitate operations. b. Identify and discuss the use of radio frequency technology in operations. c. Use Warehouse Management System (WMS) as applicable in operations. d. Discuss the importance of globalization on the supply chain. e. Identify and explain current trends in the supply-chain field.

Scenario

Advanced Material-Handling Equipment and Technology

The following tasks rely on access to radio frequency (RF) barcode equipment combined with WMS application software or wireless applications for the handheld reader that feed back to a host application for data tracking or simulation.

Scenario 1

Inventory Moves Utilizing RF Readers

Divide the students into small groups or pairs. Have the students utilize their RF barcode readers through a series of inventory moves from various shelf locations, either to staging for a "recall" inspection and then back to the proper locations after inspection, or from bulk storage to picking locations. In either case, have at least one student (supervisor) confirm the move in the application.

Repeat some Year 1 picking and shipping functions utilizing RF readers and WMS software.

Scenario 2

Troubleshooting

This is a very advanced function, but it will provide students with valuable experience that will give them an advantage in the work place. This task is also a good crossover activity with Unit 11.

The instructor should divide the class into groups depending on how many barcode readers are available (maximum of four students per reader). Select a supervisor for each group who will act as the technology lead. This may be a student who has previously shown proficiency in electronic devices or computer technology. This activity may need to be performed one group at a time depending on equipment availability.

- Allow the groups to begin selecting inventory for a simple move. Start with one or two products. If test moves are being used, be sure to have the groups reverse the move at the end of the task.
- The instructor should create a series of hurdles that cause the reader not to respond and the students should work through a troubleshooting process to determine the issue. The solution should ultimately be to process the transaction however possible without allowing the "system down time" to slow their progress on completing the work assignment.
- This task can get quite involved and is a good source of interaction for the advanced students for any occasion. Start with unplugging the wireless access point (assuming it only serves the barcode readers). Allow the students to attempt to determine why the reader is not communicating.

- Introduce another issue to a different group such as exiting the application (if possible) and having the reader start at a command prompt, etc.
- There are multiple lessons to be learned in this process, but the primary lesson is that the warehouse must continue to operate regardless of the status of technology in the workplace. The students should eventually decide to process the transactions manually but should not quickly abandon troubleshooting. Their ultimate response should be to have one person continue to work on the reader while the others continue processing transactions.

Scenario 3

Additional Lift Equipment

Introduce more advanced order picking or other warehouse equipment during this task. Perhaps the instructor could invite an equipment rental company to come out and display some of the newest equipment available and provide some brochures or even a demonstration.

Attachments for Scenario

None

Unit 11: Managing Distribution Center and Warehouse Facilities

Competencies and Suggested Performance Indicators
1. Explain various aspects of facility design and management. DOK 1, WM, SA a. Recognize and identify various facility layouts and designs. b. Explain facility management practices. c. Describe the role of management in quality control practices. d. Explain the organizational structure of warehouse management. e. Explain the nature of management/supervisory training. f. Explain the nature of environmental regulations. g. Identify ways that technology impacts business. h. Plan and organize the work efforts of others.

Scenario

Managing Distribution Center and Warehouse Facilities

Scenario 1

Facility Design

If possible, the instructor should download a warehouse facility simulator program for this task. If a simulator is not available or students don't have access to a computer, then this task should be performed manually.

Divide students into small groups or pairs and have them design a warehouse with the following characteristics:

- Warehouse is to be approximately 50,000 sq ft with 30-ft ceiling. Allow students to use their own choices for the specifics of the facility.
- Two warehouse receiving doors
- One warehouse shipping door
- Shipping station with a computer, packing table, printer, scale and other items used in a typical shipping environment. Students may list the smaller items in lieu of drawing them.
- Staging locations for shipping
- Receiving station with a computer, floor staging locations for inspections, lift truck and other equipment used for receiving.
- Design at least five 100-ft rows of triple-level pallet shelving
- Create two 100-ft rows of pallet floor space
- Mark the aisles with floor tape for lift-truck paths
- Layout a location and zone scheme
- Insert proper mirrors for blind spots
- Include a supervisor's office within the facility but not in the main office area
- Include a lift truck storage area that should contain 2-9,000lb fork lifts and 3-4,000lb pickers
- Design a break room and restrooms
- Design a main office area (five offices) for the operations manager, purchasing manager, accountant, personnel manager, and an area for an industrial engineer/maintenance
- Add other items at the instructor's discretion or allow the students to complete the remainder of the requirements. Include such items as a computer room/wiring closet, phone system, HVAC, sprinkler room, etc.

Scenario 2

Supervisory

If the educational facility is an operational warehouse, the instructor can begin a transitional process of allowing each student to become a supervisor for a week, a day, or any amount of time that allows the full gambit of operational responsibilities.

Choose a series of supervisors and divide them among each of the functional areas of the warehouse, such as shipping, receiving, inventory control, quality control, etc., and have the students supervise the day-to-day operations, including troubleshooting inventory problems, working with other departments to resolve issues, delays, or order processing. The instructor may choose to introduce potential issues to see how each person reacts to a given situation. Management personnel should typically be limited to second-year students; exceptions are at the discretion of the instructor.

Before beginning the task, select the management team and convene a management meeting to set goals for the period of time for which that team will be responsible.

- Create a shipment goal for the week
- Create a replenishment goal for the week
- Minimize stock outages
- Create any additional goals relevant to the operations of a warehouse and have the students be major players in their establishment
- The instructor may choose to select the management team through creation of a résumés and an interview process
- Have the supervisors choose members of their teams through interview processes, including salary offers
- Perhaps assign each supervisor a budget, including salaries, and require them adhere to it, thus limiting the salary offers for the employees
- The instructor may choose to simulate any process that does not occur on a daily basis with the live operations of the warehouse

This task can be a fun and inspirational. Take care not to allow it to get out of hand and keep stressing the importance of operations and safety. Try selecting two students to serve as OSHA inspectors, similar to the earlier task involving safety.

