NBA Accreditation and Teaching - Learning in Engineering (NATE)
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Lecture 26 - M2 U5: Design Phase

Greetings and welcome to Module 2 Unit 5 on Design Phase.

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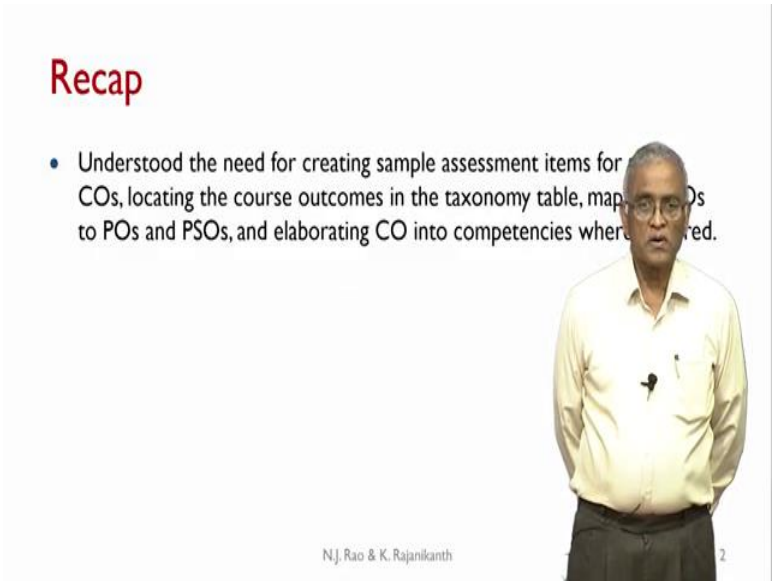

In the last unit, we looked at some of the sub processes of analysis phase and these included creating sample test items for COs, locating the course outcomes in the taxonomy table and mapping the strength of POs and PSOs with respect to COs and elaborating COs into competencies were required. These were the sub-processes we have extensively looked at in the last unit.

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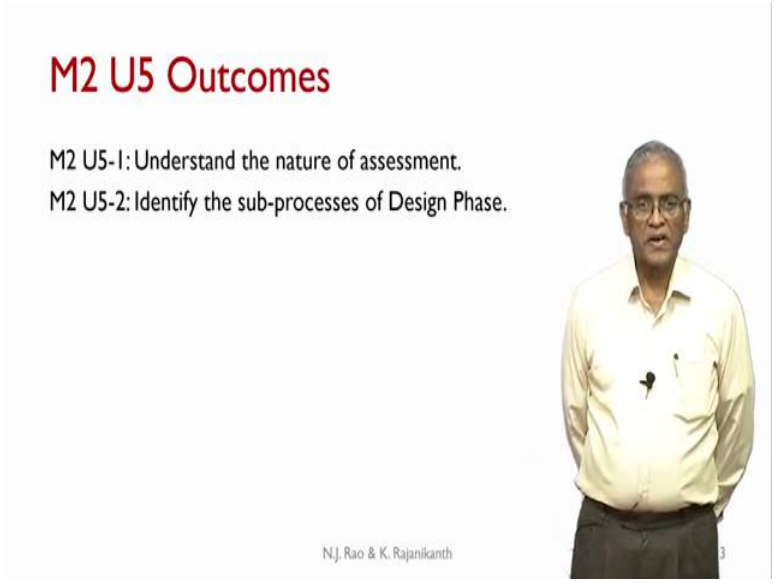

Now, in the current unit, we try to understand the nature of assessment and identify the sub process of design phase.

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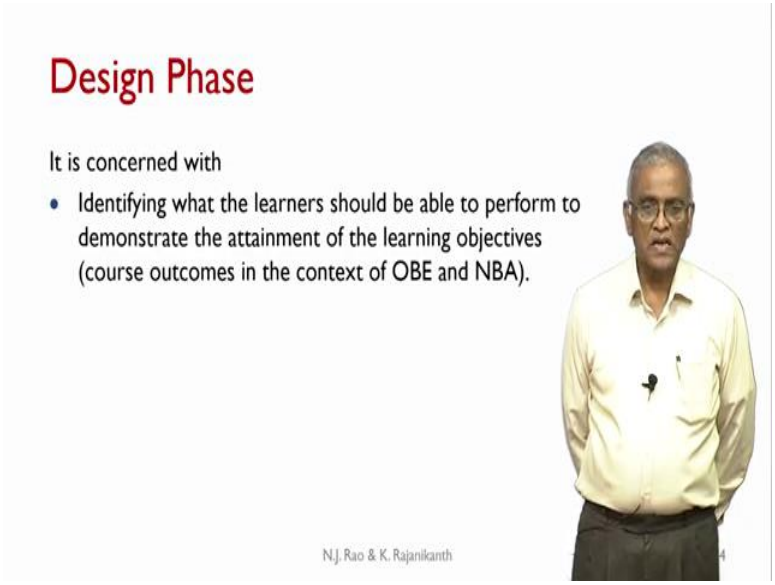

Now, what is design phase? Design phase is concerned with identifying what the learners should be able to perform to demonstrate the attainment of the learning objectives. And here, this is a broad definition of design phase. But in our case, we have to demonstrate the attainment of course outcomes in the context of OBE and NBA.

So, we have written COs then we have to say what the learner should be able to perform to demonstrate the attainment of those COs. So, it is all related to what are the things that we are identifying as the learner should be able to perform.

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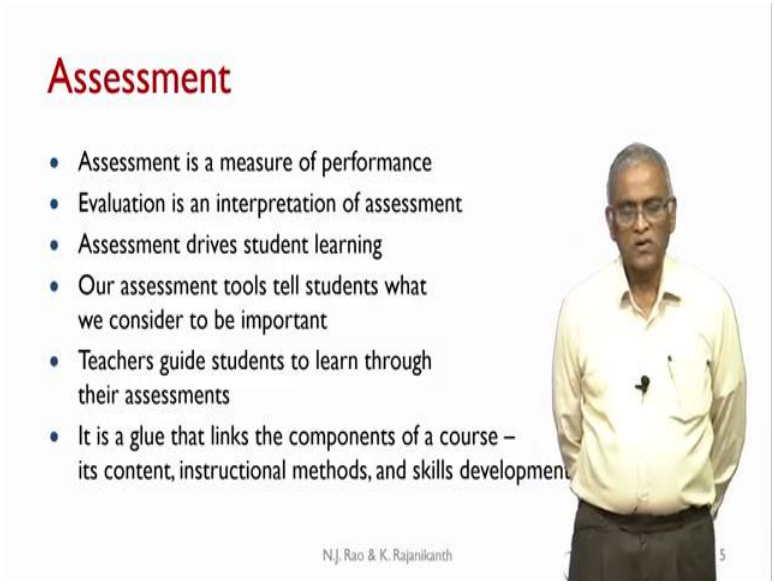

And that is where the assessment comes into picture. Let us look at the formal definitions of the terms associated with this. There are two terms; assessment and evaluation. Assessment is a measure of performance for example, if in a mathematics course, the measure of performance is the student should be able to solve some problems as given or in a laboratory course, the performance represents conducting an experiment, that means I have identified that as a measure of performance, whereas evaluation is when this having the student has performed, either has written an essay, solved a problem or conducted an experiment, then you are interpreting the assessment.

