NBA Accreditation and Teaching - Learning in Engineering (NATE)
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Lecture 39 - Instructional Components

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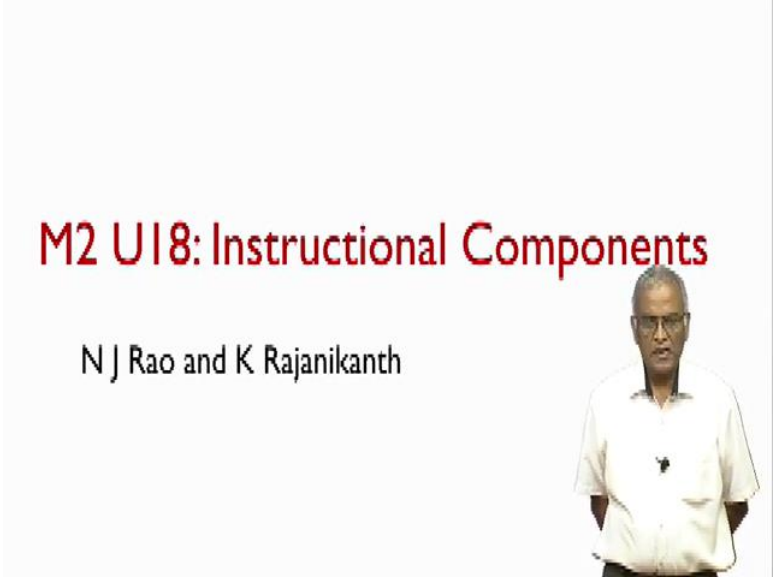

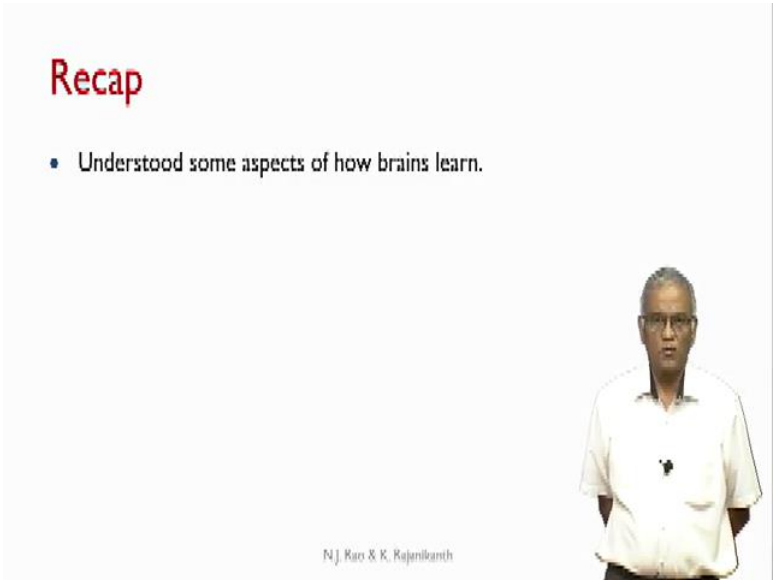

Greetings and welcome to NATE, Module 2, Unit 18 related to Instructional Components. In the earlier unit, we tried, we understood a few aspects of how brains learn. We only looked at three or four small activities that can facilitate learning, which are based on our understanding how brains learn.

