Effective Engineering "Teaching" in Practice
Prof. G. K. Suraishkumar
Department of Biotechnology
Indian Institute of Technology, Madras

Lecture - 11a3
The Class, as a Whole - (part - A3)

Welcome back. In the previous lecture we looked at how to use the research information that is available in the literature, how we could access it, first how to access it and then you can think of how to use it and we are just trying to introduce you to the kind of literature that is available there, just to give you a slight peek into the literature.

To do that, we started at our usual stage where we are, an intuitive stage and then some work done on that and I said in this lecture, I would let you know more about the scholarly view on things on this particular aspect. So, let us move forward with a scholarly view. Just to recall we were looking at the left students, right students and means of improving the learning of left and right students in the previous lecture.

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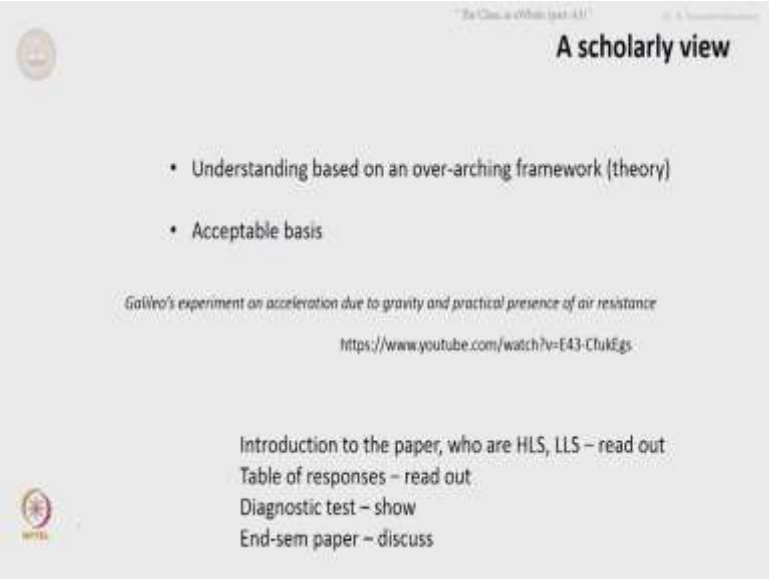

The scholarly view usually brings about an understanding based on an over-arching framework or theory right. This is what it is, let me explain this a little better as we go along. And the acceptability of the theory is important, it should be acceptable to the relevant peers around for the theory to be useful.

To understand where we are coming from, let us take a look at an experiment that all of us would know, we are all engineers, we would certainly know this experiment from physics. The Galileo's experiment, where Galileo was supposed to have dropped a cannonball and a feather from the top of the tower of Pisa. That is given as the experiment that established the fact that the acceleration due to gravity is the same on all objects, but the conditions under which that experiment was done was realistic.

So, on top of the Pisa tower, the person dropping the cannonball and the feather at the same time that is realistic conditions that is equivalent to us teaching a class. The fact that the acceleration due to gravity acts equally on both objects is the theory part, is the framework, the understanding that is necessary for us to be able to generalize some aspect across various different objects and so on so forth to make it a lot more general. And this acceleration due to gravity aspect equivalent is the one that we are going to look at in this particular lecture on theory, scholarly view and so on so forth.

So, you get this idea, there is a practical aspect, there is a framework aspect, theoretical aspect, the theoretical aspect will help us understand things in a lot better fashion. We all know the role that the understanding of the same acceleration due to gravity on all objects plays, in various designs and so on so forth, it is so gentle; it is widely applicable.

So, the wide widely applicable aspects are the ones that we are looking for. In fact, you might want to watch this particular video that is available to everyone. I cannot play it here of course, this shows the same experiment that was done in a chamber, a huge chamber that is made into a vacuum, the air is completely removed and it involved a huge expenditure and so on so forth.

Under those conditions actually the cannon ball and the feather when dropped, reached the ground at the same time. It is wonderful to watch and that is an experimental demonstration of the theory that the acceleration due to gravity is the same for all objects.