Try establishing an operations/warehouse manager to whom all supervisors report in order to add a level of responsibility to an advanced student. The instructor may combine this unit task for second-year students with the operations tasks for first-year students. There should be much flexibility to tailor this task to each educational facility since it relies heavily on resource and equipment availability.

Attachments for Scenario

None

Unit 12: Logistics and Supply Chain Management

Competencies and Suggested Performance Indicators
1. Discuss supply chain management and logistics terminology. DOK 1, SC a. Identify and describe the components of the supply chain. b. Identify and describe the relationships between supply chain components. c. Identify and describe the purposes of Third Party Logistics Providers (3PLs). d. Define common logistics terms. e. Identify and explain reverse logistics.

Scenario

Logistics and Supply Chain Management

Scenario 1

3PL

Divide the students into groups of four or more members or fewer as necessary.

The students should clear out three areas of racking and label them as 3PL customer 1, 3PL customer 2, 3PL customer 3, or assign them more traditional names. It is at the instructor's discretion as to exactly how much space to utilize for the locations. The idea is to create locations for specific product suppliers for whom the distribution center is providing 3PL services.

Create a series of boxes or products for each of the distribution center's customers and place them in the corresponding locations. Once again, volume is at the instructor's discretion, depending on class size, space availability, and materials. Be sure to explain to the students the difference between their "customers," who are the product suppliers, and the product suppliers' customers , who are likely the "end users." Explain why they might be providing such a service along with the methods of how charges occur, such as for storage space, hourly services, per piece picked and shipped, per order filled, etc.

This task is a visual representation to help further explain the need for inventory accuracy and location accuracy since, in this case, the distribution facility does not own any of the products they are shipping and will have to pay for anything that is lost, damaged, or mistakenly shipped.

Have the students or student supervisors create a series of orders/pick tickets for each of the 3PL customers and prepare shipping documentation showing the package as being shipped, not from the distribution center (DC), but from the DC's customer to the end user. Students may use the DC's address but must use the 3PL customer's name.

Scenario 2

Logistics Terms

Vocabulary should be a part of weekly lesson plans and many of the terms will be reinforced in daily usage. This task is meant to serve as a reminder of the not-so-common terms associated with the industry.

Consider using such sites as puzzles.com or freepuzzles.com or any number of the available resources on the internet to input vocabulary terms from the logistics industry and safety words to create fun activities such as word jumble, word search, cross-word puzzles, or vocabulary bingo.

Consider dividing the students into groups to enforce team-building activities with these events.

Attachments for Scenario

None

Student Competency Profile

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation, Advanced Leadership, and Employability Skills		
	1.	Review local program and vocational center policies and procedures.
	2.	Describe employment opportunities and responsibilities.
	3.	Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
	4.	Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.
Unit 2: Environmental Safety and Health		
	1.	Identify and describe the basics of safety in a distribution facility.
Unit 3: Overview of Supply Chain Management, Transportation, and Distribution		
	1.	Develop an understanding of the relationship between supply and demand, transportation, and distribution.
Unit 4: Basic Material-Handling Equipment and Technology		
	1.	Discuss the various types of basic material-handling equipment and technology.
Unit 5: Procurement and Inventory Management		
	1.	Identify and describe the fundamental concepts of inventory management.
Unit 6: Receiving, Stocking and Put-away Procedures		
	1.	Discuss procedures regarding receiving, stocking, and processing.
Unit 7: Order Selection and Packing Procedures		
	1.	Demonstrate an understanding of packing procedures.
Unit 8: Environment Safety and Health and Year 1 Review		
	1.	Identify and describe procedures for various shipment types.
Unit 9: Introduction to Intermodal Transportation		
	1.	Discuss the different aspects of intermodal transportation.
Unit 10: Advanced Material-Handling Equipment and Technology		
	1.	Develop an understanding of advanced handling equipment and technology.
Unit 11: Managing Distribution Center and Warehouse Facilities		

	1.	Explain various aspects of facility design and management.
Unit 12: Logistics and Supply Chain Management		
	1.	Discuss supply chain management and logistics terminology.

Appendix A: Unit References

All of the Transportation Logistics units use the same resources for each unit. Suggested resources are listed below.

Transportation Economics Management:

Bardi, E. J., Coyle, J. J., & Novack, R. A. (2011). *Transportation: A Supply Chain Perspective* (7th ed.). Mason, OH: South-Western Cengage Learning. (ISBN: 978-0-324-78919-0)

Logistics Management:

Bardi, E. J., Coyle, J. J., ,& Langley, Jr., C. John. (2008). *Supply Chain Management: A Logistics Perspective* (8th ed.). Mason, OH: Cengage Learning. (ISBN: 978-0-324-37692-0; includes student CD-ROM)

International Transportation and Logistics:

David, P., & Stewart, R. (2010). *International Logistics: The Management of International Trade Operations* (3rd ed.). Mason, OH: Cengage Learning.. (ISBN: 978-1-111-46498-1; online material access key included with purchase)

General Management Principles and Techniques:

McHugh, J., McHugh, S., & Nickels, W. (2006). *Understanding Business* (8th ed.). Boston, MA: McGraw-Hill Irwin. (ISBN: 978-0-073-10597-0)

Barrett, B. (2009). *A Student Assessment & Learning Guide to accompany Understanding Business* (9th ed.). Boston, MA: McGraw Hill. (ISBN: 978-0-077-26842-8)

Bandmann, T. (Producer). (2004). *The Container Story* [DVD]. Available from http://www.containerstory.com/

Lean Logistics:

Goldsby, T., & Martichenko, R. (2005). *Lean Six Sigma Logistics: Strategic Development to Operational Success*. Boca Raton, FL: J. Ross. (ISBN: 1-932159-36-3)

Logistics and Supply Chain Strategy:

Christopher, M. (2005). *Logistics and Supply Chain Management: Creating Value-Adding Networks* (3rd ed.). Harlow, UK: Pearson Education. (ISBN: 978-0-273-68176-2; this text is also used for the Professional Designation in Logistics and Supply Chain Management (PLS) certification program)

