# Generated imagePLTW Compound Machine Project — Student Guide

**Objective:** Build a compound machine using VEX parts that transports a payload (such as a 1000-gram weight) from the floor to a tabletop (≥50 cm high). The machine must move the payload continuously without human intervention and must include at least 3 different simple machines. Creative variations of this challenge are welcome with instructor approval.

**Footprint:** The machine must fit entirely on the **15 × 30 in. VEX base plate**.

**Materials:** Only **VEX components** are allowed. Exceptions: string, rubber bands, and tape as connectors or tension elements. No other parts.

**Documentation:** All notes, sketches, calculations, tests, and reflections **must be kept in your engineering notebook**. Nothing should be submitted separately.

## Steps to Success

### 1. Define the Problem & Constraints

* Write a clear statement of what your machine will do.
* List criteria for success (payload height, smooth motion, safety, etc.).
* Record everything in your engineering notebook.

### 2. Research & Inspiration

* Look at examples of compound machines.
* Record ideas from videos, books, or websites.
* Cite your sources in your notebook.

### 3. Ideation & Planning

* Make **4+ sketches** showing different ideas in your notebook.
* Use a **selection matrix** to choose the best design.
* Plan your build timeline in the notebook.

### 4. Build Mechanisms & Ensure Payload Transport

* Include **3+ different simple machines** (lever, pulley, wheel/axle, inclined plane, screw, wedge).
* Machines must work together to move the payload.
* Ensure the payload moves from start to finish without hand assistance.
* Record your design notes in the notebook.

### 5. Calculations & Analysis

* Calculate IMA (ideal mechanical advantage) and AMA (actual mechanical advantage).
* Compute efficiency.
* Record gear or pulley ratios.
* Compare predicted vs. actual performance in your notebook.

### 6. Build Quality & Safety

* Build sturdily and neatly.
* All parts must stay on the VEX base plate.
* **Take notes on any construction challenges or adjustments.**

### 7. Testing & Iteration

* Test your machine multiple times.
* Record data in tables or graphs in your notebook.
* Make changes and improvements based on test results.
* Document each iteration.

### 8. Documentation

* Keep a dated, legible engineering notebook.
* Include sketches, parts lists, BOM (bill of materials), calculations, test results, and reflections.
* **This is the only place for your project documentation.**

### 9. Communication & Presentation

* Prepare a short demo showing payload transport.
* Explain your design process using visuals from your notebook.
* Be ready for questions.

### 10. Teamwork & Professionalism

* Assign roles fairly.
* Work collaboratively.
* Meet deadlines and stay on task.
* **Record your team roles and contributions in your notebook.**

## Quick Checklist (for students, all in notebook)

* Problem statement & success criteria
* Research notes & citations
* 4+ sketches + selection matrix
* Final digital detailed drawings / CAD / exploded view
* Parts list (VEX components only)
* IMA, AMA, efficiency, gear/pulley ratios
* Testing data tables & graphs
* Iteration notes
* Final prototype photos/video showing payload transport
* Presentation slides/poster & demo plan