Cooking Solutions for Indian homes: An Engineer-Focused Simulation
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This simulation was created for a cohort of first-year undergraduate engineering students enrolled in a Engineering Design Course with support of language enrichment tutorials. The cohort was divided in four sections of 20 to 25 students. The simulation was organized to be conducted in six sessions of 50 minutes.

The overall purpose of the simulation is to provide a space to use language in the context of a professional discussion. Students were expected to apply what they had previously learned about conceding and countering into a problem similar to the ones analyzed in one of their engineering courses (Sustainability and Engineering Design).

Briefing (Session 1)
Introduction

A Chulha (see Figure 1 below) is a type of oven that has been used in Indian homes for centuries. Recently, the practice of cooking at home with a chulha has received criticism because these ovens are fueled with wood. A few chulhas here and there would not be a problem, but millions of homes consuming wood for everyday cooking may lead to an environmental disaster. Additionally, since most Indian homes feature a chulha inside the living area, the carbon emitted by these ovens is a threat to people's health. In fact, chulha's fumes are considered one of the main factors leading respiratory diseases in the country.

Figure 1. An Indian woman cooking with a chulha

It is clear that a new type of stove should be designed to solve this problem. However, advice from social science experts and community leaders has warned authorities that people may resist to switch to new stoves because chulhas are linked to their most cherished family traditions. Also, economist recommend finding a cost-efficient solution because a great number of chulha users would not be able to afford expensive devises.

Exploration of the topic
Jigsaw reading and video. See supplementary materials at:
https://avalos-rivera.weebly.com/materials.html and https://www.youtube.com/watch?v=f7PwotIXXgg

❖ Students are divided in teams and assigned a reading or a video. Each team will answer a series of comprehension questions and identify the definition of 6 to 10 new terms.

❖ Students are regrouped in new teams (2 video watchers and 2 text readers). Students create an outline of a problem-solution text on the topic of chulhas using the information previously collected.

❖ Written feedback: the teams share their outlines online and receive feedback from their peers and the instructor.

Situation (to be read as homework and discussed during the following session)

An environmental organization in India has appointed an international team of engineers to propose a sustainable solution for the chulha problem. Each member of this team has strong opinions about the problem. However, they should also be willing to negotiate with the group in order to achieve the goal of substituting chulhas for an affordable and environmentally-friendly solution.
In this simulation, you will assume the role of one of the engineers in the team. The ideas that you will propose have already been outlined for you below.

Roles
[1] The environmental engineer
As an environmental engineer, you are appalled by the high levels of deforestation in India. You have calculated the present rates of cooking wood consumption. These calculations have led you to conclude that, every year, Indian homes are consuming biomass that is equal to the forest area of the state of Texas in the United States. You are convinced that the most effective solution should be one powered by solar energy. You are aware of how expensive this solution can be, but are convinced that it is the only long-term and sustainable way to address the problem.

[2] The energy engineer
You are convinced that a solar solution is not feasible for India at this moment because each solar cooker can cost hundreds of dollars. On the contrary, the more affordable gas stoves would be a perfect solution considering India's vast reserves of natural gas. Unfortunately, the country's infrastructure to extract and make natural gas available to every home is yet underdeveloped. In spite of this challenge, you believe that the team should come up with a solution to develop the extraction of natural gas in the country. This development would not only allow Indian homes to switch to gas stoves, but would also boost the economy.

[3] The industrial engineer
You are convinced that it is impossible to solve the environmental and the health problem at the same time. For that reason, you believe the team should focus on the most urgent problem which, in your opinion, is health. You have read that at least 1.6 million people die per year from conditions associated to the toxic fumes generated by in-door built stoves that are fueled by biomass. Therefore, you want to propose the generation of a design that can be cost efficient while keeping the dangerous fumes outside Indian homes. You think this solution should have an exhaust pipe mechanism made of affordable materials. The new device should also have easy access so that a house wife can clean it without having to climb to the roof.

[4] Mechanical Engineer

You agree that the solution for the problem is in the stove, but it does not necessarily require high technology. You are also mindful of the recommendations provided by the anthropologists and sociologists regarding the users' possible resistance to get rid of their traditional chulhas. So, you believe that the structure of the new stove should be kept similar to the old stoves but with a mechanism that improves the air flow. More oxygen would produce more efficient fire, burn less fuel, and minimize the production of soot and fumes which are so dangerous for human's respiratory functions.

[5] The moderator
You are also an engineer, but your main role in this simulation will be that of moderating the discussion. You will organize the agenda for the discussion, let the participants know in advance (in written form) the order to be followed during the meeting, administer time for every participant to present his/her ideas, and coordinate the presentation of objections from all participants after each presentation. You will use language to encourage the participation of each member in an orderly manner and by the end of the presentations will guide the discussion to reach a conclusion.

Preparation (Session 2)

Q&A about the Simulation
Brainstorming students' questions about the organization of the simulation (10 to 15 minutes).

Language Focus
When engineers work in teams to solve a particular problem, they often find that their colleagues may hold different opinions regarding the problem they tackle and the possible ways to solve it. In such situations, team members may engage in discussions to decide what solution is best. Each discussant should provide reasons and evidence to support their position and be ready to defend their points of view. However, winning an argument is not the goal of a team-centered discussion. Participants should be opened to listen to others, negotiate and agree on a solution as a team.