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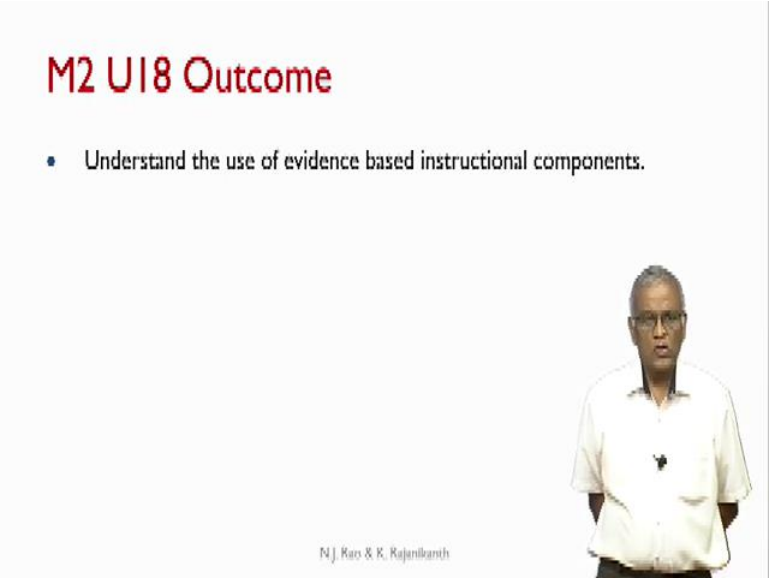

Now in this unit, we try to understand the use of evidence based instructional components. First, let us define what instructional components are.

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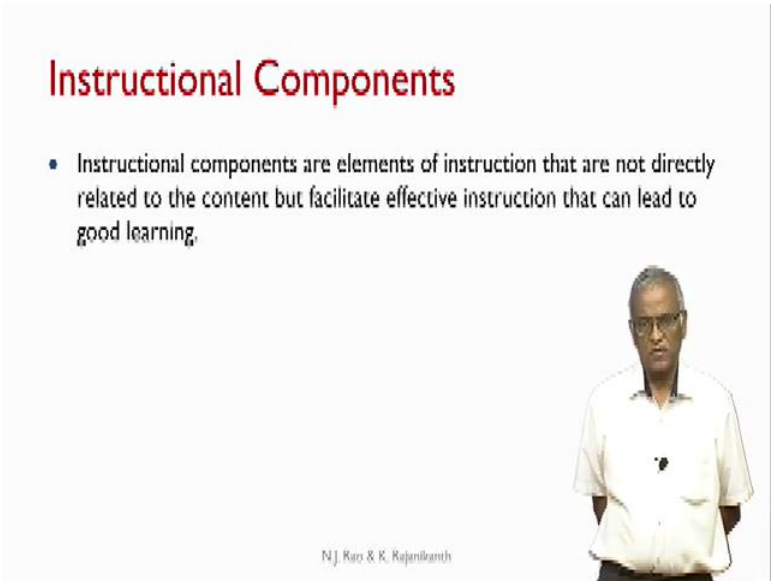

Instructional components are elements of instruction that are not directly related to the content, but facilitate effective instruction that can lead to good learning. So whatever instructional components that we are going to look at, they are not specific to any particular content, means that they are not specific to any discipline, nor a subject matter. And to take a simple example, we draw graphs to show relationship between two variables, we draw graphs.

And drawing a graph facilitates for us to get a picture of what is a relationship between two variables irrespective of the subject matter. So, you can say drawing a graph is one instructional component, which all of you are familiar with. So, we look at such instructional components and try to, and some of the instructional components that we are going to look at, they are evidence based, that means extensive fieldwork is done. And it was established that using these instructional components do make a lot of difference to the quality of learning.

