Effective Engineering "Teaching" in Practice
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Lecture – 12c
Feedback and Reflection (Part – 3)

Now, coming to feedback on portions of your lectures. So, here is an example, something that I have published in the IEEE transaction and education. All of us know that how you introduce a topic or a course makes a lot of difference to student motivation or student interest in that particular topic. So, I teach a course called semiconductor device modeling and I wanted to increase the interest level of my students in the course right at the beginning. So, I have formulated some introduction, I really wanted to check whether the introduction that I have formulated really is making a intended impact. Has it made any difference?

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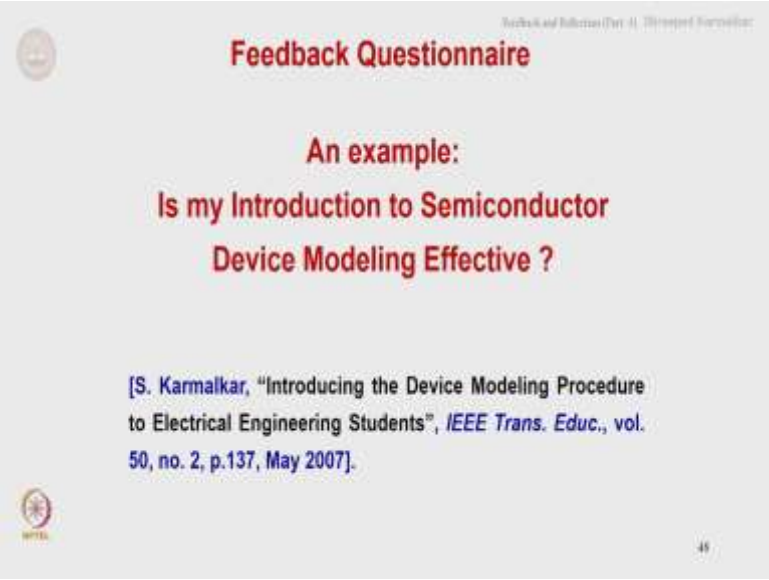

So, what I am going to describe in the next few slides is how I went about collecting feedback on introduction.

So, there were two assessments: pre lecture and post lecture. So, the introduction part spanned two lectures. So, on the very first day when the students came, I circulated some slips, what was written on them, I am going to talk to you about shortly. So, I circulated the slips to the students and sought their feedback, then after two hours I again

recirculated a similar slip right to get the feedback and the slips had some other questions also which were not there in the pre lecture assessment.

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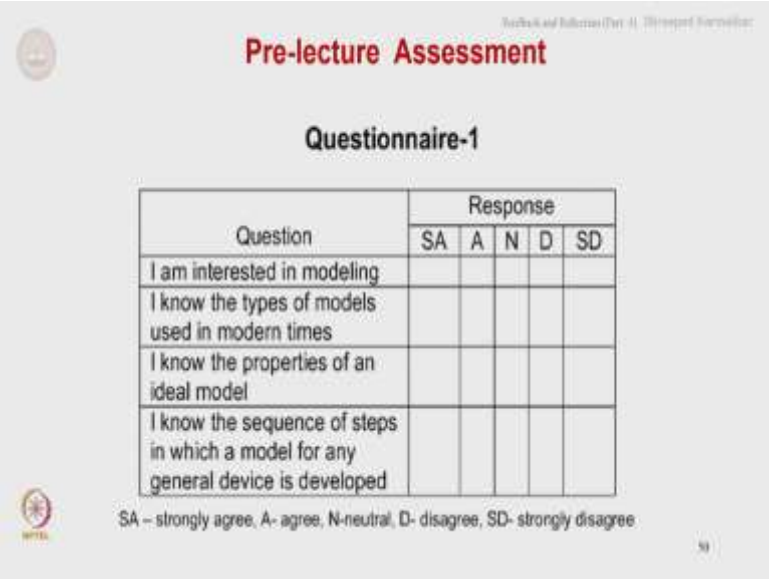

So, what was the pre lecture assessment? The pre lecture assessment, in first part the students were asked to respond to the statements or questions. So, let me go through the questions. So, the first one is students were asked to tell whether they were interested in modeling. So, here I am talking about semiconductor device modeling. So, they have to respond, they had five options. SA stands for strongly agree, A stands for agree, N stands for neutral, D stands for disagree and SD stands for strongly disagree.

