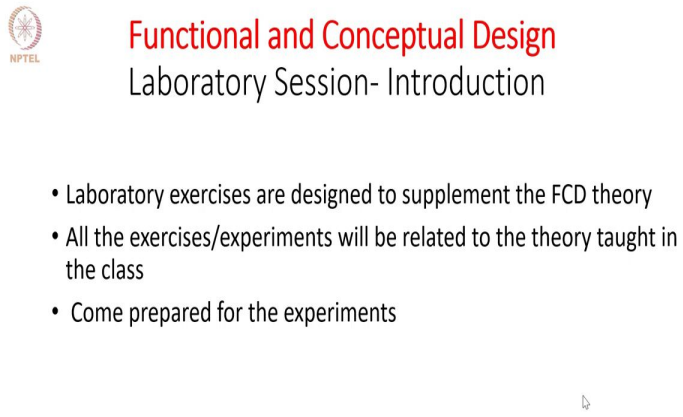
Functional and Conceptual Design
Professor Dr. T. Asokan
Department of Engineering Design
Indian Institute of Technology, Madras
Laboratory Exercise 1

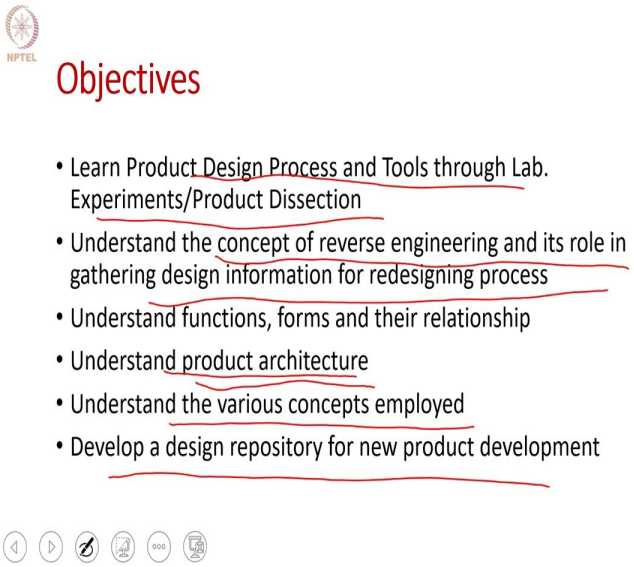
We will start the lab session today. As I mentioned, the lab session is basically to supplement whatever we learn in the theory class. In the theory class, we will be talking about many of the product design strategies, processes and methods and those processes, methods and you will practice it in the lab session. So you will be having a lot of products which you need to open up, identify the components, the assemblies, the structure, and then we will be asking you to do some exercises, which will be related to the theory which you already learnt. So, it is more of an application of the theory that you learned in the theory class.

(Refer Slide Time: 00:58)



As I mentioned, laboratory exercises are designed to supplement the FCD theory and the exercises should be related to the theory taught in the class. Please come prepared for the experiments.

(Refer Slide Time: 01:15)



The objectives of all these lab exercises basically to ensure that you will learn the product design process and tools through laboratory exercises. You will be doing this product dissection and then through this dissection and assembly process, you will learn some design process that is the idea here. We want you to understand the concept of reverse engineering and its role in gathering design information for redesigning processes, understand functions, forms and their relationship and understand the product architecture.

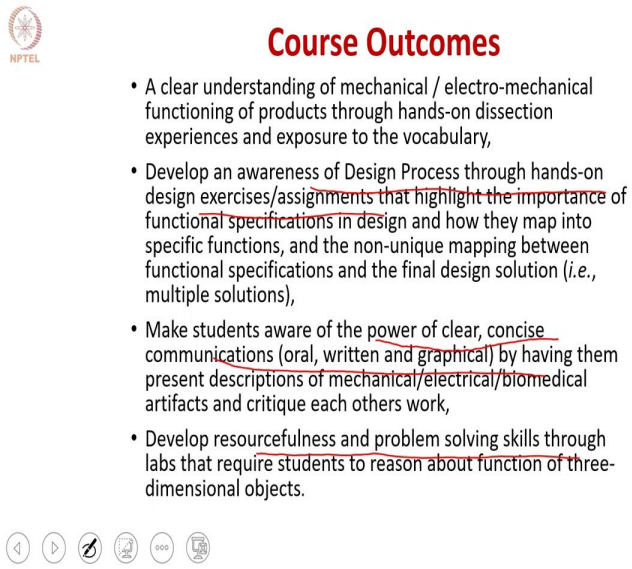
When you go through the products and the dissection you will be learning or you will be coming across these parts and what are the functions of each part and how these parts are assembled and what kind of interfaces are provided in the product. That actually helps you to understand the architecture of the products and there are various architectures used in the product and you will be able to know this architecture by going through various products.