So, I hope you get the distinction between the importances of theory and how you could possibly use the theory in practice, do not confuse the two. Usually the thinking about theory is that yeah it is theory, it is not applicable in practice, no. It is applicable in a very fundamental fashion across, only thing is that you need to be wise enough to see how to apply it.

So, please take a look at that. Here what I am going to do is, we looked at the left students and right students in an intuitive fashion, I told you how I went about addressing their learning needs. When converted into a scholarly contribution, let us see how it was done and this kind of bridges the practical world with the theoretical world and then we will move more into the theory where you will see the applicability suddenly encompass a large canvas.

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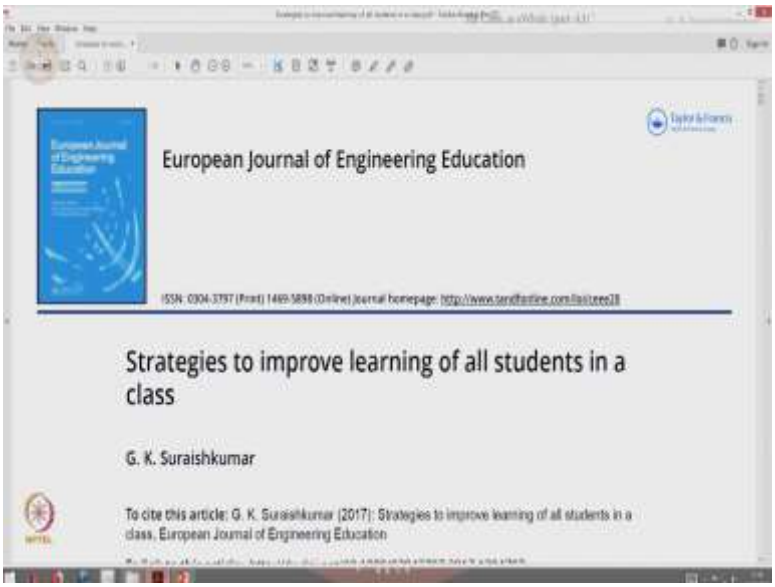

So, to do this, let me pick up where we left off here. This is full view, I think, yeah very good. This is the paper, I have been talking about strategies to improve learning of all students in a class, this was published recently in the European journal of engineering education. I am going to read out only relevant parts here.

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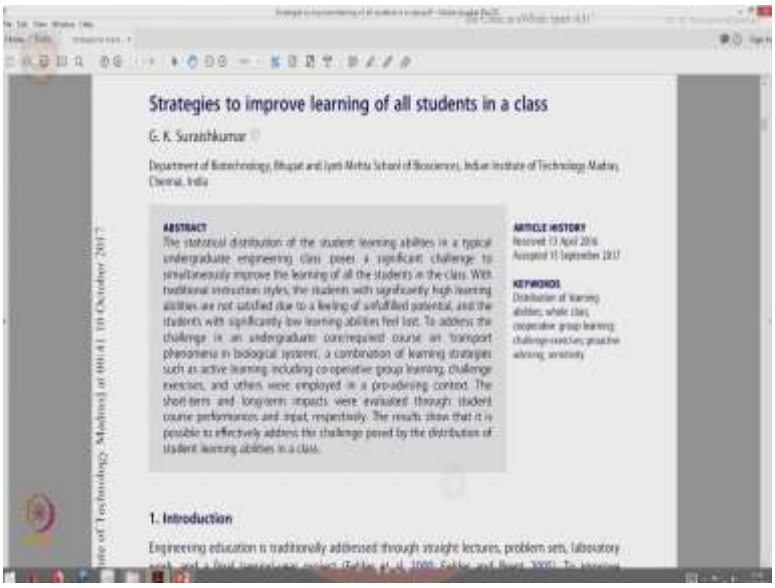

First the abstract, the statistical distribution of student learning abilities in a typical undergraduate engineering class poses a significant challenge to simultaneously improve the learning of all students in that class. With traditional instruction styles, the students with significantly high learning abilities are not satisfied due to a feeling of unfulfilled potential and students with significantly low learning abilities feel lost. To address the challenges in an undergraduate core course on transport phenomena in biological systems, a combination of learning strategies, such as active learning including cooperative group learning, challenge exercises and others were employed in a pro advising context. I would like you to note the terms active learning, cooperative group learning, challenge exercises, pro advising context.

