NBA Accreditation and Teaching - Learning In Engineering (NATE)
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M2 U9: Development Phase

Greetings and welcome to NATE module 2, unit 9 concerned with development phase of ADDIE.

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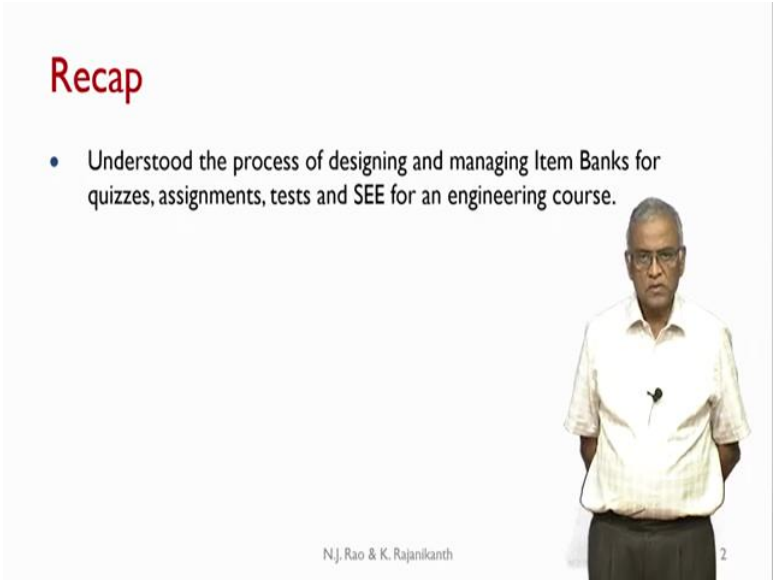

In the last unit, we understood the process of designing and managing item banks for quizzes, assignment, tests and semester and examinations of an engineering course. Item banks involves lot of work, but when it is well done and well managed, it can have a significant influence on the quality of testing first. Because of quality of testing is good, quality of learning will also be good.

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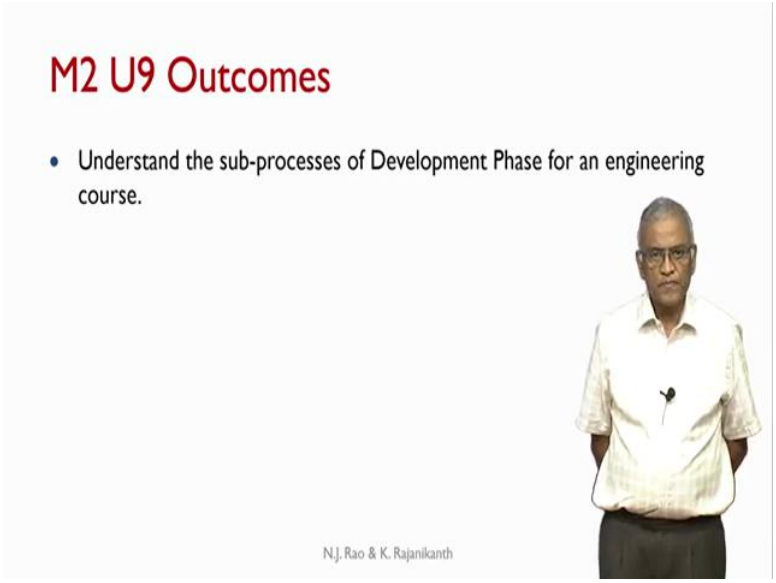

In this unit, we try to understand the sub process of development phase for an engineering course. So, if you recall the phases of ADDIE is analysis design and development.

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Now, we will look at development phase. Development phase consists of these activities which include identifying the delivery technologies, choosing instruction type, development of instructional material and identification and selection of learning material. These are the four activities.

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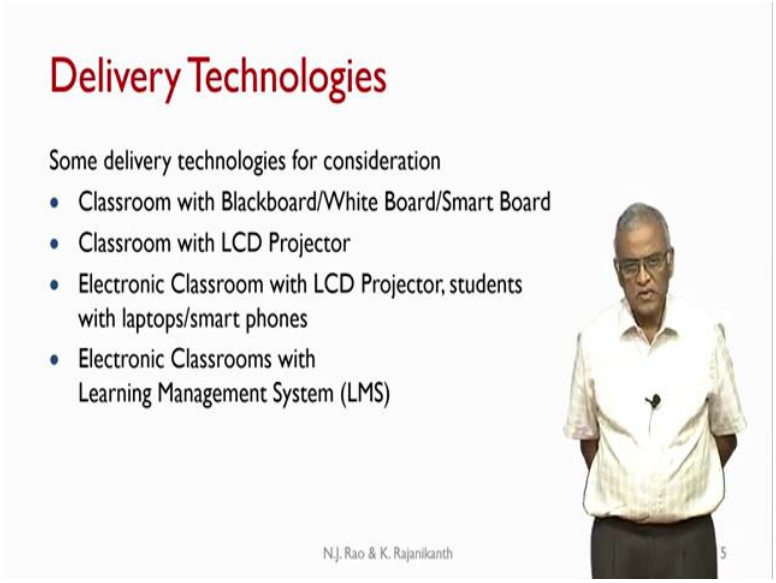

Now, let us look at delivery technologies. Before you do, before you start planning for your course in detail, you have to make a choice about the delivery technology. What kind of classroom do I have? What kind of technology do I have access to? For example, if the students have to bring their own devices, what kind of devices they should bring and so on. So, let us look at some of them. You can there can be many more type of delivery technologies.

First thing is classroom with black board, white board or the smart board. Smart board is a bit rare but it will come under the same category. There is you have a black board or a white board on which the teacher writes, classroom with LCD projector, electronic classroom with LCD projector, students with laptops and smartphones under smartphones you can say and electronic classrooms with a learning management system.

