

Ideas and Resources for Teaching to ILO #3: Quantitative Literacy

Assignment, Assessment and Activity Ideas to Support Students in Achieving ILO #3

- There is constant reflection and analysis of technical data and application. (AMT)
- Assignments that require the student(s) to gather data through taking measurements and applying that data to tables and charts to interpret results to be within limitations or not. (AMT)
- Test questions that will require the student to calculate total displacement of a power plant. (AMT)
- Interpretation of data discovery to properly determine tolerance conformity. (AMT)
- Workbook - calculate thermal and volumetric efficiencies for reciprocating engines. Determine total displacement of various heat engines. Using graphs/tables determine mixture settings for different power settings. (AMT)
- FAA General Math assessment. Utilizing graphs, tables and equations to interpolate temperature ranges for aircraft thermal expansion rates, wire gage selection for aircraft circuits and equation interpretation and evaluation for hydraulic and pneumatic system regulation calculations. (AMT)
- Students apply knowledge learned through course materials to pre-existing assumptions they may have brought with them in relation to prehistory, the ancient world, and the manner in which data is mined from archaeological contexts. This requires recognition of culturally differentiated attitudes about the past and who should/does have access to material goods from the ancient world. (ANTH)
- Glaze chemistry project (ART)
- Assignment that evaluates the students' ability to prepare financial statements (analyzing, calculating, and coding transactional data), interpret the final results, and communicate those insights to company management. (BA)
- Review Balance Sheet and Income Statement for "Family Furniture, Inc." to calculate liquidity, solvency, and profitability ratios for the purpose of analyzing the company's financial position and performance from 20X1 and 20X2. (BA)
- Research based presentation on bodily systems physiology, pathology and medical assessment. (BI)
- Group presentation with citations of quantitative research surrounding a body system or pathology. Students created a document and presentation with APA citations. They synthesized quantitative data to create relevance, analyze outcomes and integrate these findings into a larger narrative. (BI)
- Calculate and interpret: Real Income changes; Real Output goal from a fiscal policy prescription; Real Output outcome from consumer spending changes and multiplier effects (EC)
- In 1993, Congress failed to pass President Clinton's \$16 billion economic stimulus package intended to create jobs. A major criticism was that his new government spending was not matched by tax increases. Assume (for this problem) a similar situation exists now and the U.S. economy is below full employment and Congress had passed a law that requires that an increase in government spending of \$16 billion be matched or balanced by an equal increase in

taxes. The MPC = 0.75 and aggregate demand must be increased by \$20 billion to reach full employment. Will the economy reach full employment if Congress increases spending by \$16 billion and increases taxes by the same amount? Show or describe why or why not for full credit. (EC)

- Economan has been infected by the competitive bug. He takes over the Friendly Space Trooper Agency (FSTA) and makes it the only sweet deal available in the galaxy. The only variable input he employs is labor. He is currently producing 150 units of super-duper Trooper service and selling them for \$20 apiece. He is considering the possibility of hiring an additional full-time employee. Economan estimates that daily output would increase to 160 units if he hired this additional person and that he would be able to sell all of those units at a price of \$19 each. (EC)
- What is the MRP of labor equal to in this situation? (EC)
- Assuming that Economan takes the price of labor as a given, what is the maximum daily wage that would make it in his best interest to hire this additional employee? (EC)
- (Economan needs to have you explain your answer to him fully to award you full credit and the chance to be an honorary space cadet in the FSTA. Points are given for attempting to blast off.) EC)
- Application and analysis of electronic circuits and applications. (EET)
- “Documentation scavenger hunts.” A key function of an electro-mechanical technician is sorting through device documentation to find the information you need. I believe this supports ILO #3 regarding quantitative literacy. Rather than give the students every relevant number, parameter, and piece of information that they need, I would like them to be able to scan a datasheet/manual to locate and interpret that information, as this is a key that separates exceptional technicians from mediocre ones. (EET)
- Quantitative Literacy is advanced through the use of their food journals and the Chronometer app where they analyze their current nutrient intake and develop methods of finding nutrient balance through food. Students also use the Chronometer app to determine an adequate 1-day diet for a hypothetical person, as well as analyze their Cooking Video meal's nutritional density. (FN)
- (Application/Analysis): Budget activities and planning tools encouraged real-world application of financial literacy and academic planning. (FYE)
- There are tons of graphs in the book. We discuss these and compare data from past and present to make predictions about the future, regarding the societal trends covered in the course. Students also have to review and summarize research articles that include quantitative data. (HEC)
- Quantitative Literacy is advanced through the use of their food journals and the Chronometer app where they analyze their current nutrient intake and develop methods of finding nutrient balance through food. (HPE)
- ILO#3 - This is advanced through the use of SMART Goals and Plan development, cooking videos, and the label/ingredient list assignments. These assignments require that students take information and knowledge from class and apply that in the real world. (HPE 295)
- Application and analysis based on the earlier assumption of need to create a product. At the core of what students in manufacturing do is finding applications and using quantitative analysis to solve the problem the application presents as they develop the solution in form of product. Not much adaption was necessary beyond making students more cognizant of the process and procedure. (MFG)
- Analysis of weld and design (MFG)