And of course, you need to understand the various concepts employed by the designers in order to achieve different functions. There can be different concepts for the same function. For the same function you can have multiple concepts employed. So, this exercise will allow you to

understand what kind of concepts are employed by the designers you know to achieve the functions and all these will help you to develop a design repository for new product developments.

While going through many products and seeing different components used in the product and different functions needed in the product, you will be developing a good design repository for yourself, which can be used for designing your products. The database that you generate or you understand while doing this dissection is going to be there with you to help you in the design of your products.

(Refer Slide Time: 03:31)

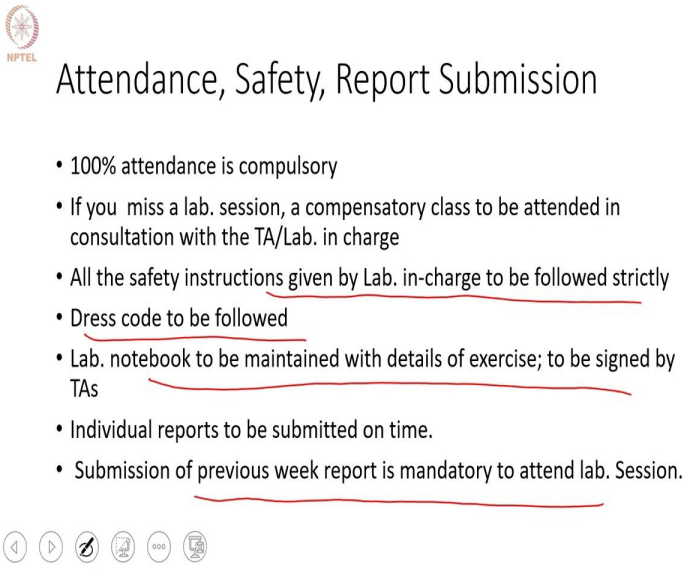


The course outcomes, I have already mentioned this in the class. We want you to develop an awareness of the design process through hands on design exercises. By having a hands-on exercise i.e., by opening the product and then removing the components and then trying to reassemble them, you are actually creating an awareness to yourself about the design process. Apart from doing these hands-on exercises, we want you to have a power of clear concise communication also oral, written and graphical.

So, if we are asking you to prepare the report, identifying the parts, their functions and making the sketches, we want you to have a good understanding as well as clear and concise communication capability also. And of course, we want you to be resourceful when it comes to problem solving, as any design activities or problem solving. And through these exercises, we expect you to be resourceful in solving design problems.

The schedule of experiments will be given to you later, thus we have around 10 lab experiments, and in each class we will be opening up a new product and there is something common in all those exercises. The outcome expected from you in each exercise will be slightly different. So, we will tell you these things in detail during the class.

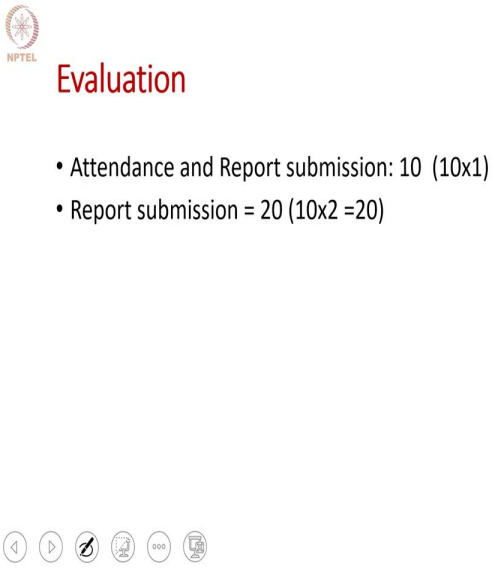
(Refer Slide Time: 05:07)



These are some general instructions about attendance and then the safety and report submission. So, all the safety instructions to be followed and then a dress code to be followed. Do not come with loose clothes or half pants, you should have full pants and shoes. And then there should be a lab notebook maintained with the details of exercises. Each lab report should be maintained in the notebook. So, keep a separate notebook to make notes during the lab exercises and prepare a