That means, you are now trying to give a value how well the student has performed. In our language, you can say how many marks do I give, what grade do I give for his performance, there is I giving marks are identifying the grade constitutes evaluation. These are the two things obviously every student is familiar with. Unfortunately, these two terms are used in some context in interchangeable fashion, which is not appropriate.

Now coming back to assessment, one can very directly say it is the assessment that drives student learning. When something is presented, why is it following? What should we follow, to what depth should we follow? That is all decided by his perception of the assessment. So, a

student's perception of the assessment is the one that drives student learning that he has to prepare to perform well in those assessments.

So, whenever, either when I give my sample test items, when I write my COs, in the analysis phase, or the problems that I solve in the classroom or the questions that I ask in the classroom, these are the assessment tools that we are using, and they tell the students what we consider to be important. You have to tell them what is important. If you do not tell them very clearly, they get that information by looking at the previous question papers and also talking to the senior students.

That will form the basis for them to prepare. So, essentially, teachers are guiding students to learn through their assessments. In summarizing the whole thing, assessment is a glue that links the components of the course, which are the components of a course? The content, instructional methods and skill development. These are all linked through the glue of assessment.

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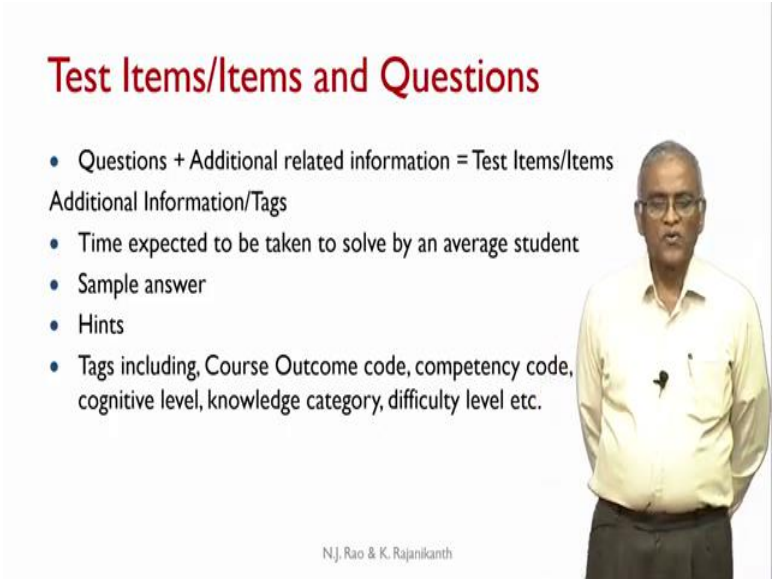

And here some terminology, we are used to the word questions. Question is a kind of some kind of a statement, question plus some additional related information are called test items or merely items. In today's standardized terminology, in education, test items are items. The additional information we are talking about, one thing we certainly know one information is how many marks you allocate for a question.

But there can be much more many other types of information. Like for example, the time expected to be taken to solve by an average student. And sometimes we have a sample

answer written for ourselves, not given in the exam paper, but you write the sample answer, you may sometimes give hints.

And also you can tag a test item with regard to course outcome code, competency code, for example, course outcome code is you have a code for the course. Some we can say C 123 like that and then you have a C 123 CO5 is the code for course outcome and in that if you have competencies, you will add again C1, C2, C3 and so on.

And you can also have tags like cognitive level, knowledge category, difficulty level and a few more are there, but it depending on the requirements, you can have several such tags connected to linked with a particular question.

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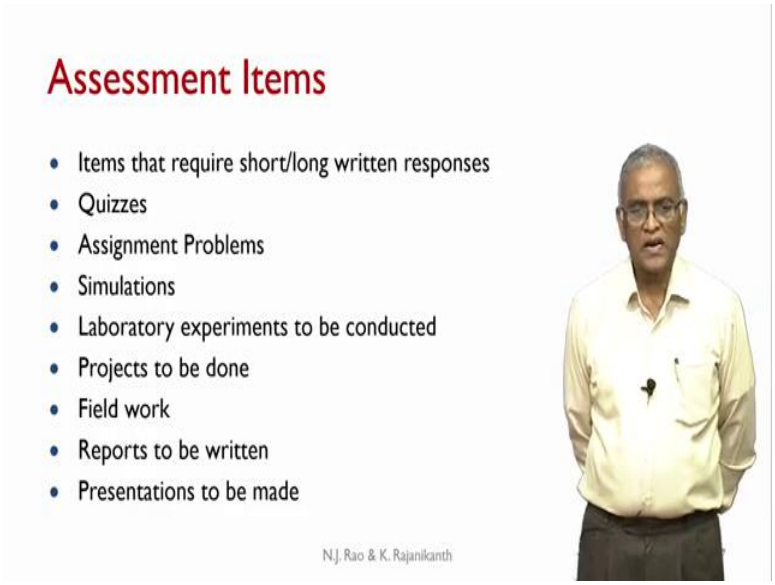

And now the assessment items, what kind of assessment items do we have? Items that require short or long written responses that is quite common to us. Then you have quizzes, assignment problems, simulations, laboratory experiments to be conducted, projects to be done, fieldwork, reports to be written, presentations to be made, all these are and if you want depending on the course, you can have additional test items as assessment items.

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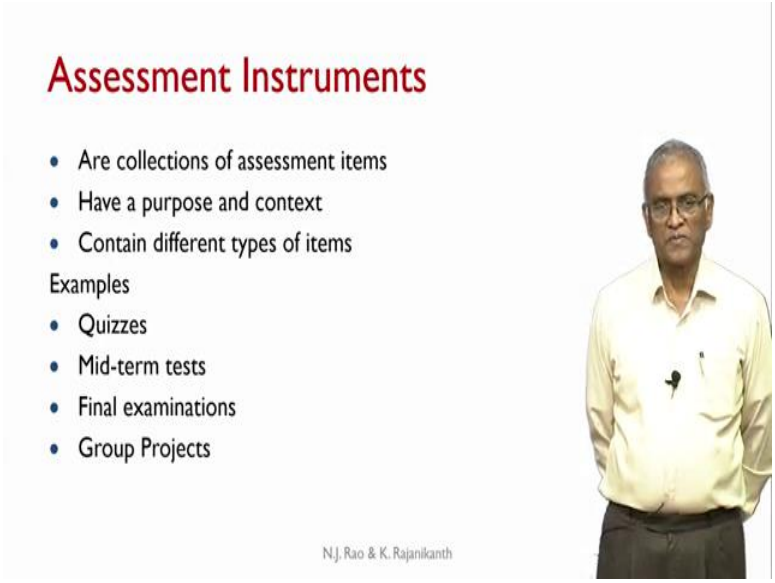

Now, assessment instruments are collections of assessment items. For example, if you have a mid-term test, it will consists of several assessment items in that. So, a collection of assessment items is called assessment instrument and any assessment instrument have a purpose and a context. It could be a quiz that I give it in a classroom.