- The assignment I chose was a production project sample. Students were tasked with developing a manufacturing process for a unique item in a small scale for data gathering. From this process, with consideration for Hands on Time cost, Tooling Expenditures, Material Expenditures, they were asked to interpolate costs on 2 scales, increasing production volume by 200% and 800%. Finally, they were asked to provide 3 scenarios to manufacture the product, one where Time Cost was removed, one with two changes made to tooling (specifically to reduce time), and one with changes made to material size to show how the process could be optimized based on best selection of materials. (MFG)
- Students were memorizing graphical depictions of component behavior rather than gleaning a deeper understanding of what the graph was conveying, so I re-wrote exam questions and held in-class discussions to help students develop their ability to analyze and understand the implications of data rather than simply commit data to memory (MFG)
- Through the application of written manufacturing process, applied mathematics, as well as introducing basic metallurgy/chemistry, this course aided in the students' abilities in both quantitative literacy and critical thinking/problem solving. (MFG)
- Students are trained to be extremely analytical in their learning of welding so that they know the problems they encounter and the diagnostics required to adjust equipment and process for a more desirable outcome. This is done through a variety of learning styles, including journaling, analytical comparison via physical rubric and a Socratic method in pairs. (MFG)
- Written papers (MP)
- Students write a report on a town, city, wherever and calculate the growth curve. (MTH)
- Final exam (MTH)
- Because this is a math class, the students applied new quantitative literacy with every unit. Problem solving techniques. Explored and discussed how to approach problems. Addition subtraction, multiplication, and division methods. Explored and discussed a variety of algorithms to find solutions. (MTH)
- Students have a final project where they research a math topic of their choice and present this to the class. The topic choices allow for excellent discussions, which students lead. Students' application of the knowledge and analysis of ideas flows. Researching and learning about math rather than making assumptions is important Students learn the material and interact with the math. (MTH)
- Small assignments revolve around reading and critiquing articles that use data in some way, especially if it is used to draw conclusions. (MTH)
- Write their own problems and solve them. Then share the problems with a small group or the class. (MTH)
- Multiplication Methods assignment (MTH)
- Assignment where students are to develop an alternative hypothesis at odds with a null hypothesis, collect data in order to test their hypothesis, then use the data to calculate the strength of the evidence against the null hypothesis. Each of these steps (except perhaps the last step) takes quite a while, so I mention the project on the first day of class, and regularly. We study sampling techniques right before their first exam, so right after that they are expect to get to work in earnest designing a sampling method to get the data they need. Of course students have never done anything like this so they need a lot of feedback from me. Once this part is finalized, they can collect the data they need. There are a lot of things to worry about in this part of the project, which they have to show they accounted for. For example, what are likely sources of bias (the statistics meaning of bias), lurking variables, and so on. Once this is done

then they can actually do the data analysis part. We don't get to that until week 8 or 9, so that just leaves the last part of the term to wrap it all up into a well written report of what they did. (which is why this assignment works well for the written communication outcome as well.) (MTH)