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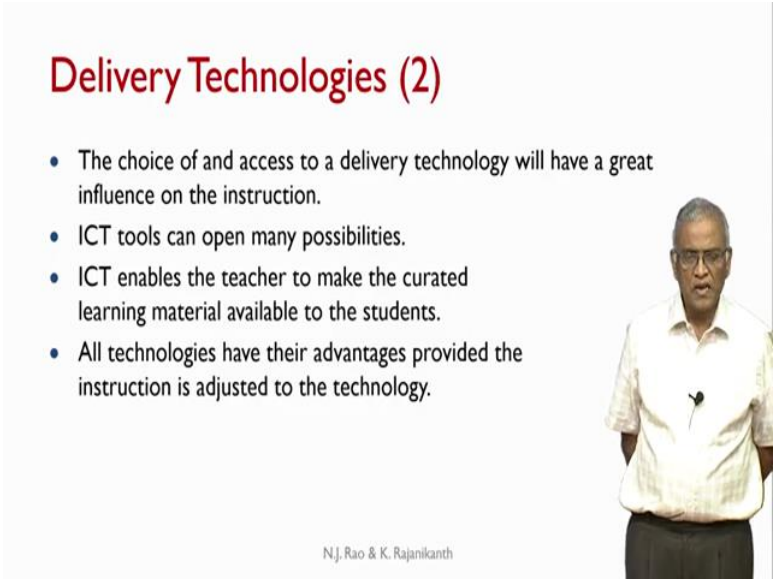

Let us look at the first one. Yes, before we go to the first one, the choice and access to delivery technology will have a great influence on the instruction because you have to plan everything based on your choice of the both devices, environment, everything. And these days you have several informational communication technologies tools are available to us.

Some of them in open source, some of them can be acquired by the college or university. The university level ICT tools will be quite expensive. That is why many universities hesitate to use that. But as an individual teacher, you can use some of these tools. We will look at the possibilities.

And what happens when you use these tools, one of the requirements is teacher has to either create his own material or develop the whole material that he wants to use in teaching in the classroom or he can curate the material from the internet and so on and he can make this readily available to the students because once it is available in electronic form, it has several possibilities.

The time the students take in drawing a diagram in the classroom, or writing a lot of notes that is essentially making copies of what the teacher is writing on the board, a lot of time can be saved. And all these technologies have their advantages. Obviously, otherwise technology would not even be considered provided the instruction is adjusted to the technology. They have to be really compatible with each other. That is you have to take, the teacher has to make use of the possibilities that are created by the technology.

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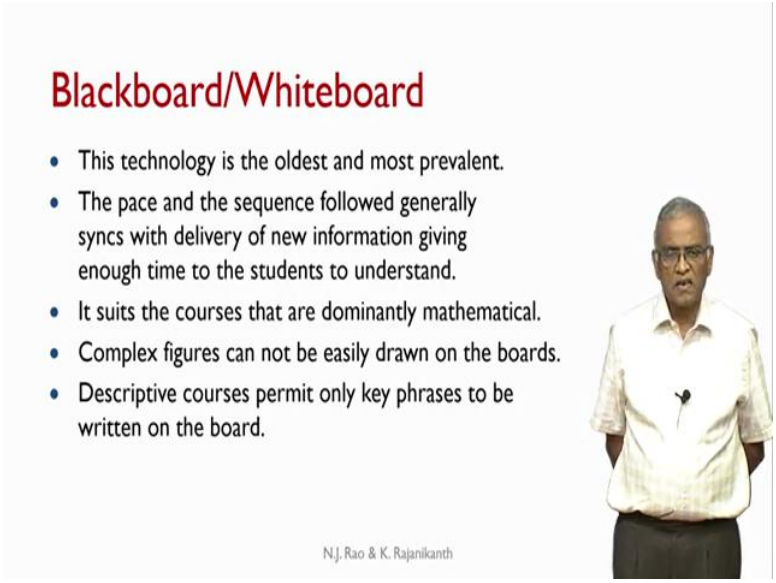

Now, let us start with Black board and white board. This technology is the oldest and most prevalent I think last maybe 150 years, some variant of Black board is being used that still people prefer, vouch by this. Yes, there are some advantages, but there are also many limitations. And it is also sometimes I feel a bit meaningless to keep on hanging on to that saying the other technologies do not meet or give the advantages of the black board.

The major advantage of black board or white board is the pace and sequence followed generally syncs with the delivery of new information, giving enough time to the students to understand. That is the major advantage. That is, while the teacher is writing on the board, there is a certain sequence and he can also write only at particular speed.

So, to that extent, when these two weather the student writes that down in his notes or just keeps on watching, there is certain time available for the student to kind of absorb and consider the knowledge that is presented and also evaluate and see whether he has full, there is time to really internalize whatever that has been presented.

But of course, there is one single pace at which the teacher kind of presents the information. If there are students with very poor cognitive abilities, obviously the time is not adequate. And people with higher cognitive abilities they will find it is too slow. So, it has its limitations as well.

And this one suits the courses that are dominantly mathematical or all kinds of equations have to be written, then in that case, the black board is still the ideal one and to adapt it to an

LCD projector can be done but it takes more effort and it requires some special abilities to do that.

And what happens to the black board if you have a very complex diagram to be drawn on the board first of all, it takes lot of time, not every teacher will have the drawing ability to present a neat picture on the board and when it is very complex, there are likely to be errors creeping in.

And once errors are again noted down by the student, obviously that means you have transferred some wrong information and students sometimes the students may stay with that, may not be able to correct that. And then you have descriptive courses where a lot of information is being presented then what happens, what you can write on the board is only key phrases and even the student may not be able to keep on writing down what the teacher is speaking. So, even for descriptive courses, black board may not be the best.