So the purpose is to find out whether they have understood the previous information before I move forward. And that quiz is only to get a feedback about the current state current knowledge of the students. And they also can contain assessment instruments can contain different types of items. Some can be what we call explanatory type of questions where you write a few paragraphs or few lines, or it can be solving a particular problem.

So, examples of assessment instruments include quizzes, midterm tests, final exams, group projects, and so on.

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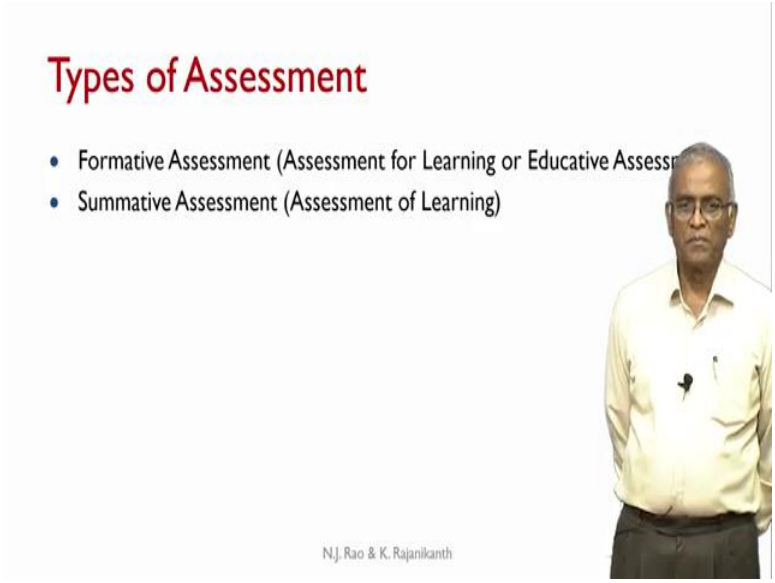

Now types of assessment are formative assessment and summative assessment. For formative assessment is mainly it is meant to guide the learning process. That is why it is called assessment for learning. So I can ask a question in the classroom and I look for students to respond, respond to that. In that process and facilitating the learning, I am not giving any marks or grades for their performance. That is why it is also called educative assessment or assessment for learning.

And this is a very powerful method of what we call facilitating the learning by student. But there are issues always with the formative assessment, because they do not carry any marks that add up to the final grade. What happens is students can become a bit indifferent to respond to anything that is asked under formative assessment.

So it is okay, I do not have to exert myself to think about it, maybe in a class always there are a few students who are going to respond. So let me leave it to them. That is the kind of approach students may take in such case, some of the formative assessment does not serve its purpose, but there are several such kind of issues with regard to teaching and learning. But it can be a powerful tool if one can persuade the students to participate in formative assessment.

Summative assessment is something everybody is clear. It is assessment of learning, how much have you learned? And the students have to demonstrate that by answering a set of questions which are presented to them as assessment instrument.

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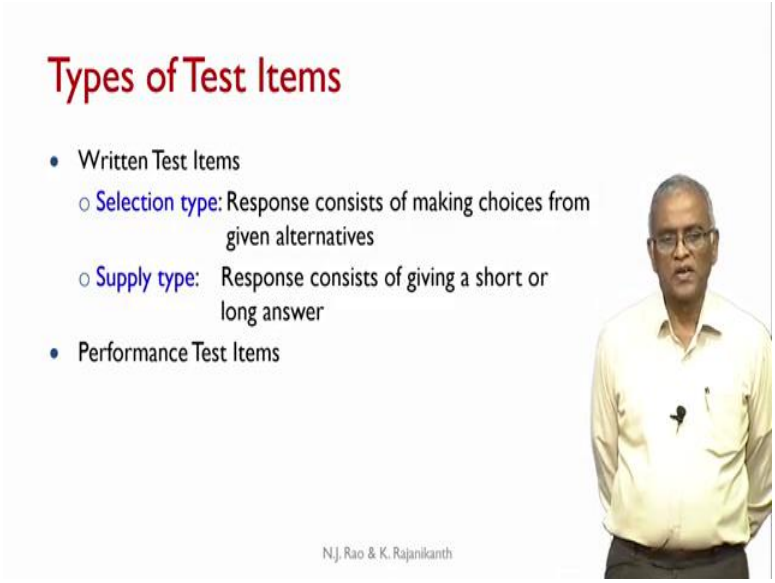

Now, the types of test items if you do, they are broadly classified into two categories, Written Test Items, and Performance Test Items. In performance, you are doing something by yourself in a laboratory or in the field and so, are making presentations and so on. Whereas, written test items again are two types. One is selection type, response consists of making choices from given alternatives. Supply type consists of response of giving a response in the form of giving a short or long answer.

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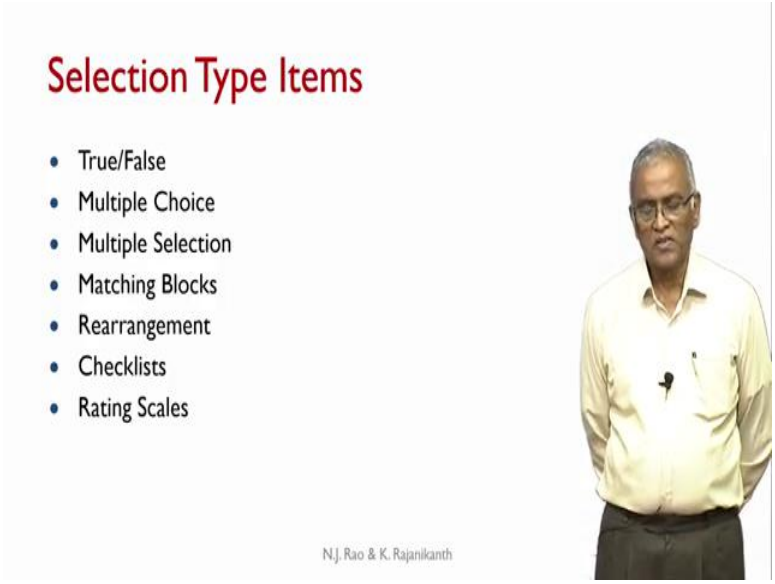

And now selection type of items, where you have true or false multiple choice, multiple selection, matching blocks, rearrangement, checklist, rating scales. So, all these are selection type and they serve a good purpose, but they alone will not be sufficient to test the student.