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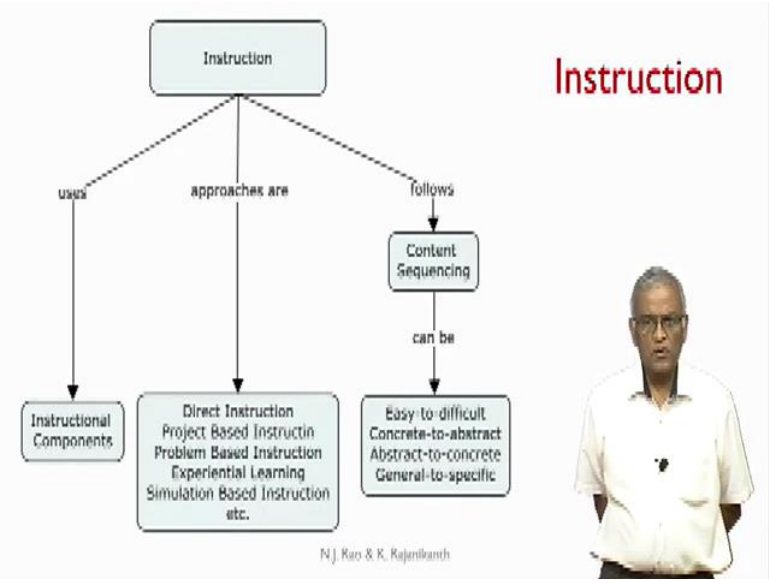

Now, looking at where exactly these instructional components come in the broad what you call area of instruction, as we have seen earlier, instruction uses instructional components and we have instructional approaches are like direct instruction, project based instruction, problem based instruction, experiential learning, simulation based instruction and some of these approaches we will be exploring in the following units. And instruction also follows a certain type of content sequencing.

East to difficult, concrete to abstract, abstract to concrete, general to specific, the choice of content sequence, sequencing will depend on the kind of students that you have or the preference of the teacher and sometimes the nature of the subject. These things we will not be exploring in this course. But we will look at the instructional approaches and now we look at instructional components.

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Now, these are some of the instructional components, whatever that has been indicated, most of them are field tested and were shown to make a difference to the quality of learning. They are arranged in alphabetical order, we are not going to deal with all these elements, we will pick some and explore how they can be used and why they are used and maybe many of you are already familiar with them in various contexts.

You have advanced organizer, analogies, authentic tasks, coaching, collaborative work, cooperative work, demonstration, elaboration, examples or non-examples, feedback, goals and feedback, independent practice, peer tutoring, personalization, preview, reciprocal teaching, reflection, guided practice, teamwork, etc. You can add many more or you can invent your own.

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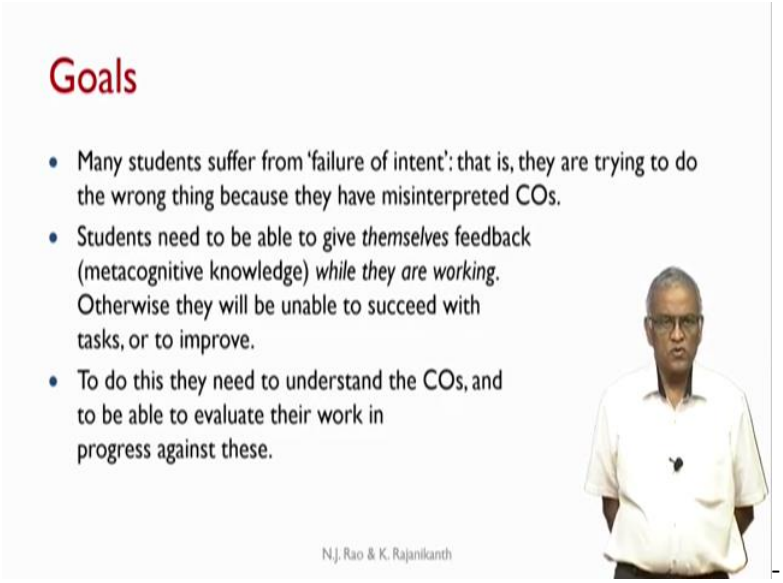

Now we look at a few important ones. Let us start with goals. That is every student must work towards a goal. And the goal should be very clear to him. Many students suffer from failure of intent. That is, they are trying to do the wrong thing because they have misrepresented or misinterpreted the course outcome. That is, if I have understood my course outcome wrongly, then I am working towards that, means there is a failure of intent. My goal itself is set wrongly, then obviously, I will not reach the correct goal.

