Engineering and Design Using LEGOs

Content Area: **Undefined**
Course(s): **TAG Enrichment 2**
Time Period: **Trimester 1**
Length: **Approximately 12 weeks**
Status: **Published**

Unit Overview

This unit is to introduce the students to the following simple machines: gears and wheels/axles. By using this LEGO education kit, it enables students to work as young scientists and engineers, helping them to investigate and understand the operation of simple machines and compound machines found in everyday life. Students will develop skills such as creative problem-solving, communication of ideas, and collaboration/teamwork. They will be using the scientific method through observation, reasoning, prediction, and critical thinking.

Essential Questions

- What is a simple machine?
- Where have you seen a gear before?
- Where have you seen a wheel and axle before?
- Why do we use simple machines?
- Do you like Merry Go-Rounds?
- Which simple machine might be needed for a merry go-round to turn?
- Have you ever tried steering a go-kart?
- Which simple machine is needed for a go-kart to move and turn?

Content

- identify gears as either spur or crown
- build a model that will gear up and increase speed of rotation
- build a model that will gear down and decrease speed of rotation
- arrange gears so they turn in the same direction, in opposite directions, or at 90 degrees to each other as desired
- recognize that how fast or how slow one gear makes another turn depends on the number of teeth on the gears and their positions
- identify a wheel-and-axle as a simple machine
- investigate a single fixed axle
- invest separate axles
- build a wheeled model that turns a corner easily
- build a model that can be steered
- identify where friction might be found
- build a 3-dimensional model

- follow steps of the engineering process
- predict outcomes of various trials

Skills

- estimating
- counting
- predicting
- discussing
- measuring
- compare and contrast
- identify
- recognize
- investigate
- design

  building

  exploring

  communicating

  measuring

  timing

Assessments

- teacher observation
- teacher inquiry through oral questions
- individual answers to teacher-directed questions
- problem-solving skills observed
- cooperatively working with partner to successfully achieve the task at hand

- ability to work independently at times

Lessons/Learning Scenarios

Gears: Teacher will do an overview of gears: what they are, what they look like, the different types, what they are used for, etc... Students will be given Build Book A. The groups will begin working at their own pace in the Build Books. When they complete A1 (for example), they will raise hand and let teacher know they are finished so she can come and check that it is built properly and ask a few questions regarding what they built and why they think it works a certain way(or why it doesn't work the way it should). Teacher will then grant permission for group to move on to the next challenge. They will repeat those steps for each of the challenges in the Build Book. Everyone is working at their own pace and teacher is conferencing with each group individually after each challenge and assessing their understanding of the engineering process. Once the students have completed the Build Book, they will be given the Problem-Solving activity sheet for that simple machine. This problem-solving activity sheet has very minimal directions (unlike the step-by-step directions in the Build Books). They are given a basic design brief. They then build, test, evaluate, and redesign (if necessary). Once they have successfully completed the Problem-Solving activity worksheet, they then have permission to move on to the next Build Book.

Wheels and Axles: Teacher will do an overview of wheels and axles: what they are, what they look like, what they are used for, etc... Students will be given Build Book B. The groups will begin working at their own pace in the Build Books. When they complete B1 (for example), they will raise their hands and let the teacher know they are finished so she can come and check that it is built properly and ask a few questions regarding what they built and why they think it works in a certain way (or why it doesn't work the way it should). Teacher will then grant permission for the groupp to move on to the next challenge. They will repeat those steps for each of the challenges in the Build Book. Everyone is working at their own pace and the teacher is conferencing with each group individually after each challenge and assessing their understanding of the engineering process. Once the students have completed the Build Book, they will be given the Problem-Solving activity sheet for that simple machine. This problem-solving activity sheet has very minimal directions (unlike the step-by-step directions in the Build Books. They are given a basic design brief. They then build, test, evaluate, and redesign (if necessary). Once they have successfully completed the Problem-Solving activity worksheet, they then have permission to Free Build.

Free Build Days: One day a week during class meetings, teacher will have a Free Build Day for the students to explore their creativity and imagination using the LEGO Simple machines kits. Sometimes the teacher will give them a "theme" to follow, other days they will have free reign to use their imaginations and engineering skills to build whatever they choose.

Standards

SCI.K-2.5.1.2.A	Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.
SCI.K-2.5.2.2.E.1	Investigate and model the various ways that inanimate objects can move.
SCI.K-2.5.2.2.E.2	Predict an object's relative speed, path, or how far it will travel using various forces and surfaces.
SCI.K-2.5.2.2.E.a	Objects can move in many different ways (fast and slow, in a straight line, in a circular path, zigzag, and back and forth).
SCI.K-2.5.2.2.E.b	A force is a push or a pull. Pushing or pulling can move an object. The speed an object moves is related to how strongly it is pushed or pulled. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.
TEC.K-2.8.2.2.G.1	Describe how the parts of a common toy / tool interact and work as part of a system.
WORK.K-4.9.1.4.1	Collaboration and teamwork enable individuals or groups to achieve common goals with greater efficiency.
WORK.K-4.9.1.4.A.1	Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
WORK.K-4.9.1.4.A.5	Apply critical thinking and problem-solving skills in classroom and family settings.
WORK.K-4.9.1.4.F.2	Establish and follow performance goals to guide progress in assigned areas of responsibility and accountability during classroom projects and extra-curricular activities.
	The design process is a systematic approach to solving problems.

Resources

- Build books
- LEGO Simple Machines kits
- Problem-solving activity sheets