The short term and long term impacts were evaluated through student course performances and input respectively, this is very important it, or anything that you say needs to be backed up by data. Otherwise it is not really acceptable in a scholarly framework; the results show that it is possible to effectively address the challenge posed by the distribution of student learning abilities in a class.

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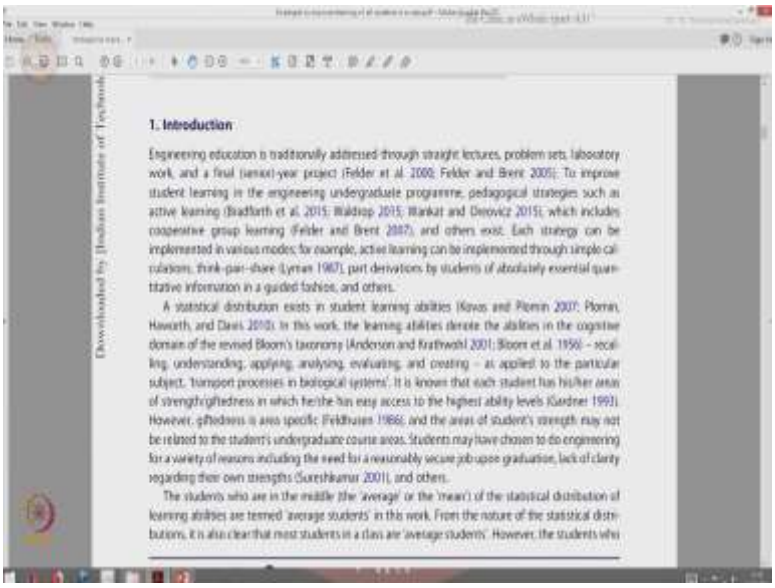

So, let me read out some parts of this. You can read out, read the entire paper later. I will start somewhere here. A statistical distribution exists in student learning abilities references are given. In this work, the learning abilities denote the abilities in the cognitive domain of the revised Bloom's taxonomy references recalling, understanding, applying, analyzing, evaluating, and creating - as applied to the particular subject "transport processes in biological systems".

It is known that each student has his or her areas of strength or giftedness in which he or she has easy access to the highest ability levels, a reference given there, this might be an intuitive thing now, but it needs to be backed up by a hard reference here.

However, giftedness is area-specific reference and the areas of student strengths may not be related to the students undergraduate core course areas or course areas. Students may have chosen to do engineering for a variety of reasons; reasons are given there.

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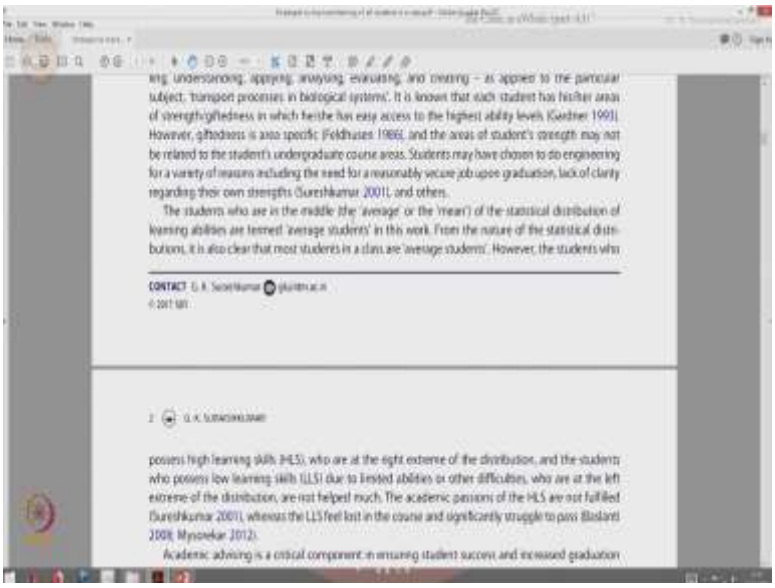

The students who are in the middle, the average or the mean of the statistical distribution of learning abilities are termed ‘average students’ in this work. From the nature of the statistical distribution it is also clear that most students in a class are ‘average students’. However, students who possess high learning skills, who are at the right extreme of the distribution and students who possess low learning skills due to limited abilities or other difficulties, who are at the left extreme of the distribution are not helped much by such an approach.