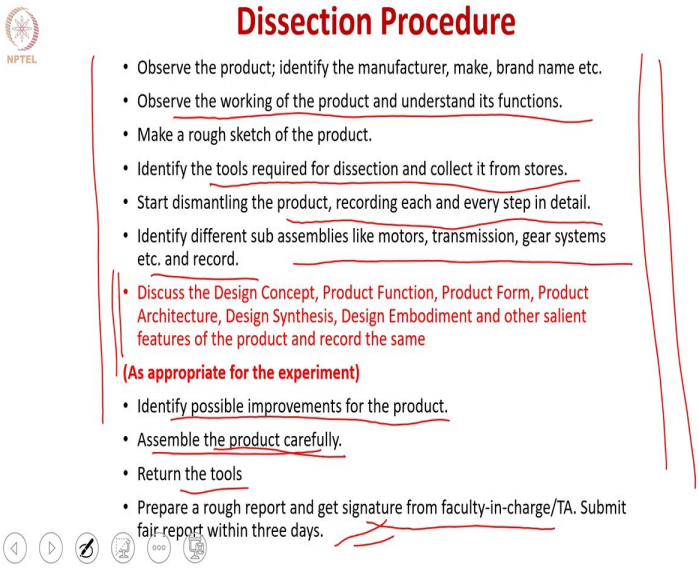
draft report during the class and get it signed by the TAs. And finally, you submit a fair report every week to be evaluated.

(Refer Slide Time: 06:00)



These are the evaluation criteria that we will be using.

(Refer Slide Time: 06:05)



So, this is a general instruction for the dissection procedure, this will be common in all the experiments, but what is the outcome that is expected from you or the report the expected from you is different in each exercise. When you come to the class, go to the table assigned to you and

the product will be available on the table and there will be a technical assistant, sorry a teaching assistant available, who is a senior student and there will be technicians also in the lab.

Observe the product, identify the manufacturer, make brand name, etc. and have a brief discussion with the TAs as well as your teammates about the function of the products and what was its shape or the size or the function in the previous generation or 10 years back how the product looked like. What was the origin of this product and how it evolved? Some brief discussion you can have about the products and then if possible observe the working of the product and understand its functions.

This leads to understanding how the product works or provides the main function. It may not be possible always to do the dissection of a working product because some of the products are not in a position to operate because of various reasons and safety issues. So, if there is a working product available then the TA will demonstrate that product to you and make a rough sketch of the products, identify the tools required for dissection and collected from stores.

So, look at the product and with the help of the TA identify the tools required, screwdrivers, spanners, cutting plier or whatever it is and then get it from the TA. Start dismantling the products, recording each and every step-in detail. So, this is an important stage. So, 1 by 1 you need to remove the parts and then record each one. Whenever you remove parts, you keep a note on the notebook.

All of you need to make notes. And if you know the name of the part, like a screw or top cover etcetera, you can write them otherwise better to use numbers. So, use the sticky notes to stick the numbers on the parts. And then for each part the number can be given and you record it in the

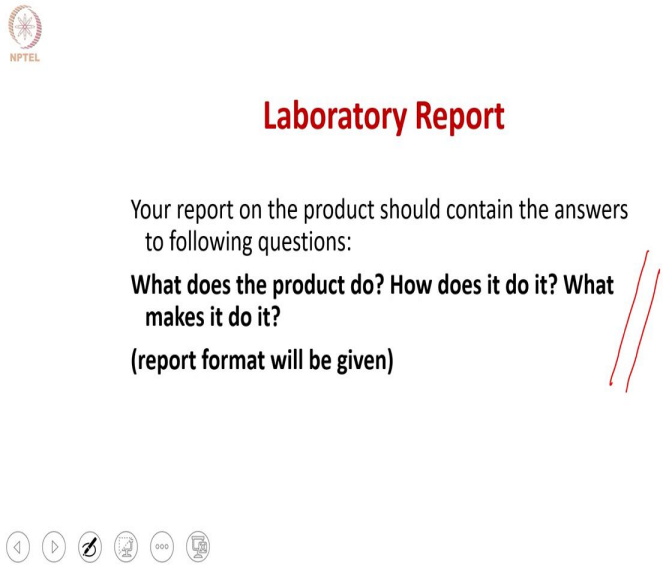
notebook. This will be needed for you to prepare the report also. And be careful while removing the components.