So what happens, students need to be able to give themselves a feedback while they are working. So they have to explore on their own whether they are trying to go towards the correct goal and this kind of thing is called metacognitive knowledge. Good performers, performing students have good metacognitive knowledge and normally, they do not misrepresent the course outcomes. So, the teacher's role is to find, to kind of understand that the student is misrepresenting the course outcome.

And you have to facilitate the students to understand the current COs and be able to evaluate their work progress against these. That is, one can talk about the goal itself and possibly set some milestones kind of thing. And you can say, you can give you can plot to what extent the student has achieved the goal.

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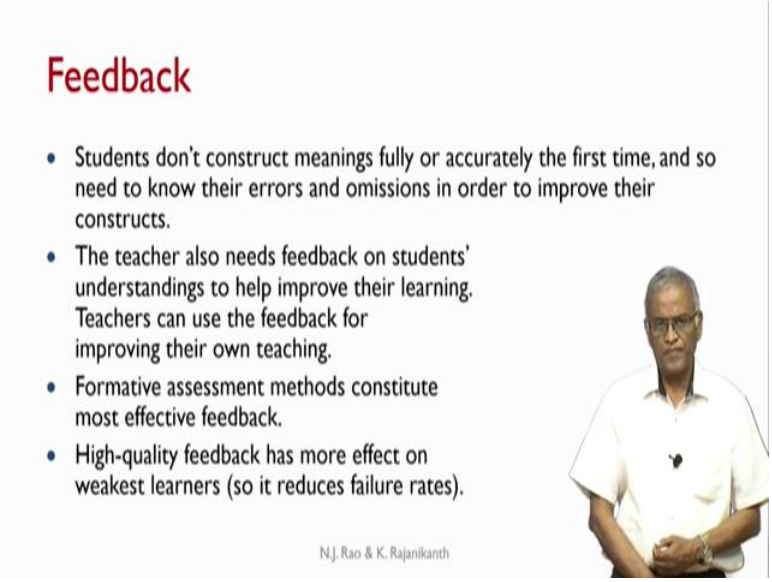

And something connected with this goal itself is a feedback. Students do not construct meanings fully or accurately the first time, that is true of anyone. And so need to know their errors and omissions in order to improve their constructs. So if I am not constructing the meaning properly and the somebody will have to give feedback, it could be a peer feedback, or it could be teacher feedback. And the teacher also needs feedback, this kind of feedback on students' understanding to help improve their own learning.

And teachers can also use the feedback for improving their own teaching as well. So the feedback can be used for learning as well as teaching by the teacher. And generally, formative assessment methods constitute the most effective feedback. That is, you give some kind of a quiz and from the response to the quiz, you try to find out at what level there is a misunderstanding or inaccurate representation of the meaning of the course outcome. And high quality feedback has more effect on weakest learners.

So, what one should be doing is, when your the feedback should be given to weakest learners rather than only listen to the best students and if they give the correct answer, I kind of move on. So, if you want to help weakest learners, you should be able to make arrangements to give high quality feedback to the students.

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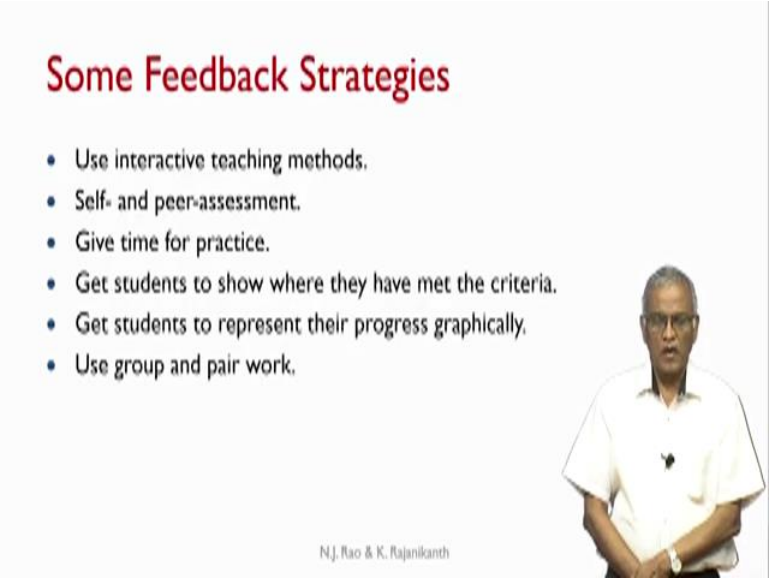

