Introduction to Biomimicry
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Lecture – 17
Step 1: 'define' the Problem: The Biomimicry Design Spiral

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So, the title of this slide is enough to help you understand what this slide is about. So, it is time that you choose the goal. You have learned enough biomimicry to understand that biomimicry will lead you to out-of-the-box solutions. You have done enough problem identification of understanding it is important to identify a problem before you start looking for solutions, we have spoken about that enough.

You have been introduced to the United Nations Sustainable Development Goals. You have seen a student project that has gone from problem definition to solution. So, it is time for everyone to choose the goal that you are emotionally connected to. There are 17 goals for you to choose from. Why am I asking you to choose the goals? Because over the next 2 weeks, this week or the next, Mrinalini and I will take you through the biomimicry process in detail. We will talk to you about 'define', 'biologize', discover, abstract, emulate and evaluate.

And if you pick up a goal now, it would be easy for you to follow the process through and keep the goal in front of you. And using the goal and the information on the goal, by the way you must read a lot please, try and read as much as possible. Keeping the goal in front of you

that you want to solve, find out what we are saying about discover, ‘biologize’, ‘define’, etc., and start working along with this. So now for week 2, week 3, week 4, week 5, maybe week 6.

By the end of week 6 you will probably have a complete solution. And then of course, you can actually show off and say this is the solution I have and you can maybe try and improve the solution, you can publish the solution. There are so many things that you can do with it, we will come to that later. So, all the best. I am really hoping to listen to each of your goals, the goals that you have chosen. And we are excited to be working with all of you and collaborating with you to find a solution for the goal.

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We are going to look at the spiral in a deeper way. Remember the spiral, right? Remember the spiral we had ‘define’, ‘biologize’, etc., in the spiral. So, what we are going to do now is to look at ‘define’ in a deeper way. So let me start with the presentation.

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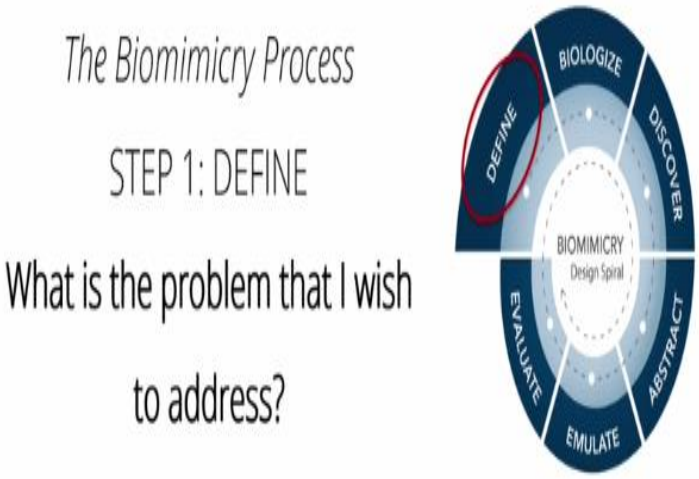

So, therefore, there you have ‘define’, ‘biologize’, discover, abstract, emulate and evaluate. We are looking at ‘‘define’’. Now, remember one thing please when you are learning ‘‘define’’ you are learning ‘define’ not only for biomimicry but for in general when you are solving a problem. One of the things that I want to talk to you about that I unfortunately cannot talk too much about creativity in this class.

But there is definitely a connection between creativity and the spiral. Because in creativity, you will learn, at some point you will learn that creativity is a process. You start with a problem and then you end up with a solution. Between the problem and the solution, you have various steps. But even when you are not doing biomimicry, when you are solving any problem, you start with defining the problem.

Tell me one thing, just think about this, how can you solve a problem when you do not know what the problem is, which is why ‘‘define’’ is important. Just like in creativity, ‘‘define’’ is important in the biomimicry spiral also ‘define’ is important. You go back to the UN SDG, what did you learn in the UN SDG? You learned to identify a problem which in other words is to ‘define’ the problem.

So, you may ask me, Shiva, then if ‘define’ the problem and identify the problem is the same, then why are we having this lecture? Because it is not as easy as it sounds. ‘define’, there are some rules about finding out what is the problem you want to solve. Sometimes, like I said I am so tempted to get into creative thinking, but anyway, sometimes you fail in creativity, not

because your ideas are horrible or stupid, but because you may have ‘define’d the wrong problem.