Very small parts like screws or nuts may, you may miss them. So, keep all things in any small bowl you want to you and do not leave it on the table. And identify the sub-assemblies like motors, transmission, gear system, etcetera, and record and then discuss the design concept. Once you have completed the dissection process, you will discuss the design concept employed for each and every part and then look at what is the function of each part, what kind of concept is employed and what is the kind of shape given by the designer for that particular part.

Look at the overall architecture of the product. Then the product is all usable parts or there are some modules which can be separately taken out. So, all those things can be analyzed after the dissection. And then note down all these information in the notebook and then look at the products and then see whether anything can be improved from your own understanding, check whether anything can be improved.

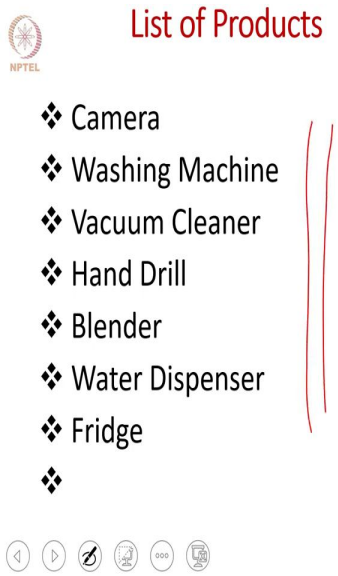
And then finally, assemble the product carefully to make sure that it is properly assembled. Take the help of the TAs or the technician to ensure that it is assembled properly and return the tools, prepare the rough report and get signature from faculty in charge or the TA. So, this rough report format will be given to you to prepare the report in that format and then get the signature from TA. And then you can leave and submit the fair report within 3 days. This is what is to be followed in every lab class. So, please keep this in mind. You need to have a notebook to record all the work that you are doing and preparing rough reports before you leave the lab.

(Refer Slide Time: 10:37)



So, the 3 questions that you need to answer and you prepare the report is this; what does the product do? How does it do it? And what makes it do it? So, if you can answer all these 3 questions that means you understood the product very well. And the idea of how the product has been designed or what kind of design concepts are employed.

(Refer Slide Time: 11:03)



These are some of the products that you will be using. We have what products but I am just giving you a sample of the products.

(Refer Slide Time: 11:11)

Safety instructions will be available on Moodle and can be displayed on the lab notice board also, please follow them, ok. So, that was a brief introduction about the lab sessions.

(Refer Slide Time: 11:28)

So, we start the first session today. And in the first session, we do not make any product decision, but we look into some other aspects of doing some group project. So, whenever you are doing a group project, as you know there are 5 or 6 members in the team, and all these team members need to work together in order to accomplish the task assigned to you. But many times

you will find that the team is not functioning well or the team disintegrates very soon because of the differences of opinion or someone not contributing or someone is becoming more authoritative or taking a dominant position and all others would not be comfortable with that and then slowly the team is not working well.

So, to understand the individual behaviors and to make sure that everyone understands each other, and how each one of the team members would behave in that situation, there are many team exercises planned by design houses or in any industry, if they take people for a particular project. They will ask them to do some team building exercises to ensure that the team members have a good understanding of each other.

So, these are known as team building exercises and it has nothing much to do with the actual tasks to be completed by the team. So, in this session, we will try to understand how these team exercises can be carried out, and how team exercises can be used to understand the behavior of each other, as well as to build confidence between team members.

(Refer Slide Time: 13:21)