On the following table you will find language that is useful to engage in group discussion presenting your point of view, expressing agreement and disagreement with others, and asking for clarification. Revise the table and select language that may be useful for your role during the simulation. Consider other expressions and phrases that may be useful to show agreement or to negotiate a solution with your colleagues. Organize a search to collect expressions and present your findings to the class.

Useful Language

For the moderators	For the presenters	For team members that present objections, ask questions or request clarifications
We need to discuss . . . **We will focus on . . .** **Our agenda for today is . . .**	My presentation will cover the following points . . . I will focus on . . . . I will present a solution based on . . .	How do you know that . . .? What evidence do you have for . . .?
We need to move on to . . . **Shall we move on?** **Should we now hear the next participation?**	I have considered the following factors . . . I have weighted the pros and cons of	Why is that best? What other alternatives are there? Is there another way to look at it?

Time is over for this presentation, does anyone have any comments or objections?	I have studied the evidence and concluded that . . .	
Let's focus on the facts **We need to consider the pros and the cons . . .** **Let's consider the advantages of** **We should not forget the disadvantages of . . .**	Some members of the team agree with me regarding. . . I am certain you would agree that . . .	How would you solve the problem of . . .? What would you do to address . . . .?
What is your opinion . . .? **What are your thoughts about. . ?** **Any thoughts?**	Other members of the team favor a different solution but they have not considered . . . Although it is true that . . . the team should also consider . . . While x solution effectively addresses . . . . , it does not. . .	I'm afraid I do not agree with you because . . . I beg to differ, I think that. . . I believe you have not considered . . . You have not addressed the problem of . . .
Should we then conclude that . . ? **How can we conclude this discussion?**	I see your point. However, have you considered . . .? That is an interesting way to see the problem. We can also attempt a different solution by . . . I do not see it that way. We should remember that . . .	What do you mean by . . .? I don't quite follow. I didn't get what you meant by . . . Can you clarify that?

Homework: Find more information about the subject to inform your performance.

Preparation – Part 2 (Session 3)

During this phase, you will prepare the language and the information you will use to participate in the discussion with your colleagues. You will organize your ideas to present them in a manner that is both respectful and assertive. You will structure your talking time (2 min) considering the presentation of your solution and your objections to the ideas proposed by other team members. For this reason, you need to read the role descriptions of all the participants beforehand. If part of the solutions presented by your colleagues is reasonable, you should openly admit it during your presentation. However, you will also have to point out the weak aspects of your colleague's proposal. You should also prepare yourself for a discussion session (after the individual presentations), in which you will defend your point of view when needed and probe/question/challenge the solutions presented by your colleagues. During the preparation phase, you will work with other classmates that will be playing the same role as yours. You will support each other to structure your presentations. Remember to apply relevant language from the previous lesson.

Action (Session 4)

In this phase, you will work with colleagues that will take up different roles and engage with them in a discussion session. Each participant will present his/her point of view. Each presentation (2 minutes) will be followed by a discussion (15-20 minutes). During this time, the team will consider all the solutions presented and decide which one should be pursued. Although each member will try to defend his/her solution, **the ultimate purpose of the session will be that of reaching a decision as a team**. During the final discussion, one of the members (not the moderator) should function as a secretary recording the solutions that the team decides to propose. By the end of the simulation, the moderator (aided by the

notes taken by the secretary) should be ready to present an oral report of the team's solution. The secretary will present a brief written report of the solution which will be submitted to the judges (students in a different section).

Debriefing (Session 5)

In the final phase, you and your instructor will discuss the challenges experienced and the learning that took place during the whole simulation (if any). Also, each team will briefly discuss the conclusions they reach and compare experiences.

Debriefing Questions:
What was the most challenging aspect of the simulation?
What was the best aspect of the simulation?
What was your least favorite aspect of the simulation?

Post-Simulation Reflection:
The team leader or moderator will post the audio of the debate in mp3 format. After the audio is posted, each member of the team (including the moderator) will post a reply commenting on their experience during the simulation and attach the audio of their individual presentation. Your response

should be at least 150-word long and in the form of a well-developed paragraph in which you answer the following questions:

1. How do you assess your experience and why?
2. Did this experience contributive to your learning? Why do you think this was so?

To fulfill the two communicate purposes expressed above, you will need to write a paragraph with at least 2 well-focused topic sentences and two or three supporting sentences for each one of the topic sentences. Additionally, don't forget to wrap-up your paragraph with a closing sentence that highlights something relevant that you said in the paragraph.

Post-simulation written task (Session 6)

In this final phase you will write a 400/500 problem solution text describing, explaining and evaluating the chulha problem and one of the solutions proposed during the discussion. As you prepare this text, imagine that your audience will be a team of second-year engineering students who have some knowledge about the problems you will discuss. The first paragraph (situation) will give your reader an overview of the problem and the solution. Paragraph 2 (the problem) will describe in more detail why the use of chulhas is considered problematic. Paragraph 3 (the solution) should explain in detail the solution you propose. Finally, paragraph 4 (evaluation) should assess the strengths and weaknesses of the solution. In this final paragraph you should concede and counter to argue in favor of the solution proposed. Use reliable published sources to support your claims and organize your in-text citation and reference page using IEEE citation standards. You may use RefWorks to support your citation management.
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Testimonials of students about this simulation along with more samples of materials I have developed can be found at:

https://avalos-rivera.weebly.com/