35 Design Activities to Try in an Engineering Design Class.

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Abstract:
Fresh New Ideas! Are you looking for new design activities to try out in your engineering design course? This paper provides a description of 35 different ideas for in-class activities that you might find appropriate for use. While our target was for use in a mechanical engineering freshman design course, many of these ideas may be applied just as easily for other disciplines. Each of these activities help students explore different aspects of the design process and are short and concise enough in duration to be used in a single lecture period. From this list of activities, the reader will perhaps find several ideas that fit their teaching goals and style; ideas that they may want to adopt, adapt, and/or just tryout in their classroom. In addition, exploring these varied design activities is likely to help the reader trigger some of their own ideas on how to use some of their current activities in different ways. This paper is intended to be a resource of interactive, in-class activity ideas that support and reinforce the concept of engineering design.

Introduction:

One of the most important aspects of attending the annual ASEE conference is to take home a number of new inspirational ideas that you can try in your own classroom. That's exactly what this paper is attempting to offer. Within the following pages are ideas that have been created or repackaged to provide a source of potential activities for your engineering design classes. Some of these ideas are our own originals; some are not. Many of these activities have been modified so much that we're not sure who to credit for their origin. We don't claim all the ideas here are all new. Nor do we claim that they are all our own original ideas. However, if you haven't seen them, then maybe they are new to you. It is hoped that perhaps they'll provide you with an idea that you will want to adopt for you own use.

The activities of design really do cover such a broad spectrum of topics. Creativity, idea generation, team building, decision making, consensus building, documentation, project management, device specification, and design modeling are just a few of the many different types of skills that need to be developed. It's not always easy or desirable to separate one topic from another, however to try and categorize the listings in this paper we have grouped the activities into six different categories:

- Design and Creativity Activities
- Decision Making Activities
- Communication Activities
- Team-Building Activities
- Documentation and Specification Activities
- Other Activities

Don't be fooled. Most of the activities described really cover a number of different important design concepts. We hope that you will see ways to extend each activity to make them even more useful and robust in their ability to help you present the concepts of design. So feel free to read or browse the list. If an activity catches your imagination, we invite you try it out, modify it until it can't be recognized, and claim it for your own.

Design and Creativity Activities:

Activity 1: Paper Tower Design and Construction
Materials Required: Paper and tape
Goal: to practice the design process, including planning, predicting performance, and teamwork to achieve the same goal.
Description: Assign students to a team. Tell them that they will be building a paper tower and that the group with the best performance will win the contest. The performance is weighted based on the number of sheets of paper they use, the height of the tower, and the time it takes to construct. However, before students are allowed to begin construction, they must plan what they are going to do and estimate their performance. After a predefined amount of time, all construction must stop. A typical performance weighting might be

$$\text{Performance Score} = 10H - 67N - Z(T - 300)$$

where H is the height of the tower in inches, N is the number of sheets of paper used, T is the construction time in seconds, and Z is a weighting factor. For example, Z = 0 if the construction time is less than 5 minutes, Z = 3 if the construction time is between 3 and 10 minutes, and Z = 15 if the construction time is greater than 10 minutes. The exercise is enthusiastically received by students and it gives teams a good chance to reflect on what can go wrong. Allow teams to reflect on their performance following the competition.
Acknowledgement: Stephen Batill, University of Notre Dame

Activity 2: Paper Clip Design Challenge
Material Required: Lengths of Steel Wire, Long nosed pliers.
Goal: to give students practice and insight into the function of even simple objects.
Description: Provide each student with a length of steel wire (suggested length of 12 inches of 16 gage stainless steel wire). Tell them they are to redesign the paper clip. Require them to start their design process on paper. They need to quickly develop 5 to 10 possible designs. After they have enough possible ideas, have them develop a quick list of strengths and weaknesses for the design ideas. Have each student pick one of the ideas and bend the wire to form it. Form small groups (of 5 to 8 students). Each student shows their design and the other group members will list strengths and weaknesses of each individual's designs. The group is to rate the clips presented to it and identify the top 3 clip designs. After the exercise, assign the students to read the chapter on paper clip design in Petroski's "Invention by Design"[1]. Additionally, the paper clip is also a good object for working with measuring instruments such as micrometers and calipers. Students may measure the paper clip and then document it by creating a CAD drawing.