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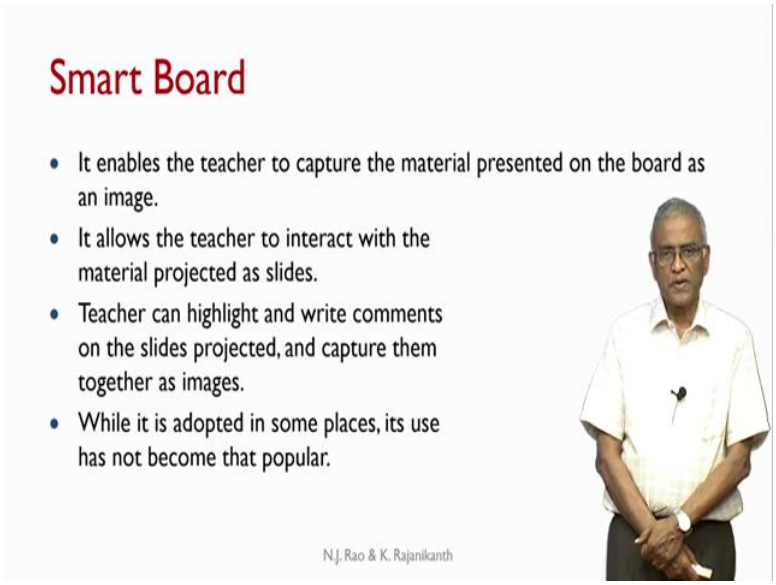

Some variant of smart board, it enables the teacher to capture the material presented on the board as an image. That is whatever teacher writes on the board using a pen related to the smart board, in the end that image can be captured. It has the facility to capture and maybe you can make photocopies of that.

So, when smartboard came on the scene, maybe about 20 years ago, it was considered a great boon, but somehow that kind of thing did not catch. It also allows the teacher to interact with the material projected as slides. If you are projecting through using an LCD projector onto the smart board, what can be done smart board? Let us say after the image is presented, the

teacher can interact with that, highlighting things, circling key elements in that and so on, all that also can be captured. But it is adopted in some places, but its use has not become that very popular.

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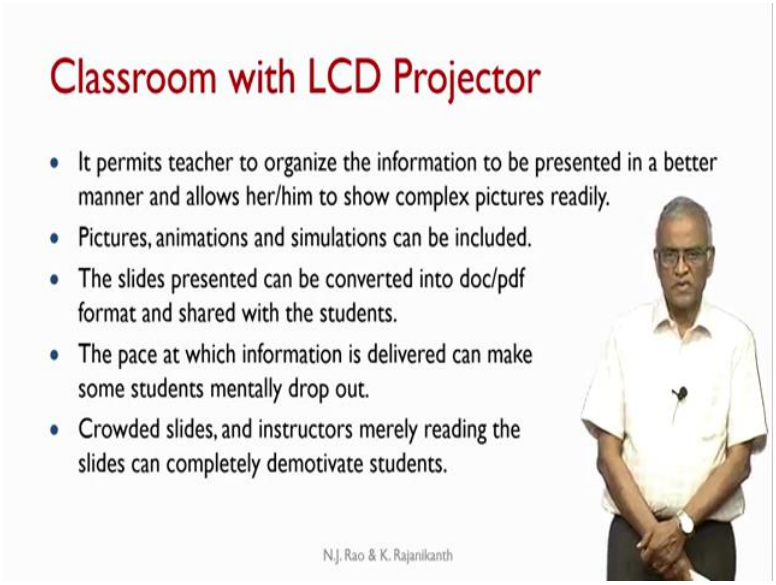

Now, come the classroom with LCD projector, which many of you may already be using that. It permits the user to organize information to be presented in a better manner and allows her or him to show complex pictures readily. Whether it is equations, pictures, sometimes and animations also can be projected and so on. So, the material can readily be presented in a much better fashion.

But of course, that requires a lot of pre planning. What can happen if it is connected to the working computer of the teacher? He can even simulate something and something can be dynamically presented on the screen. So, there is one advantage and the slides presenter can be converted into doc or PDF format and you can share it with the students.

To convert that is pretty easy and you can share it with the student these days and the pace at which information is delivered can make some students mentally dropout. If you are narrating or presenting the information at a fast pace because that is available to you right in front of your eyes, so you are likely to go a little faster. When you go faster, you may lose your students.

They may go out of step. Once you student goes out of step, at some point, he or she will mentally drop out. That is one disadvantage. And also it requires some discipline, you should not make the crowd slides too crowded. And sometimes the teacher can end up merely

reading the slide, just face in the opposite direction, towards the screen and start reading the slides and you cannot have a worse situation than that.

Right in the first slide itself you will lose all your students mentally. So, one has to be careful. In my experience, some people acquire some habits. If they happen to bad habits somehow, they keep on hanging on to that. For example, making the slides crowded which is in my opinion is a bad thing.

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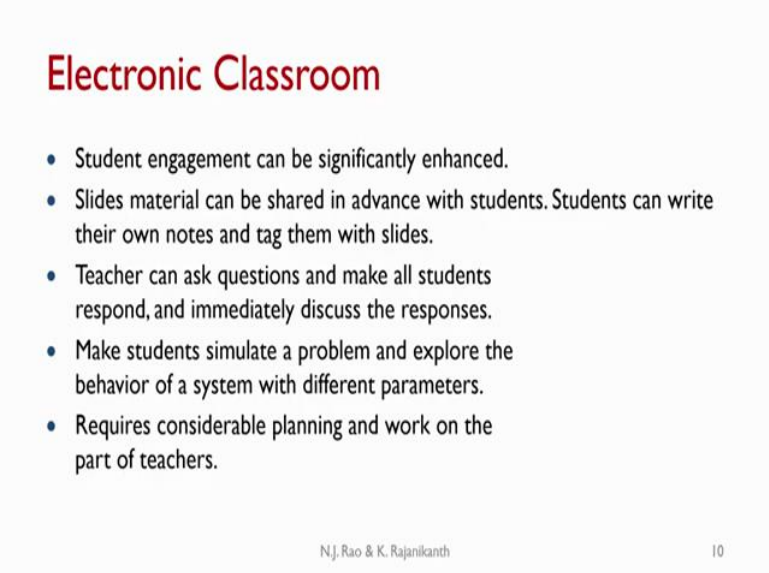

Now, let us look at electronic classroom. It is a next level and first of all electronic classroom can make this engagement of the student much significantly enhanced. First of all, slide material can be shared in advance with the students. Students can write their own notes and tag them with the slides.