Some feedback strategies that you can use. Use interactive teaching methods, self and peer assessment, give time for practice, get students to show where they have met the criteria, because you cannot merely say that you are doing something wrong here, but you should also give feedback how far they were correct and from what point they are actually deviating. Get students to represent their progress graphically if you wish, and use group or pair work.

There are several such instructional, what you call, approaches that you can use. For example, use group and pair work, that itself is an instructional component. And where exactly do you use that? It depends on the situation.

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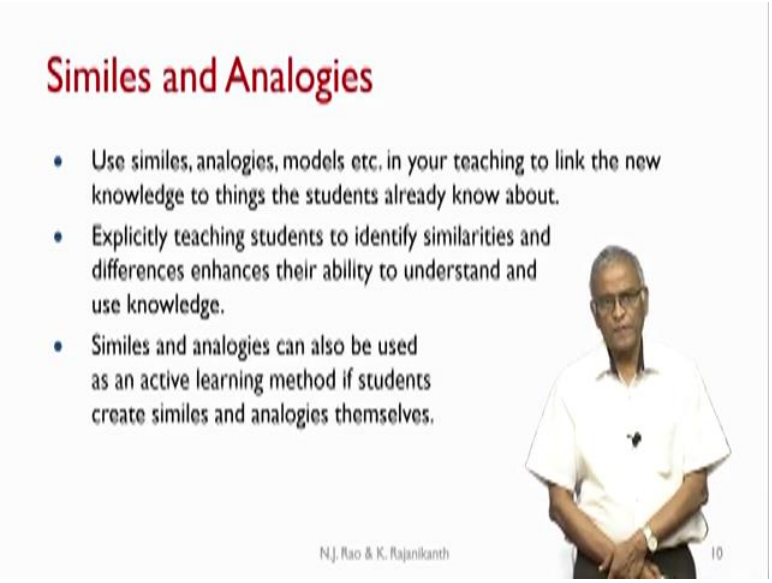

Now another instructional component is similes and analogies. Similes, analogies, models and such things in our teaching, they link the new knowledge to things that the student already know about. See, one of the things the way the brain learns is it tries to link the new information to already what the brain has inside. And if it is not able to link to the whatever knowledge that was constructed by the brain or mental model that was constructed by the brain, then the new information will stay in isolation.

And it possibly is available to you only as information recall for a limited period, but not actually using it in practical situations. So one of the methods that will help for the new information to get a link to what is already known is, one method is using similes and analogies. And these can also be used as an active learning method and it is like this, either the teacher can facilitate the students to identify similarities or differences, just identify, provide something else and say what are the differences between these two or what are the similarities between the two.

Or still a better method is if each student can build or identify their own analogies or create similes and analogies. Okay, so, this is one way of the, it is a very effective method to link new information to the existing body of knowledge that the student already has.