And therefore the risks that you take in getting that solution, all of creativity is the risk by the way, the risk that you take in getting the solution becomes a little lesser if you have been able to ‘define’ the problem very well, which is why we are going to spend about 10 minutes on learning how to ‘define’ the problem. So, therefore as you can see the title of this session is what is the problem that I wish to address?

I would really like you to pay a lot of attention to this session right now because once you are very sure about what problem you are trying to solve, it is easy for you to go to ‘‘biologize’’ because it is logical. The question that you would ask in ‘biologize’ is related to the ‘define’. The organisms that you look for discovering is related to ‘biologize’ and so on and so forth. So, now can you imagine how powerful defining a problem is.

And whether you are an engineer, whether you are a homemaker, whether you are a designer, whoever you are, even if you are a coach you need to ‘define’ what the coachee wants. And that is why this session is very critical. I would request that you have pen and paper with you and learn along with me what it is, what it means to ‘define’ a problem.

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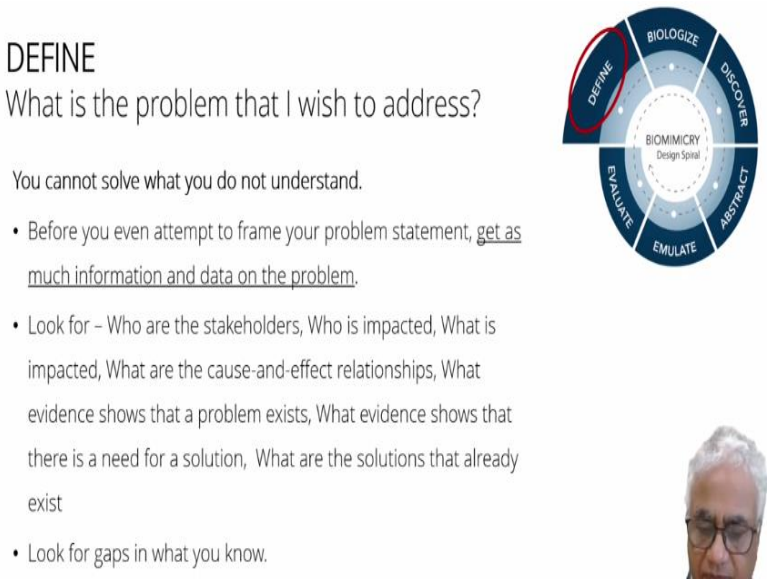

So, therefore, the general question is what is the problem I wish to address? The next line is not a joke, it is very important, you cannot solve what you do not understand. Even though it looks like a very obvious statement, it is not so obvious. Tell me how many of us really try to

understand what we are trying to solve. Because once you understand, what is the meaning of understand? It means once you look at all the implications of the problem, all the contexts related to the problem that is easier to understand.

Only if you understand the problem, you will be able to solve it which is why it is important. So, one of the ways that we recommend is before you jump to a solution which is that human tendency, the minute I look at a problem I want to jump to a solution, one of the things we recommend is do not jump to the solution especially if you have some time to solve the problem. If you do not have the time that is a different issue.

But when you have time to solve a problem once you have the problem in front of you try to get as much information as possible. Why? Because information about a problem gives you a chance to look at different angles about a problem. Let us take even the case of let us assume you want your father or mother to cook something for you. And they are struggling with what to cook for you. So, they have a problem what do I cook for my daughter?

What do they do? They open the fridge? What does the fridge contain? The fridge contains information. It has some idli batter or it has some dal or something like that and then your father imagines maybe he can mix dal with the batter and make some nice dosa for you something like that. So, the information gives him ideas. And that is why information on the problem is very important. It is also important to ask who are my stakeholders?

Who am I solving the problem for? What will be the impact when I solve the problem? What will be impacted? Who will be affected? What evidence is there to tell me that this problem exists? And most important that most of us do not do- what are the solutions that already exist. Supposing there are already some solutions to a problem, then all you have got to do is look at those solutions.

