



**CTE Externship Lessons: Lean Production and Management**  
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This resource was created by Tennessee teachers who participated in teacher externships sponsored by the Tennessee Department of Education, Division of Career and Technical Education. Many of the resources within the activities may be specific to industries where teachers completed their externship. Teachers may opt to substitute resources from companies within their region for better local alignment.

**This resource is best for:**

<b>Teachers of:</b>	Business Management	<b>Career Cluster:</b>	Business Management & Administration
<b>Addressing Standard(s):</b>	Business Management 1, 6, and 7	<b>Grade-Band</b>	11-12

**Learning Objective:** The goal of this activity is to develop a student's understanding of how LEAN manufacturing and a passion for detail interact in the fast paced, highly competitive automotive industry. Students will gain an understanding of LEAN manufacturing and how it is used to create an efficient workplace with waste minimized, and employees who are constantly working to improve the manufacturing process. Also, students will learn how paying attention to detail makes a better product and creates an expectation of excellence both for every team member in the manufacturing environment while incorporating proficiency of Tennessee literacy standards in Technical Subjects.



Texts	Text Complexity Analysis
<p><b>Text 1 Title:</b> <u>Lean Manufacturing: Is It Really Worth It?</u></p> <p><b>Author:</b> Michael Donavon</p> <p><b>Citation/Publication Information:</b> “Lean Manufacturing: Is It Really Worth It?” Reliable Plant.com. Michael Donavon, Web. 03, July 2014.</p> <p><b>Link:</b> <a href="http://www.reliableplant.com/Read/138/lean-manufacturing">http://www.reliableplant.com/Read/138/lean-manufacturing</a></p>	<p><b>Quantitative:</b> Lexile: 1385</p> <p><b>Qualitative:</b> The purpose of this article is to present an understanding of a manufacturing concept. The text contains moderate levels of discipline-specific content, recognizable ideas and challenging abstract concepts.</p> <p><b>Reader and Task:</b> Students should be able to engage with the text on a close reading level. Scaffolding should be provided for students who need assistance with reading comprehension.</p>
<p><b>Text 2 Title:</b> <u>Top 25 Lean Tools</u></p> <p><b>Author:</b> Vorne Industries, Inc</p> <p><b>Citation/Publication Information:</b> “Top 25 Lean Tools.” Leanproduction.com. Vorne Industries, Inc., Web. 03, July 2014.</p> <p><b>Link:</b> <a href="http://www.leanproduction.com/top-25-lean-tools.html">http://www.leanproduction.com/top-25-lean-tools.html</a></p>	<p><b>Quantitative:</b> Lexile: 1150</p> <p><b>Qualitative:</b> This article contains domain-specific vocabulary; for this reason, teachers may want to preview prior to assigning students this article. The text structure is essential to the understanding of the content. Using the chart should assist in this process.</p> <p><b>Reader and Task:</b> This document will be used as a reference and assist in demonstrating an understanding of LEAN concepts. Comprehension strategies should be employed for students who need assistance managing the large amount of diverse information in the text.</p>



<b>ELA/Literacy Standards addressed by task</b>	
<b>Strand</b>	<b>Grades 11-12</b>
Reading Standards for Technical Subjects: Key Ideas and Details	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> </ol>
Reading Standards for Technical Subjects: Craft and Structure	<ol style="list-style-type: none"> <li>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.</li> </ol>
Writing in Technical Subjects: Text Types and Purposes	<ol style="list-style-type: none"> <li>1. Write arguments focused on discipline specific content.               <ol style="list-style-type: none"> <li>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.</li> <li>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while point 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.</li> <li>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.</li> <li>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.</li> <li>e. Provide a concluding statement or section that follows from or supports the argument presented.</li> </ol> </li> </ol>
<b>Tennessee CTE Standards addressed by task</b>	
Business Management	<p>Standard 1) The student will develop and apply concepts related to human relations, safety, career development, and communication and leadership skills.</p> <ol style="list-style-type: none"> <li>1.2 Demonstrate the interpersonal, teamwork, and leadership skills needed to function in diverse business settings, including the global marketplace.</li> <li>1.3 Communicate effectively as writers, listeners, and speakers in diverse social and business settings.</li> </ol>



