Physics For Humans!

Created by Randall Tagg

Contributors: Tyler Sanford, Noah Johnson, Brad Conrad

This workshop is designed to help create connections between subjects in physics and problems that humans have on a day to day basis. Students will be given a number of physics technologies and a problem they have to solve, and they will have to to develop an invention to help solve the problem. Creative and outside the box thinking is encouraged.

Materials Needed

- 52 Card Technical Domain deck
    - Download here: www.spsnational.org/programs/outreach/psistar
- White board and/or a large sheet of paper (2x3 feet) with dry erase markers for group work
    - 1 for each group
- Sheets of paper for individual work, with pens

Construction Materials can include (but are not limited to):

- Pieces of cardboard - various
- Glue sticks (1 for each group) or double sided tape
- Construction Paper (10 sheets for each group, various colors)
- Scissors (2 for each group)
- Twine or string, 2 meters
- Scotch tape, one per group
- Masking tape, one per group
- 10-20 Paper clips per group
- 10-20 Drinking straws
- 10-20 Wooden sticks or tongue depressors per group

Workshop Outline

1) [PSI*: Entrepreneurship Outreach](#) using Physics
2) Introduction of [Physics for Humans](#)
3) Explanation of process
   a) Task 1 - Read about and discuss area of application
   b) Task 2 - Identify a need within the area of application
   c) Task 3 - Receive the technical resources
   d) Task 4 - Brainstorm several possible innovations to meet the need
   e) Task 5 - Prepare a visual aid and calculations for the concept
      i) System block diagrams
      ii) Sketches
      iii) 3D Mockups made from paper, tape, etc.
      iv) Back of the envelope calculations
         f) Task 6 - Reconvene and share everyone's ideas

Introduction

The Compleat Physicist and application of physics to human needs

How in the 21st Century might we view the activities

Task 1 - Choose, read about, and discuss an application area

For this task, the leader may either randomly assign groups different application areas or the groups may pick their own. The choice is up to the discretion of the leader.

Innovation responds to human needs, which fall into several broad application areas. What devices and methods could you provide for people around the world working in one of the following areas?

All of the application areas can be found on the SPS Website, linked here: https://www.spsnational.org/programs/outreach/physicsforhumans.

Task 2 - Identify a need within the chosen/given application area

Here are some approaches to consider in finding a need.

On-site observation and direct interviews

If feasible, one of the best ways to discover needs is to go to a location involved with your application area, such as a grocery store that is engaged in sales of food items (application area 16). Observe how people act in the store and see if there is a better way for them to accomplish their goal. This is exactly what the design firm IDEO did as a challenge for the TV show "Nightline".

https://www.ideo.com/post/reimagining-the-shopping-cart

In addition, talk with people experienced in the application area and find out what their activities include. Seek their ideas for what they perceive as issues needing some further development. However, it is perhaps even more important to find out the whole picture of what their activities entail.

Personal experiences

Write down any connections between your life experiences and the application area. Was there a trouble spot? Or was there something that was extremely satisfying that might be replicated elsewhere?

Imagination and team role playing

Imagine you and your team are working in a situation involving your application area. Act out a possible scenario and note down what issues bubble up.

Consult the application area web page and other websites for suggested topics

Look over the web page (if accessible) for the application area and see if there is a list of "topics to consider".

Task 3 - Randomly assign the technical resources for solving the application problem

The leader should pass out 3 cards to each group. Using these cards, have each group do a bit of research of the technical resources to make sure that everyone understands what each card means.

For example, students could be given "Materials", "Fluid Systems", and "Signal Processing". To have a better understanding of how to implement the technical resources, students would do a little research on materials, fluid systems, and signal processing. Through this research, the students might discover a technology or concept that already utilizes these and can implement that into their design.

Task 4 - Brainstorm possible innovations that could address the need

On a dry-erase board or a large sheet of paper, start brainstorming. The goal of brainstorming is to produce a lot of ideas quickly. A major rule of brainstorming is NOT TO CRITICIZE any ideas. Jot down any and all ideas. You can use post-it notes or individual lists compiled into a master list.

Task 5 - Choose an idea, develop it, and prepare a 3D mockup with other visuals

Sketches, paper mockups, and calculations

Nothing conveys an innovative concept better than an adroit use of visual elements. These can be sketches or three-dimensional renderings. The task of generating such visuals is in fact an important part of the solution process, costing relatively little as you try out different ideas.

Here are some tips for making mockups for your idea.

- MAKE A FOLDED TITLE CARD for the whole project including the application area, a title for the innovation, and a sentence describing the purpose of the device.
- Use pens, paper, card stock, scissors and tape to mock-up the concept that you generated.
- Consider using a unique color for each subsystem or each technology.
- If useful, perhaps draw simple diagrams on parts of the mockup to help clarify their purpose, but on the whole make the visual impact elegant and clear.
- Label the components of your mock-up.
- IN THE LAST 5 MINUTES please CLEAN UP the table, placing spare materials and scraps in the cloth bag and pens in the paper bag. CREATE A DISPLAY of your invention in the center of the table

As physicists, we relish the opportunity to employ quantitative thinking. If you challenge yourself to think about numbers that might describe the performance and design of your invention, you will likely enjoy "aha" moments when insight truly comes from a quantitative approach. Aim to find at least one key quantitative aspect for your project and lay it out in a quick, clear calculation - perhaps as a "back-of-the-envelope" estimate.

Task 6- Reconvene and share everyone's ideas

For an invention to become an innovation, it must be actually produced and used by the people for whom it was intended. A working prototype must be created. One or more patent applications might be filed. Financing for further development is needed. This means you need to "pitch" your idea and its impact to potential investors. Eventually, you would need to find a way to manufacture the device or implement a process. Then comes advertising and in many cases sales...although some innovations may be distributed by other means, for example through nonprofit organizations engaged in helping communities in need.

As a first step in this process, share this with neighboring groups, observing their innovations as well. Then take photos of your invention and your team.

(Please make sure that working materials & scraps have been put away.)

Save your visual materials. Who knows? Maybe you will decide that your idea is worth pursuing further!