If you like those solutions, adopt them as long as you know, you acknowledge where you got the solution from, go ahead and adopt them. Why should you waste time redoing the whole thing, reinventing the wheel and all that or you can try to improve that solution. So therefore. when you are looking for information on the problem, these are the things you can look for. What is the impact? Who are the stakeholders, etc.

Now, I can talk all day long about that. But there is a gap between what you know and what you do not know, what you need to know. If you can fill up that gap, you can ask yourself what do I need to know about the problem? I am passing on a paid secret to you here. One of the ways to solve a problem is to not only look at what you know about a problem but also about what you need to know about the problem. What do I need to know?

If I look at a bottle of water what do I need to know about the bottle of water? I know that the bottle of water is made of plastic, I need to know how much the bottle costs, I need to know what was the process of filling up the water. I need to know how hot liquid this bottle can hold. Now, when you get the information for your need-to-know questions, your information becomes more and more complete.

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Once you have the problem, you cannot 'define' the problem or challenge unless reframing, redoing the sentence. I am saying you cannot 'define' the problem unless you have enough information. Try, no you just try. You just try to 'define' the problem without any data at all, you will surely struggle because the data on the problem helps you to broaden the problem, look for small, small, small problems lying within that big problem.

Now, you are probably learning one of the most important things about problem-solving and this is what I learned, I benefited a lot from this learning. When you are defining the problem, ask yourself what do I want my solution to do? Do not say what I want to make. So, the verb is important. What do I want my solution to do? I want my solution to regulate temperature, to regulate temperature is important.

You cannot say I want to build a termite mound. You say I want my solution to regulate temperature. So, focus on, remember we learned function. Function, what is it that you want your solution to do is what you think about, focus on the function of your problem. What do you want your solution to do?

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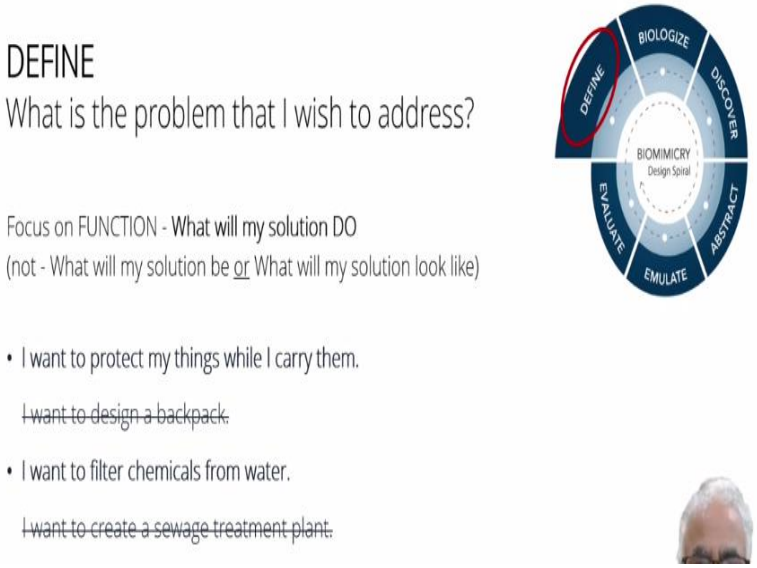

So you say when you want to address the problem, you say what does my solution do or what is my solution? Do not say what will my solution be. My solution will be a termite mound. What will my solution look like? My solution will look like a termite mound. After I am talking about termite mound, you will notice that the final product which is the Eastgate Mall and the termite mound do not even resemble each other.

Because for him, for Mick Pearce he did not want the mall to look like a termite mound. He wanted to imitate the function of the termite mound and imitate it and use that function in the Eastgate Mall. I want my solution to regulate temperature and therefore that is how he will be able to imitate the termite mound. So instead of saying I want to design a backpack, you say I want to protect to my things while I carry them.

The minute you say that, see the possibilities. The minute you say hey Shiva, what do you want to do? I want to protect my things when I carry them. The minute you listen to that, alternatives jumped at you. You can go beyond a backpack. You can even have someone to carry your things for you, not joking but it is an idea anyway.