Activity 3: Let the Idea Fly: A Concept Generation Exercise
Material Required: A sheet of 8.5" x 11" paper
Goal: to build on the ideas of others
Description: When the class is faced with trying to come up with a solution to a problem, ask each member of the class to write an idea for the solution on a sheet of paper. Then instruct the members to make a paper plane out of the sheet of paper. After each class member makes an airplane, have them throw the airplane into the air. Each student picks up one of the thrown planes. (Students are not to pick up their own idea and should trade if they get their own idea back.) Each class member adds an idea to the idea on the plane and throws the airplane again. This continues for about four rounds. Then each student finds their original idea and reads what has been added to it. Have the students form groups and discuss the ideas that they have seen. Each group then presents their best to the entire class.

Activity 4: Goggle
Material Required: Pencil and paper.
Goal: to generate the most different ideas.
Description: Students are often shy about suggesting outlandish ideas. This game may be used to encourage more outlandish ideas. It is played similar to the word game Boggle, but instead of finding words, the groups are to come up with different design ideas. The students are presented with an existing problem or design concept and given a general statement about how it is to be improved. The groups are given a 10 minute period in which to generate as many and as diverse ideas for improvement as possible. The idea is to generate the most different, and unique ideas, that nobody else has thought of. Each idea is to be written down with a name and a short description of between 25 and 75 words. After the 10 minutes have passed, each team takes turn reading one description. The team to present a new idea is given a point for being the first to present the idea. The description must be read word for word. The students may not alter or edit the written description at this point. Other teams cross off the same or similar ideas from their lists. If a team reads off an idea that has already been presented or is very similar to another idea already presented, the class will use a thumbs-up or thumbs-down vote. If the concept is rejected as not being unique or substantially different, the team loses a point and its turn. Ideas are alternatively shared until no new ideas are left. After all ideas are presented, the students may be asked to judge which idea was the most likely to provide a successful design, was the most logical, was the most outrageous, was the most controversial, etc.

Activity 5: Box of Straws Structural Design
Material Required: A box of drinking straws, string, and a hot glue gun.
Goal: to plan, design and construct a simple toy
Description: Divide the class into a number of 3 person teams. Each team is assigned to create a working child's toy using only box of straws, the string, and the hot glue gun. Each team is to start with a timed idea generation period. Next, each team is to pick one of the ideas and develop it conceptually. Next have them move to the building and construction phase. Conception, design, and construction should take 40 minutes. Give

each team 2 minutes to demonstrate their design. The instructor can act as a judge and select the top designs. Ribbons or snacks may be awarded as prizes.

Activity 6: A Quick Lego Design Project
Material Required: Sets of Lego Building Blocks, bowling ball, electric fan
Goal: to practice idea generation and team work
Description: Break the class into teams. Each team is given a set of Lego building blocks and told to create a freestanding structure which can support a bowling ball at least 2 ft above the table (as measured to the lowest point of the ball). The team is required to spend the first 5 to 10 minutes planning on paper. Then allow them to build their structure. A performance measure can be used to rate the structure. It is suggested that the performance measure include weighted parameters for number of blocks, area of the structure's footprint, aesthetics, and bonus points for distance over minimum height. No points are allotted if the structure doesn't meet the minimum height requirement of 2 feet or maintain support of the load for 30 seconds. To make it interesting, you can require the structure to be able to withstand an added unspecified wind load (supplied by an electric fan).

Activity 7: Recycled Engineering Contest.
Material Required: Bring in a box of cans, plastic bottle, plastic bags, cardboard boxes, newspaper, string, duct tape…and whatever else you want to include.
Goal: to practice creative thought, idea generation and teamwork.
Description: The class is broken into 3 to 5 persons teams. Students are given access to a box of common trash. The students are to create a design using just the materials from the box. Require a mandatory idea generation period before letting them lose to build. Construction should be limited to 45 minutes at which point all work must stop. Judge the creations based on creativity, aesthetics, utility, and the promotion of recycling.

Activity 8: The 1-hour Mouse Trap Boat.
Material Required: Mouse traps, Popsicle style craft sticks, hot glue guns, wire, ribbon, wood dowels, empty thread spools, Styrofoam packing peanuts.
Goal: to practice idea generation and teamwork
Description: Break the class into teams of about 5 members each. Each team is to design and build a small mousetrap-powered boat using the materials listed above during the class period. Boats are to attempt to travel across a straight 3 foot long stretch of water. The time needed to cover that distance will be measured as the performance criteria, or alternatively, a drag race style competition may be held during the class period following the design and construction.