Goddard, S. B. (1994). *Getting There: The Epic Struggle Between Road and Rail in the American Century* (1st ed.). New York, NY: Basic Books. (ISBN: 978-0-465-02639-5)

Swift, E. (2011). *The Big Roads: The Untold Story of the Engineers, Visionaries, and Trailblazers Who Created the American Superhighways*. New York, NY: Houghton Mifflin Harcourt. (ISBN: 978-0-618-81241-7)

Logistics Analysis:

Ballou, R. H. (2003). *Business Logistics/Supply Chain Management* (5th ed.). Upper Saddle River, NJ: Prentice Hall. (ISBN: 978-0-131-07659-4; includes Logware CD package)

Supply Chain Management:

Lambert, D. M. (Ed.). (2006). *Supply Chain Management: Processes, Partnerships, Performance* (3rd ed.). Sarasota, FL: Supply Chain Management Institute. (ISBN: 978-0975994931)

Logistics Finance:

Cokins, G., Klammer, T. P., & Pohlen, T. L. ,(2009). *The Handbook of Supply Chain Costing*. Hinsdale, IL: Council of Supply Chain Management Professionals. (ISBN: 978-0-9825348-0-9)

Appendix B: Glossary

These definitions were gathered from the following sources:

Dictionary. (2012). *Investopedia US*. Retrieved from: http://www.investopedia.com/dictionary/#axzz2E5ucpIDW

General line of merchandise. (2011). *Wikipedia*. Retrieved from: http://en.wikipedia.org/wiki/General_line_of_merchandise

Home. (2012). *WebFinance, Inc.*. Retrieved from: http://www.businessdictionary.com/

Overstock. (2012). *HighBeam Research, Inc.* Retrieved from: http://www.encyclopedia.com/doc/1O999-overstock.html

Portcentric logistics. (2011). *Clipper Logistics Group Ltd.* Retrieved from: http://www.clippergroup.co.uk/local/assets/portcentric_brochure.pdf

PLU codes. (2012). *International Federation for Produce Standards*. Retrieved from: http://www.ifpsglobal.com/en-us/home.aspx

Widget (economics). (2012). *Wikipedia*. Retrieved from: http://en.wikipedia.org/wiki/Widget_(economics)

Logistics terms can also be found at Logisuite: http://www.logisuite.com/logistics-terms-glossary/

What is document automation? (2012). *Intelledox Pty Ltd.* Retrieved from: http://www.intelledox.com/Products/Business-Needs/Document-Automation.aspx

SC sustainability. (2012). *TechTarget*. Retrieved from: http://searchmanufacturingerp.techtarget.com/definition/SC-sustainability

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ABC analysis - Classification of items in an inventory according to importance defined in terms of criteria such as sales volume and purchase volume. (logisuite.com)

Accounting software - Computer programs that assist bookkeepers and accountants in recording and reporting on a firm's financial transactions. The functionality of accounting software differs from product to product. Larger firms may choose to implement a customized solution which integrates a vast amount of data from many different departments. Smaller firms often choose an off the shelf product. (investopedia.com)

APICS - The Association for Operations Management, is a not-for-profit international education organization, offering certification programs, training tools and networking opportunities to increase workplace performance. (businessdictionary.com)

Build to order - Produced or prepared specifically when someone requests the item, so that the item can be customized as desired by the person who requested it. (businessdictionary.com)

Build to stock – a build-ahead production approach in which production plans may be based upon sales forecasts and/or historical demand. (businessdictionary.com)

Bullwhip effect - Tendency of consumers of a material or product in short supply to buy more than they need in the immediate future. (businessdictionary.com)

Carrying cost - Also called holding cost, carrying cost is the cost associated with having inventory on hand. It is primarily made up of the costs associated with the inventory investment and storage cost. For the purpose of EOQ calculations, if the cost does not change based upon the quantity of inventory on hand it should not be included in carrying cost. Carrying cost is represented as the annual cost per average on-hand inventory unit. See article on EOQ for more detailed info on carrying cost. (logisuite.com)

Channel coordination – Also called "supply chain management," the coordinated management and control of the supply chain, from the acquisition of raw materials from vendors through their transformation into finished goods to the delivery of merchandise to the final customer. It involves information sharing, planning, resource synchronization and performance measurement.

The management and control of all materials, funds, and related information in the logistics process from the acquisition of raw materials to the delivery of finished products to the end user. (logisuite.com)

Common carrier - A transportation company which provides service to the general public at published rates; a for-hire carrier that holds itself out to transport goods and serve the general public at reasonable rates and without discrimination. (logisuite.com)

Consumables - Goods used by individuals and businesses that must be replaced regularly because they wear out or are used up. Consumables can also be defined as the components of an end product that are used up or permanently altered in the process of manufacturing, such as semiconductor wafers and basic chemicals. (investopedia.com)

Cool chain quality indicator - is an open and auditable industry standard that employs a benchmarking system to establish transparent and comparable quality measures – a world premiere. It offers guidance and support to continually improve and assess the logistics chain for PTSP. (businessdictionary.com)

Customer - An enterprise that uses the services as provided by another enterprise. (logisuite.com)

Demand signal repository - A resource used by consumer goods companies to capture and manage large volumes of external demand data, such as retail sales and inventory information. A demand signal repository can help companies analyze consumer trends and make decisions about marketing and distribution. (businessdictionary.com)

Direct shipment - direct shipping and drop shipping are two terms generally used interchangeably. They describe a process whereby three parties interact with the sales transaction (the buyer, the seller, and the supplier). The buyer initiates a purchase from the seller, who then arranges with the supplier to ship the product directly to the buyer. The seller does not carry inventory of the product and the supplier does not have any direct communication with the buyer. The buyer pays the seller and the seller pays the supplier. Though both terms (direct ship and drop ship) are generally used to describe the same process, I've always considered a small distinction between the two that relates to where you are in the supply chain. To the seller, direct shipping describes both the process and an inventory/sales strategy, however, the supplier will frequently just use the term "drop ship" to describe the process whereby he is shipping the product to an address other than that of his customer (the business that is paying him for the product). Sometimes the term drop ship also describes the process of shipping to any location that is different from the customer's normal shipping location. This subtle distinction is sometimes evident in the terminology used in software documentation. (logisuite.com)