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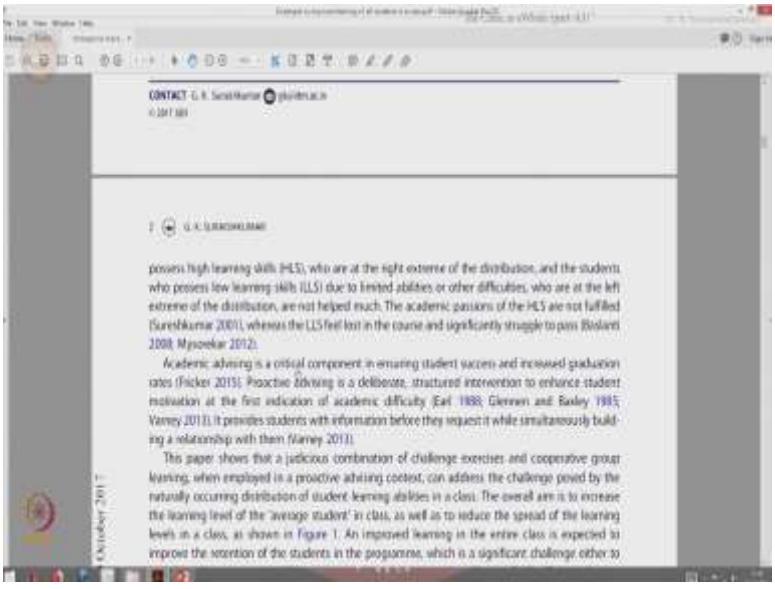

The academic passions of the HLS are not fulfilled, whereas the LLS feel lost in the course and significantly struggle to pass. Academic advising is a critical component in ensuring student success and increase graduation rate, academic advising becomes a theoretical concept, some other aspects active learning, theoretical concept and so on.

Proactive advising is a deliberate structured intervention to enhance student motivation at the first indication of academic difficulty. It provides students with information before they request it while simultaneously building a relationship with them.

So, you see the various things that were done as a part of improving a practical situation, a practical challenge has these theoretical frameworks, then what one can use to understand things a lot better and apply it much wider. That is a whole idea.

So, this is where I will stop and then you I welcome you to read the paper, what I am going to finish up with is a couple of things you could, I will also invite you to read the comments in table 2 for the CFA exercise, how it helped him I did mention I was surprised by some fraction of the class which found it helpful

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You could see that people even with a C and a D have actually found it helpful. So, this was the surprise that I was talking about. You can go through this table to understand that a little better.

The last thing that I am going to talk about is the question paper design.

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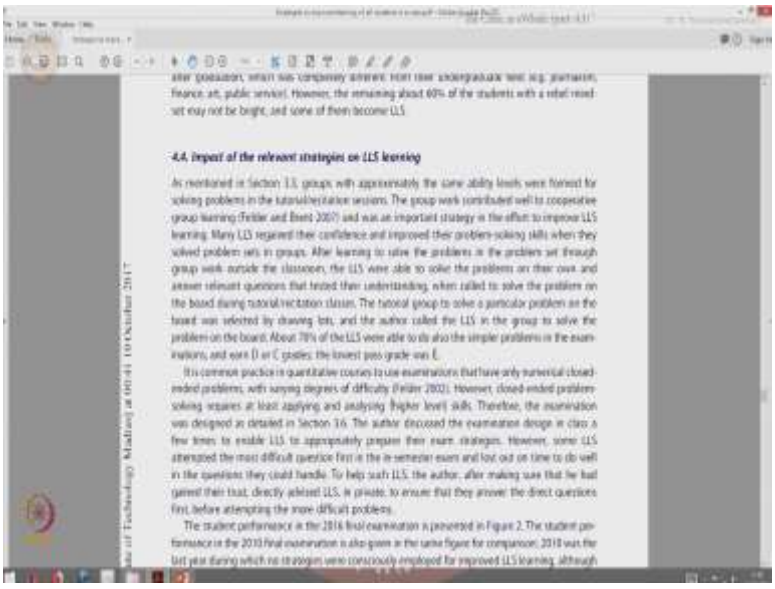

That I said needed to be balanced, said I will tell you that later, I am going to tell you that now the; this is essential to help the left students.