So, therefore, when you put the function in your sentence the possibilities of new solutions crop up. You do not say I want to create a sewage treatment plant. You do not say that because when you say that you are limiting yourself. Instead of that, you say I want to filter chemicals from water. Look at the beauty of that sentence. There is a verb in it. What do you want your solution to do? I want my solution to filter chemicals from water.

What do you want your solution to do? I want my solution to protect my things while I carry them. See the power of that. Creativity is much better, you know exactly what you want to do rather than saying this is what I want to make.

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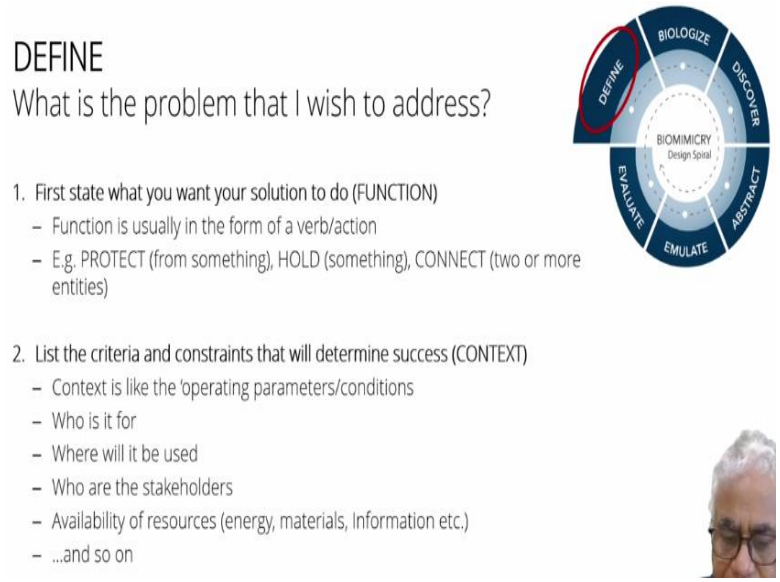

So therefore, first state your solution, when you look at the UN SDG when you have chosen the UN SDG, state your solution, you say I want my solution to do this. Normally, it is always a verb because there is an action involved in the verb. So look at that sentence. Look at the sentence, I want to protect my things, where is the verb here? The verb is 'protect'. Connect, hold, protect are verbs.

Then list the criteria and constraints, this we already saw. Context is who is it for? So therefore, I want to design, I want to protect my things while I am traveling in the train, while I am walking or in the rough rain. Therefore, what are you doing? You are saying I am defining the context. Who is it for? When you are thinking about your solution you also have to find out who it is for?

If it is for an old person, which means a solution will have to give some sort of leverage to that person's age? Is it for a child? So finding out who it is for. Where will it be used? Will it be used on a train? Will it be used to give some rest to your head? Will it be used to prevent breakage inside of the things that you are carrying? And what are the resources you have?

You look around you and find out what resources you have to build the solution. If you are thinking of a backpack, please do not think of a backpack that is so automatic, right that you already get the backpack picture in your head. Do not think of the backpack. Please do not jump to the solution. You have to tell yourself you do not even know what is the meaning of a backpack, you have never looked at one.

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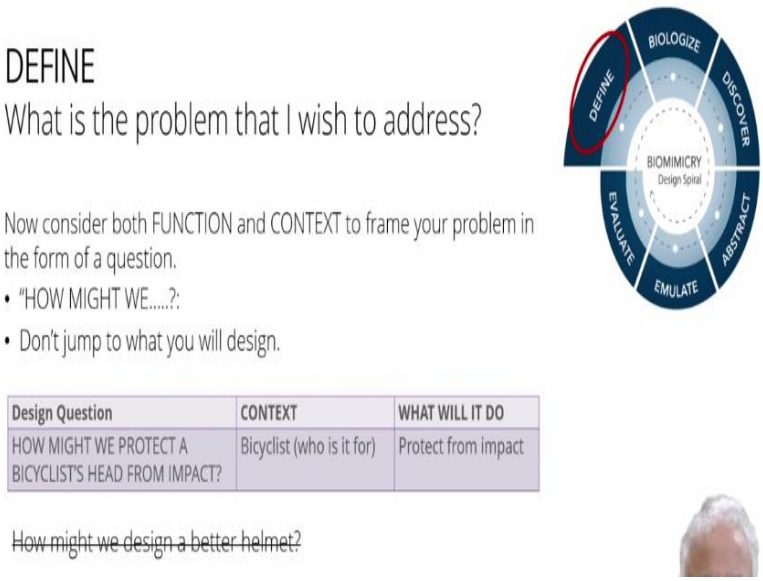