Document automation - Document Automation is a software-based process of assembling repetitive documents to meet specific business needs. (intelledox.com)

Final assembly schedule - The end-item assembly to fulfill customer orders. It is the last stage of the product assembly process and precedes shipping the item to the customer. (businessdictionary.com)

Finished good - Products completely manufactured, packaged, stored, and ready for distribution. (logisuite.com)

Forecasting - The use of historic data to determine the direction of future trends. Forecasting is used by companies to determine how to allocate their budgets for an upcoming period of time. This is typically based on demand for the goods and services it offers, compared to the cost of producing them. Investors utilize forecasting to determine if events affecting a company, such as sales expectations, will increase or decrease the price of shares in that company. Forecasting also provides an important benchmark for firms which have a long-term perspective of operations. (investopedia.com)

Any quantifiable item that you can handle, buy, sell, store, consume, produce, or track can be considered inventory. This covers everything from office and maintenance supplies, to raw material used for manufacturing, to semi-finished and finished goods, to fuel used to power equipment used in the business.

Fulfillment house - A company that specializes in providing fulfillment services on behalf of a product owner. In addition to providing storage facilities, a fulfillment house accepts, fills, and ships orders. (businessdictionary.com)

General line of merchandise - a term used in retail and wholesale business in reference to merchandise not limited to some particular category. General merchandise stores (general stores) address this sector of retail. (Wikipedia.com)

Goods and services - The most basic products of an economic system that consist of tangible consumable items and tasks performed by individuals. Many business portfolios consist of a mix of goods and services that they offer to potential consumers via a sales force. (businessdictionary.com)

Institute for Supply Management - the largest supply management association in the world as well as one of the most respected. ISM's mission is to lead the supply management profession through its standards of excellence, research, promotional activities, and education. (businessdictionary.com)

Inventory - A list of raw materials, components, work in progress, finished goods or other supplies held in a warehouse or distribution center. (logisuite.com)

Inventory control - The direction and control of activities with the purpose of getting the right inventory in the right place at the right time in the right quantity in the right form at the right cost. Inventory administration through planning, stock positioning, monitoring product age, and ensuring product availability. (logisuite.com)

Last mile (transportation) - a term used in supply chain management and transportation planning to describe the movement of people and goods from a transport hub to a final destination. (investopedia.com)

Order fulfillment - The process involved in receiving and entering orders, passing the orders through planning, and scheduling and completing delivery of the orders after manufacture.

Order picking - Withdrawing items from inventory to fulfill an order. (businessdictionary.com)

Overstock - Supply with more of something than is necessary or required (encyclopedia.com)

Part number - Code that uniquely identifies an inventory item without reference to any list or manual. A part number may also include the model number, year of manufacture, and other such information. (businessdictionary.com)

Port centric logistics - A distribution center (DC) that is located at a port as opposed to inland bringing companies closer to the markets they serve and decreasing freight miles. (Clipper Logistics Group Ltd.)

Price look-up code - commonly called PLU codes, PLU numbers, PLUs, produce codes, or produce labels, are identification numbers affixed to produce in grocery stores and supermarkets to make check-out and inventory control easier, faster, and more accurate. (ifpsglobal.com)

Product - Something that has been or is being produced. (logisuite.com)

Purchase order - A document used to approve, track, and process purchased items. A purchase order is used to communicate a purchase to a supplier. It is also used as an authorization to purchase. A purchase order will state quantities, costs, and delivery dates. The purchase order is also used to process and track receipts and supplier invoices/payments associated with the purchase.

A document created by a buyer to officially request a product or service from a seller. It contains, among other things, the name and address of the buyer, the ship-to address, the quantity, product code [and expected price], requested ship or receipt date, sales and shipping terms, and other appropriate information. (logisuite.com)

Purchase requisition - Document generated by a user department or storeroom-personnel to notify the purchasing department of items it needs to order, their quantity, and the timeframe. It may also contain the authorization to proceed with the purchase. Also called purchase request or requisition. (businessdictionary.com)

Purchasing manager - An individual in a company who has the responsibility of purchasing the items required by the company. The purchasing manager is typically in charge of purchasing whatever the company needs, from regular office supplies, to the materials that would be used to manufacture the company's products. In larger companies, the purchasing manager's role will sometimes be more supervisory, with other employees in charge of placing the orders. (businessdictionary.com)

Raw material - A material or substance used in the primary production or manufacturing of a good. Raw materials are often natural resources such as oil, iron and wood. Before being used in the manufacturing process raw materials often are altered to be used in different processes. Raw materials are often referred to as commodities, which are bought and sold on commodities exchanges around the world. (investopedia.com)

Requisition - A formal request. Shareholders can issue a requisition notice to a company requiring it to put resolutions to a vote. In business, one department of a company might submit a requisition to the purchasing department for supplies it wants to order. (investopedia.com)

Rotable pool - Components or inventory items that can be repeatedly and economically restored to a fully serviceable condition. (businessdictionary.com)

Safety stock - quantity of inventory used in inventory management systems to allow for deviations in demand or supply. Safety stock calculations will take into account historic deviations and use a required service level multiplier to determine the optimal safety stock level. See article on safety stock.

The inventory a company holds above normal needs as a buffer against delays in receipt of supply or changes in customer demand. (logisuite.com)

Sales order - The seller's internal translation of their buyer's Purchase Order. The document contains much of the same information as the purchase order but may use different Product IDs for some or all of the line items. It will also determine inventory availability. (logisuite.com)

SCM software - Management of material and information flow in a supply chain to provide the highest degree of customer satisfaction at the lowest possible cost.