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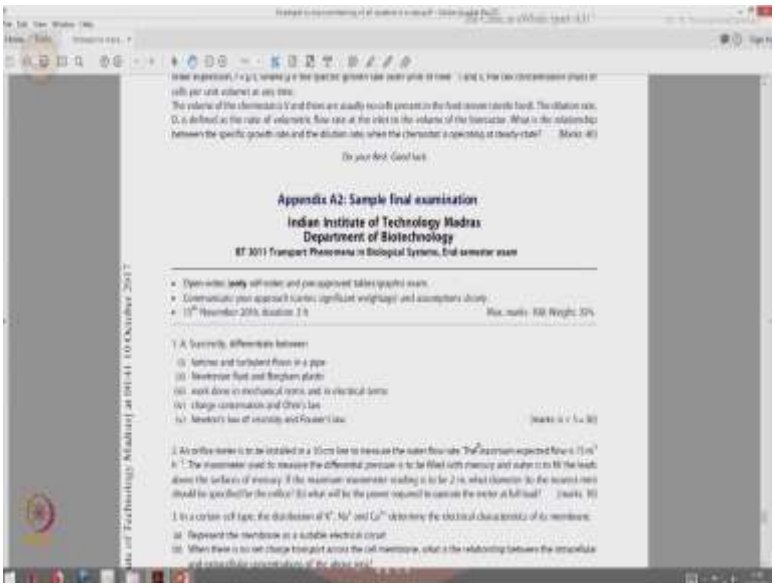

This, let me first tell you the standard paper, then or before I tell you the standard paper the diagnostic test which is a deliberately tough test to completely identify all LS.

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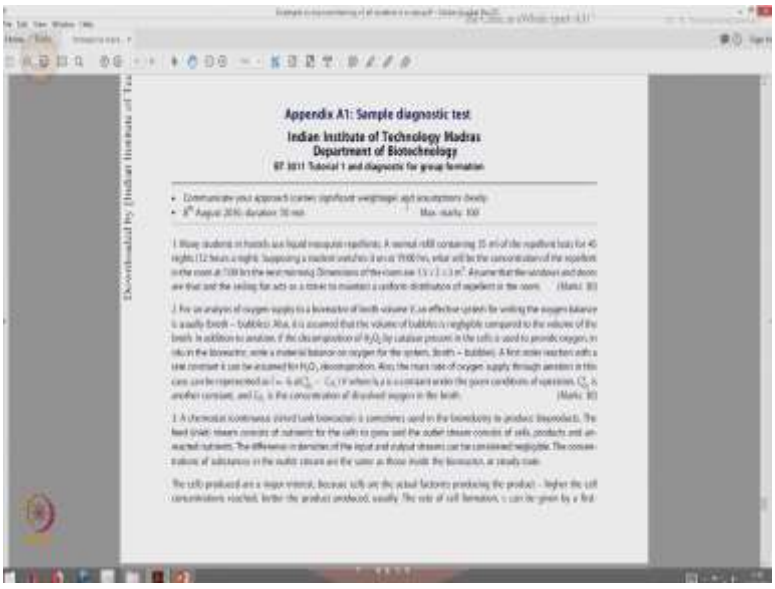

An example is given there, you can go through that, that is appendix a 1, appendix a 2 is a sample final examination. This was the actual examination, that was used, the end semester examination that was used in 2016 when after which this manuscript was finalized.

