Unit Conversion

Subject Area(s) Mathematics and Engineering

Associated Unit: Units of Length

Activity Title: Unit Conversion

Image 1: 2 [position: centered]

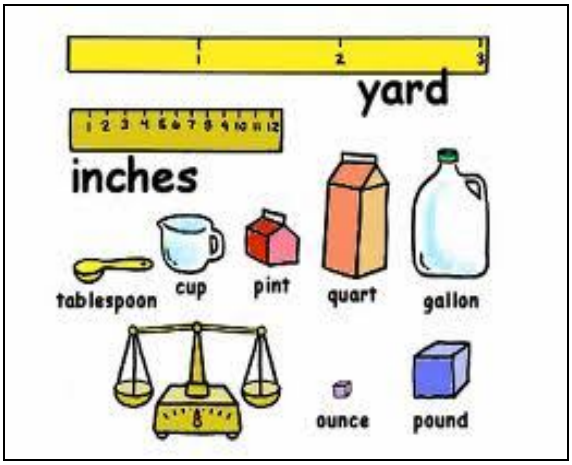

Figure 1: Units of Measurements

Image 1

ADA Description: Figure 1 above shows different units of measurements, this image highlights different measurement that are used in everyday life

Caption: Units of Measurements

Image file: Figure_1

Source/Rights:

http://www.dimensionsguide.com/unit-conversion/

Grade Level _4_ (_3_-_4_)

Activity Dependency

Time Required 45

Group Size 3-5

Expendable Cost per Group US $0

Summary

In this activity students will gain a better understanding of different units of measurements. Students fail to grasp the concept of different units of measurements and conversion at an early stage in their education. The problems that students are asked to solve in classroom such as converting from either yard to feet or feet to inches and so forth may seem simple to us adults and teachers, however to students the arithmetic may be difficult and often the concept of "unit conversion" may be abstract. Although Students may know the conversion factors such as 1 feet is equivalent to 12 inches or 1 yard is equal to 3 feet, they have not yet developed a mental model of the magnitude these units represent (i.e. inches make up feet therefore a foot is larger in magnitude than inches). The goal of this activity is to develop and strengthen the mental representation of different units so that students may convert one unit to another with ease. Furthermore, this activity will also give students a visual and physical representation of the magnitude of feet, yard and inches are.

Not only does this lesson focus on unit conversion in simple mathematical language, this lesson also incorporates units and measurements in engineering modeling and calculations. Unit conversions play a significant role in Engineering and Science, almost all of the data that are collected by scientists and engineers have units, and these numbers are converted to other units depending on either how the number is to be utilized in an equation or some type of calculations.

Engineering Connection

Measurements and unit conversions are related to engineering in various ways. The connection to engineering can be made in this example:

If there is a manufacturing company located in U.S. that produces desk for an elementary school and the models that they have designed are all in inches. Suppose that the same manufacturing company now wishes to produces a similar model at a large scale for the elementary school children in China. The model that the company developed in the U.S. are all in inches, however China does not use inches to do calculations, the unit of measurements used in China is meter (SI unit).

Not only does conversion play a significant role in manufacturing a product, products that are manufactured in large quantities are represented by larger units such as kg rather than grams.

Engineering Category

1. Relating math concept(s) to engineering

Keywords
Units, conversion, and measurements.

Educational Standards

NY math, 4.N.16 Understand various meanings of multiplication and division

NY math, 4.R.8 Use mathematics to show and understand physical phenomena
NY math, 4.R.10 Use mathematics to show and understand mathematical phenomena

Pre-Requisite Knowledge
Students should have mathematical skills such as multiply, divide

Learning Objectives
After this lesson, students should be able to:

- A better mental representation of different units of length
- A clear and physical understanding of different lengths
- Converting one unit of length into another with ease
- Develop stronger mathematical skills in multiplying and dividing
- Gain a better sense of how units, measurements, and conversion are used in Engineering related areas

Materials List
Each group needs:

- A LEGO NXT brick and additional LEGO parts for setup
- Pre-programmed NXT brick and set up instructions
- Tape (white paper tape)
- Yard stick, Ruler.

Introduction / Motivation

Conversion of units may be a difficult task to learn during the elementary stage of education, the mathematics and concepts behind unit conversion represents a fundamental and significant part in engineering related work. Engineers deal with many sorts of data obtained from experiments and related to modeling, data are sometimes required to be converted from one unit to another depending on where the number will be used. Students do not have a good understanding of where unit conversions play a significant role. The only contact that students engage with unit conversion in classroom is from multiplying or dividing one number into another to obtain different units. The result of multiplying and dividing (i.e. from yards to feet) only adds confusion to children and therefore conversion of units is seen to be an abstract topic rather than an easy to comprehend lesson.

This Activity motivates students to learn unit conversion and take measurements in different units through the use of robotics. This activity hopes to transform a tedious classroom lesson (multiplying and dividing to convert units on paper) to an exciting atmosphere where students will have a "hands on" opportunity to make measurements with a robot.