So, suppose a student is strongly interested in modeling, then he would tick strongly agree with the statement. On the other hand if the student was not so much interested in modeling he would tick either disagree or strongly disagree. If the student is ambivalent then he could for example, tick neutral. So, like this there are four questions here. So, I know the types of models used in modern times, types of device models. If they feel that they are familiar with the types of models and they are very confident about it, then they will tick, again they are asked to fill up this same table and they are asked to respond to these questions. Then post lecture, they were also asked to write something else.

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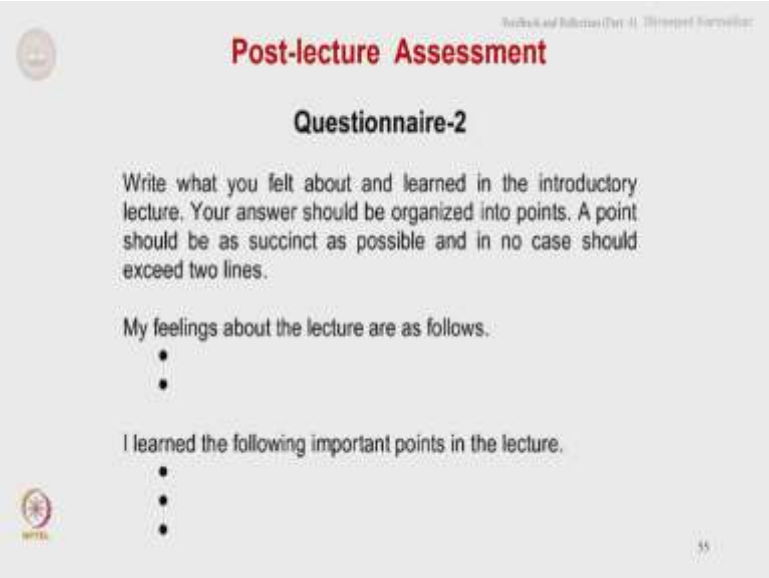

So, write what you felt about and learned in the introductory lecture. Your answer should be organized into points. A point should be as succinct as possible and in no case should exceed two lines. My feelings about the lecture are as follows. So, they can write whether it was boring, it was interesting and so on whatever they feel about it. Then I learned the following important points in the lecture. So, where they write, what are the important points they learned, in their own words.

Now, I will come to the responses and that will throw more light on the utility of this entire feedback process.

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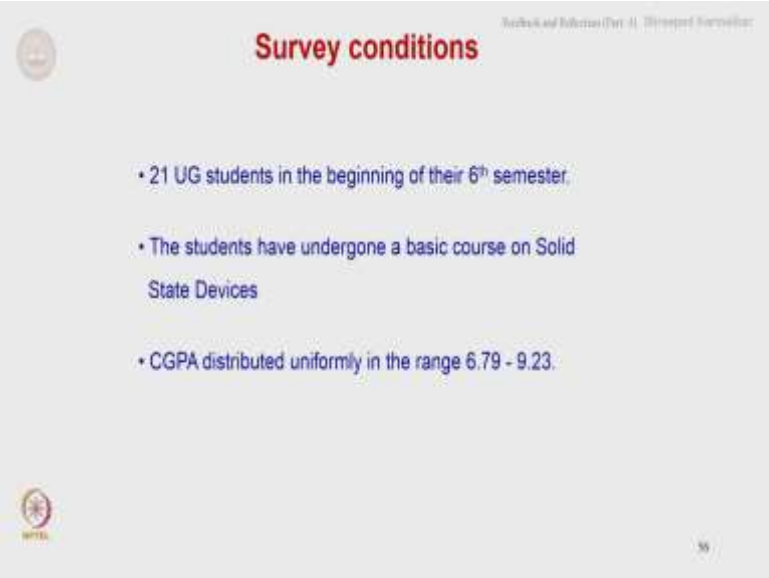