Activity 9: Popsicle Stick Miniature Trebuchet
Material Required: Popsicle style craft sticks, hot glue guns, nylon cord, marbles, rocks, thread spools, and drinking straws.
Goal: to practice design conception, design construction, and teamwork.
Description: Explain the concept of ancient war machines called trebuchets. (Software demos are available on-line which allow students to change parameters.) Break the class

down into 5 person teams and provide each team with the material listed. Each team is to agree on a design structure and then build a working model. Have the teams bring the completed trebuchet prototype to the next class and hold a competition to test which team's model works the best to fling a marble for distance and accuracy. Award prizes for distance, accuracy, and aesthetics.

Activity 10: The Newspaper Bridge.
Material Required: a supply of newspapers (of the same approximate number of pages), a roll of masking tape.
Goal: to understand truss construction, practice design, and teamwork.
Description: The class is broken down into teams. Each team is to design and construct the longest freestanding bridge out of the newspaper and masking tape. Indicate to teams that the ends of the bridge will not be allowed to be taped to the foundation or be hooked over ends of the foundation support. The bridge is to be able to support a paperback book (approximate weight, 1 lb), laid flat at the mid-span. It helps to show and suggest the teams work with rolled tubular elements made from the newspaper and tape. There is no set length that their bridge must span, however the winning team will be the one that is able to support the book for a given period of time (30 s) while spanning the largest distance. This exercise is a good one to hold after the students have been introduced to the topic of truss forces.
Variation: For an even tougher challenge substitute a roll of toilet paper for the newspaper.

Decision Making Activities:
Activity 11: Sporting Predictions using Group Decision Making
Materials Required: A listing of teams in a tournament of interest to students
Goal: to demonstrate one method for group decision making and consensus development
Description: Assign students to a team. Provide each team with the bracketed matches for an up coming sports tournament (such as the NCAA basketball tournament, football playoffs, baseball championships, etc.). These brackets are often printed in local newspapers. Tell the students they are to select the winners of each contest by voting. Each team member votes on each contest and the team must reach a consensus on each contest. By repeating this process, the team then reaches a consensus on who they think will win the tournament. After the tournament, the teams that picked the winner can be given recognition. This shows teams that voting is a viable method for making decisions as a group, but that it may present some problems since some members may passionately disagree with specific choices. After the exercise, let students reflect on their experience.

Activity 12: Number of Ping Pong Balls to Fill a Room
Material Required: ping pong ball and tape measure.
Goal: to demonstrate different levels of modeling solutions.
Description: Without doing any math, ask students to estimate the number of ping pong balls that they believe would be needed to completely fill the room they are in and write it down. Next give them some elementary size information, such diameter of a ping pong ball, and the three principle dimensions of the room. Ask them to use a simple model to

try and get a better estimate for the same problem. They should write this number down as well. Now form small groups and have the students compare both estimates with each other. Discuss and record what assumptions or inaccuracies may affect their best estimate. Also estimate how much each assumption affects the overall estimate. Have the group come to a consensus on what the best estimate is. Then bring the groups back together to see just how close the estimates of different groups were. Have each group share one or two assumptions which they used to alter their numerical estimate.
Acknowledgment: Starfield, Smith, and Bleloch [2]

Activity 13: Over-Constrain to Kill…A Game of Elimination
Materials Needed: Paper and a simple consumer product.
Goal: to understand the exact nature of product specification.
Description: Provide the class with a general description of a product and its primary function. Break the class into groups of 5 or 6 students each. Each group will work through the following activity. Taking turns, each student is to provide an additional qualifying statement to the specification of the product, without adding a redundant, contradictory, or superfluous requirement to the previous product description. As each new statement is added to product specification, any member of the group can challenge the new statement as being Redundant, Superfluous, or Contradictory to Design Intent. At which point the person who added the statement gets 30 seconds to explain why it is not (if they can). The players (including any eliminated members) vote to agree or disagree with the challenge. If the challenge is upheld, then the person who added the statement is eliminated from the round and their statement is removed from the specification. If the challenge is vetoed, then the student who challenged the specification receives a black mark. Any challenger receiving a third black mark is eliminated from the round. Play continues until only one person is left. By completing this game, students get some idea of the complete nature needed to specify all aspects of a project to be designed and manufactured.