	<p>1.4 Apply the critical-thinking and soft skills needed to function in students’ multiple roles as citizens, consumers, workers, managers, business owners, and directors of their own futures.</p> <p>1.5 Analyze and follow policies for managing legal and ethical issues in organizations and in a technology-based society.</p> <p>1.6 Investigate the life-long learning skills that foster flexible career paths and confidence in adapting to a workplace that demands constant retooling.</p> <p>1.11 Apply appropriate typography concepts to industry documents.</p> <p>Standard 6) The student will examine how effective decision-making skills are used in the management process.</p> <p>6.1 Classify the steps in an effective decision-making process.</p> <p>6.2 Evaluate the procedures for making every day managerial decisions.</p> <p>Standard 7) The student will describe the communication process and any barriers to communication, including ways to improve communication.</p> <p>7.1 Illustrate terms needed for effective communication.</p> <p>7.2 Analyze the networks of communication.</p> <p>7.3 Interpret why communication is important.</p> <p>7.4 Examine the various barriers to communication.</p> <p>7.5 Analyze ways that businesses may improve their own communication.</p>
<p><b>What key insights should students take from these resources?</b></p>	
<ol style="list-style-type: none"> <li>1. A thorough understanding of the principles of LEAN management, how the concepts are used in a manufacturing environment, and their application to other business organizations.</li> <li>2. Determine the reason(s) that companies might implement the LEAN management.</li> <li>3. Explain how LEAN management and company based quality concepts affect performance, safe labor, and money in the manufacturing process.</li> <li>4. Demonstrate effective business communications and decision making.</li> </ol>	



**Text-Dependent Questions**

**Text 1**

- How does this article describe the LEAN concept for manufacturing?
- How does the author say LEAN can improve operating performance?
- According to the article, how are LEAN goals measured, and what technologies are used to gather these measurements?
- What does the article say are the cost benefits of LEAN?
- Describe why companies fail using the LEAN process. What conclusions can you draw about companies that fail versus those that succeed? Be sure to cite evidence from the text to defend your conclusion.

**Text 2**

- According to the text, what is the LEAN tool for organizing the work area, and how do you apply each concept?
- Explain how the authors describe the concept of Just-in-Time (JIT) as it relates to inventory in the manufacturing process.
- What does the text say are the benefits of using Just-in-Time inventory management in LEAN? Do you agree with the outcome?
- According to text, what is “takt” time and how is it used in LEAN production evaluation? How could it be improved?
- Based on your study of the table, how does “takt” time relate to Just-in-Time? Be sure to cite evidence from the text to support your answer.

Writing Mode	Writing Prompt
Argumentative	When one thinks of close attention to detail, it requires being careful and taking time to ensure every small thing is done perfectly. As a CEO, you have to make a presentation to your Board of Directors on recommending changing your manufacturing/management environment to a LEAN system. Write a proposal describing the LEAN process and provide reasoning for your recommended change. Use evidence from the articles to defend your decision. Point out strengths and limitations, and make a strong persuasion. Create a presentation which can be used to accompany your proposal to the Board of Directors.

**Additional Resources**

**Suggested Additional Website References:**

- Video “Building the Passat in 105 Seconds” link <http://normvan.weebly.com/passat-video.html>
- Volkswagen: Passion for Detail Philosophy: <http://wardsauto.com/auto-makers/volkswagen-adopts-passion-detail-philosophy-passat-production>



**Potential Lesson Plan Design:**

**Day 1:** Read the article [Lean Manufacturing: Is it Really Worth It?](#)

Open the lesson by having the students engage in the following bell ringer activity:

Consider this: If you were purchasing a car, what are the most important things you look for concerning that vehicle? Would you be more likely to purchase a car that took several weeks to build or one that rolled off the line in a few days? Be prepared to share out.

- Today we will discuss what it means to be LEAN in manufacturing.” Ask students what the word ‘lean’ means to them.
- Have students read the text and highlight key words and or phrases that explain LEAN concepts.
- Break class into small groups. Each group will develop a definition of LEAN based on their interpretation of the reading, citing evidence from the text.
- Have each group share their definition and compare common concepts.
- Show the “Building the Passat in 105 Seconds” video and have the students discuss how many processes they see and how they relate to LEAN manufacturing concepts (small groups or as a class).
- Close the lesson by having the students compare their conceptions of manufacturing prior to today’s discussion to what they learned today. Have students revisit their definition of lean and compare it to the one they came up with in their groups. Ask students, “Have you changed your mind about which car you would purchase from the question at the start of class?”

Text Under Discussion	Sample Teacher Dialogue & Guiding Questions
<p><b>Text 1:</b> <a href="#">LEAN Manufacturing: Is It Really Worth It?</a></p>	<ul style="list-style-type: none"> <li>• How does this article describe the LEAN concept for manufacturing?</li> <li>• How does the author say LEAN can improve operating performance?</li> <li>• According to the article, how are LEAN goals measured and what technologies are used to gather these measurements?</li> <li>• What does the article say are the cost benefits of LEAN?</li> <li>• Describe why companies fail using the LEAN process, be sure to cite evidence from the text.</li> </ul>



**Day 2:** Demonstrate how LEAN is used with a group project.

- Review the concepts of LEAN and explain how implementing LEAN is a process of implementation and change based on results.
  - To demonstrate how this change works, give each group 10 sheets of paper and 10 inches of masking tape.
  - Have the groups create a device that will hold as many books as possible, at least  $\frac{3}{4}$  of an inch above the table, with no prep time or guidance from the instructor.
  - Allow the students ten minutes to complete a device and then test each device by stacking textbook on the device one at time until the device falls below the standard.
  - Have students evaluate their process and write ways to improve their device and how it was produced.
- Give the students another set of the materials (paper, tape) and repeat the task again and repeat until students see how changing the process can lead to a more efficient product and process (possibly 3 times total).
- Have students explain how they improved and economized the manufacturing process.
  - Ask students what barriers to communication existed in their groups as they were trying to come up with the best device?

