TALE - 2 Course Design and Instruction of Engineering Courses
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Lecture - 09
Item Banks

Greetings, Welcome to Module 2 Unit 9 on Item Banks.

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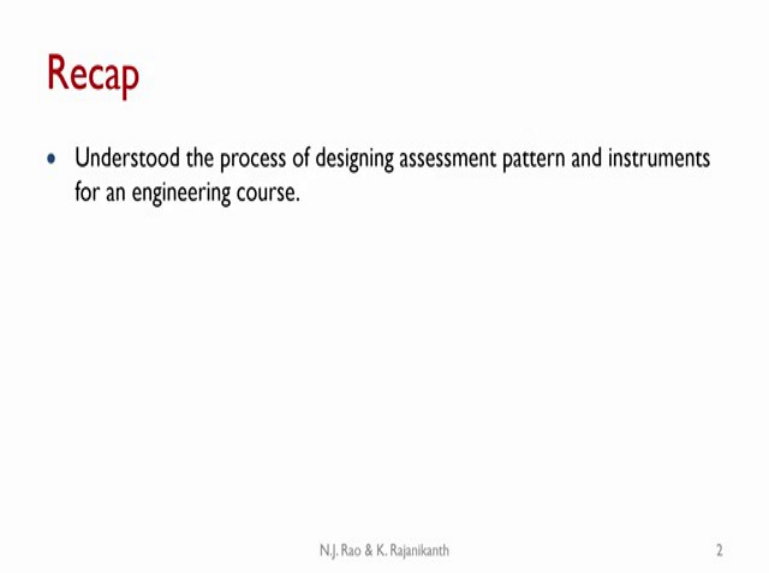

We understood the process of designing assessment pattern and assessment instruments for an engineering course.

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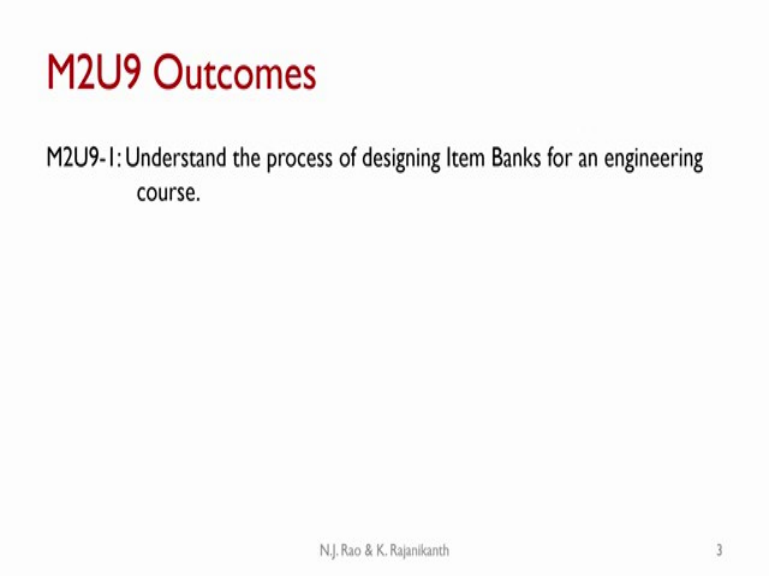

The outcome for this unit is to understand the process of designing item banks for an engineering course. Before we proceed further, I would like to touch upon a couple of issues. We will revisit those issues towards the end of this unit. Some instructors may have some reservations about considering the item bank as a proper part of the design phase. True, it can differ. But we will see that there are advantages to designing the item bank during this phase.

The second issue is that, the moment we say item bank or question bank, certain segment of the faculty might consider that this will dilute the quality of learning by the students. We will come back to these issues towards the end of this unit, but for the present assuming that these two issues are deferred, we will proceed with the idea of designing the item banks for an engineering course.

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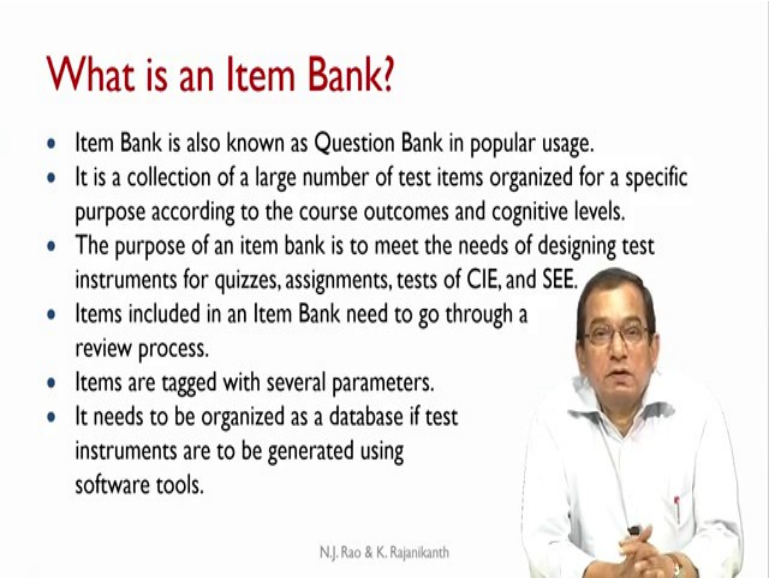

Item bank is also known as question bank; that is a more popular usage! What is an item bank? It is a collection of a large number of test items organized for a specific purpose according to the course outcomes and cognitive levels. One of the important points is that it is a fairly large number of test items. This is very important to ensure that the quality item bank serves its purpose. The purpose of an item bank is to meet the needs of designing test instruments for quizzes, assignments, internal tests and semester end examination.

Primarily, the purpose of an item bank is to design quality assessment instruments for a variety of assessments - quizzes, assignments, internal tests or tests of CIE and SEE. Another important aspect is that the items included in an item bank must be reviewed. There must be a process in place to review the items before they are entered into the item bank. The review would be to ensure that the items which get included in the item bank have certain quality standards. Some of the issues with the items can be - issues of language, ambiguities in the way the question is phrased; there could be technical loopholes in the way the question is posed etc.

It is necessary that there is a process in place to review the items before they are allowed to enter the item bank. Items included in an item bank need to go through a review process. And in order to make use of these items in the item bank, while composing a specific assessment instrument, we need some additional information. The items are

tagged with several parameters. We will presently see what the parameters are with which we need to tag the items. This is necessary in order to use the items effectively in composing an assessment instrument.

The item bank needs to be organized as a database, if test instruments are to be generated using software tools in an automated way. If assessment instruments are to be generated, then obviously, we must have the item bank organized as some kind of a database. Even otherwise the organization would make it easy to use the item bank even if one were using it only manually.