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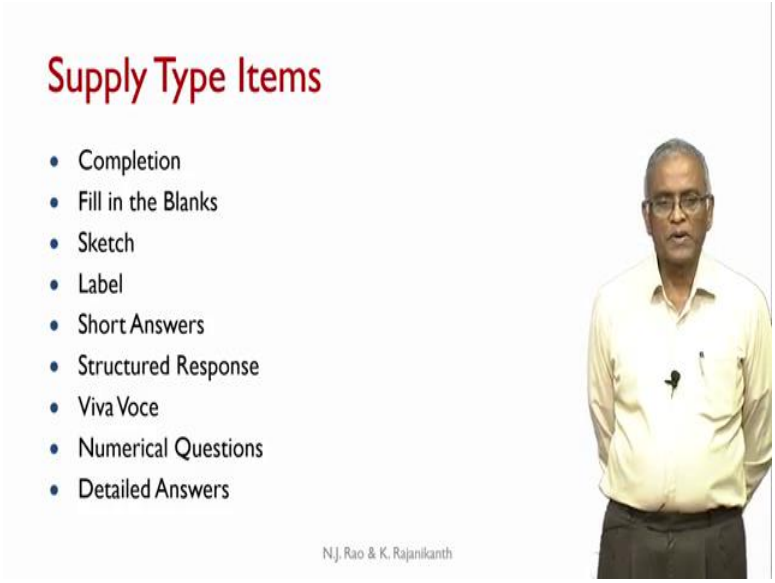

Supply type, one is completion half written sentence can be completed, it can be fill in the blanks or draw a sketch, label something, you have short answers, structured response, viva voce, numerical questions and detailed answers. It can be, you can expect the student to write a 500 word or 600 word type of answers to our test items that you give.

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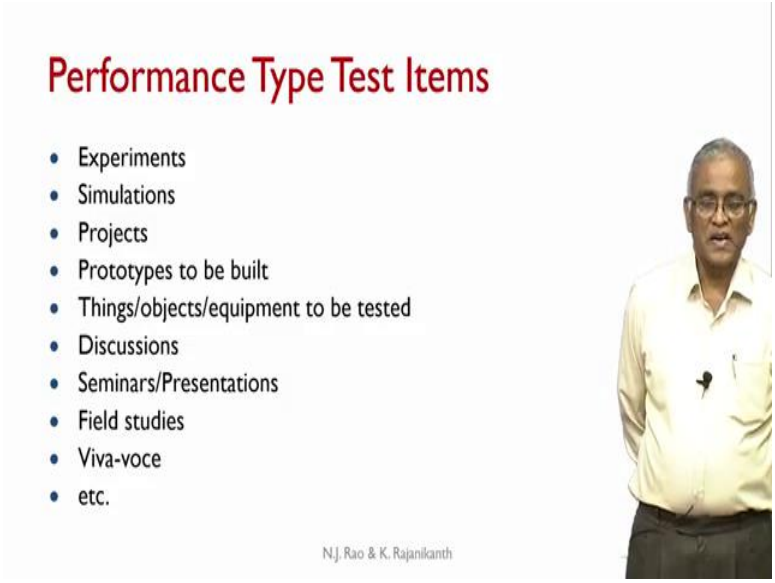

Now performance type test items could be experiments that you conduct, simulations that you can do. It is projects, prototypes to build, things objects, equipment to be tested, discussions, seminars and presentations, field studies, viva voice. In the other type of programs where you have let us say humanities and social sciences are art forms. There are several other types of performance test items.

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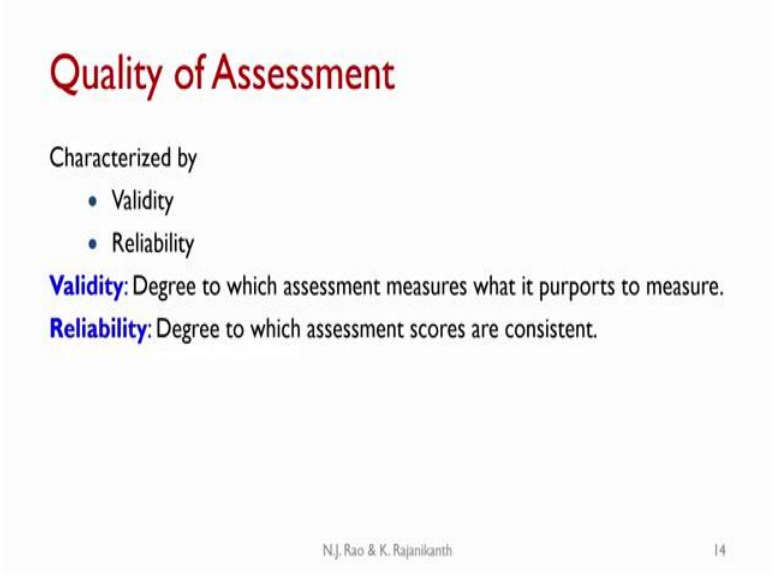

The quality of assessment is officially characterized by two parameters, validity and reliability. This is for what is called era standards, which is the agency that talks about the standards. Anything related to assessment that is the world authority. There is an organization that talks and about assessment and also every 10 years it kinds of upgrades its characterization.

Validity refers to the degree to which assessment measures what it purports to measure. For example, let us say my outcome, the student has to demonstrate that he can solve problems of certain type. But whereas the actual assessment item consists of asking him to explain something.

In that case, we say that particular assessment item is not valid, or its validity is limited. So, validity means the degree to which assessment measures what it purports to measure, whereas reliability degree to which assessment scores are consistent. What do we mean by that? In our context, you can say, can you consider 60 percent of last year in a subject or in a GPA, grade point average of, let us say out of 10, I got 6.5 and some other students I got 6.5 in the present year, are they the same? Can I consider they these two assessment scores are equivalent? That is what is called reliability.

You can consider it is equivalent provided my question papers are the assessment instruments are not only valid, they are they satisfy the requirements of validity, the reliability.