Team Formation and Team Building

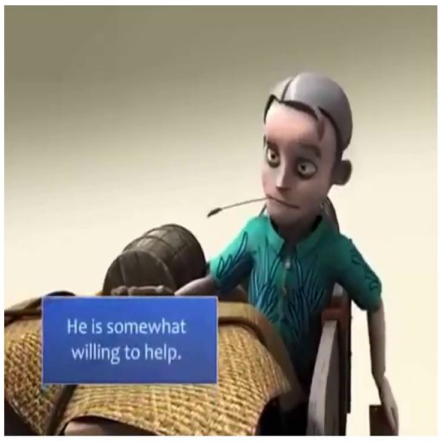
Team Formation and Team Building

Team Formation and Team Building

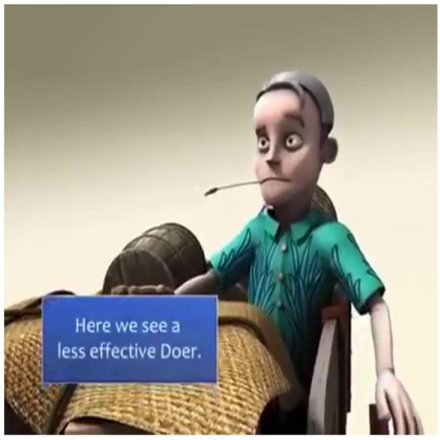
Team Formation and Team Building

Team Formation and Team Building

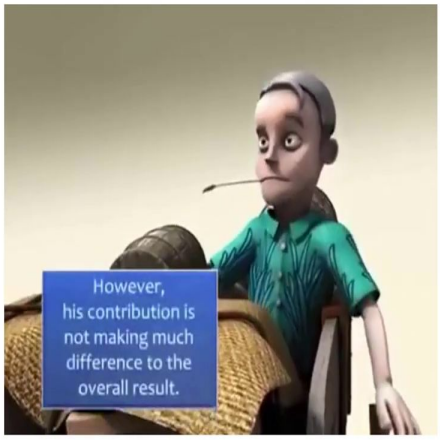
Team Formation and Team Building



Team Formation and Team Building



Team Formation and Team Building



Team Formation and Team Building

Team Formation and Team Building

Team Formation and Team Building

Team Formation and Team Building

Team Formation and Team Building

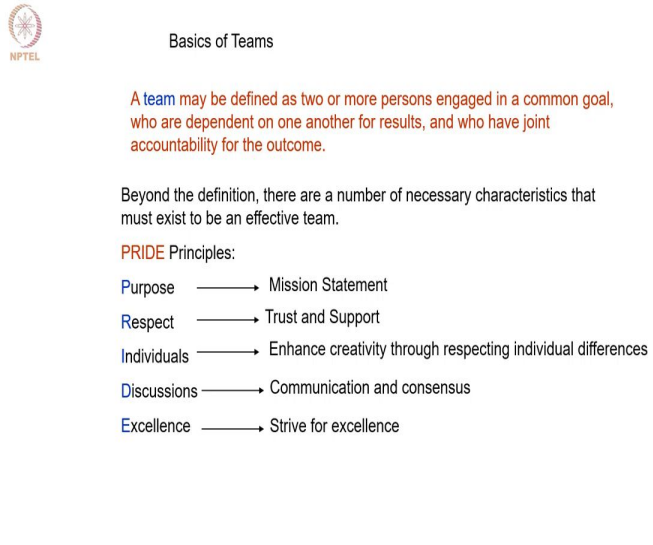
Team Formation and Team Building

Team Formation and Team Building

Team Formation and Team Building

To explain this or the importance of the team activity, I will show you a small video. Very short one, which is actually self-explanatory for you to understand the importance of team playing and the roles played by team members. So, please watch this video. I hope you got the message. So, the objective of any team activity is basically to ensure that you identify the potential troublemakers well in advance and then take corrective actions that are very important to have a very successful and productive team.

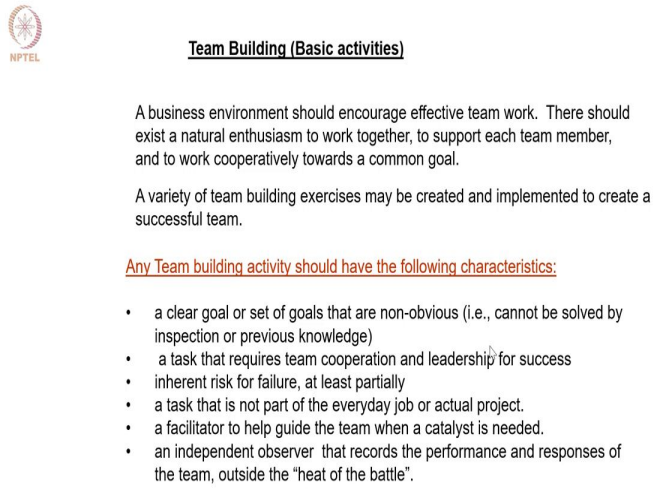
(Refer Slide Time: 16:38)



A team may be defined as 2 or more persons engaged in a common goal, who are dependent on one another for results and who have joined accountability for the outcome. And we say that apart from the definition, there are some principles to be followed by the team members and we call this as de PRIDE principles. Let us talk about purpose, respects, individuals, discussion and excellence.