So, what happens? If the information is already shared, and the students do have the internet devices with them in the classroom, that is what an electronic classroom is, they not only have their laptops or smartphones or tablets with them, in such a case what happens the material is already made available to them.

Whatever you want to note while the teacher is presenting the slide material, they can just type short points on that and can be tagged on to the slide which the information is being dealt with. And what can happen is teacher can also ask questions and make all students respond and immediately discuss their responses.

Of course, this particular thing, if you have an LMS also part of it, learning management system is a part of it, it becomes much easier, even otherwise, through emails, the students

can directly communicate with the teacher right in the classroom. So, you require corresponding Wi Fi facility for students to communicate with the teacher.

And another thing is, you can these days simulation is a very becoming a very powerful tool in many subjects to learn anything. That is what essentially you are trying to explore, what happens if something is changed in a given system? So, one way of my learning the behaviour of the system, especially, when a system has several nonlinear elements in that or it has several feedback loops in that, it is not very easy at all.

First of all, modelling itself can become difficult. The models may contain very highly nonlinear equations and nonlinear equations may or may not have closed form solutions. In that case, the only tool that you have best with you is to simulate. Sometimes even simple equations can be simulated to find out what happens when a parameter is changed, which will not be very obvious by looking at the equation itself.

And for this, you have powerful simulation tools, there are a whole bunch of them. Depending on what you have access to the instruction can be planned accordingly. But, one thing about electronic classroom is, it requires considerable planning and work on the part of the teacher to make the classroom time effectively utilized. I can go on simulating, I can go on showings all kinds of things on the screen, but one has to be very, rather spend a lot of time in trying to ensure that it is leading to true learning by all the students.

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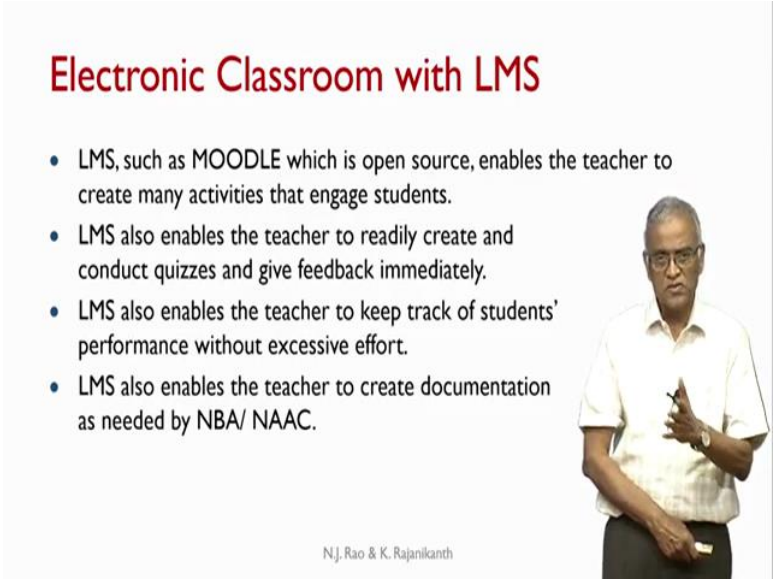

Now, you can also have, even if the Institute does not have an LMS at the college or institutional level, a teacher can have his own LMS because elements like MOODLE, which

is an open source tool. So, teacher himself, on his own laptop, can create many activities that engage students. For example, one of the easiest thing is to conduct a quiz. Quizzes generally, you ask 5 to maximum 10 questions, which are what do you call? Multiple choice questions or give a, not even short answer, fill in the blank kind of thing.

And what happens is even if you conduct a quiz, to find out to what they have done to analyse that, it takes a lot of time for the teacher because if he has looked through 50-60 responses, it takes a lot of time. And the very purpose of using quizzes as a, what do you call, as a formative assessment tool, is not served.

You can always use a quiz as I what you call summative assessment instrument, but that is a different one. But the main purpose of quiz is to find out at what level the students are with respect to certain concepts, let us say. So, you want to get the result immediately and also you want to give feedback immediately. LMS like MOODLE provides a wonderful possibility of creating such a quizzes and looking at the responses of the students.

And if the students are responding using their internet devices, then what can happen is you can exactly see how what set of students are going completely off the track. You can directly address them. It is one is a wonderful thing to be used in the class. And also LMS will enable the teacher to keep track of students performance without excessive effort.

And it enables the teacher to create documentation as needed by NBA or NAAC. That is another issue. So, I would suggest to all of you, even if your college already has some kind of an LMS, has come to agreement with or what you call academic management system, it will provide all kinds of tools that we are talking about.

Even if you do not have such a thing, at an individual teacher level, you can learn how to make use of something like a MOODLE because you can readily download and it requires a small amount of training. I am sure you can find somebody who can help you in that and setup your MOODLE site for your course.

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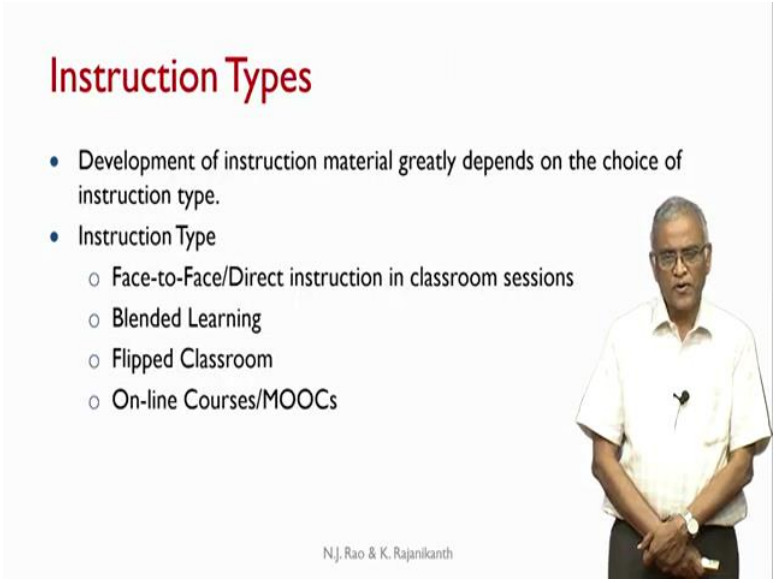

What do you call instruction types? For want of any other word, we use the word instruction type because finally, what is it that we are trying to do in development phase? We are trying to develop instruction material and learning material. So, first thing is we said the choice of the technology will directly influence the kind of instruction material that you have to prepare.