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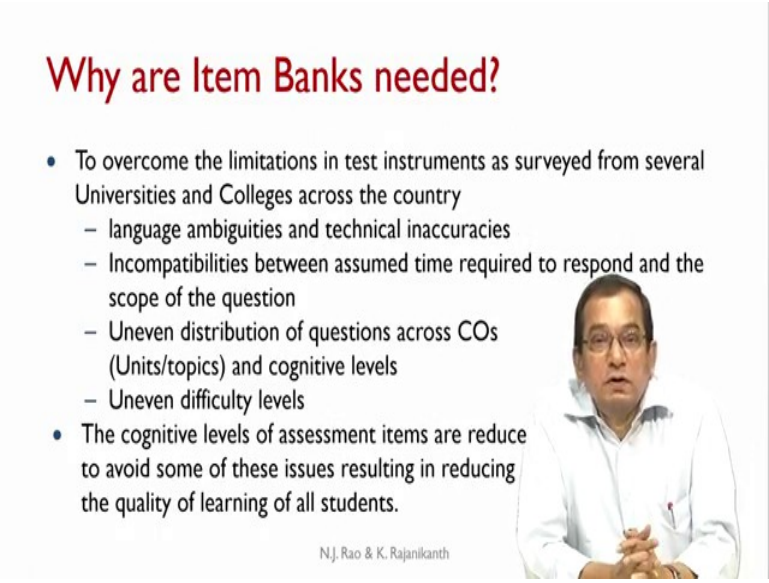

Why do we need these item banks? The main purpose is to be able to compose assessment instruments of good quality. A large number of assessment instruments generated in a wide variety of universities and colleges across the country, particularly the semester end exam papers are available. Across many institutes, they are available on the web; even internal assessment test papers are also available in many cases.

There are certain limitations which are very clearly visible and the item bank is required in order to compose an instrument which does not have these issues. What are the typical limitations that you can see in several item banks? Language ambiguities and technical inaccuracies! Once again this is not to say that majority of instruments are like that or every instruments is like this. But it is true that several assessment instruments do have these limitations.

Incompatibilities between assumed time required to respond and the scope of the question - this depends upon the specific assessment instrument that we are using and we expect certain time to be taken by an average student to answer a specific question. But, the actual time required may be either much more than that or smaller than that; more often it is much more than the time that is assumed, making the question paper very lengthy.

Uneven distribution of questions across the COs or units or topics and cognitive levels: Uneven distribution of questions across the COs; a given internal test is supposed to cover three COs: CO1, CO2, CO3; but actually that instrument may predominantly cover only CO1 and CO2; CO3 may get only a marginal attention in that assessment instrument. This is relative to the amount of time the instructor has spent on CO3 in the class room.

Uneven distribution across cognitive levels: The COs are all at apply level, but predominantly the questions asked are at understand level or remember level. This does not imply that we should not have any questions at lower levels. If a CO is at apply level it is alright to have certain items at lower cognitive levels of understand or remember. But if predominately all the items are at lower levels, then the quality of the instrument becomes suspect.

Uneven difficulty levels: The question corresponds to a particular CO and the cognitive level matches, but the difficulty levels vary substantially across several questions. That is also one of the problems that can occur. In some cases the cognitive levels of assessment items are reduced to lower levels to avoid some of these issues resulting in reducing the quality of learning of all students.

In order to overcome all these limitations it would be convenient to have an item bank which has been curated, all the items have gone through a process by which they are reviewed and the quality items only have entered the item bank.

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It is true that creating an item bank does require considerable effort; particularly the first time one is creating an item bank there is substantial effort which is involved. Faculties have to spend quality time separately for creating an item bank the very first time. Subsequently, it may not be that much time consuming because we need to only revise the item bank - maybe add certain items, delete certain items. It does take considerable effort to create good item bank for the first time.

However, there are several advantages in having an item bank. The faculty can save considerable time while designing good quality quizzes, class tests, assignments and even at university level, in designing a semester end examination paper. Paper setters at the university level can greatly benefit while setting assessment instruments of good and uniform quality. Once we have an item bank and if it is created as a proper database, some or all of the processes associated with creating and administering assessment and evaluation can be computerized.

This would again save considerable time. In fact, today if you see in many autonomous institutions, non-autonomous institutions and universities - in fact a significant part of their time is devoted to the examination process. Setting up the question papers, evaluating them, announcing the result - all these things take considerable amount of time and many efforts are devoted only towards these activities. If we have a good

quality item bank that is electronically available as a database then many of these processes can be computerized.

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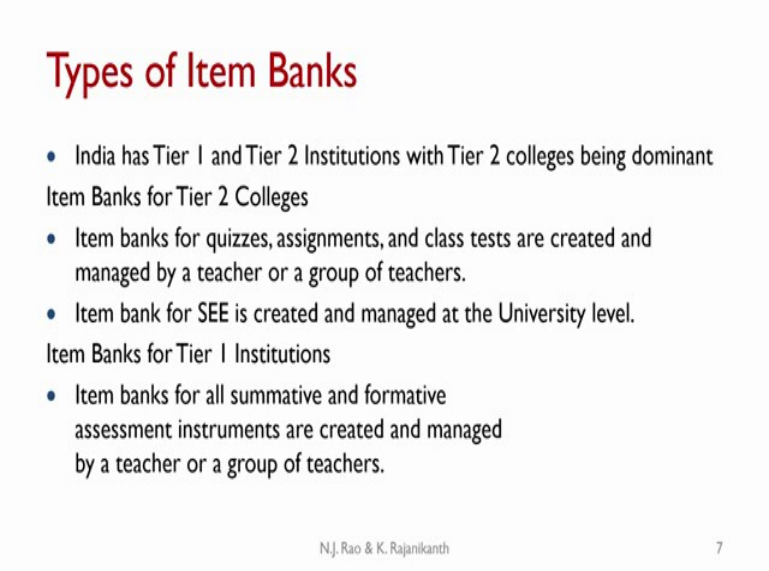

What are the types of item banks? We know that, in India, basically there are two types of colleges'- tier 1 and tier 2 institutions. Tier 1 institutes are autonomous, they have their own assessment mechanisms and processes in place. Whereas, in Tier 2 institutions usually the CIE is in their purview, but the SEE is by the university; hence item banks primarily would be for quizzes, assignments and class tests

Item banks are created and managed by a teacher or a group of teachers. In some cases, the course is offered to a large number of students, may be 6 or 7 or even 10 sections. There are 6, 7, 8 faculty teaching the same course with one of them acting as the course coordinator. The item bank could be managed by the group of teachers. Item banks for SEE are created and managed at the university level for a tier 2 institution.

