**Lesson 3: Production Process**

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| **Lesson** | **Title & Short Description:** | **Learning Outcome:** |
| #3 | **Production Process**:  A key part of this lesson is the concepts of ‘systems’ and manufacturing production processes. Students will watch a time-lapsed video of a plane and a Tesla car being made:  [Norwegian Dreamliner](https://www.youtube.com/watch?v=jiH3-rJ-iYc)  [Telsa Model 3 Assembly Line](https://www.youtube.com/watch?v=RQHBR3rjGXM&feature=emb_logo) | Students will learn more about the concepts of ‘systems’ and ‘manufacturing production processes’.  Students will produce a ‘mock assembly’ line for a simple task like making cookies (at home) or constructing a LEGO set or object.  Students will create and refine the production process and learn the importance of being organized & having a system in place. |

**Problem statement: *How can we improve our production process so that we have less debris (foreign object debris or FOD) left on the airplane during the build stage and can deliver a clean, safe airplane? What turns an object into a FOD?***

**Learning objectives:**. I can define what is meant by a ‘system’ and how systems are important in manufacturing production processes.

**Standards: Next Generation Science Standards (NGSS), Common Core Standards (CCSS)**

**NGSS:**

5-PS1-3: Make observations and measurements to identify materials based on their properties.

3-5-ETS1-1:

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2:

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem

3-5-ETS1-3:

Plan and carry out fair tests in which variables our controlled and failure points are considered to identify aspects of a model or prototype that can be improved

**CCSS**

[ELA-LITERACY.SL.5.1](http://www.corestandards.org/ELA-Literacy/SL/5/1/)

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.5.1.A](http://www.corestandards.org/ELA-Literacy/SL/5/1/a/)

Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.5.1.A](http://www.corestandards.org/ELA-Literacy/SL/5/1/a/)

Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.5.1.C](http://www.corestandards.org/ELA-Literacy/SL/5/1/c/)

Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

[CCSS.ELA-LITERACY.SL.5.1.C](http://www.corestandards.org/ELA-Literacy/SL/5/1/c/)

Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

**Soft Skills:**

Listening, Critical Thinking, Collaboration, Communication (written and oral), Creativity & Innovation

**Materials:**

* LEGOs (or another set of objects that can be disassembled and reassembled again)
* Copies of Lesson 3 - Student Planning sheet
* Copies of Lesson 3 - Production Line Check-off sheet
* Paper or a science journal
* Pencils
* Timer or clock

**Lesson preparation:** 40-50 minutes to prepare the sets for assembly, copies, etc.

**Time required:** 1-2 hours (Time required will depend on how many times the groups tries their assembly line

**Grouping of students for instruction:**

Students will be placed in groups of 3-4 people. They will be utilizing an assembly line to create a ‘product’ such as a toy car or structure out of LEGOS. Groups can assign roles for each person such as recorder, supply manager, time keeper, recorder, and so on.

**What is the instruction? Consider the PBL procedure that is being addressed here:** The students are still in the ‘exploration’ phase of the PBL unit. They are building their background knowledge about how a manufacturing production process might work and the importance of being organized so that the process is efficient. They will learn later how this not only saves time but also money for the company.

**Understanding the Problem**

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| **Teacher** | **Student** |
| 1. The teacher will show the videos of the Dreamliner airplane and the Tesla car being made on the PPT slides. Teacher will discuss how these are examples of the production process. Teacher will ask the students to write down what they notice during each video. | Students will jot down a few notes of what they notice about each video clip.  Students will discuss what they noticed, and then will be asked to define what they think a ‘production process’ is just by looking at the videos (inquiry). |
| 1. Teacher guides the students towards the ‘actual’ definition’ and shows them their definition. | Students record the definition in their science journal or packet. |
| 1. Teacher has the students get a box of LEGOs or building blocks. Teacher shows the students a ‘model’ LEGO building & asks them to build a certain structure. (The teacher is trying to demonstrate how it would take a longer time if there is no preplanned plan.)   (Optional: If you have more time, you could have each group create a unique toy car that has at least 20 pieces.) | Students try to rebuild the LEGO structure as the teacher times them. This will be the group's initial time.  The assembly line should have at least 3 people if possible so that different students will each be doing certain tasks. |
| 1. Optional: Teacher will have the students share their initial plans in groups. | Students will share their initial plans in groups and get feedback. Students will adjust their plans as needed. |
| 1. Teacher will provide a planning sheet for the production line (See Lesson 3 - Student planning sheet) | Students will fill-out the planning sheet for how to create their product as well as a checklist for knowing if their product was well made.  Students try to rebuild it again, maybe laying out the pieces by color or size.  Each group should try at least 3 variations of their production process. |
| 1. Teacher will provide a recording and reflection sheet for their production line. | Students will fill-out a recording and reflection sheet for their production line. |
| 1. Teacher will have the students share their results. (Note: This could be done in break-out rooms remotely.) | Students will share their results in groups. Students will analyze the quality of their product based off of their checklist. |
| 1. Teacher facilitates a discussion about adding a checklist to look for errors / quality of product. Teacher discusses the importance of safety & quality over quantity. (Add infographic to PPT) | Students discuss in whole class or in small groups the quality of their final products. |

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| Extension for Distance Learning |  |
| Teacher explains the framework for the activity (Assembly Line Task) with the criteria. Teacher will present a list of 5 choices and have students one to execute.  Students will assign certain parts of the ‘task’ to each person, and then estimate how long it would take their assembly line to create a dozen of that item.  Adding a checklist to look for errors / quality of product. (Safety & quality over quantity). | Students will plan-out & produce a ‘mock assembly’ line for a simple household task like making cookies or constructing a LEGO set. The assembly line would need to have at least 5 people doing certain tasks. Students will assign certain parts of the ‘task’ to each person, and then estimate how long it would take their assembly line to create a dozen of that items.  If possible, they could try this assembly line with their parents and analyze how well it works.  Possible example: take pens apart & reassemble.  Adding a checklist to look for errors / quality of product. (Safety & quality over quantity). |

**Accommodations:** Students with special needs or accommodations (IEPs or 504s) can have some extra one-on-one time with the teacher(s) to help clarify the definition of F.O.D. and provide additional support as needed. Students can also work with a partner versus alone for the entire lesson to help them clarify and communicate their ideas.Finally, a student might be given a print-out of the PPT slides and/or more time to answer the ‘poll’ questions.

**Extensions:** Students can create an assembly line with more steps or more people.

**Assessment:**

Students will each fill-out a Production Line Rubric. Teacher will also monitor each group's progress and final product.

Final assessment: Students will create an organizational system to help in the classroom or at home.

**References/Resources:**

Production Line Rubric

PPT with links to videos