Communication Activities:
Activity 14: Listening Exercise
Materials Required: None
Goal: to demonstrate how difficult it is to really listen to other team members.
Description: Assign students to a team. Then give the team a task to perform. A typical task might be selecting the best alternative for a design from a set of possibilities. Then instruct the teams that while they are discussing the ideas they may not interrupt any of their team members. Once a team member is speaking, no one may interrupt until the team member says, "I am finished." A fun (and frustrating) alternative is to require that no other team member may speak until someone has paraphrased what the team member just said. After the exercise, let the students reflect on their experience. This reflection can be in a logbook entry or class discussion.
Acknowledgement: Beth Fauber, Indiana State University

Activity 15: How Do You Think?
Materials Required: None
Goal: to demonstrate that we all think differently and that the way we think affects our communication.
Description: Assign students to a team. Ask each student to think of a year. Then ask them to describe to each other how they think of a year. You may want to tell students some typical answers that are given so that they are willing to share. Some people see the word "year" either in script or block letters, etc. Some people see a calendar. Some people see the calendar with two rows of six months each. Some people see a calendar with three rows of four months each, etc. Ask students to be very specific and tell which months go where on their calendar. Some people see spirals of various shapes. Some people see various configurations of a roll-a-dex.
Acknowledgement: Ron Artigue, Rose-Hulman Institute of Technology

Activity 16: The Specification Game:
Material Required: Some simple manufactured parts.
Goal: to demonstrate the detail of communication needed to specify exact details
Description: The instructor provides the same item to each team and assigns them to come up with list of specifications that describe the object. They are to pretend that they are a customer who will be dealing with a manufacturer who is going to produce the part for them. What information must be given to the manufacturer to make sure that the part meets their requirements? The team is to create a list of these requirements that describe the part and ensure that the part meets their standards. After each team has completed its list, the list is shared with the class and a more complete list is generated.

Activity 17: Origami Dissection and Specification.
Material Required: A number of different origami creations, origami paper.
Goal: to practice communication emphasizing graphics.
Description: Divide the class down into a number of 3 person groups. Each group is given a completed origami figure. The group must examine the figure and understand how it was created by unfolding or dissecting the figure. Then they are assigned to create a set of instructions on how to construct the figure starting from a blank sheet of paper. Encourage them to use both graphic and written communication. When complete, each group will give their instructions only to another group who must attempt to reconstruct the figure from scratch with just the help of their instructions. When the figure has been reconstructed, it will be compared to original figure. The team that performed the reconstruction will provide feedback on what they felt were the weak communication points of the instructions and return them to original team.

Activity 18: One-Word-Story…Moving Toward a Goal One Word at a Time.
Material Required: None
Goal: to practice working together with a team.
Description: A team is to give instructions on how to complete a specific task (changing a tire, tying a shoe, etc.). However, each member is only allowed to contribute one word to the description at a time. Team members take turns supplying a single word to be

added to the instructions. This exercise can be run either orally or in written form. It's interesting to see how well team members are able to keep the thought process moving along the same direction without external discussion and only being able to provide a single fragment of their idea.

Team Building Activities:

Activity 19: Group Building: The Team Quiz
Material Required: Textbook
Goal: to demonstrate variations in note taking ability.
Description: Assign students a section of the text to read and tell them that there will be a group quiz on the material. Tell the students that they will be allowed to bring in one sheet of paper to use for the quiz and that they should take careful notes on the assigned reading. During the next class period, give a quiz over the assigned material and have them work in a group to complete the quiz. Make the quiz challenging for the average student so that they will have to work as a group.

Activity 20: Group Building, Worst Teaming Experience
Material Required: a student essay completed in class on their worst teaming experience.
Goal: to facilitate group contact and understand member preconceptions.
Description: Have students pair off. Each student is to interview the other about their worst teaming experience. Each student is to complete a one page paper describing the other student's experience prior to coming to the next class. The paper should describe the experience briefly. It should identify the attributes that caused the experience to be such a bad one, and identify what attributes might have kept the experience from being so bad. At the next class, give each student the paper written about their experience and allow them to read the paper. Assign students to a team and ask the teams to brainstorm for five minutes on what attributes they would most want in a team member. Tell them that they can look at their papers for ideas. After five minutes, ask each team to list their three most important attributes. When the teams have finished listing their attributes, ask each team to state one of the attributes and make a list that the class can see. Some teams may say that their attributes have been listed which is fine. After you have a list of five or six attributes, ask the class if there is anything that any group thinks is missing from the list. The list can then be used as a basis for peer evaluations.