Then the next issue is what instruction type are you following. There are four types we are talking about, one can think of more, but these are the dominant ones. Face to face are direct instruction in the classroom sessions. This is still the most dominant method of instruction. I should not call it method of instruction, type of instruction. And you have blended, learning flipped classroom, online courses and still later version is the MOOC.

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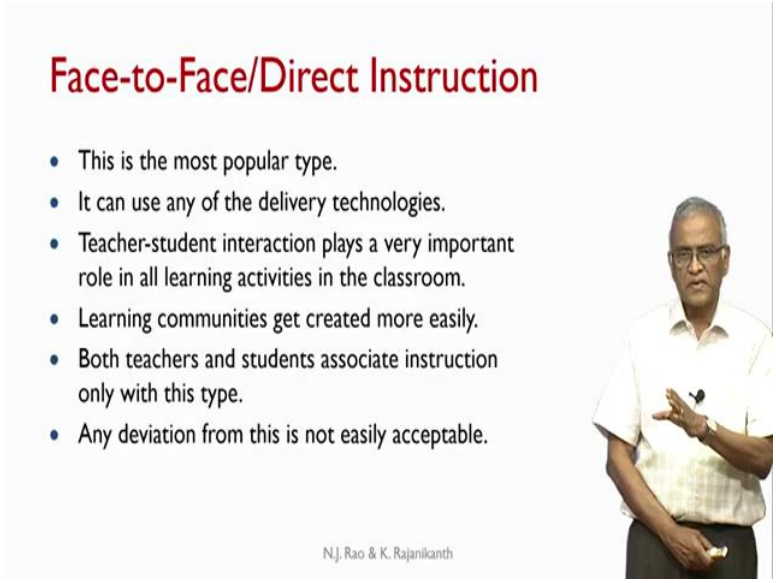

Now, face to face direct instruction, obviously this is the most popular type and it can use any of the delivery technologies that we have used, that we have mentioned. So, what happens is the direct instruction now is categorized further depending, based on the delivery technology that is chosen. And here teacher-student interaction plays a very important role in all learning activities in the classroom.

And here what happens is, there is a level of comfort felt by both the students and the teacher because the students right from their childhood, they are used to that mode of doing and the teacher because of that is also used to using face to face instruction. And when you deviate from that, both the students and teacher may feel a bit uncomfortable.

So, this a this becomes an important issue whenever you want to deviate from this face to face type of instruction. And because students are always they are all sitting in one classroom, they are also interacting with each other, they know each other. Even then they go out of the class, they are interacting with each other.

So, automatically what happens? That very type of interaction facilitates creating learning communities. That means 3 or 4 will get together and say, let us start sharing the information, start explaining to each other, start solving problems together and so on. So, learning communities can get formed more easily. And any deviation from this as I said, is not going to be easily acceptable. And even practically any institute that I have seen, we talk about all kinds of other technologies but in the end, the face to face or direct instruction seems to be the main choice of the faculty.

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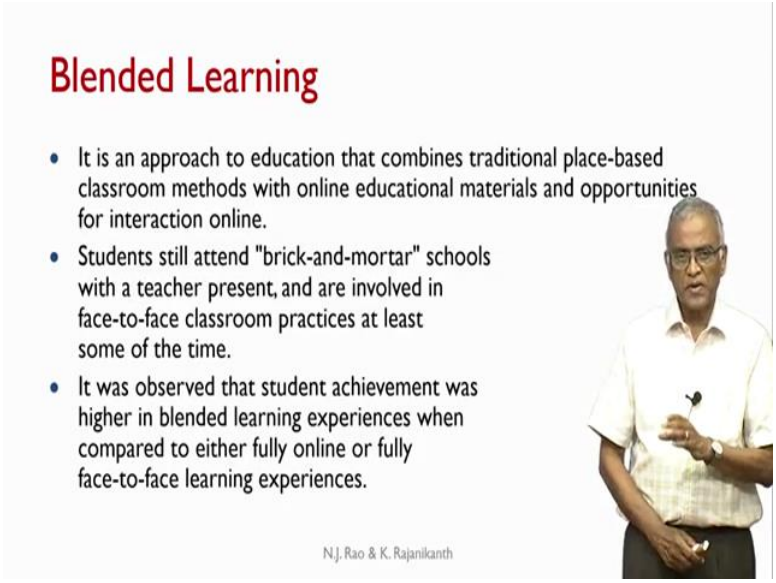

Now, blended learning is an approach that combines traditional place based classroom that is students do come to a specific place, there is an identified classroom, and then the teacher is also in front of them. So, it is a kind of face to face interaction is possible. But it also has all the educational materials is available online. So, what can happen is once, that means you also facilitates students to interact with each other online.

That means learning communities are facilitated to form online. That means they do not have to sit across the table and talk to each other. But the present day technology allows you, to communities to form online and a lot of work can be done online. And how the classroom time is utilized is left to the teacher. And it requires certain amount of practice and also students have to get used to it.

But once you properly organize, it was observed that the student achievement was much higher in blended learning then that face to face or fully online or fully face to face learning experiences. The possibilities will become many, but it is fairly well understood. But if you want to use it, you have to dare, the teacher has to dare to get into this.