**Day 3:** Introduce the Volkswagen Passion for Detail philosophy and have students examine objects for defects.

Intro: "In the exercise yesterday, you may have discovered that in order to get your product to work, you had to pay attention to the details of how to create a product to do what you needed it to do. You had limited resources and time, but the small things mattered in getting it to work and work properly. Today we will look at the importance of detail with a hands on activity."

- Have students read the Passion for Detail philosophy (Volkswagen: Passion for Detail Philosophy: <http://wardsauto.com/auto-makers/volkswagen-adopts-passion-detail-philosophy-passat-production>)
- Demonstrate the concept the students just read by having student use multiple senses to detect defects in items (sight, touch, smell, and hearing).
  - Have students look at two identical items and point out the differences in the items.
  - Have each student describe one difference they found in the objects.
  - Demonstrate using other objects how they may be alike but through defect or difference in manufacturing, they are different
  - Have students then reexamine their object to see if other differences are found.
- Introduce text 2, *Top 25 Lean Tools*.
  - Describe how waste in manufacturing adds price to a product without adding value. Then ask, what application does this have to managing a business?
  - Have student's present ideas as to why attention to detail important, citing evidence from texts they have read.



Text Under Discussion	Sample Teacher Dialogue & Guiding Questions
<b>Text 2:</b> <u>Top 25 Lean Tools</u>	<ul style="list-style-type: none"> <li>• According to the text, what is the LEAN tool for organizing the work area, and how do you apply each concept?</li> <li>• Explain how the authors describe the concept of Just-in-Time as it relates to inventory in the manufacturing process.</li> <li>• What does the text say are the benefits of using Just-in-Time inventory management in LEAN?</li> <li>• According to text, what is “takt” time and how is it used in LEAN production evaluation?</li> <li>• Based on your study of the table, how does “takt” time relate to Just-in-Time? Be sure to cite evidence from the text to support your answer.</li> </ul>

**Day 4:** Students will use the writing prompt to demonstrate their knowledge of LEAN.

**Writing Prompt Set Up:** Students will write an essay arguing for the implementation of LEAN management to their Board of Directors. You can assign students different business such as a manufacturing company, hospital, human resources agency, etc. Students will then create a presentation of their proposal to the Board of Directors and present to the class.

**Writing Prompt:** When one thinks of close attention to detail, it requires being careful and taking time to ensure every small thing is done perfectly. As a CEO, you have to make a presentation to your Board of Directors on recommending changing your manufacturing/management environment to a LEAN system. Write a proposal describing the LEAN process and provide reasoning for your recommended change. Use evidence from the articles to defend your decision. Create a presentation which can be used to accompany your proposal to the Board of Directors.

**Discussion:** These texts could be explored orally and used to form the basic foundation of a lesson or series of lessons. Close-reading questions should be developed in advance in order to drive student understanding of the material while also practicing reading skills. For information on how to develop questions for this type of discussion, visit [http://www.tncore.org/literacy\\_in\\_science\\_and\\_technology/curricular\\_resources/text\\_dependent\\_questions.aspx](http://www.tncore.org/literacy_in_science_and_technology/curricular_resources/text_dependent_questions.aspx).





**Writing and/or Assessment:** The writing prompt included can be a longer-term writing assignment for students to develop and refine over time to gauge student understanding of technical content as well as reading and writing skills as outlined by the Tennessee State Standards for Literacy in Technical Subjects. An appropriate writing rubric should be used to assess student work. A rubric can be found at: [http://www.tncore.org/literacy\\_in\\_science\\_and\\_technology/assessment/scoring\\_resources.aspx](http://www.tncore.org/literacy_in_science_and_technology/assessment/scoring_resources.aspx).

- **Task:** If using this material as a writing task, you may scaffold the texts with close readings and text-based questions to guide student exploration of the texts. A culminating task of this lesson or sequence of lessons could be the writing prompt – either assigned in class, as homework, or as a report that is drafted and refined over time to build writing skills.

**Scaffolding and support for students with special needs, English language learners, and struggling readers:** Consider pre-teaching synonyms of difficult vocabulary words. Lower-level readers and ELL students can still be challenged without being overloaded with difficulty. This strategy can also be used to differentiate for stronger readers by introducing new, and more challenging, vocabulary. Struggling readers would also benefit from visual aids to illustrate many of the ideas presented. Pictures, diagrams, and charts alongside the text will go far to aid students as they dissect the articles.

**Note:** Social, ethnic, racial, religious, and gender bias is best determined at the local level where educators have in-depth knowledge of the culture and values of the community in which students live. TDOE asks local districts to review these materials for social, ethnic, racial, religious, and gender bias before use in local schools.