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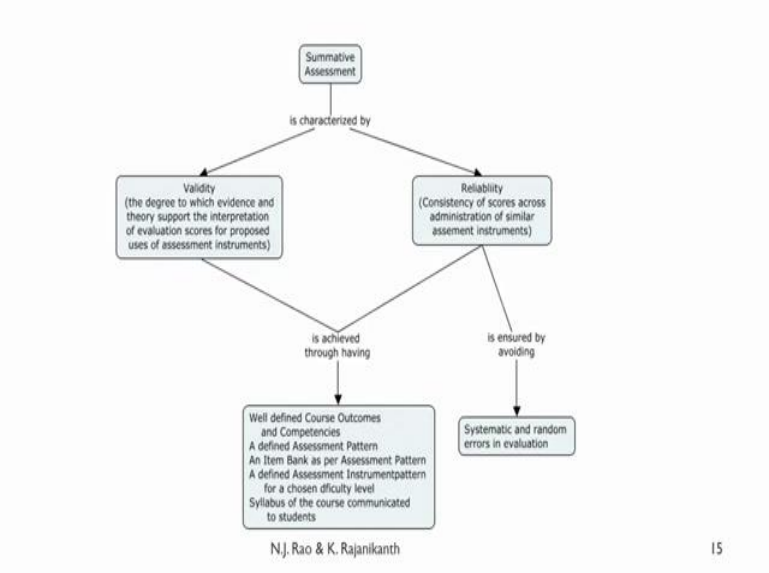

Now, let us look at how the issue of summative because we are talking of summative assessment, summative assessment is characterized by validity and reliability. Validity we have defined the degree to which evidence and theory support the interpretation of evaluation scores for proposed user of assessment instruments.

Whereas reliability, consistency of scores across administration of similar assessment instruments, for example, if I have a makeup exam I conduct is the makeup exam paper satisfies the reliability that means the marks obtained in the makeup examination and the oral examination are they comparable. That is what we call reliability and we have found these two can be achieved practically by the same set of conditions.

These include well-defined course outcomes and competencies, a defined assessment pattern and item bank as per assessment pattern, a defined assessment instruments for a chosen difficulty level, syllabus of the course communicated to students. When all these conditions are satisfied, then we can consider summative assessment is first valid for reliability not only this condition, we should also satisfy is ensure by avoiding systematic random errors in evaluation. What do they consist of? Systematic and random evaluation, if two in which two evaluators give totally different marks for something or there are random factors that come in when the students are responding to a given question paper, the conditions are not equivalent.

In all such cases, you have the systematic and random errors can come into picture and if these are avoided, then the situation or the both validity and reliability can be achieved by following these factors satisfying these factors.

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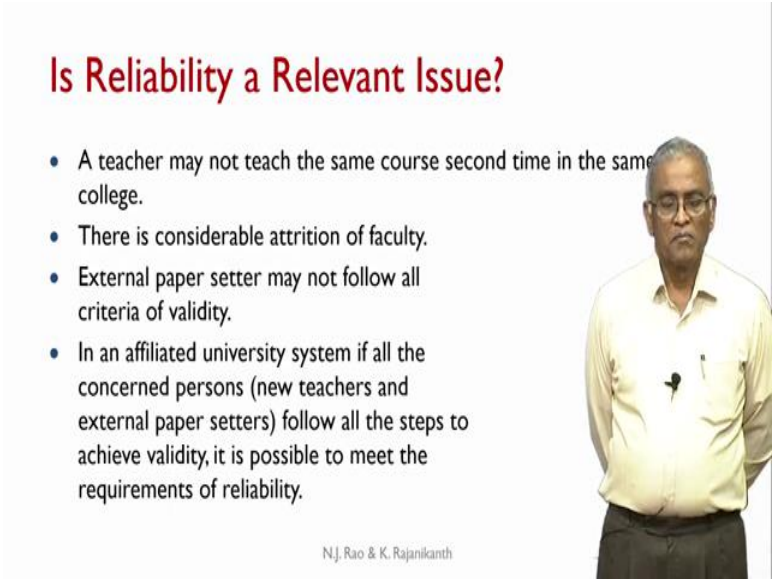

Now, one can ask, is reliability a relevant issue? First of all, if there is issue of what we call makeup examination in an autonomous institution, somebody has not been able to attend a particular test and the teacher is required to give it another test on the same topics. In such a case reliability makes sense.

And also, if a teacher is giving a course given course over several years, then also it makes a difference. But what happens in a given institution? A teacher may not teach the same course second time in the same college and because there is a attrition of faculty from an institute, people keep leaving and new teachers join, in that case same (teach) a course may be given by different people in different years.

And also you have in a affiliated system, external paper setter may not follow all the criteria (())(20:26) because you can inform them, but they may or may not follow and it may be difficult to insist on that. And in an affiliated university system if all the concerned persons, new teachers, external pepper setters, follow all the steps to achieve validity, it is possible to meet the requirements of reliability.

As you can see, it is a tall order. But if university can set up all the processes in place, which are they? You train the paper setters, create good question bank and possibly you can even have a tool, a software tool available to produce assessment instruments as well as manage the item banks. Yes, it is possible to achieve the reliability. But if the course content changes from year to year, obviously, the issue of reliability does not make sense.

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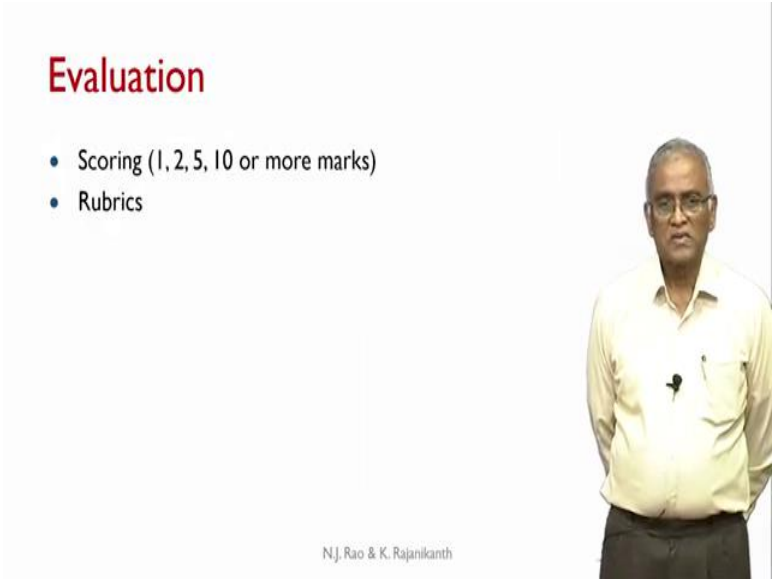

Now, we come to evaluation. Evaluation, there are two, one is scoring. As you can see most of the class tests or exam and semester exam papers, your course you have marks given for questions say 1, 2, 5 or 10. Sometimes 1, 2, I have seen 8, or 16 or so on. You have several types of scores that are given and then you have what are called rubrics.