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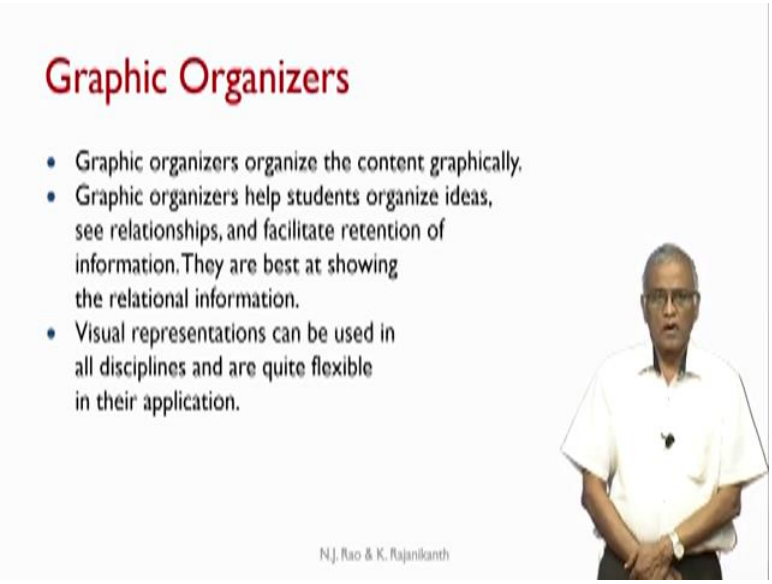

And then come another instructional method, graphic organizers. This all of you must be knowing many times by just drawing a picture, however bad or good it is or drawing a graph or putting a table, one can understand things much better. So the graphic organizers organize

the content graphically, that is all. And graphic organizers help students to organize ideas, see relationships, and facilitate retention and retention of information.

And graphic organizers are best at showing the relational information. And this kind of method, instructional method or sorry instructional component can be used in all disciplines, whether it is history or physics or sociology or an engineering subject, they can all be, in every place they can be used.

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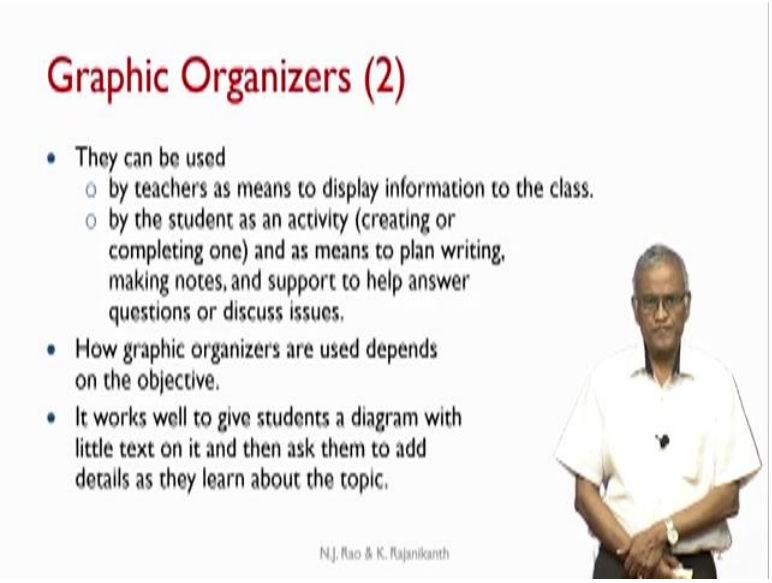

And for example, they can be used by teachers as means to display information to the class, like you draw a graph on the board or write, put a table on the board or if there are other tools that are available, you can also use that using a computer and projecting it. Or it can also be used by the student as an activity and as a means to plan writing. For example, a student can create his own graphic representation of the information, that is one way of internalizing.

And also it can, graphic organizer can be used for planning, writing, making notes and supports to help answer questions and discuss issues. There are, for each type there are open source tools are available. And how graphic organizers are going to be used will depend on the objective and preference of the teacher as well. And one way to do is you present a graph, a diagram either on the, using any of the Internet devices the students use, or draw a diagram on the board, but with little text, and ask the students to keep filling it up.

If they are able to effectively fill it up, that means they are learning better. That is one way of half finished graphic organizer can be used as an effective learning tool.