- Derive the formula for the area of a circle in terms of the limit over inscribed regular polygons. (MTH)
- Problem set concerning Riemann integral. (MTH)
- Identifying Qualitative Graphs. Plotting points on the quadrant plane Graphing lines using the formula $y = mx + b$ Determining how to find parallel and perpendicular lines based on their slopes Predicting a qualitative graph based on the size and shape of a container. When water is poured into the container time (independent variable) and height of the water in the container (dependent variable) are graphed. (MTH)
- Professional papers and concept maps (NRS)
- Theory, assignments, and clinical practice focus on the development of clinical judgment through assessment, interpretation, and response to patient care situations. (NRS)
- Theory exams (NRS)
- Treatment Plan assignment (NRS)
- Students are given laboratory results of 3 patients. With this data, the students need to make calculations with the data provided to ascertain the patient's fluid status as well as their acid base balance. Upon completion of their calculations, students need to make clinical judgments regarding the clinical manifestations they might see in their patients based on the patient's fluid status and acid base balance. Students present their information/calculations and rationale to their peers utilizing modality of their choice. (NRS)
- Medicine Cabinet Survey assignment: The Med-Cabinet Survey is a two-part assignment that first ask the student to survey a home medication cabinet for OTC medications. The student researches the data presented to the general public on the use of OTC medication and compares to the best practice recommendations for healthcare providers on the use of the medication. This portion requires the student to present the required information on the medications in a table format. The second part of the assignment requires the student to design a patient teaching informational pamphlet based on the gathered data in the first part of the assignment as it applies to a selected age group of patients. (NRS)
- Analysis of OTC medications used in the home in connects to patient risk and patient teaching in a two-part assignment project. (NRS)
- Article summaries, discussion boards, concept maps, and nursing care plan. (NRS)
- Writing an Advocacy Letter to an Oregon Legislator: This group assignment will engage students in the legislative process by researching legislator stances, gathering data from three (3) reputable sources to support your group's shared position on that stance, and crafting a well-structured advocacy letter that clearly presents their viewpoint. Students will learn how to effectively advocate for issues, understand the legislative process, and develop their communication, quantitative literacy, community and environmental responsibility skills. (PS 202)
- We spend a lot of time looking at journal articles and discussing assumptions we might make from the data, and as well how to analyze research data and apply it to ourselves or the general public. (PSY)
- Students are required to use peer-reviewed journal articles for their final research papers. They must look at the data for "application and analysis" related to their research topic. (PSY)

- I included in MTH 244 some discussion/review of quantitative and pseudo-quantitative measurement (topics discussed more thoroughly in MTH 243) as it relates to conclusions arising from statistical analyses. (STAT)
- Students used quantitative data as support for their thesis statement in the proposal essay (WR)
- We go over the use of visuals, such as graphs, and how they can be used to highlight or de-emphasize certain data. (WR)

Resources, Assignment, Assessment and Activity Ideas Specific to Dimensions

INSTRUCTION IDEAS

Assumptions:

- Instructors should talk more about assumptions in class.
 - After formative assessment, several group members mentioned their students' knowledge of assumption is limited to assuming the data used in the course is collected properly.
 - Instructors should introduce critical information literacy by encouraging students to question sources of information
- Instructors should also be cognizant of what assumptions they are making when they generate assessments.
 - Talk to the students to determine how to develop culturally sensitive standardized test questions to ensure outcomes can be measured accurately.
 - For example, "How many times do you eat chocolate during Lent?" makes the assumption everyone knows what Lent means.
- Instructors should remind students that there are multiple ways to accomplish a task.
- Ask students whether they are aware of the assumptions they are making when viewing and interpreting data?
- Application/Analysis is fairly easy if taught, the hard part is teaching Assumptions. They are so trained to just find the answer they don't look at the parts of a problem/issue to make an assumption.
- I have been emphasizing the importance of assumptions more. They are used to their other classes where you must be aware of your own biases and any assumptions you have made so that you can try to eliminate or at least ignore them, because they are yours and probably get in the way of properly analysis. In math however it is the assumption that leads to the model (yes, in math we don't pick an equation for our model, we form assumptions and they lead to the model). It's a work in progress. (MTH)