Now, there are some slides here which I am not going to discuss in detail. This is only to tell you if you are doing a scientific study of teaching and learning, then you have to specify all the conditions under which this study was carried out. So, here are some of the conditions. You want to know more about this, you can go to the publication right, which is available on the internet readily for others. So, here survey conditions for example, include the number of students here, 21 undergraduate students in the beginning of their 6th semester. The students have undergone a basic course on solid state devices and another point was that grade point average of the students were distributed uniformly in the range of 6.79 to 9.23. Then there are some more information about the survey conditions, you can see these things on the slide or you can refer to the publications.

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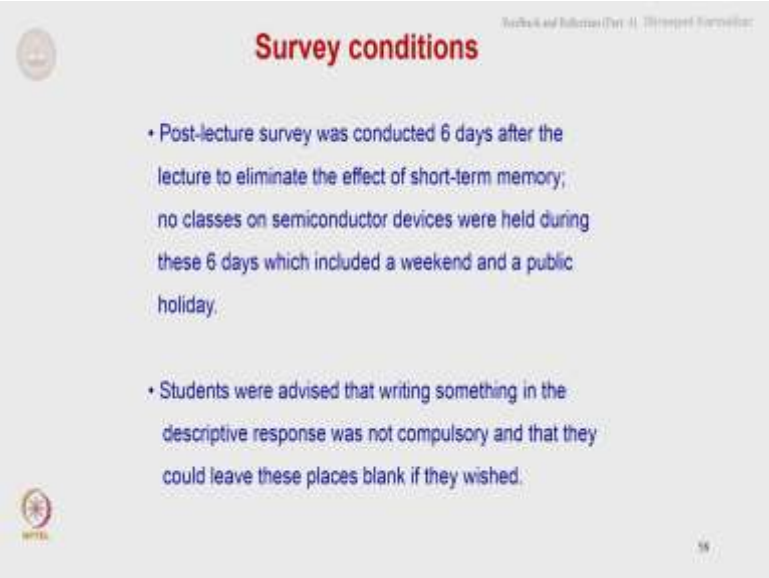

I am just flipping the slides right because these things are available in the publication.

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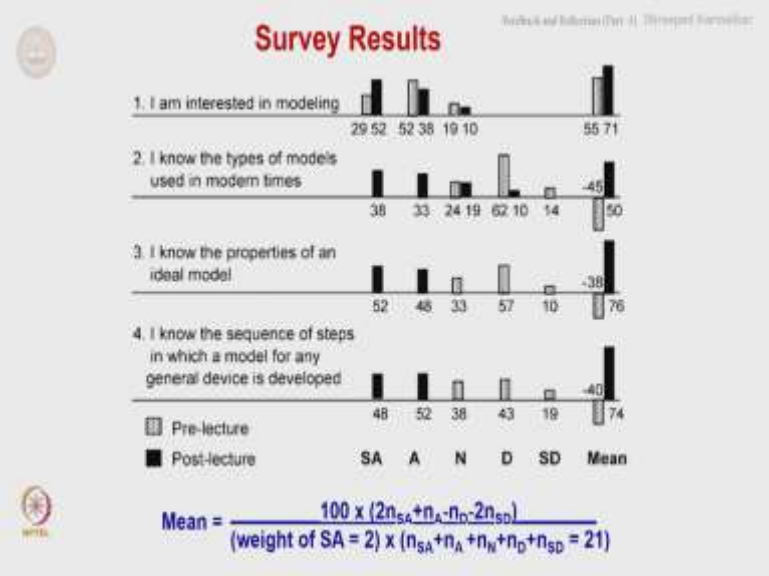

Many others results were tabulated or collated in some form. For example, let me tell you what this is talking about. So, let us take the response to the question or statement, I am interested in modeling. So, how many of the students responded strongly agree, how many of them said agree and so on is what is collected here, collated here.