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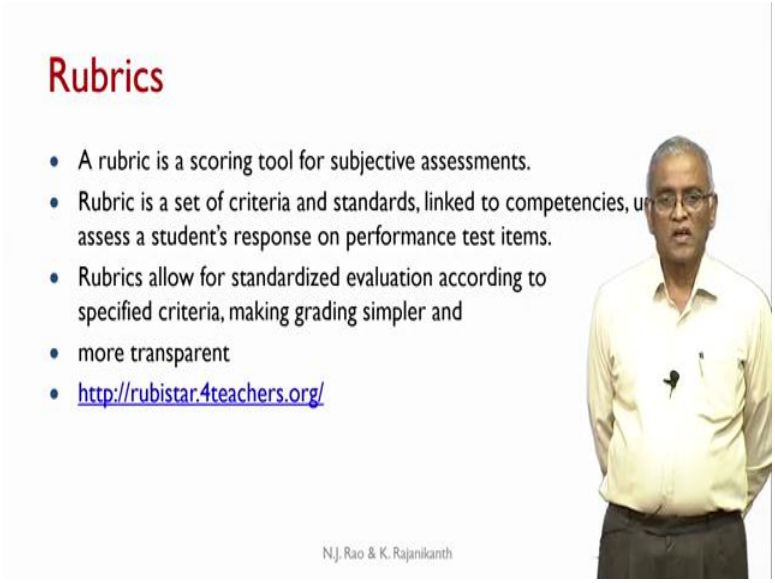

The first one everybody is familiar with rubric means, a rubric is a scoring tool for subjective assessment. Means, let us say when somebody makes a presentation or like gives a seminar, how do you mark? We say we feel kind of thing, which means it is a subjective assessment. So, again, it need not be very arbitrary. You can have a set of rubrics to scoring tool for subjective assessments.

So, rubric is a set of criteria and standards linked to competencies used to assess student's response on performance test items. And rubrics also will allow for standardized evaluation according to specified criteria, making grading simpler and more transparent. So if, let us say four teachers are asked to evaluate the performance in a seminar, so the marking by the four should not be very arbitrary. And where you can actually have a set of rubrics, where each one will mark according to the same set of rubrics, then we get some kind of a transparent mechanism of grading.

Going back there is, how do you design your rubrics? There is a website given here rubistar for teachers, wherein people have for different types of performance and performance test items people have designed rubrics and make them available on this particular site. So you can take a look at it and see whether any of them is relevant to your particular activity.

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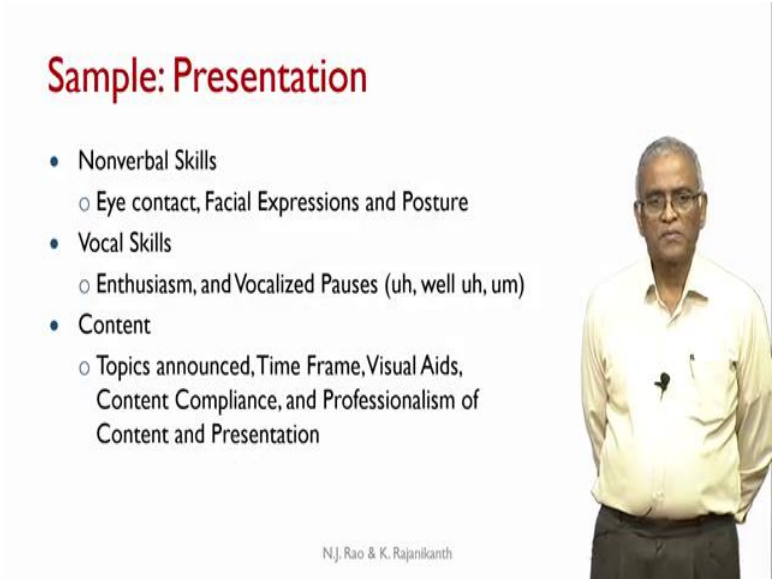

Now take presentation, most of the colleges do have seminars where the students present and one issue about rubrics is you cannot have too many levels or make it too complicated. Now, for example, for the presentation skill, you have three items that are chosen: nonverbal skills, vocal skills and content. But nonverbal skills include eye contact, facial expression and posture. For example, you can make your life very difficult and complicated by marking separately about eye contact, separately for facial expressions and posture or you can have these three characteristics in mind and give some mark with respect to nonverbal skills.

Similarly, voice skills, enthusiasm and vocalized pauses, how are they? And content topics announced, time frame, visual aids content compliance and professionalism of content and

presentation, all these can be looked at and how do you give weightage to these three? Do I give equal weightage to all of them or do I give different weightage? For example, I can give content 10, vocal skills 5, nonverbal skills 5 or I can change that. I can give equal weightage to all of them. And then ask whoever is marking the evaluating the performance or to follow that particular pattern.

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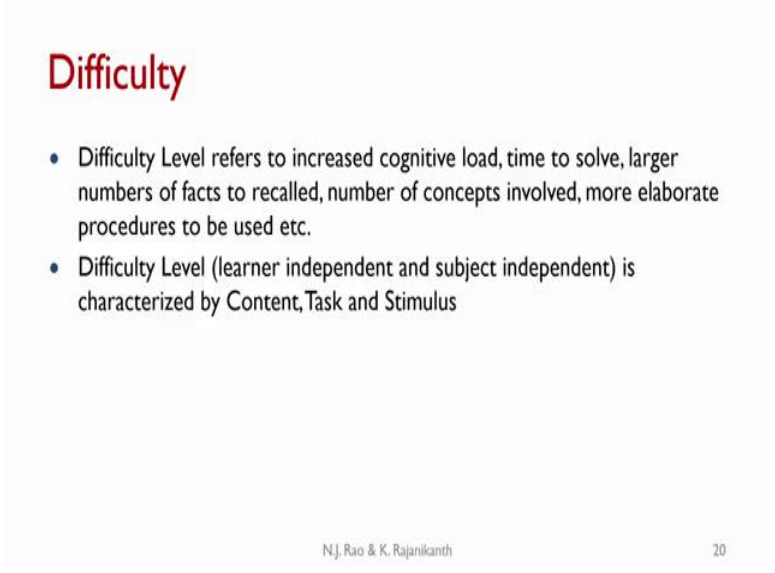

Now, we come to another issue that we intuitively understand when I say what is difficulty? A question is difficult or an assessment item is difficult if it involves too many processes, too many concepts to be brought together and it requires a lot of time to complete all the steps related to that and so on. Then it becomes a difficult, its level of difficulty is higher.

So, difficulty level refers to what we call increased cognitive load, time to solve, large numbers of, number of facts to be recalled, number of concepts involved, more elaborate procedures to be used. For example, I can ask apparently simple question like, write all the capitals of all the 29 states in India in alphabetical order, which is actually factual information, no problems to be solved, but what happens you have to the number of facts to recalled is very large.

Once you recall all of them, it is easier to do that. So, even the number of facts to recall is very large, the level of difficulty can be higher and formerly, difficulty level is dependent on endless number of factors. For example, a given question may appear to difficulty difficult to one person, not so difficult to another person.