For a tier 1 institution, the item banks for all summative and formative assessment instruments are created and managed by a teacher or a group of teachers at the institute level itself. In a tier 1 institution, not only CIE, but SEE is managed at the institute level.

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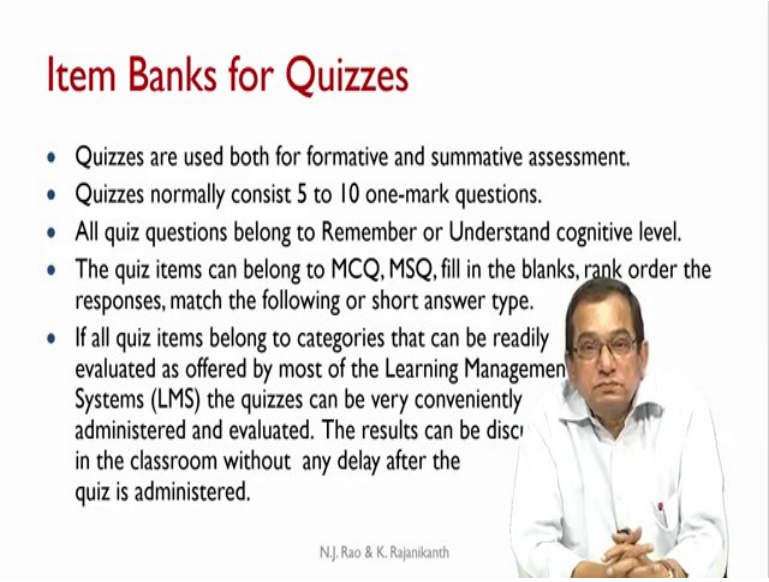

Let us look at the item banks for some of the possible assessment instruments like the quizzes, assignments, class tests and semester end examinations. This is only representative; there is nothing like an algorithmic way of doing all these things which holds good for all institutes.

We know that the assessment process varies considerably from institute to institute and from course to course and from instructor to instructor too. It is definitely not the case that one shirt-fits-all! We are not trying to say that this is something which is to be legislated. It is only an indicative of what are the possible ways of creating a quality item bank and how the institute can go about the process of creating an item bank for different types of assessment instruments.

Item banks for quizzes: Quizzes are used both for formative and summative assessment. The marks scored in the quizzes can go towards the grades of the students. Sometimes we may conduct quizzes only for formative (diagnostic) purposes in order to assess quality of learning by the students. Quizzes normally consist of a small number of items- 5 to 10 one-mark questions typically. It is possible to have questions of two marks also. But, that is relatively less popular; normally 5 to 10 one-mark questions. Usually the questions in a quiz belong to remember or understand cognitive level which is much more common.

This is not to deny that we cannot have quiz questions which are at apply level. It is possible to compose a question at apply level, but that is relatively less popular. Most of the times the quiz questions belonging to remember or understand level are used. The quiz items can belong to multiple choice questions or multiple select questions, fill in the blanks or rank order the responses or match the following; sometimes even very short answers - one single line kind of answers - are also possible. Primarily these would be the type of questions that one could encounter in quizzes. If all quiz items belong to categories that can be readily evaluated automatically as offered by the learning management systems, then the quizzes can be very conveniently administered and evaluated.

If primarily we choose multiple choice questions, fill in the blanks from a given set of words, rank order the responses or match the following; then the learning management system can automatically evaluate the responses. In this case the instructor can discuss the results in the classroom without any delay after the quiz is administered.

This will serve the purpose of a formative assessment also. The quiz can be administered, the results can be tabulated and they can be discussed in the classroom in a very short time. So, there is definite advantage in having an item bank for the quizzes.

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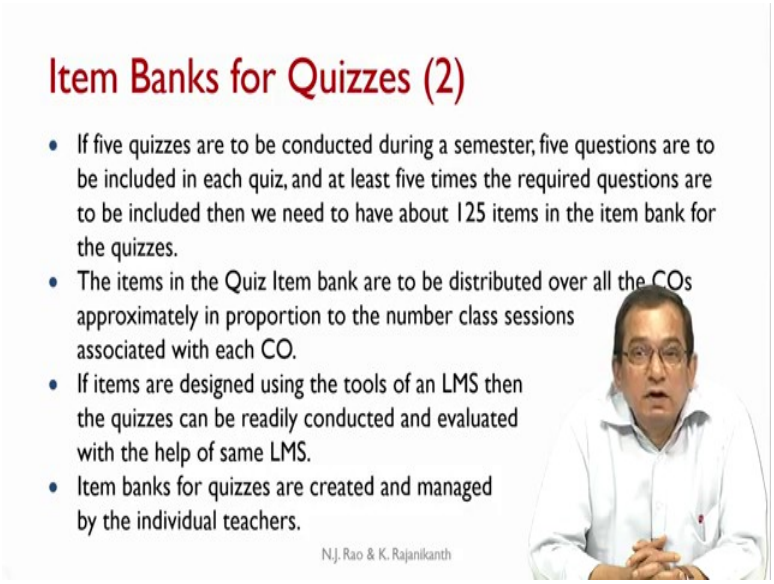

How many items do we create initially in the item bank for quizzes? There is no hard and fast rule; this is a subjective judgment of the instructor or the group of instructors

responsible for the item bank. We might be having a policy of the department or the institute also, but in a representative fashion if we assume that at least the initial item bank should have five times the number of items which are really required for the assessment instrument, we would get something like this. There is no magic about the number five; it can be four times, it can be six times! If there is a group of faculty teaching the same course we might be able to create an item bank in which the number of items is ten times the required number. All kinds of variations are possible.

In order to make the discussion specific, let us assume that we will create an initial item bank in which the number of items is five times the required number of items. If we assume that in a semester we are having five quizzes and each quiz has five questions; that mean, that totally we need 25 questions or 25 items for quizzes; then about five times that would be 125 items. Therefore we need to have about 125 items in the item bank for the quizzes in the initial stage; subsequently the item banks can grow in size. But, at least five times the required number! If we create an item bank then we will have reasonable choice in setting the actual assessment instrument.

The items in the question quiz item bank are to be distributed over all the COs approximately in proportion to the number of class session. Here again, in a specific instance, the quizzes that are conducted during the CIE may not cover all the COs.

In a specific instance, an instructor may design quizzes to cover only a subset of the COs, but in another instance the instructor may wish to cover a different subset of COs. So, in the item bank we must have items covering all the COs so that from that item bank we can pick up the items related to the COs which are being planned in a specific instance. So, the items in the quiz item bank are to be distributed over all the COs and the numbers can depend upon the number of classroom sessions devoted to these COs or it can be even larger number if it is possible.