Basically, there should be a clear mission statement or objective for the team. And there should be good trust and support between the members and enhance the creativity through individual differences, respecting individual differences, and then have proper communications and discussion. And then of course, strive for excellence. These are the major factors that will actually help the team to excel in their activities.

(Refer Slide Time: 17:31)



So, we will do some team building activities today. A variety of team building exercises may be created and implemented to create a successful team. Now to create a successful team we can have a few exercises, which will actually help the team members to have a good relationship between each other, as well as to see how each one performs in a team. Any team building activity should have the characteristics like a clear goal or set of goals that are non-obvious.

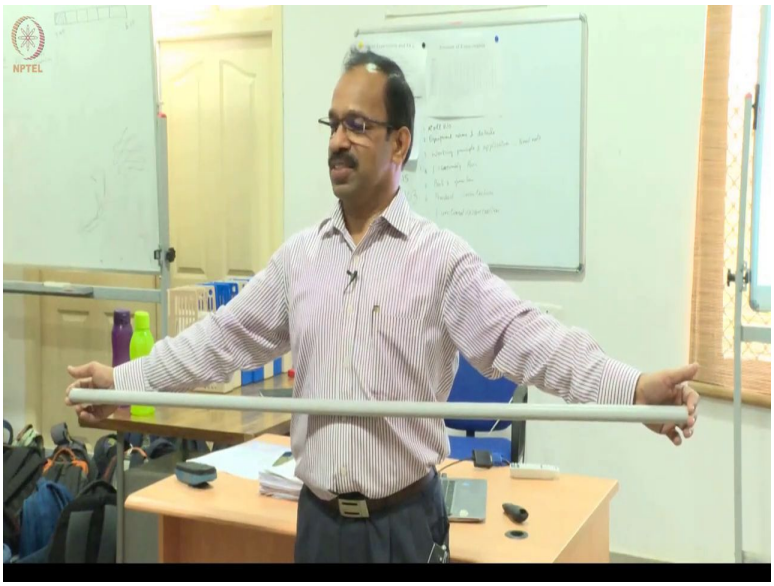
A task that requires team cooperation and leadership for success, inherent risk for failure at least partially. A task that is not part of the everyday job or actual product projects and a facilitator to help guide the team when a catalyst is needed. So, this kind of activities, team activities should not be part of the regular team roles. And that way, there should be some kind of a failure and where people need to cooperate and work together in order to achieve that objective.

And there is to be an independent observer, who can actually record the performance and responses of the team and see how each one reacts to a situation in that activity. So, these are the basic requirements in their team building activity.

(Refer Slide Time: 18:57)

So, with this background, let us start the first exercise which we call as Helium tubes.

(Refer Slide Time: 19:05)



All of you know this, right, what is this? So, this is a Helium tube, Helium. Have you heard of Helium? Helium. What is a property of Helium? Lighter than air, right. So, what will happen? It will try to float, it will go up. When you leave it, it will go up. So, this is also filled with Helium and you will see that it goes up. If you want to bring it down, it will keep going up. Not sure. Do

not believe, ok. So, I need 6 volunteers. I will prove that you can go up without any force if you keep going up. 6 volunteers come forward.

(Refer Slide Time: 19:57)

Yeah. Now, listen, I will be placing this on your fingers, and all of the fingers should be in touch with the tube, should not you should not lose contact agreed? So, whenever you lose contact, you have to start it again. Okay, I am placing it here and then what you need to do is slowly bring that tube to the ground without losing contacts, understood? Now, I am holding it. Are all of you touching? Swathi, are you touching?

So, now the moment I leave this Helium will start working, yeah. See it is going up, bring it down. Helium started working slowly. If you lose contact, you have to start again. It is now where the team role comes into picture, how do you work as a team? So probably, you can actually monitor each team and then see how are they doing? Yes. So how was this exercise? Was it good?

Student: Yes

Professor: What did you learn from this?

See, I asked you a very simple task, see I can do it very easily. There is no Helium in this one. It is just going down. Then why was it going up? When you were trying to do this? Why this was going up? What is the reason?

Student: Psychology.