And then you have the function, you know what you want your design to do. You have the context of who it is for and in what conditions. And then you say how might you start with the three words. You just keep it like that, let us see what happens. So, therefore, look at the design question you have framed. How might we protect a bicyclist's head from impact? That is what you want to do, you are a designer.

You are a problem solver and you know that cyclists have a problem when they fall down. And there have been many accidents and you are unhappy about it. You want to do something for them. So, the problem you are solving is how might we protect a bicyclist's head from impact. If you are thinking of a helmet, please do not think of helmet. Please you have to resist the temptation to look for the idea the minute you listen to a problem, please.

How might we protect the bicyclist's head from impact? What is the context? Who is it for? It is for the bicyclist. What will it do? What will my solution do? It will protect from impact. The minute I say protect from impact, I can think of various possibilities so that is how you design a question. Just look at this example. Whenever you think of this 'define', always remember the examples.

The example here is how might we protect a bicyclist's head from impact? Who is it for? Bicyclist. What will it do? Protect from impact? There I told you, do not think of hela met which is why we have cancelled helmet because that is the first thing that we are used to because our mind is so conditioned. The minute you say how might we protect bicyclist's head from impact, immediately everyone thinks of a helmet. Imagine if the whole world builds helmets after helmets, that is not right.

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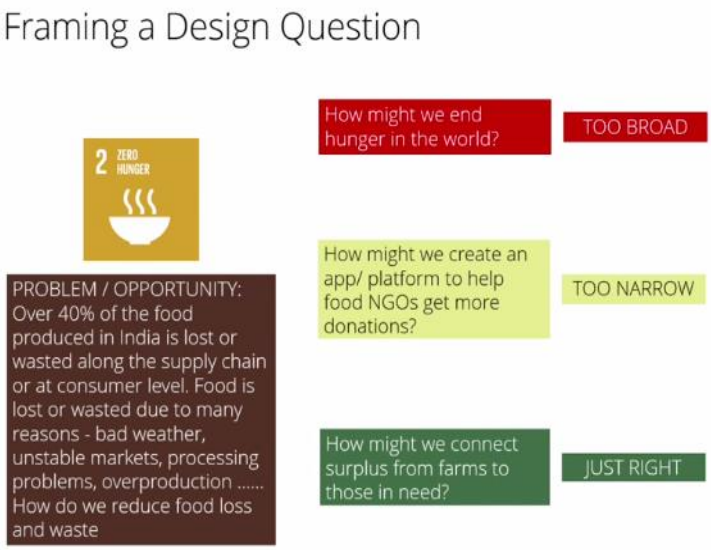

Now we are taking a UN SDG goal and this is what you will do, from now on. Here in this case the goal that you have selected is zero hunger. And I am not going to read it, it is just that this is the information on the goal, remember we have said information is important. So now you are framing. You are very interested in solving the problem. So, one question that you ask is how might we end hunger in the world. Zero Hunger?

Naturally, it is a very automatic question to say how might we end hunger in the world? But the question is too broad. Come on, be realistic. Can you really end hunger in the world just like that? I am not saying you will not, but it is just too broad, just too broad. And it is not

wrong, okay. It is not wrong. There is nothing called a wrong question. But it is not something you will want to work with.

You want to work with what is called a just-right question. A question can be too broad, too narrow, or just right. Let us see. How might we create an app platform to help food NGOs get more donations? What is wrong with that? Anyone? Look at the sentence again, look at the question again. How might we create an app? Just like the helmet it is already gone to the idea. What is the point in thinking, already the app is in the head.

So, therefore, you will turn this question as too narrow, very good, too narrow. So, you have two types of questions. I am telling you again and again, nothing wrong. Many of you can create an app that is how we do it. We are just trying to teach you how to do what is called a just-right question. There is nothing wrong in attempting a too-narrow question. There is nothing wrong in attempting a too-broad question.