If items are designed using the tools of an LMS then the quizzes can be readily conducted and evaluated with the help of the same LMS. In fact the quiz itself can be composed from the item bank by an LMS. We can give certain criteria and randomly, according to the pattern, the LMS can create a quiz instrument automatically and that would reduce the time. Obviously the quiz that is automatically created can be reviewed further by the instructor and if required, modifications can be made.

There is nothing which says that the entire process is too mechanical. Instructor's freedom is never compromised, and instructor has all the freedom to revise the instrument which is generated automatically. The item banks for quizzes are created and managed by the individual teachers or the group of teachers offering the same course across the institute. So, basically it is for CIE. So, the item banks for quizzes are created and managed by the individual teachers.

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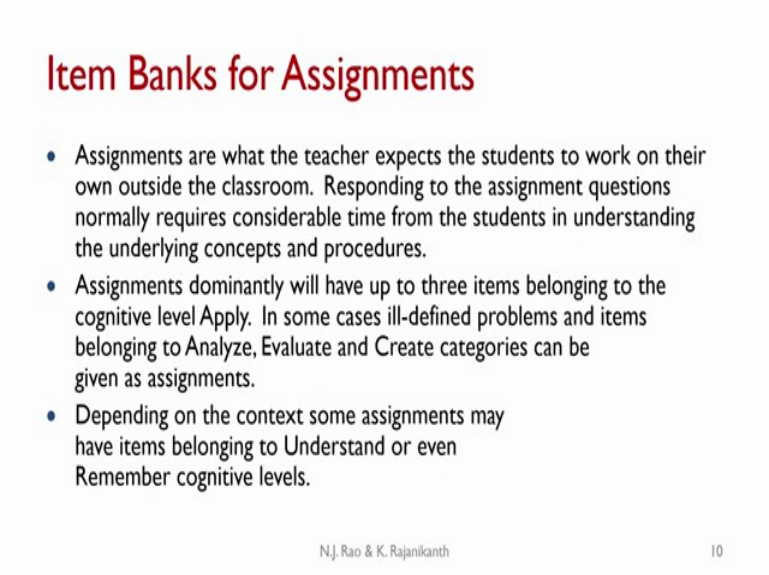

Item banks for assignments: Assignments are typically what the teacher expects the students to work on, by their own, outside the classroom - basically take home kind of assignments. Responding to assignment questions usually requires considerable time from the students in understanding the underlying concepts and procedures because most of the times, the questions posed in the assignments are at higher cognitive levels. Assignments dominantly will have up to three items sometimes only two or even one, sometimes it may be even four belonging to the cognitive level apply.

In some cases ill-defined problems and items belonging to higher levels analyze, evaluate and create categories can be given as assignments. Because, as we have seen earlier, having items at these cognitive levels of analyze, evaluate and create is very difficult in limited time assessments like class tests. It is very difficult to have items at this level. So, they can be included in the assignments.

Depending upon the context, some assignments may have items belonging to lower levels also like understand or even remember cognitive levels, though it is somewhat less common. In principle it is possible to have an assignment covering lower levels, if the instructor feels that the students have to go through these items also for better understanding of the particular CO.

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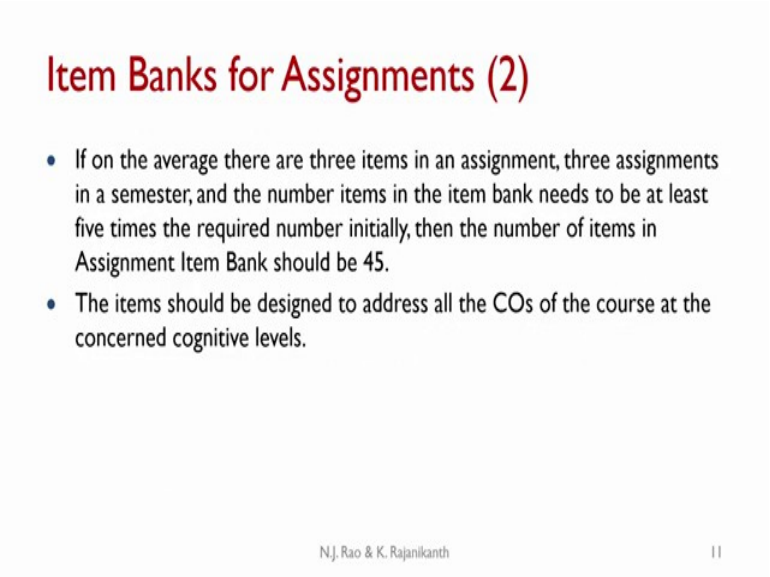

The item bank for assignments again is in indicative way. If on the average, there are three items in an assignment and if three assignments are given in a semester; that means, we need 45 items (9 items x 5 times = 45 items) or above 45 (there is nothing magical about this 45, we can have a larger item bank also).

The items should be designed to address all the COs of the course at the concerned cognitive levels. A specific assignment may not cover all the COs. In fact, all the assignments taken together in a specific instance of course delivery may also not cover all the COs! But the item bank must be designed to cover all the COs so that the instructor will have the freedom to create an assignment using the chosen COs and their cognitive levels.

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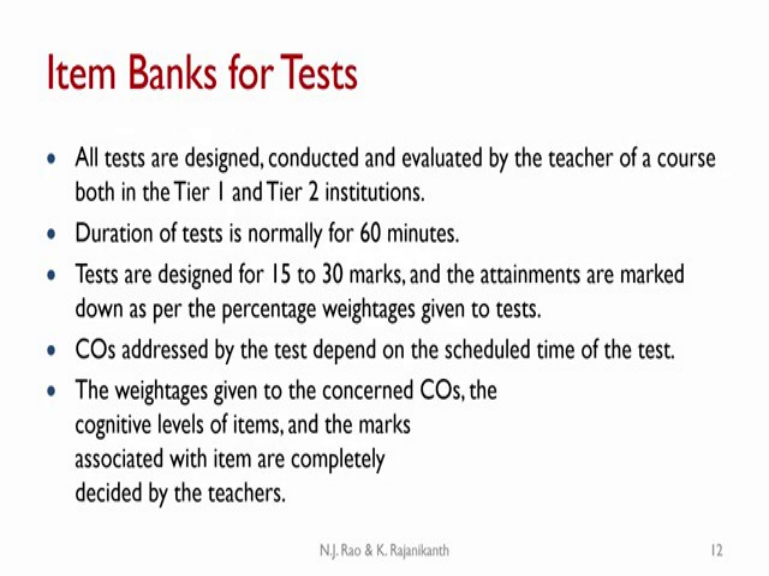

How do we create item banks for the class tests? All the tests are designed, conducted and evaluated by the teacher of the course both in tier 1 and tier 2 institutions. If a particular course is being offered by a larger number of faculties to multiple sections then usually there is a course coordinator who ensures that the tests are uniform across all the sections. So, we could say that the course coordinator along with the concerned faculty would be responsible for the tests. Normally the duration of the internal tests is 60 minutes, though it is possible to have a test of 90 minutes.