Analysis:

- Even Middle School students can do Quantitative Literacy if taught and stepped through the process. (BUS)
- Academic analysis is more than just general information. Can be used to direct &/or detect a perspective. (WR)

ACTIVITIES

Assumption:

- The instructor provides students with a link to information about dihydrogen monoxide that includes true but misleading information about the dangers of water. Students who rely on the single source often jump to the conclusion that water should be banned. Later, they are asked to reflect on this assumption. (BI)
- Students are asked to select a town, gather population data, generate a growth curve, and then compare projected data to the actual population. They must use assumptions to explain the difference between the two. (MTH)
- Raise opposing views and arguments as part of the process before any final writing. (WR)

Analysis:

- Assumptions about following directions = different results (ART)
- Students must determine the material composition of a penny. While this takes about five minutes to Google, they have to show and analyze data to support the answer (BI)
- Basic equations may be a stumbling block for students if they don't really remember from last class or last math class. Assuming that they have the knowledge is not good. Pre lab quizzes help with this. (BI)
- Students are asked to analyze financial statements to determine how a company is performing (BUS)
- Students come in. Identify and teach them to use critical thinking. Give them the same quiz at the beginning and end of the term. See growth from their assumptions. Reading-facts. Reading and interpretation. Learning how to reason and change our assumptions through reading facts. (CG)
- Textbooks include tables, graphs, charts, etc. related to content and it provides opportunities to read and interpret the data. Ask students to make future predictions. (Consumer & Family Studies)
- Explaining industry-wide vocabulary for quantifying, measuring, and making conclusions with integrity. (CS)
- Students assume that speaking slowly in another language helps them to be understood, when actually they need to put the stress on certain parts of the word to be understood. (ESOL)
- Use article of summary, concept maps, overlaying multiple maps, and focus on evidence-based decision-making to support clients (Health Sciences)
- Teaching students that they don't know what the basic terms mean. They assume that they know. Difference between academic and social norms when discussing government terminology, etc. Students assume cause and effect correctly. Assess students' assumptions through class discussion and essays (HST)
- Social sciences can use analysis to compare trends and stats across history
 - i.e. analyzing how "Patriotic history" trends parallel those of WWII Germany (HST)
- Analyzing lab results to interpret rationale for patient care (MA)
- Different equations = different answers. Using different equations and how students assume and or know what equations to use. (MTH)
- Writing assignments: Students make a claim, use evidence to support the claim, and explain how/why it supports their claim. (Pre-College)
- Pre lab quizzes so faculty do not assume what students know. (NUR)
- Can be very difficult to help students to understand difference between article summary and article critique. Summary is easier, critique takes teaching and practice. (NUR)

- Showing research papers and how to find them, then how to find specific elements/parts of what it contains - what is it actually saying? What is the hypothesis? (SCI)
- Assumptions are too easy to make (we do it all the time without thought) - get the students to write more analysis- just think about it. (SCI)
- Sciences - Support students to locate and cite credible sources and websites (SCI)
- Very applicable for technical writing especially for identifying problems, locating credible sources, interpreting the data, and making conclusions. (WR)

RESOURCES

- *Freakonomics Radio* episode called “[America’s Math Curriculum Doesn’t Add Up](https://freakonomics.com/math/)” (Ep. 391) <https://freakonomics.com/math/> (Steve Levitt investigates whether traditional math instruction is really preparing students for the work of the digital era. What he found was a curriculum that is not teaching data literacy)