And one advantage of blended learning is if you are taking 4 lectures per week, you can cut it down. You do not require that much of face to face interaction. You can cut down as low as 1 hour per classroom for face to face, provided that the teacher is available for interaction online or is able to answer questions as when the students raise them. But you do not have to be in the classroom. So, you can blend the online learning with the classroom learning.

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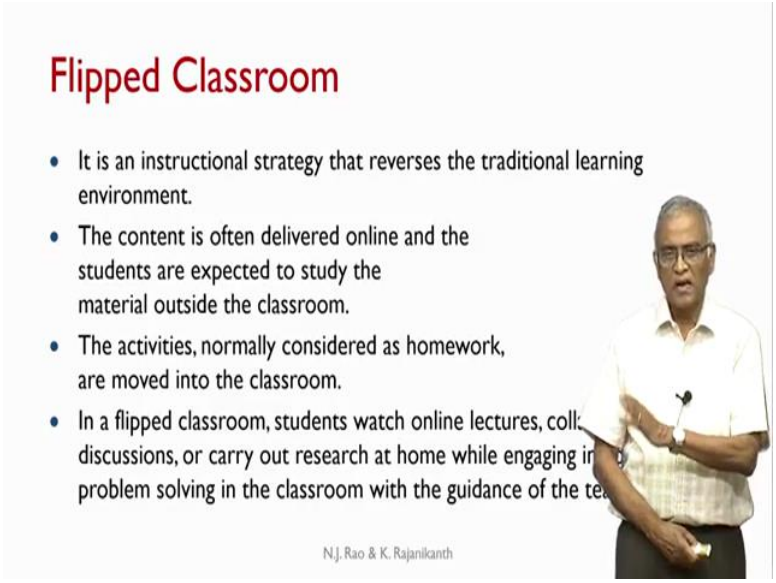

Now, another modification of this. Essentially flipped classroom is normally what do we do? We present the material, new material or demonstrate the new knowledge in the classroom and generally ask the students to study back at their hostels or in their rooms and also solve some problems that means, they are solving problems outside the classroom and in the classroom, information is transferred to them.

Flipped classroom is essentially you are switching this. Your the problems are solved in the classroom in the presence of the teacher, whereas the material that you are trying to present in the classroom is made available online, and the students do read on that. There is no need to prepare copies of the what the teacher writes on the board because the entire material can be made available to the students online.

So, the activity is normally considered as homework or moved into the classroom. So, in a flipped classroom, students watch online lectures, collaborate in online discussions or carry out research at home while engaging in concepts and problem solving in the classroom with the guidance of the teacher. This is what flipped classroom is. And when you plan it properly, when it is done, yes there are enough number of examples to show that it can be very effective. But as we said, unless the teacher really takes it, believes in that and prepares accordingly it will not be easy to make the success.

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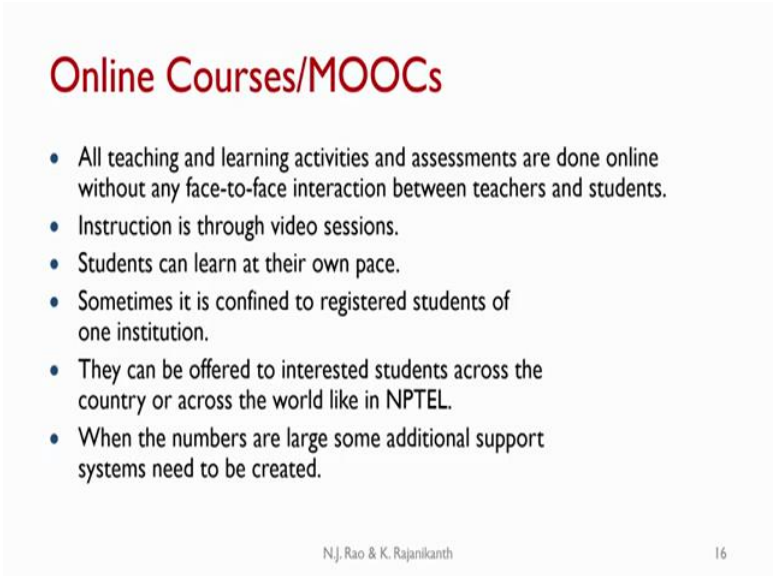

Then come the next level. Online courses would mean that the teacher does not even come to in a class and there is no face to face interaction at all. The way we are now doing in NPTEL courses, the video sessions are recorded and they are made available to the students. Lecture wise lecture can be broken into smaller units, they are all available for the student and they can listen to it as many times as possible at their own pace, at their own places, and so on.

And even the assignments, everything is given online. And there is a method of even conducting what we call both formative and summative assessment online. And the software tool itself will evaluate the performance of the student. That is complete online. But the normally when we call it online, it is meant, it refers to is what do you call?

The way we conduct our courses in any regular program, let us say 60 students are in a batch, I am conducting a course, except that everything is online, I am only dealing with the same set of 60 students here. And what can happen when I am limiting myself with a smaller number of students?

Then I can also ask them to write reports, I can ask them to submit written responses to certain questions, which they are made available online to me, either image form or text form, and I can evaluate and do, but there is no direct face to face interaction with that. So, if it is limited to the students who are registered with my course at any given time, online course can have a lot of advantages.

Except of course, because student is not directly face to face interacting with the teacher, there is that rapport cannot be easily created. There are methods to do that. But that again

requires a lot of effort. The next level type of instruction is MOOC. That is now it is not limited to the students who are registered for my course in a particular Institute, but it is open to anyone and everyone throughout the world.

And when you do that, you have a lot of issues related to conducting the assessment. Those will have to be solved. And then sometimes like we are doing in NPTEL, most of the time the numbers are large, you have to confine yourself to what do you call computer evaluatable questions. There is multiple choice or fill in the blank kind of questions that becomes a limitation in some of the courses.