Tests are typically design for 15 marks or 20 marks or 30 marks; occasionally even for 50 marks. But, then they are scaled down appropriately depending upon the actual weightage given to the tests in computing the CIE attainments. The attainments are marked down as per the percentage weightages given to the test. This is more convenient because designing an assessment instrument with 15, 20 or 30 marks would be much more convenient. (Typically if the design happens at this level and then the attainments are scaled down suitably.)

COs addressed by a test depends upon the schedule time of the test. How the instructor wishes to cover the COs in tests is part of the assessment plan. (The COs addressed by a test depend upon the scheduled time of the test and the assessment plan.) The weightages given to the concerned COs, the cognitive levels of items and the marks associated with

items all are completely decided by the teacher. There is considerable amount of variation in the way actually tests are conducted.

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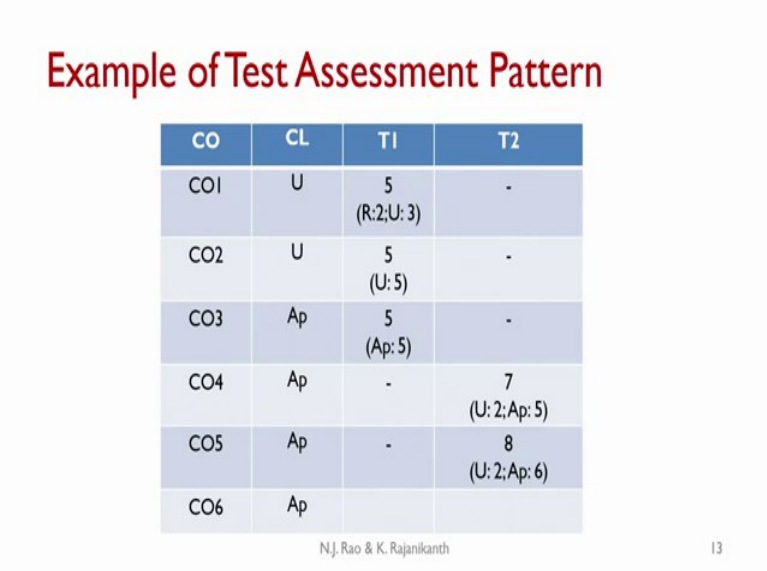

Example for test assessment pattern: There are two tests- test 1 and test 2 and the test 1 covers three COs - CO1, CO2, CO3 and test 2 covers two COs - CO4 and CO5. Please note that CO6 is not at all covered in the tests. (Two tests - test 1 covering three COs, test 2 covering two COs). Cognitive levels of the CO were also given in the table. Based on that, in test 1, corresponding to CO1 we have questions worth 5 marks, corresponding to CO2 - 5 marks, corresponding to CO3 - 5 marks. That means, in this case, the test is for 15 marks. Then corresponding to CO4 we have 7 marks in test 2 and 8 marks corresponding to CO5.

These are all part of the assessment pattern which is decided by the instructor. Marks themselves are subdivided – For CO1 - 5 marks in test 1 - there were 2 marks at the remember level, 3 marks at the understand level. For CO2 all the 5 marks are at understand level and for CO3 all the 5 marks are at apply level; for CO4 - 2 marks at understand level, 5 marks at apply level; for CO5 - 2 marks at understand level and 6 marks at apply level. The pattern is decided by the instructor.

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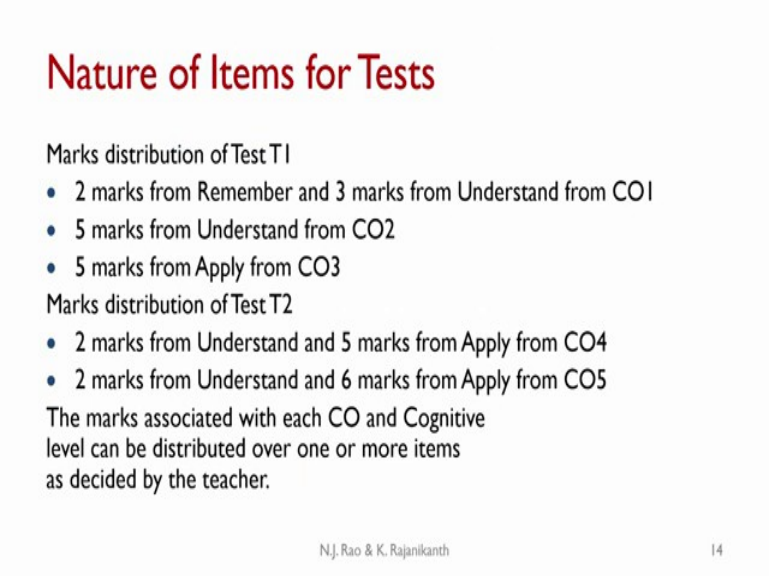

We need to look at the distribution of these marks. These marks which are associated with each CO and cognitive level can be distributed over one or more items as decided by the teacher. For example: we need 2 marks from remember level for CO1.

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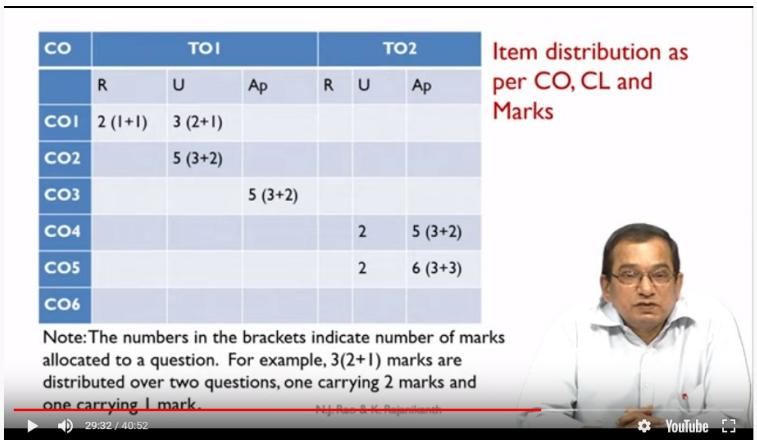

How do we get these 2 marks? We might decide that we would have two questions/two items - 1 mark each. So, in the table if you see corresponding to CO1 and remember level, 2 marks are actually composed with two questions each of 1 mark. This is absolutely the freedom and privilege of the instructor. But, the instructor needs to decide on these upfront.