But the chances of success and creativity increase when you look at a just-right question because you know you can do the other steps in an easier way. So, therefore, look at this question. How might we connect surplus from farms to those in need? So farms, you will notice that in zero hunger, you will get the information that farms get surplus food. Now one of the things you will say I want to end hunger by connecting the surplus from the farms to those in need.

You want to connect the surplus to those in need. So, therefore, I am sure you already know the answer. The answer is it is just right. Because the just-right question is not too broad. It is not solving the entire problems of the world. It does not already have a pre-existing idea in it, which is too narrow, it is just right. Now, you can argue till the cows come home saying this is right, that is right, that is not the point here.

The point here is to let you understand there are three types of questions too broad, too narrow, and just right. And you will get better and better at it as you go along. Do not stop attempting, do not worry. There is nothing called a right question or a wrong question. All questions are valid. All questions can be looked at as a challenge and they can be solved. But when you look at a just-right question it is easier to solve it.

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Framing a Design Question

HOW MIGHT WE PROVIDE AFFORDABLE AND QUALITY EDUCATION FOR EVERYONE?	**Too broad** - Does not provide specifics – many aspects need to be considered in imparting of education
HOW MIGHT WE DESIGN AN APP TO HELP YOUNG PEOPLE LEARN VOCATIONAL SKILLS?	**Too narrow** - Assumes too many details like an app; Does not leave room for discovery and innovation
HOW MIGHT WE REDUCE GENDER DISPARITY IN EDUCATION?	**Too broad** - gender disparity in education is too wide ranging
HOW MIGHT WE INCREASE PARTICIPATION OF YOUNG WOMEN IN NON-FORMAL TRAINING PROGRAMMES?	**Just right** - Enough specifics, while remaining open to a variety of possible solutions
HOW MIGHT WE PROVIDE SCHOLARSHIPS TO GIRL STUDENTS IN PRIMARY SCHOOLS ?	**Too narrow** – Idea is already specified; Does not leave any room for innovation
HOW MIGHT WE PROVIDE AN INCLUSIVE LEARNING ENVIRONMENT FOR EVERYONE?	**Too broad** – Stated in very general terms; not clear what the outcome needs to be
HOW MIGHT WE PROVIDE SKILL-DEVELOPMENT OPPORTUNITIES TO RURAL YOUTH ?	**Just right** – Specific yet allows for a range of possible solutions

Just look at this exercise. Just fun exercise. And if you have pen and paper quickly start writing down what type of question this is. So, the first one is how might we provide affordable and quality education for everyone? What is the answer? The answer is too broad. Yes. I am sure many of you got it. It says it does not provide any specific. Many aspects need to be considered while you impart education.

You cannot just say how might you provide. How might I provide affordable education for everybody in the world? There is a broadness to it. How might we design an app to help young people learn vocational skills? I am sure you are saying what type of question is it. You already understood it. Of course, it is too narrow because look at that line, it does not leave room for discovery and innovation because your mind is already narrowed.

Do you think the next one is a just-right question because you started with too broad and then you said too narrow, you think the next one is a just-right question. How might we reduce gender disparity? If you are a person who is doing this logical answer 1, 2, 3 you will say this is a just right question. I am sorry, you are going to be disappointed. It is a too broad question. Because look at the question- how might we reduce gender disparity?

How might, so therefore in one shot we just want to reduce gender disparity. Is that, I am not saying it is not possible. I am just saying it is a very broad question, wide-ranging. How might we increase the participation of young women in non-formal training programs? What is it? Just right. Because enough specifics around that. But more importantly, looking at the

question. How might we increase participation? Can you visualize that? There is a specific; increase.

If there are 10 people participating today, increase participation could mean 20 people, which means 10 more, so therefore there is a specific over there and you can work on that specific. How might we provide scholarships to girl students? This I think you know now because there is already an idea there, it is too narrow. You already decided you want to provide scholarships. How might we provide inclusive learning environment for everyone? I am sure you are getting it.

