Amp It Up! Engineering/Technology and Industry Lesson Extension

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Course Name: SEI Probability and Statistics

Lesson/Unit Name: "Where do I fit in?" (Microline Surgical Industry Partner)

Science or Education Topic(s): Graphical Representations of Data

Engineering Technology Industry Related Field/Activity: Manufacturing

When Taught: Fall 2015

Abstract: The objective for the introductory lesson will be for ELL students to build background knowledge related to the field of manufacturing, broaden academic vocabulary, and analyze graphical representations of data. The hook for this lesson will be a video taken from USA Today highlighting President Obama's Advanced Manufacturing Partnership and how high schools across the country are teaching manufacturing skills. (http://www.usatoday.com/story/money/business/2014/11/12/high-schools-teach-manufacturing-skills/17805483/) A power point lesson, including visual aids, will highlight key terms as well as specialized areas of interest in the field. Microline Surgical will be introduced, as well as a preview of what they manufacture and what job opportunities may be available at this company. Students will break up into small groups and each group will begin their research by investigating Microline Surgical's website and listing what career opportunities would be available at this specific manufacturing location. This type of collaborative effort will be used to parallel the type of teamwork that is implemented at Microline Surgical. The first activity will be a jigsaw activity where each group will be researching a specialized area; for example, quality assurance, production/assembly, research/data analysis, machining, etc. After each group has completed their research, they will present their findings to the other small groups. The second activity will be for students to interpret both a line and bar graph related to the job outlook for this industry. They will then choose a specific area in the field of manufacturing (i.e.; production, assembly, finishing, machining, etc.) and provide an oral presentation related to their topic, the necessary education and where it may be available. The oral presentation will include either a bar or line graph forecasting job growth for their chosen career. Students may access the data through the research and present a pre-made graph and/or create the graph themselves.

Objectives and assessment: Using the table below, identify at least 3-5 learning objectives (content and/or pedagogical) and describe how each will be assessed.

Objectives *By the end of this lesson/unit, the students will be able to:*	Assessment *How was the objective assessed? List the example of formative or summative assessment.*
• list different careers in the field of manufacturing	After reviewing the video and PowerPoint presentation, students will document careers available at Microline Surgical.
•define different specializations in manufacturing	Graphic Organizer/Flash Cards/Pictures/Group discussion
• explain career opportunities and prerequisites	Complete a Table: Company – Job Title – Requirements – Where you can get the education
• demonstrate knowledge through oral report and/or creating a PowerPoint presentation following a given rubric	●See attached rubric

Engineering/Technology Link: Please check the appropriate box(es) in question 1. And provide a brief answer to question 2.:

1. How did you *introduce* engineering/ technology concepts or the company/industry focus in your course? Check the appropriate box(es) or choose Other.

    ✓Defined terms (science, engineering, technology)

    ✓Described the engineering design process

    ☐ Engineering design challenge related to industry

    ✓Overview of the company

    ☐ Challenge based on 'industry specific' area of focus (manufacturing process, quality control, measurement, development, teamwork etc.)

    ☐ Other: _____

2. After introducing the concepts, what did/will the students do to explore and apply the engineering/technology and industry specific concepts? (include information about the actual activity students did, discussions they had, or instructional strategies you used)

Students will use the internet to research Microline Surgical, list the specific career opportunities available through this industry, and describe the educational prerequisites needed to obtain a position in each area. They will interpret graphical representations focused on job outlook and determine which careers are predicted to have the most job growth, discuss the steps to landing a job in this industry and provide information on where the necessary education may be available. Students will interpret and/or create graphical representations of data related to job forecasting through the year 2020.

Level of Inquiry: Which of the following best describes the level of inquiry (adapted from Bell 2005) you used for this lesson/unit? Check the appropriate level.

☑ *Structured inquiry*: Instructor provides question and procedure. Students determine the results based on given procedures.

☐ *Guided inquiry*: Instructor provides question. Students design procedure and determine the results.

☐ *Open inquiry*: Students investigate their own research question. Students design procedures and implement the procedure on their own.