Supply chain management requires the commitment of supply chain partners to work closely to coordinate order generation, order taking, and order fulfillment. They thereby create an extended enterprise spreading far beyond the producer's location. (businessdictionary.com)

Shipping list - Form that documents all goods sent out at one time against a particular order. (businessdictionary.com)

Spare part - Replaceable component, sub assembly, and assembly identical to and interchangeable with the item it is intended to replace. Also called spare or (in the US) service part. (businessdictionary.com)

Stockout - A situation in which the items a customer orders are currently unavailable. (logisuite.com)

Supplier rating - Assessment of existing or new suppliers on the basis of their delivery, prices, production capacity, quality of management, technical capabilities, and service. (businessdictionary.com)

Supply chain - A group of physical entities such as manufacturing plants, distribution centers, conveyances, retail outlets, people and information which are linked together through processes (such as procurement or logistics) in an integrated fashion, to supply goods or services from source through consumption. (logisuite.com)

Supply chain management - The coordinated management and control of the supply chain, from the acquisition of raw materials from vendors through their transformation into finished goods to the delivery of merchandise to the final customer. It involves information sharing, planning, resource synchronization and performance measurement.

The management and control of all materials, funds, and related information in the logistics process from the acquisition of raw materials to the delivery of finished products to the end user. (logisuite.com)

Supply chain sustainability - Supply chain sustainability is a holistic perspective of supply chain processes and technologies that go beyond the focus of delivery, inventory and traditional views of cost. This emerging philosophy is based on the principle that socially responsible

products and practices are not only good for the environment, but are important for long-term profitability. (searchmanufacturingerp.techtarget.com)

Vendor - The sellers of products and services. (logisuite.com)

Vendor managed inventory - A customer service strategy used to manage inventory of customers to lower cost and improve service. (logisuite.com)

Warehouse - A covered place for the reception and storage of goods. (logisuite.com)

Widget (economics) - a placeholder name for an object or, more specifically, a mechanical or other manufactured device. (Wikipedia.com)

Will call - an item of merchandise that is reserved for a customer, who takes possession of it when payments have been completed. (businessdictionary.com)

Work in progress - Material that has entered the production process but is not yet a finished product. Work in progress (WIP) therefore refers to all materials and partly finished products that are at various stages of the production process. WIP excludes inventory of raw materials at the start of the production cycle and finished products inventory at the end of the production cycle. (investopedia.com)

Glossary Matrix

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12
Term												
ABC analysis					X	X	X	X			X	X
Accounting software				X	X			X				
APICS	X		X									
Build to order			X		X							X
Build to stock			X		X							X
Bullwhip effect			X		X							X
Carrying cost			X		X						X	X
Channel coordination			X		X			X	X			X
Common carrier			X		X		X		X			X
Consumables			X		X		X				X	X
Cool chain quality indicator		X		X	X	X	X	X	X	X	X	X
Customer			X				X	X	X	X	X	X
Demand signal repository				X	X					X		X
Direct shipment			X				X		X		X	X
Document automation				X					X	X		
Final assembly schedule					X							
Finished good			X		X	X						
Forecasting			X		X							
Fulfillment house												X
General line of merchandise			X									
Goods and services			X						X			X
Institute for Supply Management	X											
Inventory			X	X	X	X	X	X	X	X	X	X
Inventory control			X	X	X	X	X	X	X		X	X
Last mile (transportation)			X						X			X
Most valuable customers					X		X		X			X
Net D				X	X				X			X
Order fulfillment			X	X	X		X	X	X	X	X	X
Order picking			X	X	X		X	X		X	X	X
Overstock			X		X	X					X	X
Part number			X	X	X	X	X	X	X	X	X	X
Port centric logistics									X			
Price look-up code					X							X
Product			X	X	X	X	X	X	X	X	X	X

Purchase order			X		X	X	X	X			X	X
Purchase requisition			X		X			X			X	X
Purchasing manager			X		X						X	
Raw material			X		X	X		X			X	X
Requisition			X		X	X		X			X	X
Rotable pool					X	X						
Safety stock					X	X		X				
Sales order			X	X	X	X	X	X	X	X		X
SCM software										X		
Shipping list			X				X		X			
Spare part				X						X	X	
Stockout			X		X		X			X		X
Supplier rating					X							
Supply chain			X		X			X	X	X		X
Supply chain management			X		X			X	X	X		X
Supply chain sustainability					X					X		X
Vendor			X		X	X		X	X	X	X	X
Vendor managed inventory					X							X
Warehouse		X	X	X	X	X	X		X	X	X	X
Widget (economics)			X		X	X	X	X	X	X		X
Will call			X				X					
Work in progress			X		X							X

Appendix C: Industry Standards

TRANSPORTATION LOGISTICS PATHWAY
CONTENT STANDARDS AND PERFORMANCE ELEMENTS

Crosswalk for Transportation Logistics

	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
TL											
WE-WORKPLACE ESSENTIALS		X			X				X		
SC-SUPPLY CHAIN MANGEMENT				X		X			X	X	X
TM-TRANSPORTATION MANAGEMENT				X					X	X	
WM-WAREHOUSE MANAGEMENT					X	X	X	X	X		X
CS-COMPUTER SYSTEMS					X		X		X		X
SA-SAFETY AWARENESS			X		X				X		
		Unit 11	**Unit 12**								
WE-WORKPLACE ESSENTIALS											
SC-SUPPLY CHAIN MANGEMENT			X								
TM-TRANSPORTATION MANAGEMENT											
WM-WAREHOUSE MANAGEMENT		X									
CS-COMPUTER SYSTEMS											
SA-SAFETY AWARENESS		X									

WE - WORKPLACE ESSENTIALS
SC - SUPPLY CHAIN MANGEMENT
TM - TRANSPORTATION MANAGEMENT
WM - WAREHOUSE MANAGEMENT
CS - COMPUTER SYSTEMS
SA - SAFETY AWARENESS

The National Standards can be viewed at the American Society for Transportation Logistics website at http://www.astl.org.