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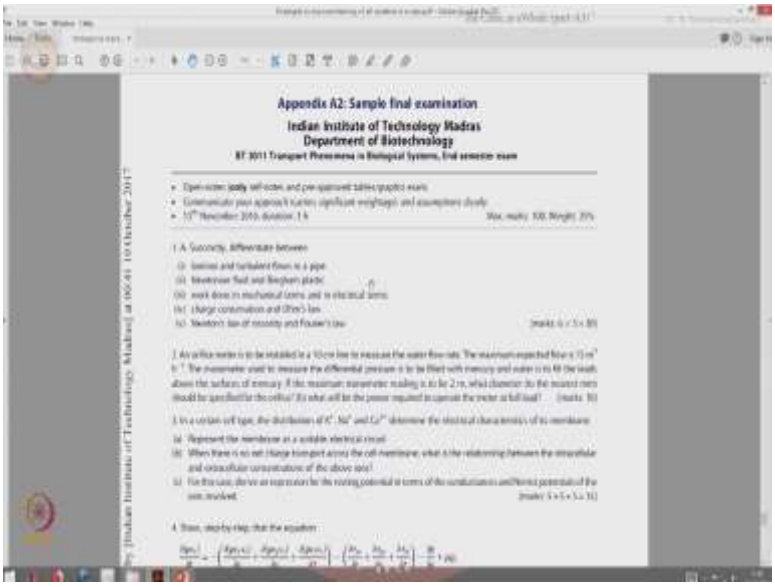

You can see here that this is a quantitative course transport phenomenon in biological systems, a standard way of giving questions in the examination is all problems at different degrees of difficulty. That is a little difficult because problem solving is a higher level skill, that we already seen and therefore, it is good to start out with or good to have some questions which should test the understanding of students at various levels.

I typically design the papers such that about 30 percent is answerable by somebody who understands the very fundamental aspects of the course; at the very essential aspects of the course to some extent and if they do that, then they can attempt to do something more and pass the course. This is the way I look at it.

So, the first question here a 1 (a) is succinctly or 1 succinctly differentiate between laminar and turbulent flows in a pipe, Newtonian fluid and Bingham plastic, these are very essential things to know if you have done a course on transport. So, I test these first, that carries about 30 out of hundred and then various problems, closed ended problems at different degrees of difficulty that are covered here.

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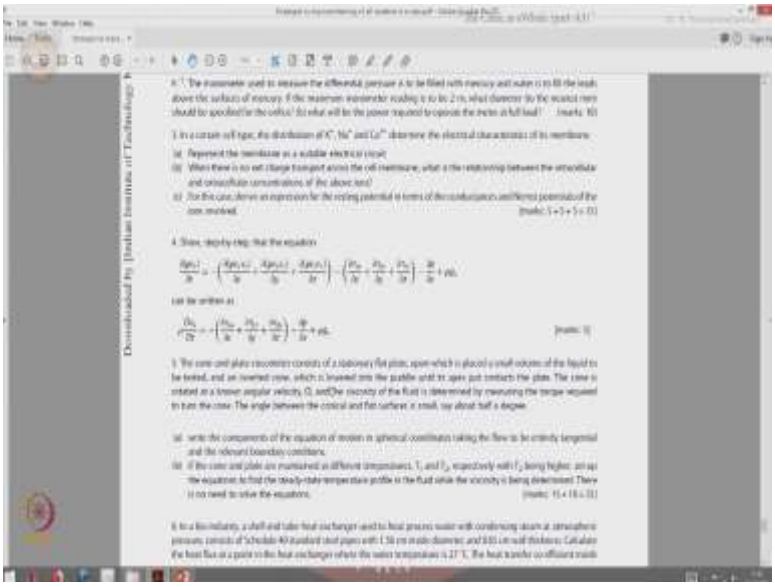

And some highly mathematical ones also. These are actually challenging problems here, the level of challenge increases as we go down, not always and so on

So, this gives you an idea that we need to give significant thought to the design of the examination or the question paper as we call it. So, that we address the needs of the entire class including the left students. This is the point that I have trying to make.

So, to summarize we looked at some link between practical aspects that we are used to and theoretical aspects where there is a lot of information that we can understand and use ultimately. There are advantages to doing that, the advantages to understanding the theoretical aspects in applying it to a more general situation. And then I told you the importance of designing the examination in a balanced fashion. Let us stop here, when we meet for the next part of this chapter. Let us take this forward, let us move more into the theoretical aspects. See you there.