Activity 21: Balloon Animal by Team Design.
Material Required: Sculpting balloons and air pumps.
Goal: to develop teamwork and consensus building skills.
Description: Break the class down into a number of 3 or 4 person groups.
Each group is supplied with the names of three randomly chosen animals. Without saying the names of the animals, the group is to select one of the possibilities and then attempt to create a sculpture of it as a group. All groups' sculptures will be displayed at the end. Each student will try to attempt to identify each animal that has been represented by the sculptures. For each student who correctly identified the animal, the members of the sculpting group get a point. For each student who correctly identifies a particular animal,

the student also gets a point. The student with the most points at the end is recognized.

Activity 22: Imagination Smimagination
Materials Needed: Any tools or objects, generally the more unique and strange looking the better. Objects which are large, but light and manageable are generally more effective for this exercise.
Goal: to practice idea creation and foster teamwork.
Description: Break the class into teams of 8 to 12 people each. Each team is given a different object and told generate a bunch of different ways that the object can be used (it is not to be used in the manner that it was intended, if it is apparent just what that is.) and will need to be able to demonstrate that use. Students are encouraged to be creative and innovative and suggest ways to use the object that may be real or whimsical. Groups alternate to show the class what ideas they have come up with. It is suggested that each group present the same number of ideas and that the instructor award points (1,2,or 3) for each example. These can be quickly tallied and a group can be designated the Imagination Smimagination winner for the day, but only if one randomly chosen member of their team, can stand up, and using a single breath, pronounce the words Imagination Smimagination three times in a row correctly.

Activity 23: Team Citizenship: What is it and what is expected?
Material Required: A survey form, scripts for each role.
Goal: to establish a context by which team citizenship or responsibility may be explained.
Description: The class will be presented with a scenario which will introduce them to a set of fictional characters. The class will be asked to rate how well each character fulfills the role as a good and contributing member of the team. Students are asked to play the following roles by being asked to stand, tell us who they are, and introduce one of the other characters which include the information given below. They're encouraged to embellish the characterizations a little bit as well…which can turn out to be quite interesting depending upon how they twist the character descriptions. The scenario:
Bill--*Struggling to maintain a C in the course. He often asked for explanations during the team's sessions, offered ideas when he could, always showed up for meetings, and prepared beforehand to the best of his ability. He is friendly and willing to work.*
Phil--*Missed a number of meetings with no excuse, and when he did show up it was almost always without having even looked at the assignment. He contributed very little during the meetings, was late to one meeting because no one told him the meeting time, and missed a meeting because his alarm clock didn't go off. He didn't bring his part of that week's work because he figured the Will would want to do it his own way anyway.*
Will--*Very bright, usually first to figure out solutions to difficult problems, but not particularly cooperative. He tended to just work out the solutions and discourage attempts of others to contribute. He was reluctant to spend time explaining things to the others, and was particularly impatient with Bill's questions. Doesn't like to explain things that he thinks are obvious.*
Jill--*Not as bright as Will but super responsible. She spent a lot of time giving one-on-one help to Bill and (early in the semester before she finally got fed up with him) to Phil. Always on time to meetings and often volunteers to call and remind everyone (especially Phil) when the next meeting is.*
After the short scenario plays out, students then complete an assessment form which rates

each of the team members as an effective team player. Student's break into small groups and attempt to come to a consensus on their rating of the team members.
Acknowledgement: Richard Layton, Rose-Hulman Institute of Technology

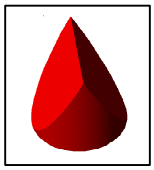
Activity 24: The Team Contract….Who Wants What from Whom?
Material Required: A prepared paper form on high quality paper or school letterhead (some type of paper which looks official).
Goal: to establish a consistent team expectation
Description: Students are separated into their respective teams and asked to brainstorm a list of what rules or regulations could be adopted to help a team or group function well and succeed. The concepts generated by all groups are shared with the entire class. The teams then meet again and are assigned to establish a set of rules that they will agree to abide by for their group activities. The students fill out a partially written charter which details the commitment that each member should make to the team and the responsibilities and penalties associated with not living up to the expectations. Each student is required to sign off on the agreed upon list. Copies of each team's signed charter are made and returned to each team member.