And the solid part here corresponds to post lecture and this part corresponds to pre lecture. So, this helps you to compare the impact of your lecture. Now, since there are

some other forms of response which are more interesting, I will skip this part as well. Those who are interested can see the publication.

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Let me tell you what was the descriptive response. Types of models known to me.

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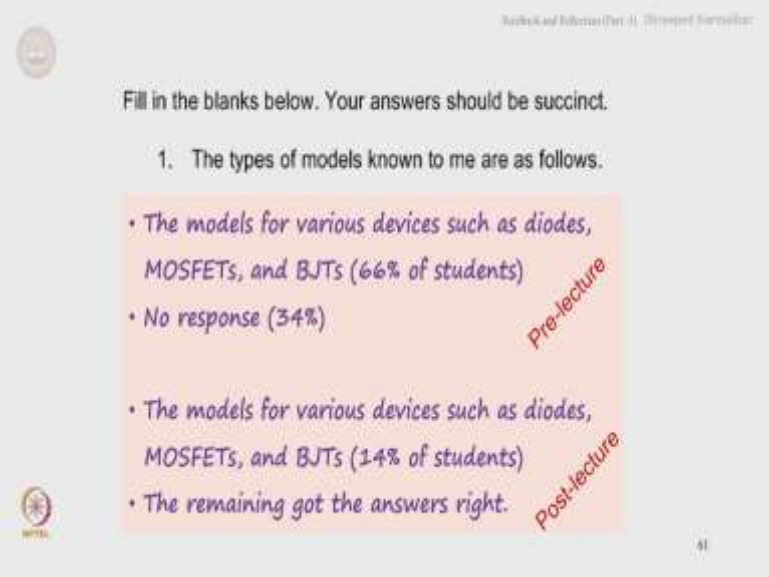

Now, very interestingly pre lecture the response was as follows. So, students wrote, the models for various devices such as diodes, MOSFETs and BJTs. 66 percent of the students claimed that they knew the types of models and in the descriptive response said that by the types of models they understood the various devices, whose models they were

aware of such as diodes MOSFETs and BJTs, clearly this was a mis-interpretation of the statement. The statement is asking about types of models which means for the same device, you can have different types of models such as analytical model, numerical model, compact model and so on. So, that is what the statement was trying to find out.

But 66 percent students misinterpreted the statement as the statement was asking the students whether they knew the models of various devices, rather than types models for the same device, they interpreted the statement as the types of devices for which they knew the models. So, this kind of misinterpretation the students always have, right and this is the job of the teacher to actually see that whatever he or she is trying to convey is understood exactly in the same way as is the intent, this is what is the effectiveness.

Now, 34 percent students did not respond anything, right, in the pre lecture. Now, post lecture what is interesting to see is that 14 percent students have continued to hold the same misconception. The models of various devices is diodes, MOSFETs and BJTs. This is what they feel is the types of models which are known to them. So, while all the remaining students got the answers right 14 percent students continue to have the misconception. Therefore, this feedback told me that in my introduction lecture, I must do something more to clarify this misconception that when we are talking about types of models, this should not be misunderstood as the types of devices for which the models are known. So, I must spend some extra effort to make this point. So, that is what the feedback says.