Image 2 [position: centered]

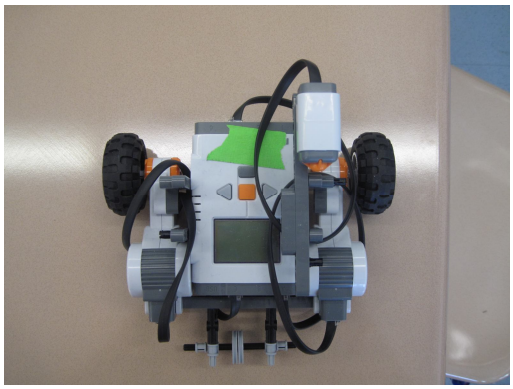

Figure # 2
ADA Description: Robot Design used in Unit Conversion
Caption: Figure #2
Image file: Robot_Design.jpg

Vocabulary / Definitions

Word	Definition
Unit	A quantity (length, time, or value) adopted as a standard measurement
Conversion	An operation used to convert between different units
Measurements	The act or process of measuring a unit from a scale

Procedure

In this activity students will measure distance a robot has travelled using different units of length. A robot will be programmed to move a certain desired distance specified by the student. The Robot is designed such that a touch sensor is utilized to command the NXT robot to move and stop with the press of the button. The distance the robot travelled will then be recorded from the specific runway (i.e. yard stick or ruler, etc.) the measurements will then be converted to a different set of units (i.e. Yard to feet by going across the value of runway 1 to runway 2). For example: a robot will be set to travel a distance of 1 yard on a "primary runway" which only measures in yards, however there will be two other adjacent tracks that serves as "secondary runways" (the secondary runway measures in feet and inches). The purpose of the secondary runway serves as a tool so that students can see the relationship between the conversion of the distance the robot travelled in yards into feet and inches. When the robot travels one yard (in the primary runway measuring only in yard) students will have an opportunity to see the difference between the distance a robot travels in one yard which equates to 3 feet and 36 inches by going across the track and matching up the corresponding numbers. The adjacent runway serves to compare the distance and make conversion of units with ease.

Students will be provided with a data sheet that contains a value either in inches, feet, or yards. Students will then take that value and place the robot in the appropriate runway track and allow the robot to travel the specified distance. Students will then record the distance corresponding to the adjacent track in the other two units. Not only will students record the distance traveled in different units they must show how that value is obtained by specific mathematical operation (i.e. multiplication or division)

In order to better illustrate this activity, the image below shows a visual display of the three different tracks:

Image 3 [position: centered]

Figure # 3

ADA Description: The tree tracks with different units (inches, feet, and yard going from left to right)

Caption: Figure #3

Image file: Unit_Conversion_Tracks.jpg

Before the Activity

- The main system of this activity is designing the robot that will move a specified distance
- Students should be aware of the different units of length used in measurements
- All NXT Brick battery packs should be fully charged prior to classroom activity.
- The setup of the activity is organized in which students work in groups of 3-5
- Different runway needs to be identified and labeled with a defined length using scotch tape
    - Runway 1: In Yards
    - Runway 2: In Feet
    - Runway 3: In Inches
- Each group should also be designated to do a specific task:
    - Recording data
    - Positioning and interacting with robot

With the Students

1. Pre and post assessment
2. Discuss different units of length
3. Review on conversion
4. Discuss how unit conversions and measurements are related to engineering

Image 4 [position: centered]

Figure # 4

ADA Description: Students engaged in Unit Conversion activity at The Brooklyn Brownstone School

Caption: Figure #4

Image file: TBBS_class_photo.jpg

Attachments

1. NXT Program: Unit_Conversion_Activity.rbt
2. Unit_Conversion_Pre_Assesment.doc
3. Unit_Conversion_Post_Assesment.doc
4. Unit_Conversion_Data_Sheet.doc

Assessment

Pre-Assessment:

Unit_Conversion_Pre_Assessment.doc

Assessment based on mathematics provided by NYC 4th grade standards

Post-Assessment:

Unit_Conversion_Post_Assessment.doc

Assessment based on mathematics provided by NYC 4th grade standards

Lesson Extension Activities

None

Additional Multimedia Support

None

References

1. "Unit" *Dictionary and Thesaurus® Miriam Webster Online*. <http://www.merriam-webster.com/dictionary/unit>
2. "Conversion" *Dictionary and Thesaurus® Miriam Webster Online*. <http://www.merriam-webster.com/dictionary/Conversion>
3. "Measure" *Dictionary and Thesaurus® Miriam Webster Online*. <http://www.merriam-webster.com/dictionary/Measure>

Attachments

Pre-Activity Assessment
Descriptive Title: Unit_Conversion_Pre_Assesment.doc

Activity Embedded Assessment
Descriptive Title: Data_sheet.doc

Post-Activity Assessment
Descriptive Title: Unit_Conversion_Post_Assesment.doc

Activity Data Sheet

Descriptive Title: Unit_Conversion_Data_Sheet.doc

Contributors

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Supporting Program

School:

Polytechnic Institute of NYU

Grant:

This Teach Engineering Lesson was developed with the support of the AMPS Project via National Science Foundation GK-12 Grant.