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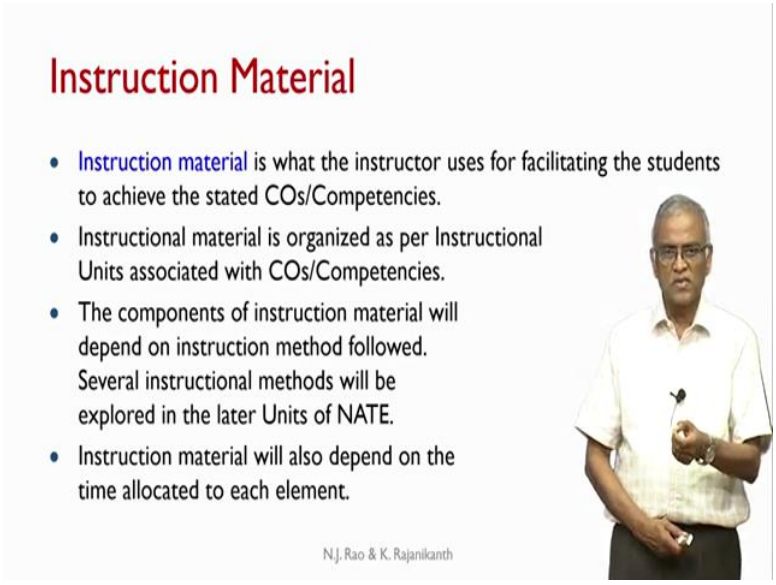

Now, having talked about delivery technologies, and instruction types, now we talk about instruction material. Creating instruction material is the main purpose of development phase. So, instruction material is what the instructor users for facilitating the student to achieve the stated course outcomes or competencies. So, essentially instruction material is what the instructor prepares for himself.

It is not necessary for him to share this with everybody. He can write specific instructions to himself. And generally what happens? This instruction material is also organized as per the COs or competencies. That is one way of classifying. That is for each competency or CO, or instructional unit as we call it. For each instructional unit, I will prepare my instruction material.

Because what happens? Depending on the type of material I am dealing with, I may use different instructional methods. Instructional methods are different from instruction types.

The instructional methods will deal within the letter units. And instructional material will also depend on the time allocated to each element because the instruction will consists of several instructional elements. Depending on the elements you choose, depending on the nature of the element, the material will also depend on the time allocated for each element.

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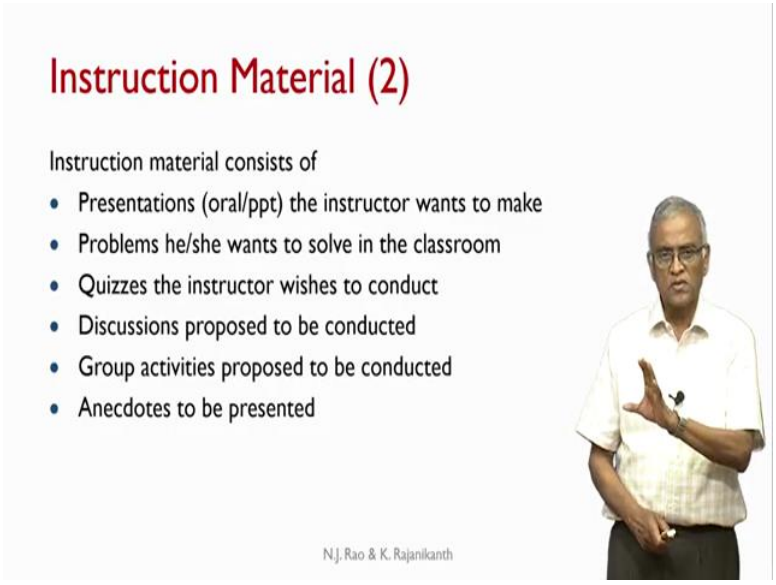

And what does it consists of, instruction material in the end? Preparations or oral or ppt of the instructor wants to make or presentations he wants to make, that is the first one, and the problem the teacher wants to solve in the classroom. And quizzes the instructor wishes to conduct, discussions proposed to be conducted in the classroom.

And the group activities proposed to be conducted and any anecdotes you want to present and you can make a long list of that. All the material will be first collected and then you organize depending on the kind of instruction method you are going to use.

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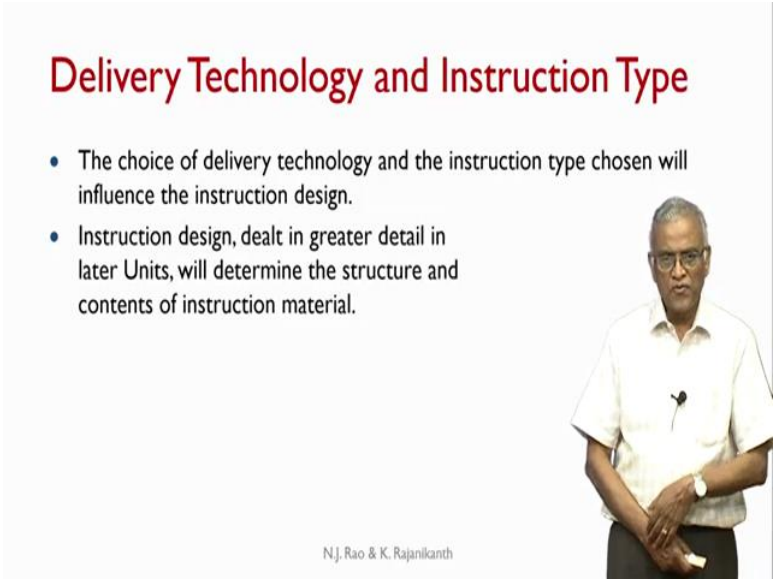

As we already said, the choice of delivery technology and the instruction type chosen will influence the instruction design and instruction design formally, we will deal with it in a later unit and it will determine the structure and contents of the instructional material.