Activity 25: Role Playing: The team peer intervention.
Material Required: Paper
Goal: to preempt possible team interaction problems.
Description: Each team is given a scenario which describes one member of their team becoming dysfunctional and not responding well or working with the rest of the team. For instance, a team member may stop attending meetings, may become combative or try to dominate the group, or may just have poor physical hygiene. Whatever dysfunction is given, the team is to discuss ways to remedy the disruptive behavior in a professional and responsible manner. Following their discussion they are to pick one method of resolving the problem and then write a short skit which shows how it might be implemented. The skits can be shared with the class.

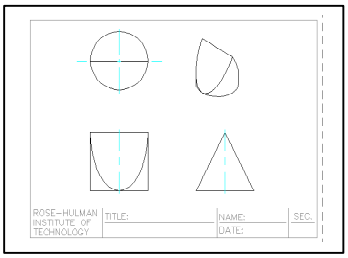
Documentation and Specification Exercises:
Activity 26: Measure This
Material Required: micrometer, caliper, and nails.
Goal: to give students practice using micrometers and calipers and to demonstrate variability in manufacturing.
Description: Explain to students that you have purchased a box of nails from a hardware store and that the nails are all the same type. (You may want to seed the box with a limited number of other size nails as well.) Introduce the designation associated with the nails and identify the specifications for the nails. Give each student several nails and have them measure and record the diameter and the length of each nail. Combine the results of all students. Use the combined results to discuss instrument reading error, acceptable part variability, and outright mistakes in reading the instruments. Determine if all nails really do meet the established size specification, or determine what percentage of nails fall outside the conventional definition. Nails may also be inspected for defects and the rate of defect occurrence.

Activity 27: The Drawing Error Challenge.
Material Required: An error filled working drawing.
Goal: to learn to recognize poor drawing techniques or other drawing errors.
Description: Break the class down groups of teams 6 to 8 people. Provide all groups with copies of the same error filled drawing. The error filled drawing should have 30 to 50 different items that could be corrected. Ask each team to put together a list of each weak or incorrect element on the drawing. After they have compiled their list, have each group exchange their list with another group. Each group should go through the other's list and determine how the listed item should be improved or corrected, or else decide it didn't need correction. After completing this exercise, hold a short class discussion where questions about specifics errors may be cleared up.

Activity 28: Sloppy Drawing Contest… Learn Good Rules by Bad Examples
Material Required: Drawing equipment, an object be drawn.
Goal: to demonstrate good drawing rules by trying to show poor ones.
Description: To add a sense of fun to a class which has a large amount of drawing assignments, it is a nice change of pace to assign a sloppy drawing assignment or contest. The students are assigned to complete a hand sketch or instrument drawing of an object, but instead of doing it to the best of their ability, they are to intentionally try to make it as poor as possible, but still create a drawing where the object is recognizable. By forcing the students to draw poorly, they become more aware about both the good and bad drawing habits they have already developed, and sometimes allows them to recognize ways that their good drawings may be lacking. When creating a sloppy drawing, the focus shifts from whether a specific line or note is correct, to the overall legibility and effectiveness of the drawing. This is a focus that isn't always there when a student is trying to draw the correct line.



Activity 29: The Triangular, Square, and Circular Hole Challenge.
Material Required: A template with square, circular, and triangular holes cut in it. Paper, Modeling Clay, Machined Object.
Goal: to develop visualization skill and idea creation.
Description: The students are shown the template with the holes and asked it they think there exists a rigid solid shape which may be passed through each of the holes in such a way that the hole is completely filled. Explain that "Of course there is!" otherwise why have the template made in the first place. Ask them try to visualize what the shape would be and draw a picture of it. Provide them with modeling clay to help with the visualization. Show them a machined version of the solid at the end of the exercise.