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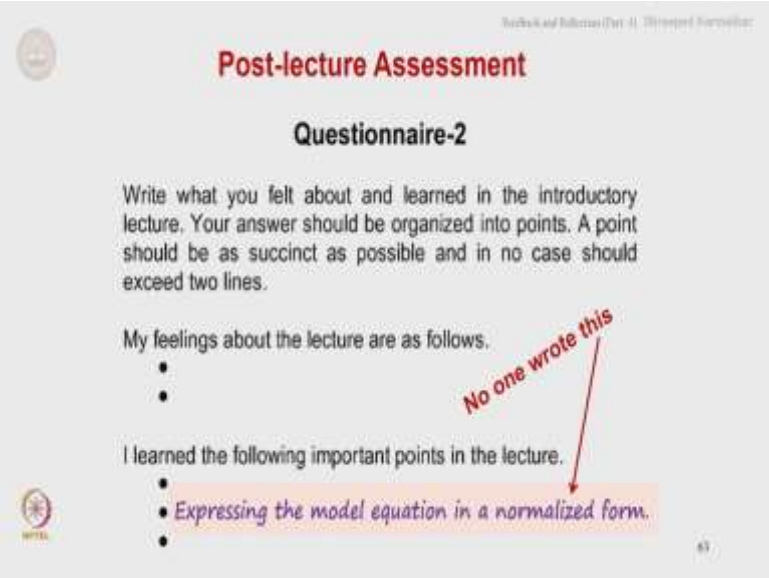

Now, let us look at one more response. Now, what is interesting is that in my introduction lecture which spanned the two 50 minute sessions, so 100 minutes, I spent about 10 to 15 minutes on talking about what is the meaning of representing a model in a normalized form. 10 to 15 minutes, I spent on this topic and I was thinking that the students would have grasped that expressing a model or representing a model in normalized form is a very important part of modeling skill.

Surprisingly no student wrote expressing the model equation in a normalized from as one of the important points that the student has learned in the lecture. Now, this tells you that just because the teacher is spending some time or sufficient time, what we call a sufficient within quotes on a topic or a on a point, the students get the point, is not really true. Now, this feedback told me that though I spent 10 to 15 minutes on this writing an equation in normalized form, students really did not get the point that this is an important skill that students should have.

Now, at this point I do not want to spend time on what is the meaning of writing an equation in normalized form. It is nothing, but you know, there are many terms in a model equation, you have to collect the terms in such a way that the equation is written in terms of collections of terms, each collection is dimensionless. Now, that is what is meaning of writing an equation in normalized form. Now, that is not so important for you to understand. The point I am trying to make here is that you may be spending time

on a point, but hoping that the students are getting it, but many times students may not get it.

So now the question is; what is the solution to this problem? Now, the solution to this problem I realized was that before I give introduction lecture, I must tell the students what are the important points that I am going to cover in this introductory lecture. This is what is called the concept of learning outcomes. Before the lecture I should tell at the end of this lecture, what are the important points they will learn and then I should repeat those points at the end as a summary. What this does is it reinforces the important points the students have to learn.

So, for example, in this particular case, the solution to this problem of students not understanding the importance of writing an equation in normalized form is that in the beginning I should tell the students, look in my introduction lecture you will learn about the various types of models, you will learn about writing an equation in normalized form and why it is important. So, I should tell this before the introduction lecture, like this, collection of about 4 or 5 points. And then I am going to touch upon each of these 5 points, elaborate on them then at the end of my lecture I should again repeat that, in my lecture you have learned these these important points.

So, this is how one can improve the effectiveness of the same lecture is. So, this is how the feedback gives you ideas about how learning has happened in the students and how you can present your information in a real organized fashion so that students learn better. You will note that stating a few learning outcomes in the beginning and at the end does not take away much of your time right. You may have to spend a couple of minutes on this at the beginning and a couple of minutes at the end. So, taking away about 4 to 5 minutes of time in 100 minutes is not much of a loss of time. So, please note that this is how in the same time we can be more effective.