Appendix D: 21st Century Skills[1]

21st Century Crosswalk for Transportation Logistics

	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
21st Century Standards											
CS1										X	
CS2				X		X				X	
CS3			X	X					X	X	
CS4			X						X		
CS5			X						X	X	
CS6										X	X
CS7		X						X		X	
CS8		X		X			X			X	
CS9			X	X	X	X	X	X	X	X	X
CS10		X									
CS11		X			X	X	X	X	X	X	X
CS12				X	X					X	X
CS13		X			X	X	X	X	X		
CS14				X		X	X	X	X	X	X
CS15		X		X						X	
CS16		X	X	X						X	
		Unit 11	Unit 12								
CS1											
CS2											
CS3		X									
CS4											
CS5		X									
CS6		X									
CS7		X	X								
CS8		X									
CS9		X	X								
CS10											
CS11		X	X								
CS12		X									
CS13		X									
CS14		X	X								
CS15		X									
CS16		X									

CSS1-21st Century Themes

CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
3. Understanding other nations and cultures, including the use of non-English languages

CS2 Financial, Economic, Business, and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

[1] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems.
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.).
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions.
4. Take individual and collective action toward addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues).

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

1. Think Creatively
2. Work Creatively with Others
3. Implement Innovations

CS7 Critical Thinking and Problem Solving

1. Reason Effectively
2. Use Systems Thinking
3. Make Judgments and Decisions
4. Solve Problems

CS8 Communication and Collaboration

1. Communicate Clearly
2. Collaborate with Others

CSS3-Information, Media and Technology Skills

CS9 Information Literacy

1. Access and Evaluate Information
2. Use and Manage Information

CS10 Media Literacy

1. Analyze Media
2. Create Media Products

CS11 ICT Literacy

1. Apply Technology Effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability

1. Adapt to change
2. Be Flexible

CS13 Initiative and Self-Direction

1. Manage Goals and Time
2. Work Independently
3. Be Self-directed Learners

CS14 Social and Cross-Cultural Skills

1. Interact Effectively with others
2. Work Effectively in Diverse Teams

CS15 Productivity and Accountability

1. Manage Projects
2. Produce Results

CS16 Leadership and Responsibility

1. Guide and Lead Others
2. Be Responsible to Others

Appendix E: Common Core Standards

Common Core Crosswalk for English/Language Arts (11-12)											
	Units	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**
Common Core Standards											
RL.11.1.											
RL.11.2.											
RL.11.3.											
RL.11.4.											
RL.11.5.											
RL.11.6.											
RL.11.7.											
RL.11.8.											
RL.11.9.											
RL.11.10.											
RI.11.1.				x					x		
RI.11.2.				x	x					x	
RI.11.3.				x						x	
RI.11.4.			x	x	x		x		x	x	x
RI.11.5.											
RI.11.6.											
RI.11.7.		x	x	x					x		
RI.11.8.											
RI.11.9.											
RI.11.10.											
W.11.1.			x							x	
W.11.2.		x								x	
W.11.3.			x							x	
W.11.4.											
W.11.5.											
W.11.6.		x	x						x		
W.11.7.		x	x						x	x	
W.11.8.		x	x						x	x	
W.11.9.		x	x						x	x	
W.11.10.			x						x		
SL.11.1.				x	x				x	x	x
SL.11.2.											
SL.11.3.											
SL.11.4.			x	x		x	x	x		x	x
SL.11.5.											
SL.11.6.											
L.11.1.		x	x								
L.11.2.		x	x								
L.11.3.		x									
L.11.4.		x	x	x	x	x	x	x	x	x	x
L.11.5.											
L.11.6.		x									
RH.11.1.											
RH.11.2.											
RH.11.3.											
RH.11.4.											
RH.11.5.											
RH.11.6.											
RH.11.7.											
RH.11.8.											
RH.11.9.											
RH.11.10.											
RST.11.1.			x	x	x	x	x	x	x	x	x
RST.11.2.			x	x	x	x	x	x	x	x	x
RST.11.3.			x	x	x	x	x	x	x	x	

RST.11.4.			x	x	x	x	x	x	x	x	x
RST.11.5.										x	
RST.11.6.											
RST.11.7.											
RST.11.8.					x						x
RST.11.9.				x						x	
RST.11.10.											
WHST.11.1.										x	
WHST.11.2.			x						x		
WHST.11.3.											
WHST.11.4.		x									
WHST.11.5.		x	x								
WHST.11.6.		x	x						x		
WHST.11.7.										x	
WHST.11.8.			x						x		
WHST.11.9.			x						x	x	
WHST.11.10.			x						x		
Common Core Standards		**Unit 11**	**Unit 12**								
RL.11.1.											
RL.11.2.											
RL.11.3.											
RL.11.4.											
RL.11.5.											
RL.11.6.											
RL.11.7.											
RL.11.8.											
RL.11.9.											
RL.11.10.											
RI.11.1.		x									
RI.11.2.		x	x								
RI.11.3.		x	x								
RI.11.4.		x	x								
RI.11.5.											
RI.11.6.											
RI.11.7.			x								
RI.11.8.											
RI.11.9.											
RI.11.10.											
W.11.1.		x									
W.11.2.											
W.11.3.		x									
W.11.4.											
W.11.5.											
W.11.6.											
W.11.7.											
W.11.8.											
W.11.9.											
W.11.10.											
SL.11.1.		x	x								
SL.11.2.		x									
SL.11.3.											
SL.11.4.		x	x								
SL.11.5.											
SL.11.6.											
L.11.1.											
L.11.2.											
L.11.3.											
L.11.4.		x	x								
L.11.5.											
L.11.6.											
RH.11.1.											
RH.11.2.											
RH.11.3.											
RH.11.4.											