That means it is learner dependent. For example, if the learner does not have the prerequisite knowledge or not adequate for prerequisite knowledge you will find a question very difficult. Whereas, a person who is familiar with the prerequisite knowledge will not find it and also in some subjects by very nature of the concepts are more difficult to appreciate.

So, what happens? You have subject dependencies also there. So, here we are trying to characterize difficulty level in a context of learner independent and subject independent contexts. Even then difficulty level is characterized by three parameters you can say content, task and stimulus. Let us see what they are.

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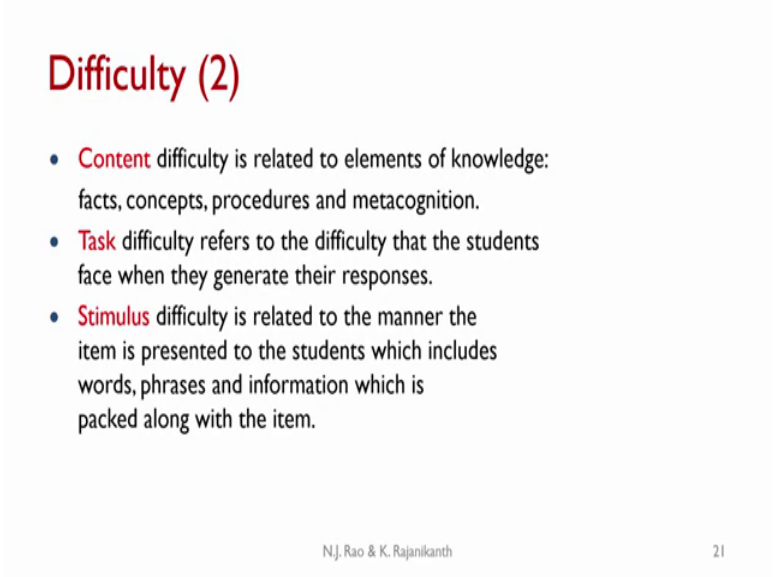

Content difficulty is related to elements of knowledge, facts, concepts, procedures, and metacognition. So, if there are many concepts and you have procedures that involve very long steps with all kinds of conditions and so on. So, in turn you can actually count the number of facts, number of concepts, number of procedures that are really involved, then you call it content difficulty.

Task difficulty refers to the difficulty that the students face when they generate their responses, there can be a lot of arthritic operations, multiplying and adding numbers. And then when you do that, or number of for example, in electrical engineering, if there are a number of loops in a given circuit or very large, one can actually make mistakes at various points in that. So you can have difficulty of the task as well.

Then you have stimulus, stimulus difficulties related to the manner the item is presented to the students, which includes words, phrases and information, which is packed along with the

item. So, I may ask my question in a kind of implicit way rather than direct way. In such a case, the student will have to really identify exactly what is it that he has to do and that is a major step. Sometimes, the way the problem is presented can be quite involved and you will have plenty of stimulus difficulty.

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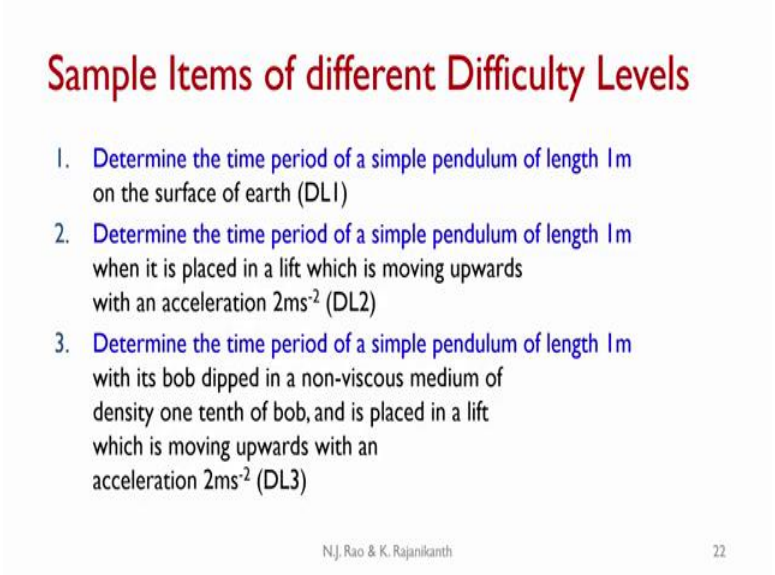

Let us look at some (simp) actually not these are the stimulus, stimulus part is not very much, but the number of concepts involved will keep increasing the number of procedures will increase. One set of examples, determine the time period of a simple pendulum of length 1 meter on the surface of Earth. We call it difficulty level 1.

And incidentally, we are not going to, we are not going to identify too many difficulty levels, once again we will come to 1, 2, 3 only. The second level difficulty question is determine the time period of a simple pendulum of length 1 meter, which is common with the above item when it is placed in a lift which is moving upwards with an acceleration of 2 meters per second, second square.

Difficulty level 2, determine the time period of a simple pendulum of length 1 meter with its bob dipped in non-viscous medium of density one-tenth of the bob and is placed in a lift which is moving upwards with an acceleration of 2 meters per second square. As you can see from one question to the other, we are adding more and more conditions on that.

So, this third one is a difficulty level 3. So you can also write for your own subject or your own course that you are teaching, whether you can write test items at multiple difficulty levels. If you can write a variety of questions like that, they can be part of item bank, and then

you can decide with respect to the students that you have how many questions of difficulty level 2 or difficulty level 3 you want to include in the final exam paper.

These should not be what you call last minute activities. You, the teacher will have to do all this activity long before the tests are conducted. So that when you when you actually present to them all the ambiguities in the questions, the language is corrected, numbers are correct and so on.

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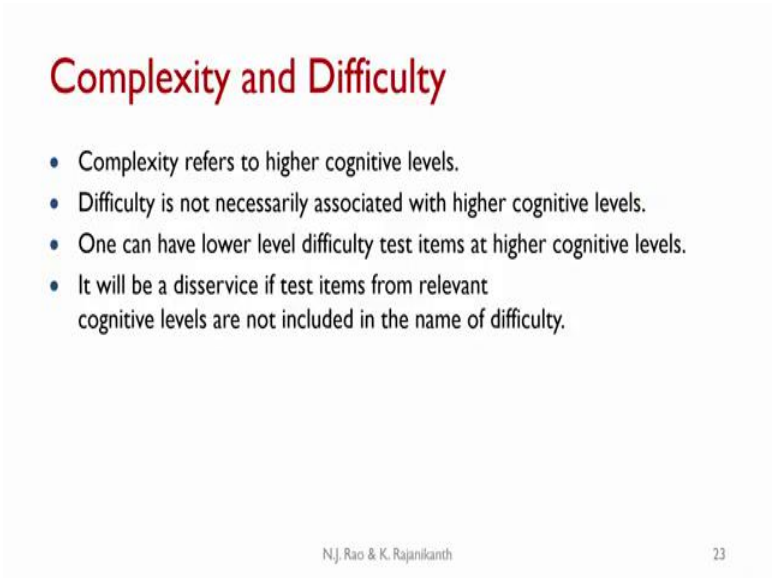

So, these two words one will have to be familiar with complexity and difficulty, complexity refers to higher cognitive levels. So, one should not mistake difficulty with higher cognitive levels. For example, as you can have a very simple question at apply level and a very complicated question at remember level.