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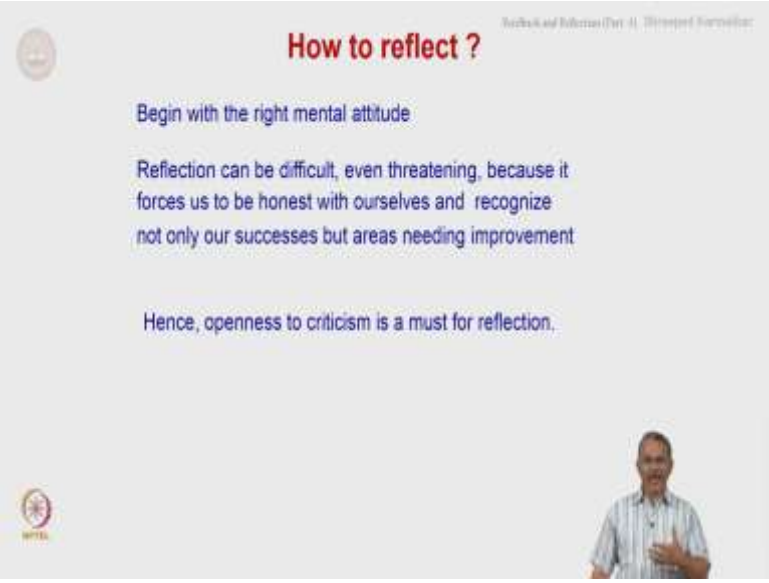

Now, let me come to a few more points about how to reflect. So, we have to begin with the right mental attitude. Reflection can be difficult, even threatening because it forces us to be honest with ourselves and recognize not only our successes, but areas needing improvement. Hence openness to criticism is a must for reflection. So, I should never have the attitude that students should only, students or my colleagues or those who are giving me feedback, should only talk good things about my teaching right.

So, we should welcome critical feedback because that is what helps us to improve.

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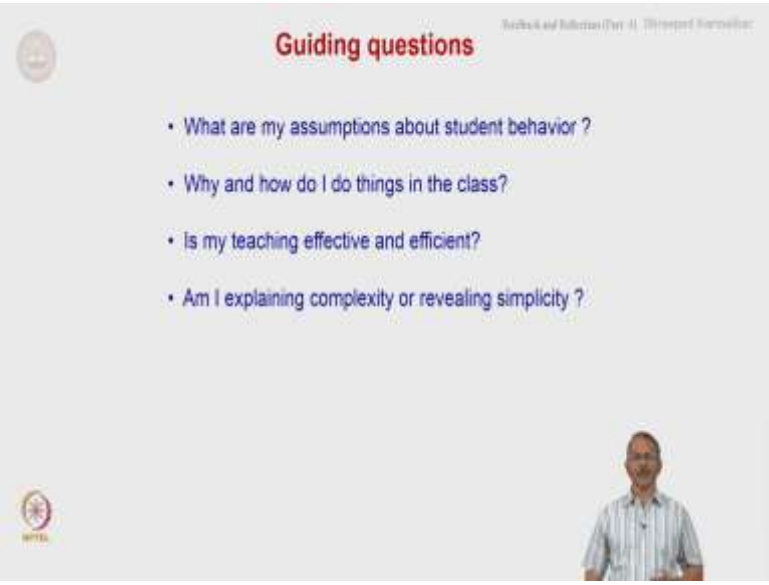

Now, I said that apart from feedback, some guiding questions are also input for reflection. Now, here are some examples of guiding questions. I can ask myself what are my assumptions about student behavior? Why and how do I do things in the class? Is my teaching effective and efficient? So, effectiveness is about how much have the students learnt right and efficient is about how much time I have spent in trying to make the students learn right. Am I explaining complexity or revealing simplicity? What is my attitude right, what am I, what is the goal of my explanation?

So, these are some of the guiding questions right about which I can ponder over right. So, for example, why and how do I do things in the class? Am I teaching to become popular among students or am I teaching so that students learn better? You can see that these two motivations are not the same. My teaching methodology may depend a lot on answers to these questions. So, there are some of the guiding questions.