Lesson Extension Plan:

Title/Topic: Statistics and Probability
Time (minutes): 60
Company Name and brief Description: Microline Surgical; manufactures medical devices for laparoscopic surgery
Overview of the Lesson : Students will analyze graphs for misleading characteristics   Students will use statistical models to analyze real world problems and apply normal distribution models to real world situations

Standard(s)/Unit Goal(s) to be addressed in this lesson:

●Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

●Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate.

Essential Question(s) addressed in this lesson:

When and how can extreme data points impact interpretation and be compared?

What efficient strategies can be used for estimating population percentages from a set of data?

Objectives: Students will describe the characteristics of a normal distribution.

Link to Industry: Students that had previously been developing a basic understanding of normal distribution and standard deviation will apply their knowledge to analyzing and interpreting Microline Surgical's method for normalizing skewed data. When Microline Surgical receives customer complaints about a specific device they record that data and follow up by determining how long the equipment was in use, whether it was operated properly, and where it was purchased. They then determine the percentages based on units sold worldwide; and by individual country. They create a normal distribution of data so that they can make better decisions related to each product in the future.

What students should know and be able to do before starting this lesson:

basic graphing skills including how to create and interpret bar, line and circle graphs as well as histograms and box plots, Students should have an understanding of how to determine a good interval and scale for a graph, and calculate the mean, median and mode. Main components of normal distribution, how to calculate standard deviation, what it means for data to be skewed and how this can affect a reader's interpretation of data

Instructional Materials/Resources/Tools: Visual aids, calculator, graph paper

Lesson Delivery

Lesson Opening: HOOK….images from companies that have created graphs to mislead consumers; what features of the graphs are misleading? Why would companies do this? Investigation of specific graphs to determine what needs to be changed to provide a more accurate representation of info

During the Lesson (activities/labs/challenges):
Each group will be given an assortment of graphs to interpret and analyze.   During this activity, they will reference the following key points and questions:

- ***When looking at a graph - always look at the scales used on both axes, the labels, and the size and shape of graph.***
- Find out who ran the study, where did they get their data from, and what are they comparing.
- Look to see if they left anything out - did they take some discrete points of data out of context?
- Did the data come from a survey? If so, who asked the questions, what were the questions that they asked (where they misleading), and who did they ask the questions to.

Lesson Closing: Whole Class Discussion….

How do others use statistics to manipulate my opinion?

What's "normal?"

How can I use a model to predict the chances that something will (or won't) happen?

How can the results of a statistical investigation be used to support an argument?

Assessment

Student Assessment: This project will combine data analysis with the students' ability to argue a point of view. Students will be separated into opposing teams so that each team will argue one position, using all of the strategies they have learned to support their opinion and potentially mislead the viewer. Students will choose from topics that include data on high school graduation rates, stock prices, or political polling data. Each team will present to the class and students will have the opportunity to question their opponents in reference to techniques used to analyze their data sets. Each team will write a brief analysis of their opponent's presentation, including areas where they may have used techniques to impact the reader's opinion.

Delivery Assessment:

Additional resources and assessments: List the attachments here.

Attachments should include handouts, readings (with references), lab write-ups, rubrics, exams/quizzes, and/or other similar materials.

Oral Presentation Rubric : Intermediate ESL Probability and Statistics

CATEGORY	5	4	3	1
Preparedness	Student is prepared and has practiced	Student is mostly prepared, but may have needed more practice	The student is somewhat prepared, but did not practice	Student is unprepared
Content	Shows a complete understanding of the whole topic	Shows a fair understanding of the topic	Shows a fair understanding of some parts of the topic	Does not understand the topic
Stays on Topic	Stays on topic all (100%) of the time	Stays on topic most (99-90%) of the time	Stays on topic some (89%-75%) of the time	It was hard to tell what the topic was
Vocabulary	Uses vocabulary appropriately, extends vocabulary by introducing words that are new to the audience and defining them	Uses vocabulary appropriately, extends vocabulary to include new words but does not define them	Uses limited vocabulary appropriately	Uses vocabulary words incorrectly
Speaks Clearly	Speaks clearly (100%) all of the time	Speaks clearly (99-90%) most of the time	Speaks clearly (89-75%) some of the time	Cannot be understood
Industry Link	Students demonstrates a clear and complete understanding of how their education can influence their career	Student demonstrates some knowledge of their education can influence their career	Student is lacking information that connects the classroom to the career	Student does not include information related to the classroom/career connection