RH.11.5.											
RH.11.6.											
RH.11.7.											
RH.11.8.											
RH.11.9.											
RH.11.10.											
RST.11.1.		x	x								
RST.11.2.		x	x								
RST.11.3.		x	x								
RST.11.4.		x	x								
RST.11.5.											
RST.11.6.											
RST.11.7.											
RST.11.8.											
RST.11.9.											
RST.11.10.											
WHST.11.1.											
WHST.11.2.											
WHST.11.3.											
WHST.11.4.											
WHST.11.5.											
WHST.11.6.											
WHST.11.7.											
WHST.11.8.											
WHST.11.9.											
WHST.11.10.											

Reading Standards for Literature (11-12)

College and Career Readiness Anchor Standards for *Reading Literature*

Key Ideas and Details

RL.11.1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RL.11.2. Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.

RL.11.3. Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).

Craft and Structure

RL.11.4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)

RL.11.5. Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.

RL.11.6. Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).

Integration of Knowledge and Ideas

RL.11.7. Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)

RL.11.8. (Not applicable to literature)

RL.11.9. Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.

Range of Reading and Level of Text Complexity

RL.11.10. By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 11–CCR text complexity band independently and proficiently.

Reading Standards for Informational Text (11-12)

College and Career Readiness Anchor Standards for *Informational Text*

Key Ideas and Details

RI.11.1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RI.11.2. Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.

RI.11.3. Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.

Craft and Structure

RI.11.4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RI.11.5. Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.

RI.11.6. Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness, or beauty of the text.

Integration of Knowledge and Ideas

RI.11.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

RI.11.8. Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., The Federalist, presidential addresses).

RI.11.9. Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including the Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.

Range of Reading and Level of Text Complexity

RI.11.10. By the end of grade 11, read and comprehend literary nonfiction in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11–CCR text complexity band independently and proficiently.

College and Career Readiness Anchor Standards for *Writing*

Text Types and Purposes

W.11.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.

b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.

c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

e. Provide a concluding statement or section that follows from and supports the argument presented.

W.11.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

c. Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

d. Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

W.11.3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

a. Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.

b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters

c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).

d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.
e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

Production and Distribution of Writing

W.11.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

W.11.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12 on page 54.)

W.11.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

W.11.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.11.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

W.11.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

a. Apply grades 11–12 Reading standards to literature (e.g., "Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics").

b. Apply grades 11–12 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., The Federalist, presidential addresses]").

Range of Writing

W.11.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

College and Career Readiness Anchor Standards for *Speaking and Listening*

Comprehension and Collaboration

SL.11.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.

c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

SL.11.2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

SL.11.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

Presentation of Knowledge and Ideas

SL.11.4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

SL.11.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.11.6. Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 for specific expectations.)

College and Career Readiness Anchor Standards for *Language*

Conventions of Standard English

L.11.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested.

b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed.

L.11.2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

a. Observe hyphenation conventions.

b. Spell correctly.

Knowledge of Language

L.11.3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

a. Vary syntax for effect, consulting references (e.g., Tufte's Artful Sentences) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading.

Vocabulary Acquisition and Use

L.11.4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.

a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.

b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).

c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.

d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

L.11.5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.
b. Analyze nuances in the meaning of words with similar denotations.

L.11.6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Reading Standards for Literacy in History/Social Studies (11-12)

Key Ideas and Details

RH.11.1 Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

RH.11.2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas

RH.11.3. Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain

Craft and Structure

RH.11.4. Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RH.11.5. Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.

RH.11.6. Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence.

Integration of Knowledge and Ideas

RH.11.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

RH.11.8. Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.

RH.11.9. Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.

Range of Reading and Level of Text Complexity

RH.11.10. By the end of grade 12, read and comprehend history/social studies texts in the grades 11–CCR text complexity band independently and proficiently.

Reading Standards for Literacy in Science and Technical Subjects (11-12)

Key Ideas and Details

RST.11.1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11.2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

RST.11.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

RST.11.5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas

RST.11.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity

RST.11.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects (11-12)

Text Types and Purposes

WHST.11.1. Write arguments focused on discipline-specific content.

a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

e. Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

WHST.11.3. (Not applicable as a separate requirement)

<u>Production and Distribution of Writing</u>

WHST.11.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.11.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

WHST.11.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.11.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.11.9. Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

WHST.11.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Common Core Crosswalk for Mathematics (11-12)

	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Common Core Standards											
N-RN.1.											
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N-RN.3.											
N-Q.1.						x	x	x		x	
N-Q.2.						x	x	x		x	
N-Q.3.						x	x	x		x	
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Common Core Standards		**Unit 11**	**Unit 12**								
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Mathematics (High School)

Number and Quantity

The Real Number System

N-RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

N-RN.3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Quantities

N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.

N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

The Complex Number System

N-CN.1. Know there is a complex number i such that $i2 = -1$, and every complex number has the form a + bi with a and b real.

N-CN.2. Use the relation $i2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

N-CN.3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

N-CN.4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.

N-CN.5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}\, i)3 = 8$ because $(-1 + \sqrt{3}\, i)$ has modulus 2 and argument 120°.

N-CN.6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

N-CN.7. Solve quadratic equations with real coefficients that have complex solutions.

N-CN.8. (+) Extend polynomial identities to the complex numbers. For example, rewrite $x2 + 4$ as $(x + 2i)(x - 2i)$.

N-CN.9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Vector and Matrix Quantities

N-VM.1. (+) Recognize vector quantities as having both magnitude anddirection. Represent vector quantities by directed line segments, anduse appropriate symbols for vectors and their magnitudes (e.g., v, |v|,||v||, v).

N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

N-VM.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.

N-VM.4. (+) Add and subtract vectors

N-VM.4.a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.

N-VM.4.b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

N-VM.4.c. Understand vector subtraction $v – w$ as $v + (–w)$, where $–w$ is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

N-VM.5. (+) Multiply a vector by a scalar.

N-VM.5.a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(vx, vy) = (cvx, cvy)$.

N-VM.5.b. Compute the magnitude of a scalar multiple cv using $||cv|| = |c|v$. Compute the direction of cv knowing that when $|c|v \neq 0$, the direction of cv is either along v (for $c > 0$) or against v (for $c < 0$).