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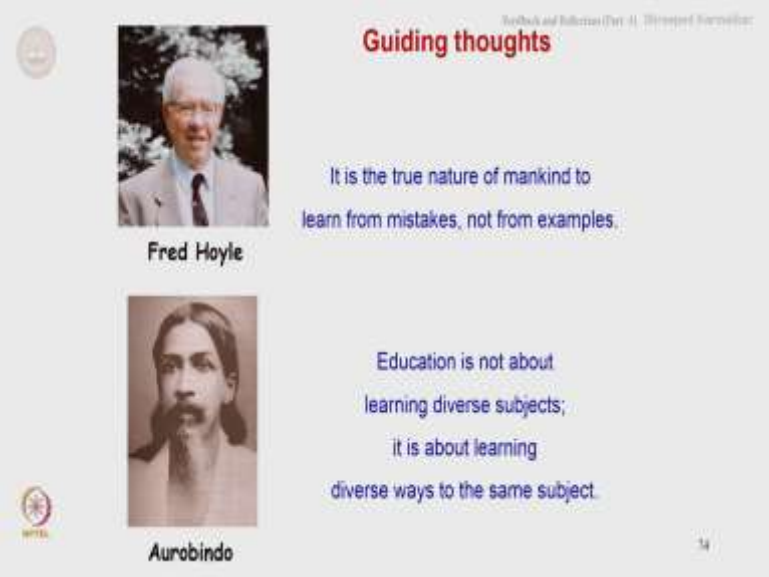

Let me now come to guiding thoughts. Fred Hoyle said, it is a true nature of mankind to learn from mistakes not from examples; this is a very profound statement. When do we learn and how do we learn better? If you carefully analyze your own experiences, you will find that you learnt best from mistakes, not from examples. Let me illustrate this. Supposing you want to learn cycling, you watch somebody do cycling. That example does not help you to learn cycling. If you want to learn cycling, you must get onto the cycle and when you get onto the cycle, you will not be able to balance in the beginning,

you will fall. So, you will make mistakes and then through those mistakes you will learn how to balance right. Correcting through your mistakes, you will learn how to balance, how to ride.

Take one more example. Now, supposing you are told that you know if you do yoga you will have a happy life. You may also have examples, illustrations of people who do yoga regularly and they are having a healthy and peaceful life. But just those examples do not really motivate you to do yoga, always. Most of the people who do yoga, start doing yoga when they face some difficulties, some diseases and so on.

So, this is another example where it is only through mistakes that we learn. Now, if this is a fact, then how should I apply this principle in my teaching? So, what this tells me is that in the classroom, I must provide an environment where students feel free to commit mistakes. They feel free to express what they have learnt and then in the process of expression reveal their misconceptions and mistakes. Now, if a teacher is very strict, if a teacher has a very serious face and atmosphere in the class is very serious, then the students will not feel free to commit mistakes, to reveal their problems, reveal their mistakes and if students do not reveal their mistakes, then learning will not happen. Because only if you are revealing the mistakes and then telling the students you know why they are committing the mistakes, the learning happens in the students.

Another point that comes out of this guiding thought is that I must spend sufficient time in telling the students, giving a feedback to the students on their mistakes. So, after a quiz or after an assignment, I must tell the students where all they have committed mistakes and why they committed the mistake. These kind of feedback sessions are very important for learning. It is not sufficient to just return the papers to the students saying they have got 60 percent marks or they have got 50 or 90 percent marks and so on.

Now, yet another guiding thought is by Aurobindo a profound one, he says education is not about learning diverse subjects. It is about learning diverse ways to the same subject. Now, what does it mean? An example is the following, should a Maths teacher teach 10 theorems to the students or should the teacher teach 5 theorems and 2 different proofs of each theorem. Now, what this quotation seems to say is that, overall the student learning will be better if they are taught 5 theorems and 2 different proofs of each theorem rather

than 10 theorems and only 1 proof for each. It is by learning different ways of doing the same thing that we develop higher thinking skills.