Similarly, the CO1, understand level 3 marks - they are composed of two questions; one question has 2 marks and another questions has 1 mark. This is required in order to pick up correct items from the item bank. If we are composing a question for CO1 at the understand level we need to pick up one item worth 2 marks and another item worth 1 mark. This is the decision that we need to make.

The item distribution as per the CO-CL and marks needs to be made. If this can be provided electronically to a tool/to an LMS, then assessment instrument can be generated automatically also. For example for CO2, at understand level it is to have 5 marks and these 5 marks are made from two items; one item for 3 marks another item for 2 marks. Similarly you can look into all the other things.

For example, for CO5 at apply level, we need to have 6 marks that is made up of two items - one item of 3 marks and another item of 3 marks. That means, for CO5 we need two items of 3 marks each. If you want to create an item bank which is 5 times that, then we need 10 items of 3 marks each. That is the reason why we need to split the marks into assessment items.

Similarly, for CO4 if you see, we need one item of 3 marks and if you wish to create an item bank which is five times that, then we need to create 5 items of 3 marks each corresponding to CO4 at apply level. Similarly, we can work out the requirements of the item bank and that would be the structure of the item bank for that test. We need 10 - 1 mark questions for CO1 at remember level. Similarly for all the other COs, what kind of item bank needs to be created! For example, for CO5, we saw that we need two items each of 3 marks so, five times that - 10.

We need to create an item bank which has 10 items at apply level, each of 3 marks, corresponding to CO5. This gives us an approximate idea of the structure of the item bank for tests. There is nothing like any rigid rule to be followed. Instead of 10, we could create 15, it could be 20; but at least this much should be the number of items in the item bank in order to make effective use of the item bank. Though it does look like we are spending considerable effort, these are only done once and the uses can be many.

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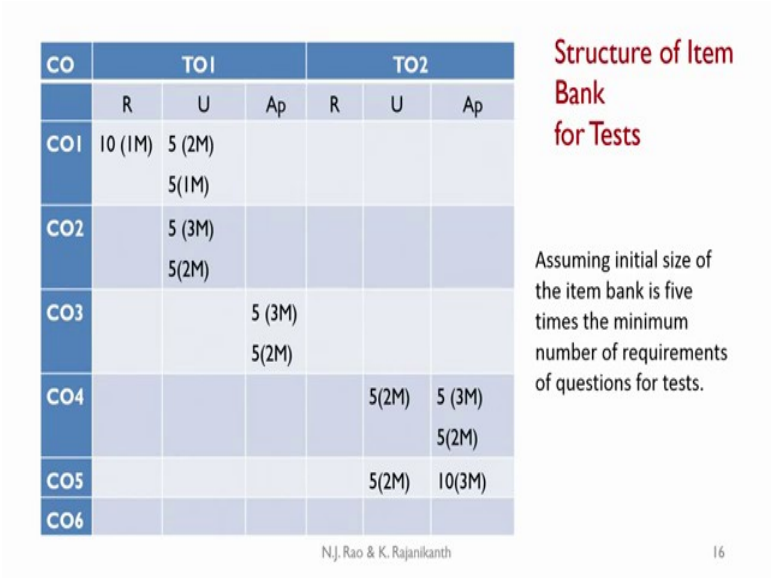

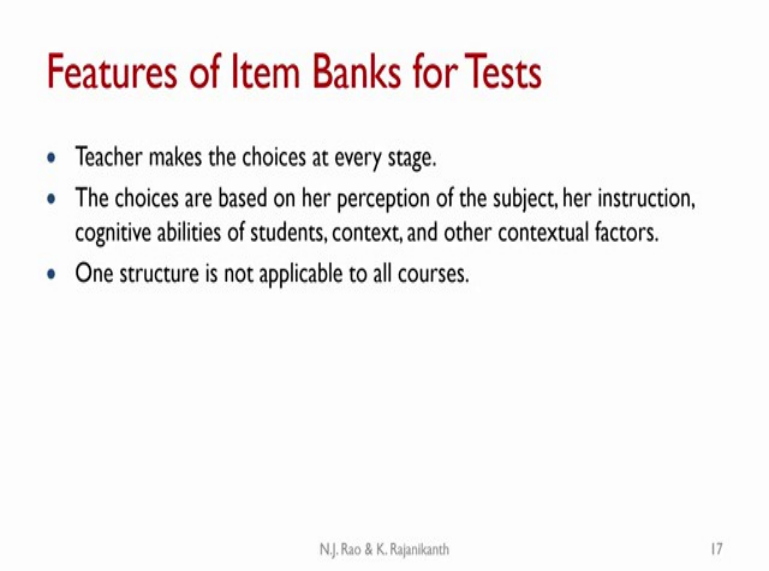

The teacher makes the choices at every stage. The choices are based on perception of the course, the content, the subject or instruction, cognitive abilities of the students, context and many other contextual factors. There is no rigidity about the structure of the item bank. Teacher has the complete freedom and this is only indicative of the way it needs to be done. Definitely one structure is not applicable to all courses, not all the institutes. There is considerable amount of freedom and responsibility that an instructor has in creating the item banks. These are all the indicative features of an item bank.

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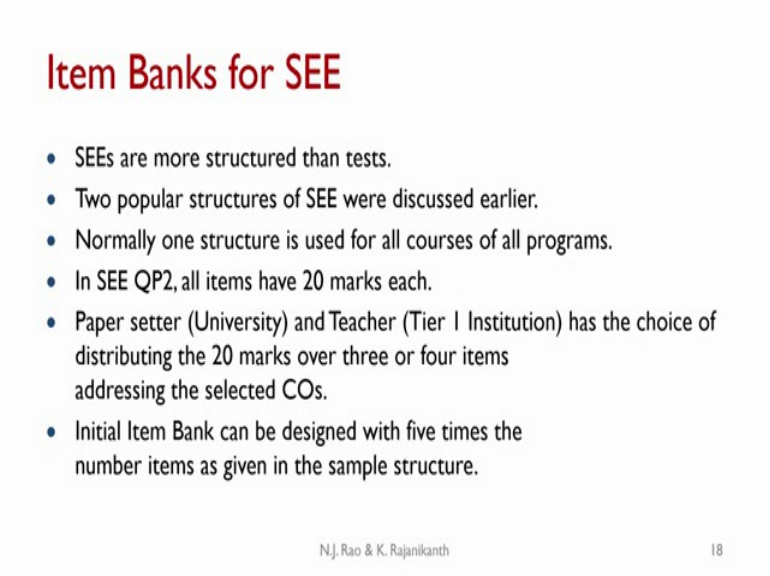

Item bank for SEE: SEE are much more structured because usually this is across the institutes. The two popular structures of SEE were discussed earlier; each question has the same number of marks. In one case they were 20 each, in another case they were 16.