Activity 30: Dissection, take apart a disposable object
Material Required: A number of disposable objects: empty butane lighter, ball-point pen, razor, mechanical pencil, camera (without flash), toy car, flashlight, lipstick container,

etc.
Goal: to examine existing project design and practice documentation.
Description: Provide each student or team with a disposable object that they may take apart and study. For each object they should create a materials list. Additionally, parts could be assigned to be drawn, and students could be asked to research how each individual component was manufactured and/or assembled.

Activity 31: Sign Off on the Drawing…Now.
Material Required: A partially completed drawing of a given part.
Goal: to demonstrate importance of multiple inspection of work.
Description: Place each group in the scenario that they work for the Smudgeco Corporation. Then give them an unfinished or incorrectly drawn part. Explain the draftsperson who had been working on it was fired for incompetence, which happens a lot at Smudgeco Corp. The company needs the drawing down on the manufacturing floor pronto, because they need to begin production in about an hour. However, before it can be sent to the floor each member of your team needs to sign off on the part. The bosses who hired you (accountants and phys-ed majors) fully expect you to be able to solve design and documentation problems in 20 to 30 minutes (You think I'm kidding…but I'm not). Your team is to work together, determine what's wrong with the drawing, mark it up, and then decide if you should send it back to drafting or on to the floor. If you decide to send it on the floor, you need to sign off on the drawing, which is what the bosses are expecting you to do. Decide what your responsibilities are as a team and as an individual to yourself, to the company, and to the public interest. After making your decision, discuss the consequences.

Activity 32: Log Book Rating Exercise
Material Required: Old abandoned log books from years gone by
Goal: to get students to create better log books.
Description: Since some log books are always abandoned after a class is finished, you can use them to improve the habits of your future students. Use old lab books by having your current students browse through them and identify good and bad examples. Students should be given several log books to quickly page through. For each book they should fill out a list of 3 to 5 things that were done well and done poorly in the given book. After completing their reviews, have the students meet in a group and compare their observations. Finally have each student go evaluate their own log book, identifying the same list of 3 to 5 good attributes and 3 to 5 things that could be improved in their own book.

Other Activities:
Activity 33: Video Day: The Deep Dive
Material Required: Video Player, Snacks
Goal: to see a well run example of the design process
Description: The Deep Dive Video [3] is a Nightline program which examined the process of design as carried through by the IDEO Corporation. Nightline crew follows the IDEO group as they redesign the grocery store shopping cart. The video is a

wonderful example that shows students the importance and success of the design process. You can turn watching the video into an event by providing popcorn and or other snacks. Running time is about 21 minutes. This video can be ordered from ABC News. After the video you can ask Deep Dive Trivia questions (garnered from the video) and give out prizes.

Activity 34: Part Search….We Need a Replacement Spring...Fast.
Material Required: Internet access, industry supply catalogs
Goal: to demonstrate access to standardized manufactured parts
Description: Design often requires going out and finding a replacement part instead of creating something new. In this scenario, you show the students a broken spring that needs to be replaced and indicate that your company's former supplier is now defunct. What are they as a designer going to do? The student's are assigned to locate a new supplier. As part of this assignment, they are to determine cost, availability, identify material of available part, identify any special order instructions needed, and estimate approximate delivery time. This is a good time to introduce students to available industrial supply houses such as McMaster-Carr, Grangers, or whatever supplier you prefer. It is also suggested that you introduce them to and show them how the Thomas Register may also be very helpful for locating possible suppliers and requesting literature on manufactured goods.

Activity 35: A Decision Matrix: Building a Better Mouse Trap.
Material Required: Paper, mouse trap
Goal: to break down a design into its functional processes for redesign
Description: Show the students a simple mouse trap. Have them break down into working groups and have them identify the individual steps in how a mouse trap does it job. Bring groups back together and have the individual processes shared with the entire class. As a class, create a morphological chart based on the individual steps of the process. Try to find 3 to 5 different methods to accomplish each step of the mouse trap process. Assign each individual to pick an alternative process for each step and use these choices to devise a concept for the new mouse trap design. Have them try and sketch out a version of the trap based on these chosen steps. Sketches can be shared with the class.

Conclusion:

These 35 activities are just a few of the many interactive activities you can use to introduce the myriad topics that fall under the umbrella of engineering design. In the authors' experience, the best way to get across design to students is for them to experience it themselves, while you provide a guiding hand to nudge them along the process. Still looking for more ideas? Explore some of the references that follow.

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