N-VM.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

N-VM.7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

N-VM.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

N-VM.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties

N-VM.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the realnumbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

N-VM.11. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.

N-VM.12. (+) Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

Seeing structure in expressions

A-SSE.1. Interpret expressions that represent a quantity in terms of its context.

A-SSE.1.a. Interpret parts of an expression, such as terms, factors, and coefficients.

A-SSE.1.b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)nas the product of P and a factor not depending on P.

A-SSE.2. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-SSE.3.a. Factor a quadratic expression to reveal the zeros of the function it defines.

A-SSE.3.b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A-SSE.3.c. Use the properties of exponents to transform expressions for exponential functions.

A-SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

Arithmetic with Polynomials and Rational Expressions

A-APR.1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials

A-APR.2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

A-APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

A-APR.4. Prove polynomial identities and use them to describe numerical relationships.

A-APR.5. (+) Know and apply the Binomial Theorem for the expansion of (x+ y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

A-APR.6. Rewrite simple rational expressions in different forms; write a(x)/b(x)in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

A-APR.7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

A-CED.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V =IR to highlight resistance R.

Reasoning with Equations and Inequalities

A-REI.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-REI.4. Solve quadratic equations in one variable.

A-REI.4.a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)2= q that has the same solutions. Derive the quadratic formula from this form.

A-REI.4.b. Solve quadratic equations by inspection (e.g., for x2= 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

A-REI.5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x2+y2= 3.

A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.

A-REI.9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

A-REI.12.Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions

Interpreting Functions

F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for $n \geq 1$.

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.7.a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.7.b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.7.c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F-IF.7.d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

F-IF.7.e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.8.a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F-IF.8.b. Use the properties of exponents to interpret expressions for exponential functions.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Building Functions

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.1.a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF.1.b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

F-BF.1.c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

F-BF.3. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.4. Find inverse functions.

F-BF.4.a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.

F-BF.4.b. (+) Verify by composition that one function is the inverse of another.

F-BF.4.c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

F-BF.4.d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

F-BF.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Linear, Quadratic, and Exponential Models

F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

F-LE.1.a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F-LE.1.b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F-LE.1.c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another

F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F-LE.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

F-LE.4. For exponential models, express as a logarithm the solution to ab ct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.

Trigonometric Functions

F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

F-TF.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.

F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

F-TF.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

F-TF.8. Prove the Pythagorean identity $\sin2(\theta) + \cos 2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Geometry

Congruence

G-CO.1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G-CO.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

G-CO.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

G-CO.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

G-CO.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

G-CO.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

G-CO.9. Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G-CO.10. Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

G-CO.11. Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

G-CO.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

G-CO.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

<u>Similarity, Right Triangles, and Trigonometry</u>

G-SRT.1. Verify experimentally the properties of dilations given by a center and a scale factor:

G-SRT.1.a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

G-SRT.1.b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G-SRT.2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

G-SRT.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

G-SRT.4. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

G-SRT.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

G-SRT.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

G-SRT.7. Explain and use the relationship between the sine and cosine of complementary angles.

G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

G-SRT.9. (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

G-SRT.11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles

G-C.1. Prove that all circles are similar.

G-C.2. Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

G-C.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

G-C.4. (+) Construct a tangent line from a point outside a given circle to the circle.

G-C.5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Expressing Geometric Properties with Equations

G-GPE.1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

G-GPE.2. Derive the equation of a parabola given a focus and directrix.

G-GPE.3. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

G-GPE.4. Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.

G-GPE.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

G-GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Geometric Measurement and Dimension

G-GMD.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

G-GMD.2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

G-GMD.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

G-GMD.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry

G-MG.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

G-MG.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Statistics and Probability

Interpreting Categorical and Quantitative Data

S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S-ID.6.a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

S-ID.6.b. Informally assess the fit of a function by plotting and analyzing residuals.

S-ID.6.c. Fit a linear function for a scatter plot that suggests a linear association.

S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9. Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions

S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

S-IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

S-IC.6. Evaluate reports based on data.

Conditional Probability and the Rules of Probability

S-CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

S-CP.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

S-CP.3. Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

S-CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.

S-CP.5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

S-CP.6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

S-CP.7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

Using Probability to Make Decisions

S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

S-MD.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.

S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?

S-MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

S-MD.5.a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.

S-MD.5.b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

S-MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

S-MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Appendix F: National Educational Technology Standards for Students (NETS-S)

NETS Crosswalk for Transportation Logistics											
	Course	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**
NETS Standards											
T1					X						
T2			X	X	X	X	X	X	X	X	X
T3											X
T4			X	X	X	X	X	X	X	X	X
T5											
T6		X	X	X	X	X	X	X	X	X	X
		Unit 11	**Unit 12**								
T1											
T2		X	X								
T3											
T4		X	X								
T5											
T6		X	X								

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

T1 Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students do the following:

a. Apply existing knowledge to generate new ideas, products, or processes.
b. Create original works as a means of personal or group expression.
c. Use models and simulations to explore complex systems and issues.
d. Identify trends and forecast possibilities.

T2 Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students do the following:

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats.

c. Develop cultural understanding and global awareness by engaging with learners of other cultures.
d. Contribute to project teams to produce original works or solve problems.

T3 Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students do the following:

a. Plan strategies to guide inquiry.
b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
d. Process data and report results.

T4 Critical Thinking, Problem Solving, and Decision Making

Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students do the following:

a. Identify and define authentic problems and significant questions for investigation.
b. Plan and manage activities to develop a solution or complete a project.
c. Collect and analyze data to identify solutions and/or make informed decisions.
d. Use multiple processes and diverse perspectives to explore alternative solutions.

T5 Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students do the following:

a. Advocate and practice safe, legal, and responsible use of information and technology.
b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. Demonstrate personal responsibility for lifelong learning.
d. Exhibit leadership for digital citizenship.

T6 Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students do the following:

a. Understand and use technology systems.
b. Select and use applications effectively and productively.
c. Troubleshoot systems and applications.
d. Transfer current knowledge to learning of new technologies.