Paper setting basically happens at the university level for tier 2 institutes and the paper setter has to make use of the item bank and she has the choice of distributing the 20 marks over three or four items. Subsection can be there in the sense that first question may have up to four subsections a, b, c, d, and the marks distribution across these four subsections - the teacher has the freedom; though some institutes do have certain guidelines regarding these. In tier 1 institution teacher has to do this. Item banks can be designed again with five times the number of items as given in the sample structure here.

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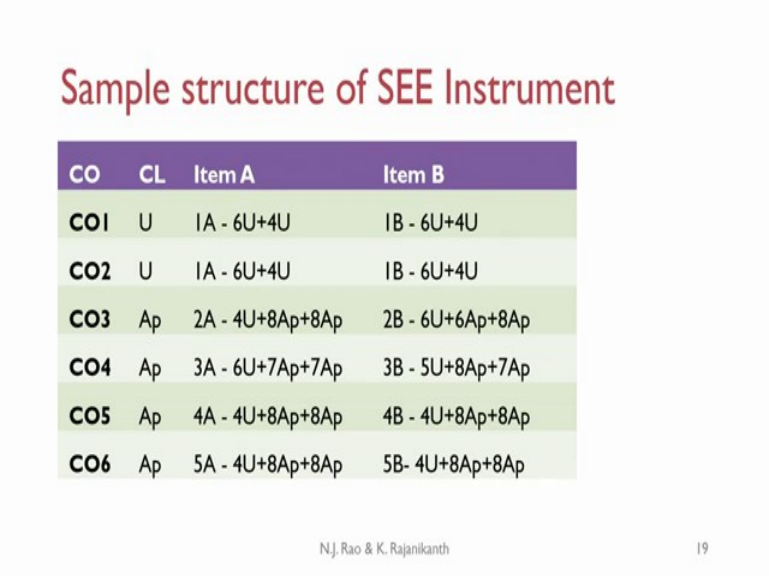

Here the first question actually has two COs covered by that. CO1 and CO2 - both of them are covered in the first question, CO3 is covered in the second question, CO4 in third question, CO5 in the fourth question, CO6 in the fifth question. Totally there are five questions; the first question covers two COs; rest of the questions cover one CO each and the choice is internal. We can say that corresponding to CO1, we would like to give 6 marks at understand level, another question 4 marks at understand level; CO1 is at understand level and that is assessed using two items - both at understand level, one for 6 marks another at 4 marks.

Similarly the alternative for it also has 6 marks at understand level and 4 marks again at understand level. We need two items - one item of 6 marks another item of 4 marks. Similarly, the second question, third question, fourth question, fifth question - you can see. For example, CO6 which is at apply level. We are having totally 20 marks; 4 at understand level, one question; two each of 8 marks at apply level. This is how SEE instrument structure is determined and that will indicate approximately how many items we should have in the item bank. Based on that, we can create an item bank.

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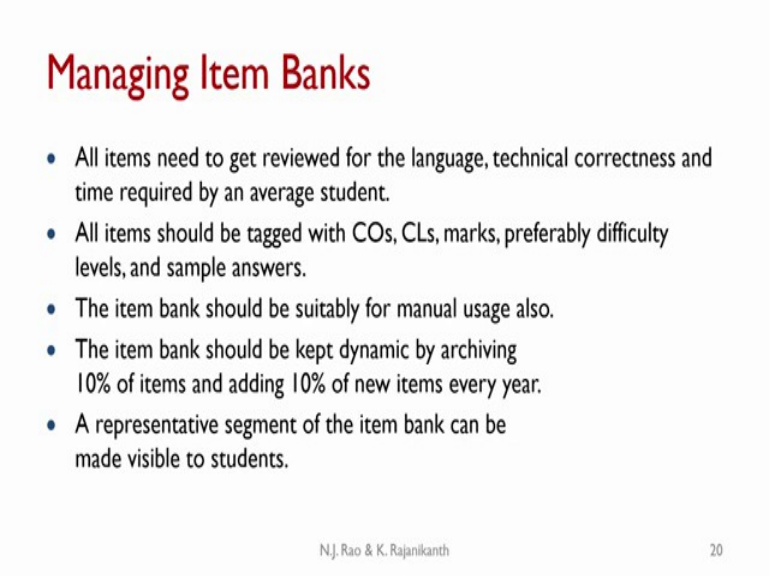

Managing the item banks: Very importantly, all items need to get reviewed for language. It is not that the language is always bad or uniformly good. It is necessary to ensure that the language is proper; there are no ambiguities in the items, technical correctness and time required by an average student. It is essential to have review process. All items should be tagged with the corresponding COs, cognitive levels, marks and if you could tag them with difficulty levels also it would be very convenient. Then we can ensure that the questions which belong to the choice are both at the same difficulty level.

If we have one question and then that is an ‘or’ and there is another question - both belonging to the same CO, we can ensure that both are at the same difficulty level. Then the choice would have more meaning. The item banks should be suitably designed so that even if you are not using any learning management system; if you are using it manually also; it is convenient. So, the item bank should be suitable for manual usage as well as electronic usage. It is very important that we should keep the item bank dynamic. Every year or every semester or every 2 years, depending upon the convenience of the institute, about 10 percent of items can be removed from the item bank and archived.

The archived items can be brought back again after couple of years; basically they are not thrown away. Then 10 percent of new items are added. That way the item bank becomes dynamic and over a period of time a large variety of items should be available. If we have an item bank which is sufficiently large, say about 50 times the required

number of questions, then a representatives segment of the item bank can be made visible to the students also. They would get an idea as to what kind of items the students can expect and that would be helpful for the students in planning their learning activities.

For this to happen, we must have an item bank which is reasonably large. But over a period of time, certainly the item bank can grow in size. Once we have an item bank which is sufficiently large, we can expose a representative segment of it to the students! That would be another advantage of having the item banks.