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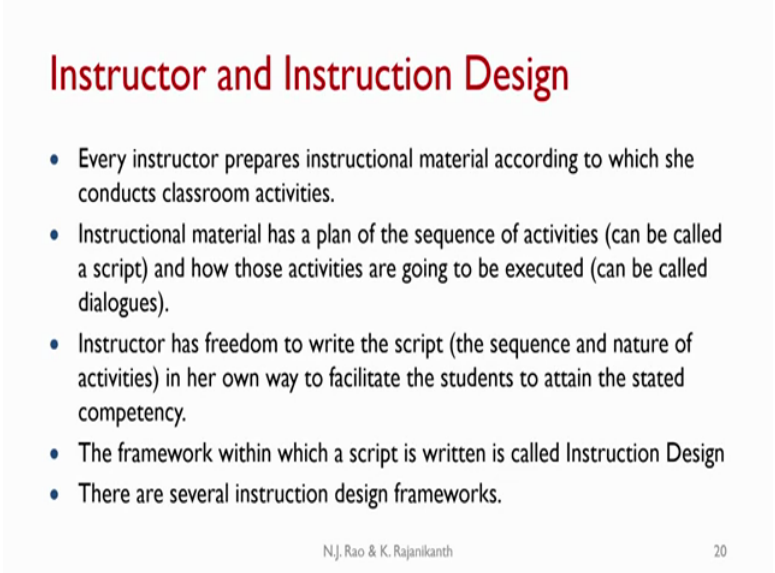

Now, we come to instructor and instruction design. Depending on the subject and preferences of the instructor even now intuitively different instructors are likely to handle their courses differently. But we are now talking about doing it in a structured manner. Every instructor prepares instruction material according to which she conducts the classroom activities.

Instructional material has a plan of the sequence of activities first, has a plan first, and we will call it as a script. I am not coining the word script, but in today's international context, it

is being seen as a what do you call? The word used is learning design for which you have a script and then you write the dialogues.

So, instructional material has a plan of the sequence of activities, which you are calling it a script and then how these activities are going to be executed or detailed out, you can call them as dialogues. So, instructor has the freedom to write the script while we use the word script, but the instructor has complete freedom to write the script of each instructional unit.

And the script for each instruction unit need not be similar. It depends on the nature of the topic that is being addressed in that particular course outcome. The framework within which script is written is called instruction design. We talk about that in later units. And there are any number of instructional design frameworks. We are not going to elaborate on all of them, but some of them we will explore in the later units.

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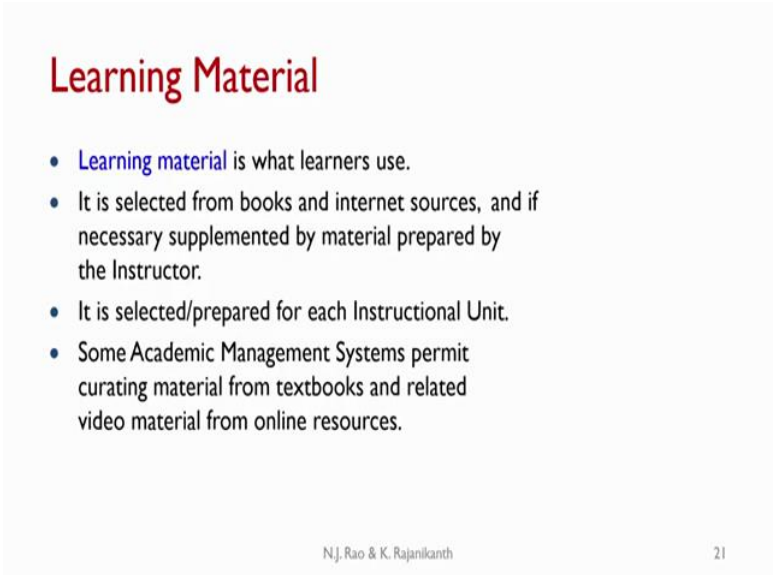

Learning material, to understand it is easy. Learning material is what the learners use. While listening to the teacher, the learner has to have material which he can make use of it at home to kind of ensure that he understood everything that has been presented to it so normally it consist of material selected form identified textbooks are internet sources and if necessary, supplemented by material prepared by instructor.

That is all the learning material. And it is also selected or prepared for each instructional unit. And these days if you have any of the academic management system, they also permit curated material from textbooks and related video material from online resources, specifically, what do you call pieced together by the teacher from the internet sources. So,

that is a great advantage but provided you have the corresponding academic management system.

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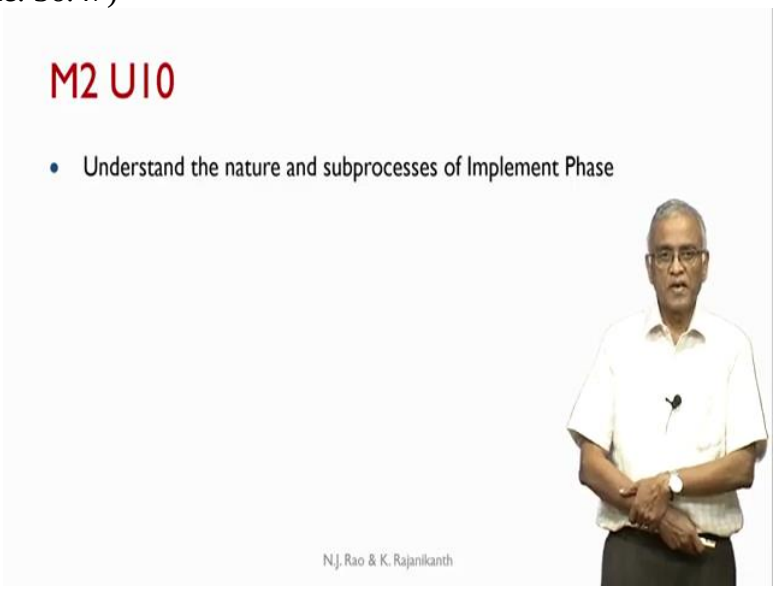

So, that is about the development phase, where ascent the final output of development phase is instructional material and the learning material. It takes considerable time obviously, but these are the two outputs of development phase. And in the next unit, we try to understand the nature and sub process of implement phase which is the fourth phase of ADDIE. Thank you very much for your attention.