So you can have a more difficult, difficulty is not necessarily associated with higher cognitive levels. One can have lower level difficulty, test items at higher cognitive levels. Now, what is the why are we particular about this issue? It is often felt by many faculty in many institutions, that questions at higher cognitive levels cannot be given to their students because there, their students are not adequate for it.

They do not have the required ability for that. If you take the decision, you are actually doing a great disservice to your students, because they are never trained at higher cognitive levels. If they are not trained at higher cognitive levels, obviously, the placement becomes very difficult for them. You confine to them thinking, confine them to lower cognitive levels

simply because you consider, consider rather looking at complexity is very difficult. So, they should not be misunderstood and should not be interchangeably used.

So, we strongly plead with the faculty that the relevant cognitive level, level should not be excluded in the name of difficulty. You can have less difficult questions at higher cognitive levels. So, at least the student is for example, you ask you can ask him to design some circuit let us say, but he must go through the process of designing something rather than completely excluding. That is what that is where the issue of complexity and difficulty become very important.

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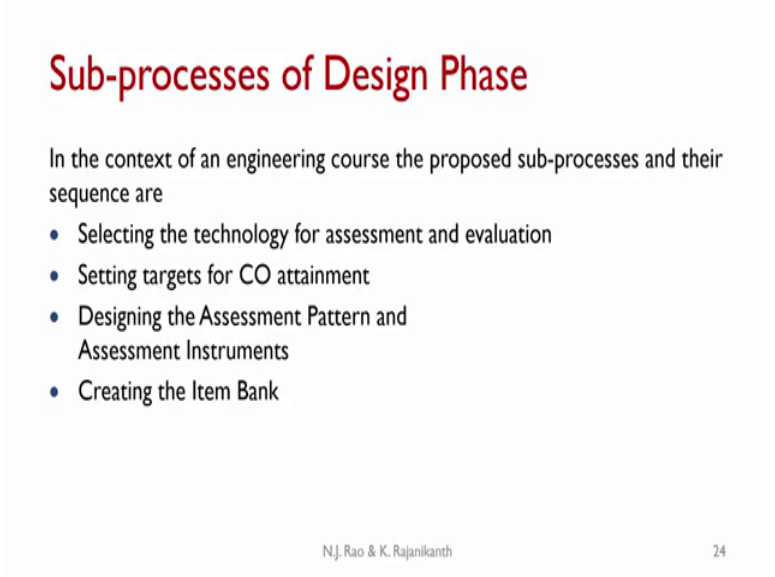

And the sub processes of design phase again as we said, in all these cases sub processes are only samples, they are not any absolute unique or the only way to do, but these activities should be kind of performed. Selecting the technology for assessment and evaluation. Setting targets for CO attainment which you have already done in the module 1, designing the assessment pattern and assessment instruments and creating an item bank. These are the four activities that one needs to undertake as a part of the design phase.

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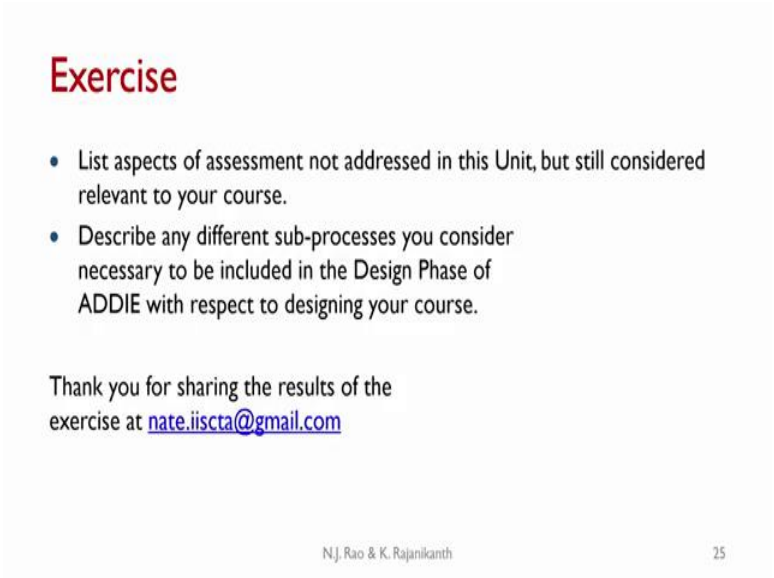

So we will request you to list aspects of assessment not addressed in this unit but still considered relevant to your course. That means we are asking have we omitted anything that needs to be included at this stage and also describe any different sub process you consider necessary to be included in the design phase of ADDIE with respect to designing your course. We request you to share the results of your exercise at this email id.

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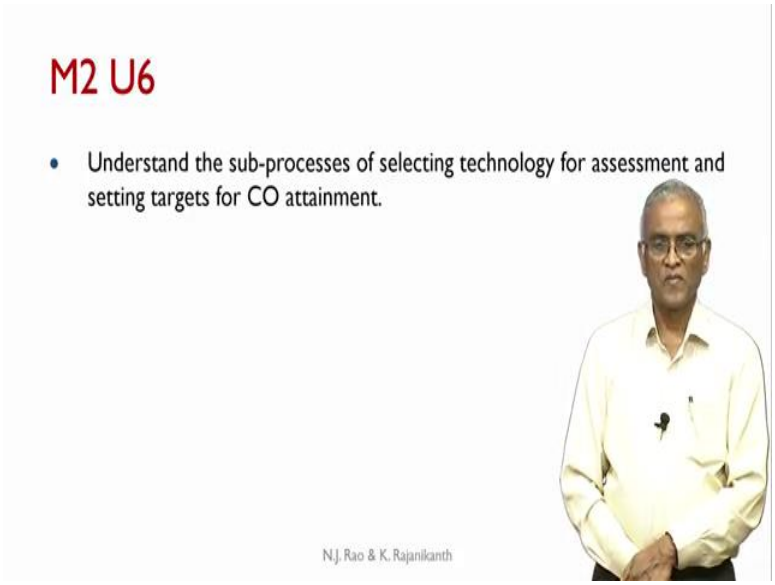

And in the next unit, we try to understand the sub process of selecting technology for assessment and setting the targets for CO attainment, these two sub processes we will address in unit six. Thank you very much for your attention.