You would have come across statements such, as you know our education is not developing creativity, our education is not developing the ability in students to solve practical problems in an efficient and novel manner. Now, if you want to achieve this goal, then you must implement this quotation of Aurobindo, that is you must spend our time in teaching multiple ways of doing the same thing rather than doing multiple things.

Now, a question will arise if I am going to spend my time like this how will I cover the syllabus. Well, it is important to note for a teacher that textbook is there for every course and everything that is there in the book or there in the syllabus need not be taught in the class, there are certain things students can learn by themselves, they are not very difficult concepts. So, the teacher can say that you know these things you can learn from the textbook righ,t learn yourself and if you have any doubts and so on you can clarify. And there are certain important things which you will handle in the class and there you will put all these ideas into practice.

So, let me summarize my one hour session. What have we learnt. So, reflection is the deliberate and structured self critical evaluation of our assumptions and practices directed towards improvement of our teaching.

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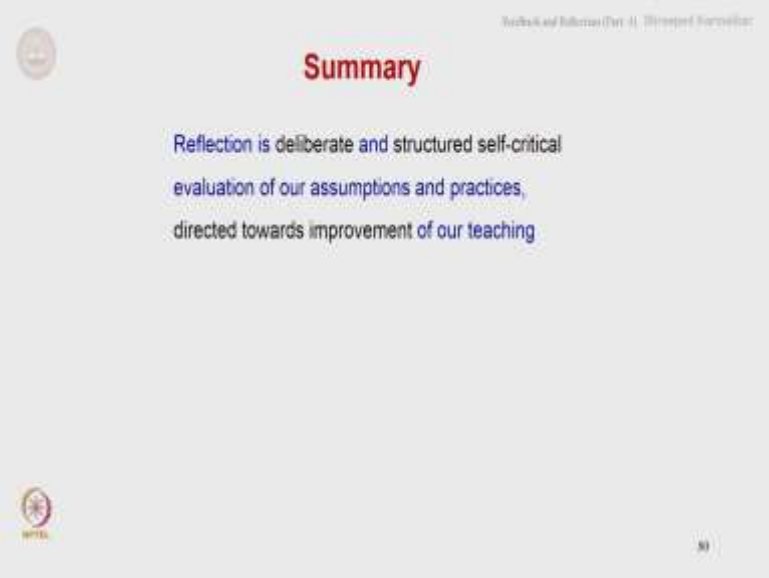

So, reflection is a deliberate process. I must set aside time to do this. It is a structured process because we have talked about how we should go about doing reflection. We said we must collect feedback and we have also discussed what is the structure of the feedback, how do I collect feedback. So, we have talked about a graphical representation of activities in the class, we have talked about slips of paper on which they can write what they liked and where is the scope for improvement and so on right. So, that is a structure of this process of feedback and reflection.

Then it is a self critical process. In other words, I should not always feel that the feedback should tell me I am doing well. Very many times a feedback may tell me that I am not doing well and that is good because only then I improve. Now, what are we self critical about? We are self-critical about our assumptions and practices. And finally what is the goal of all this reflection? It is directed towards improvement of our teaching. So, at the end of reflection, it should not be that you come up with a feeling – 'oh nothing can be done!', right things will never improve. These are not the kind of things that should be the end of reflection. At the end of reflection I should always have a plan in place which has the possibility of improving matters and I can go on repeating this right. It is not necessary that the first time you implement a plan, it will work. You learn again from the mistakes, like I always give the example of the bicycle, learning how to ride a bicycle. Then we said that you can continuously improve your teaching if you go through these activities of action, feedback, reflection and planning cyclically.

Let me repeat the learning outcomes that we had set aside, that we had set out to achieve in the beginning of the session. At the end of this session I hope that you are now able to recognize the important role teachers can play, recognize a need for feedback and reflection to improve teaching and describe how to collect feedback and reflect upon our teaching. Let me leave you with this final thought of Peter Drucker.

Thank you.