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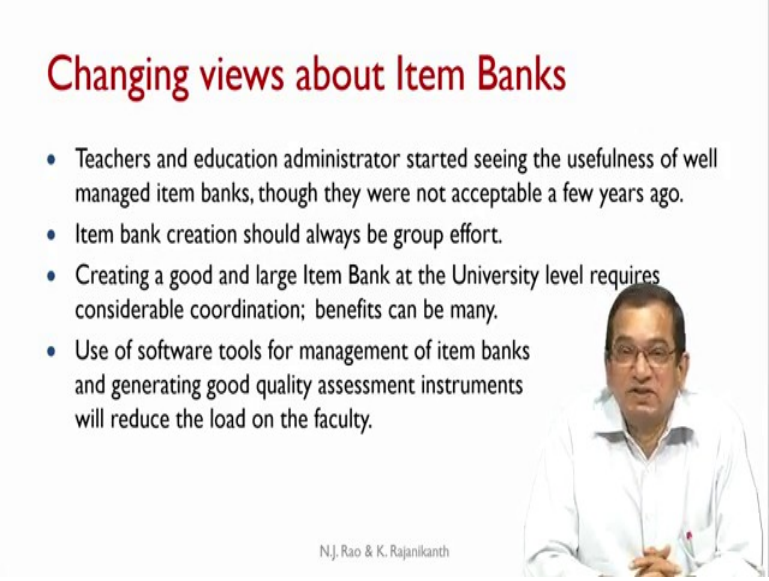

As I mentioned at the start of the session, there are changing views. Earlier, actually item banks were viewed with disfavor by most of the instructors. They believed that this would reduce the quality of learning by students. They were not acceptable. But, now teachers and educational administrators have begun to see the usefulness of well-managed item banks.

This is now more acceptable and item bank creation should always be a group effort; and creating a good and large item bank at the university level requires much greater effort; considerable coordination; but the benefits are many. Even semester end examination instruments can be of good quality, uniform quality across the years. Use of software tools for management of item banks and generating good quality assessment instruments will reduce the load on the faculty, on the institute, on the university, on the exam sections - the benefits are many.

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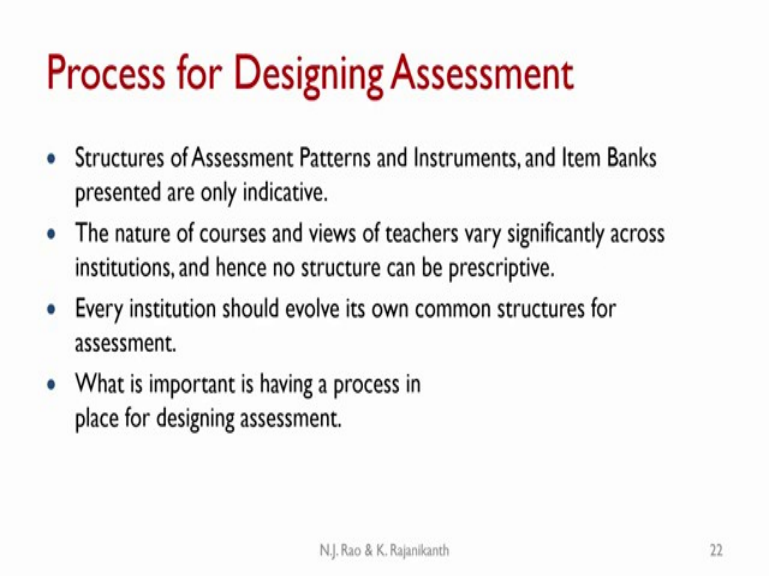

The structure of assessment patterns instruments, item banks - they are all indicative as I mentioned. The actual nature of the courses, views by teachers - they all vary across the institute, courses. Nothing of these has got any legislative character; they are not prescriptive. Every institution should evolve its own common structures for assessment. What is most important is having some process in place for designing assessment.

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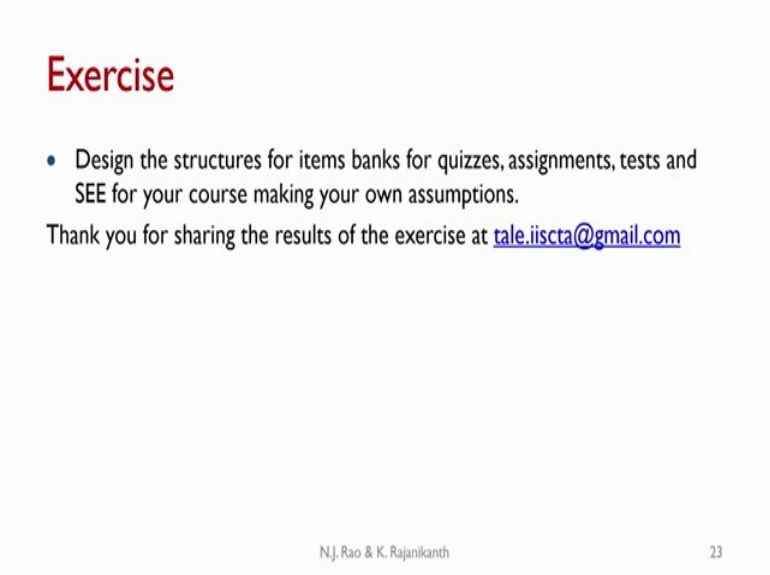

Exercise: Design the structures for item banks, for quizzes, assignments, test and SEE for your course making your own assumptions. Thank you for sharing the results of these exercises at tale.iiscta@gmail.com.

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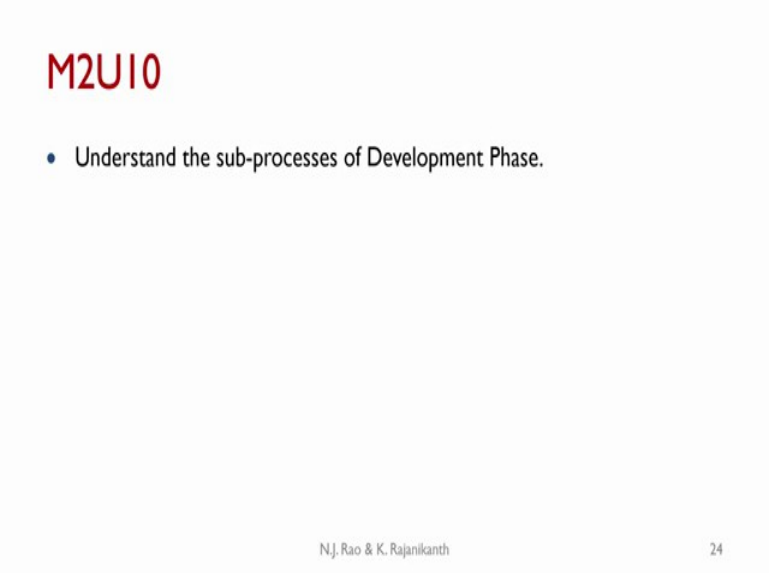

With this we have completed the design phase. In the next unit, the outcome would be understand the sub-processes of development phase.

Thank you and we will meet again.