Yes, it is too broad. Why? Very general because you do not know what the outcomes are. How might we provide an inclusive, what does it even mean? Inclusive environment for everyone. And finally, how might we provide skill development opportunities? It is very specific you want to provide skill development opportunities, therefore it is just right, very specific. So, specificity seems to be a characteristic of just-right questions.

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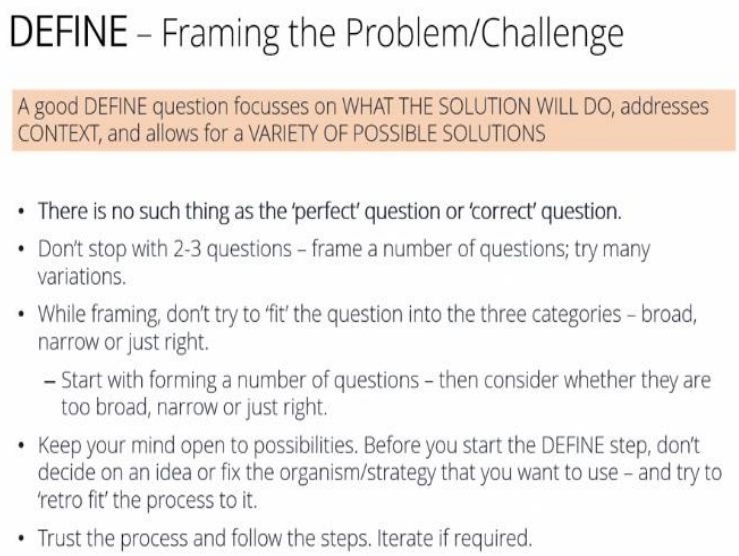

So, this one is just one, what should I say, a gyan slide so that it tells you the rules for framing a problem. Just keep this slide. You can keep this slide with you because it helps you understand what are the rules of framing a problem. There is no such thing, I think we have said this ad nauseam, there is no such thing as perfect question or correct question. Do not stop with two or three questions, frame a number of questions.

Because the more questions you have, the more opportunities you have to solve one of those questions. You do not have to solve all the questions by the way. While framing, do not try to fit the question into the three categories broad, narrow, just-right. Start with forming a number of questions and then look at whether they are narrow. Do not say, oh I am going to start a broad question. I am going to frame a narrow question, do not say that.

Just frame all the questions and then do the categorization. Before you start 'define', do not decide on an idea. This is what many people do. They already have an idea in their head. They already want to design a backpack and they somehow fit that idea into the question. How might we design a backpack they will say because the idea is already about backpack? What will it do to harm you? Because it will prevent you from looking for more information on the problem.

Yeah, this is one word I can keep on underlining, underlining, underlining; trust the process and follow the steps. Always, right, always trust, tell yourself, many people, you notice all the students who have done their work in this course have always trusted the process. You have to say in a disciplined way let me go from step 1 to step 2 to step 3. But also iterate, many times you can come back to the 'define' question, come back to the ideas.

If you think your ideas are not working, you can go back and look for some ideas. If you think your weakness is in the way you have defined the question, you go back to 'define'. There is nothing wrong. And always maintain creativity, it is something that you will fail in, that is okay. The more and more; creativity is the only thing in the world where you have a license to fail. No one passes in the first attempt at creative thinking, no one, and that is why iteration is important.

Because you say fine, I have failed not because there is something wrong with me, it is simply that I may have chosen the wrong problem to solve or I may have chosen the wrong idea to implement. So, therefore, what have we learned? We have learned how to 'define' the problem. We have learned three types of questions; just-right questions, too-broad questions, and too-narrow questions. And then we learned how to frame a problem.

The most important thing is to ask yourself what you want your solution to do rather than what should it be. So, therefore the noun, I want to design a backpack, it has a noun in the

question in the solution, that is not the way. I want my solution to protect things when I am walking is a good way to ‘define’ a problem. And then of course you also learned rules for framing the challenge.

The most important in these rules is trusting the process and iterate if required. Alright, so I hope ‘define’ is going to be a joyous experience for you. And remember whatever you are learning now is applicable not only for biomimicry, but anything in future you want to design, any process you want to design, any product you want to design, you can use this. Any problem you can use this, the rules that you learned to frame the question, frame the challenge, and frame the challenge is the first step towards solving a problem.