Professor: Psychology? No, it is not psychology. No. See, what actually happened? I told you that it has to be brought down, ok. And I told you no one should lose contacts. So, what was your individual task?

Student: Not to lose contact.

Professor: Not to lose contact, what was the group task? Bringing it down and nobody bothered about the group task. Everybody was worried about whether I would lose my hand or not, no finger, so everyone was trying to keep contact. So, they were trying to push it up and it was going up, right, nobody bothered about it. There is a group task here to finish the group task that was not the primary concern of individuals.

So, in a group task, it is not the individual task that matters. Of course, that is important, but the overall goal of the team is more important. And to do that, individuals can contribute, but there should be somebody who actually coordinates there should be a leader who can actually coordinate the task, and tell what to do when to do how to do and then others should follow and then only it can be completed.

So, any group task is like that, you will have individual responsibilities, but if you focus only on your individual responsibility, your group task will not be complete. That is the essential message from here. So, somebody asked me how you filled Helium in these 2 hollow tubes. How did I fill Helium? So, how did I fill helium in this? Was there Helium inside? No, right. There is no Helium just told you Helium just because it is going up, so basically the exercise itself is known as Helium tube, the name of this exercise is Helium tube.

So, that is, there is one basic exercise which actually talks about the importance of working in a team or how you actually work in a team to get a team goal completed, ok. And then you get this tangram exercise, how many of you did it? Did you complete, ok? So, what was the instruction given to you, do not talk, then? What about sharing of the tans. You cannot take from somebody but you can give to somebody was it mentioned?

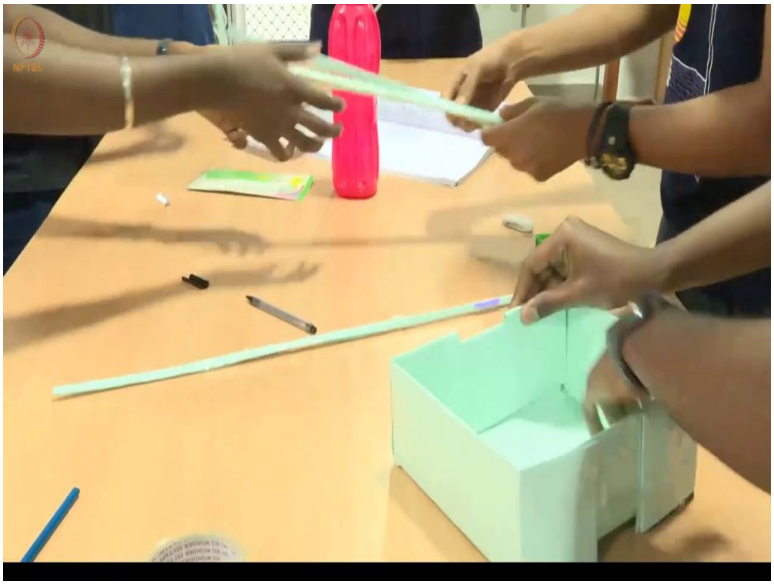
Oh, ok. That is an important point I probably missed. I can do it later. The reason is that to know who is ready to help others when I do not need something, just see whether someone can actually benefit from that one that is the key work. So, you are not worried about your own success alone, but you are worried about the team's success so they are ready to sacrifice and help others. These are the important points you should learn from team exercises.

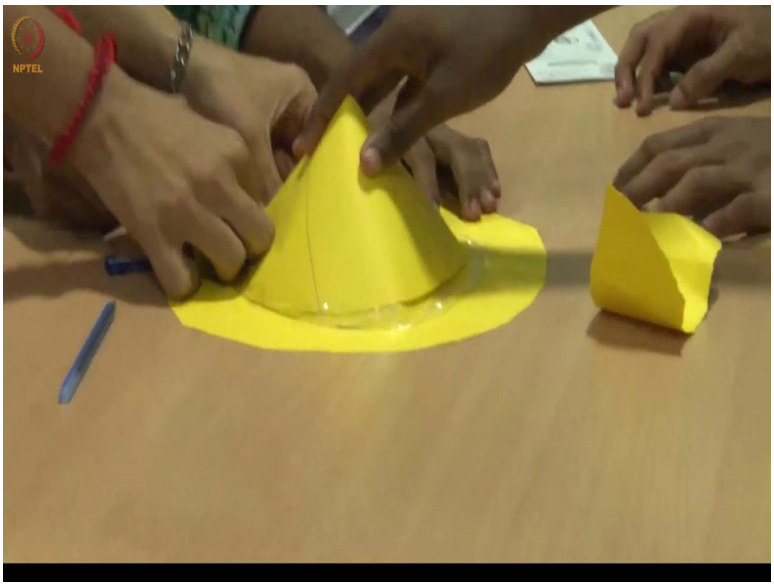
So, we will do one more exercise. This again, it is a group exercise. So, all of you can go to your table based on the groups. So, ok, before going I will just explain it is easy for me to explain it now. So, here the task, it is a competition. Each team. So, you will be given a sheet of paper, a chart paper. You will be given a chart paper, a scissor, cello tape. So, 3 ingredients will be given to you.

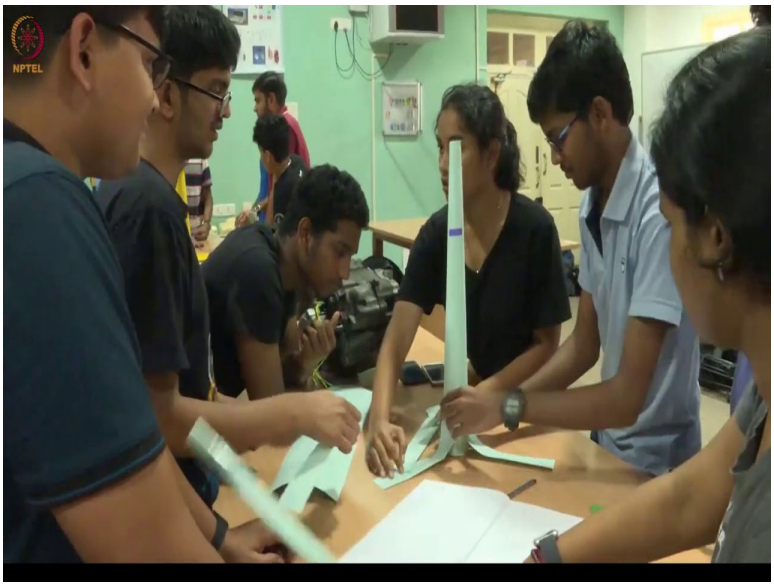
Now, you are to make a tower using the paper and the tower should be stable. And the team which makes the tallest tower will be the winner. Again, a stable, tallest tower, whoever makes that team will be the winner of this exercise and the winner will be rewarded with the Helium tube, understood? So, how do we do the stable test? So, we will blow air and then see whether it falls or not.

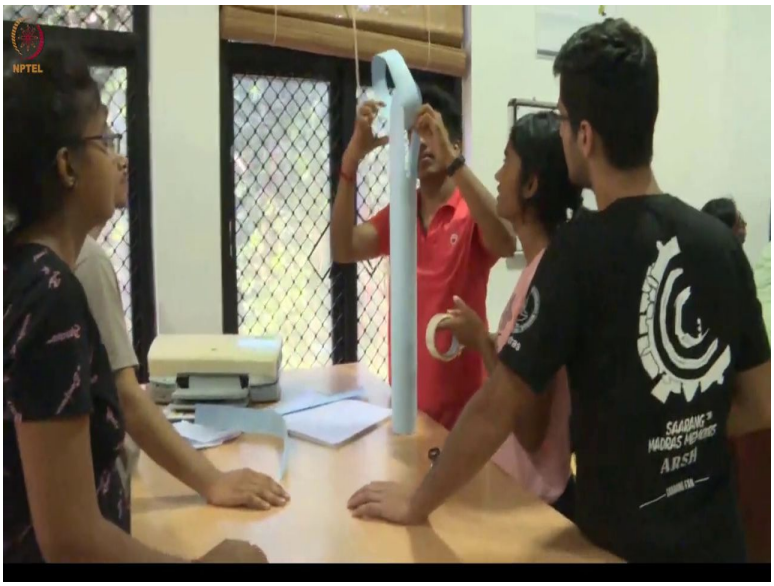
If it falls then it is not successful. It is not falling. It is a stable tower, got it, ok. Now you can go to the table and then they will supply you the chart paper and scissor and tape. Whatever you want you can do with that tape and then get the tower.

(Refer Slide Time: 26:34)




NPTEL


NPTEL


NPTEL
SAARANG '19
MADRAS MIMICRIES
ARSH


NPTEL