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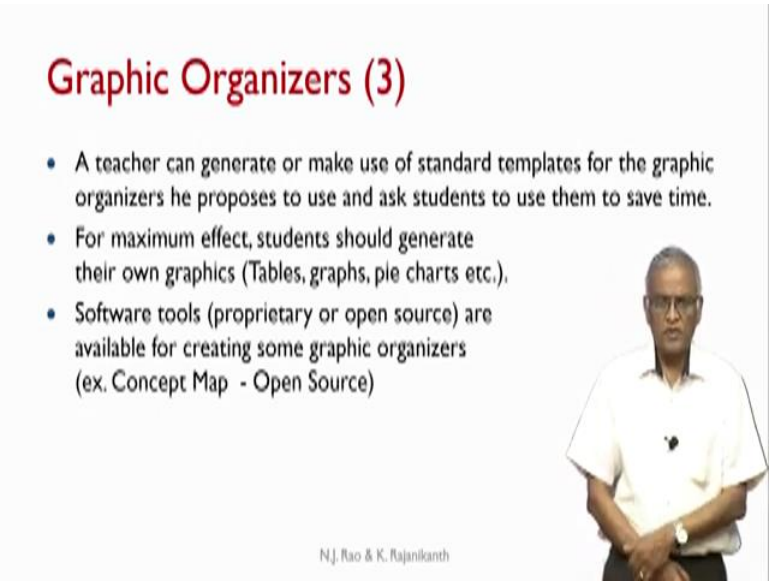

So one way to do is you make use of some standard templates. And a teacher is proposing to use and ask the student to use them to save time. Instead of trying to draw continuously these diagrams, you can use some templates in which you start filling it up. So the student is creating his own graphic representation of the information that is being given by the teacher. And still better is, you do not tell him exactly using a specific template, you ask the student to graphically represent, let the student choose whether he wants to use a table or graph or pie charts or anything like that.

And there are software tools, both proprietary and open source, are available for creating such graphic organizers, example that we have already dealt with this Concept Map, which is an open source tool.

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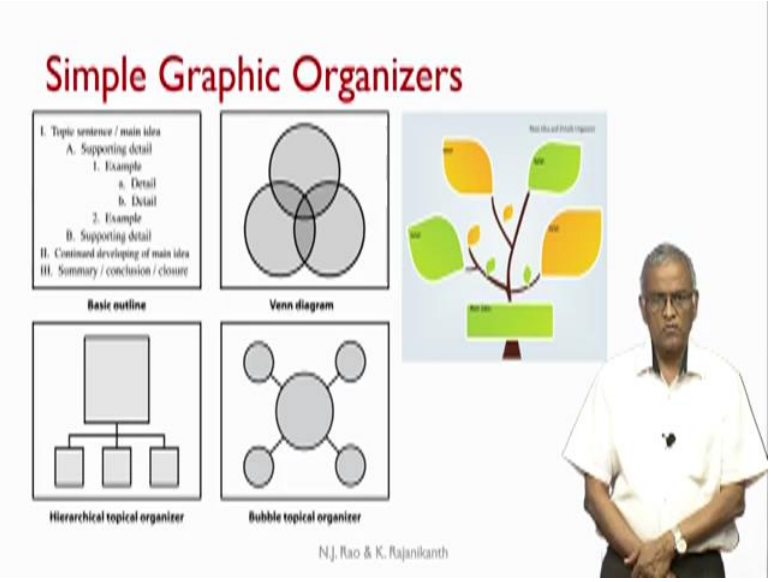

So, these are simple graphic organizers, like your Venn diagrams or something like a tree diagram if you want to make it look interesting, or a bubble topical organizer, or a hierarchical topic organizer, or just text which is organized in a hierarchical fashion. So any of these simple graphic organizers can be used by the teacher as well as the student. It does not have to happen in the class, student himself while he is reading back at home or in the hospital, he can make use of this kind of tool to record his own understanding for his own benefit.

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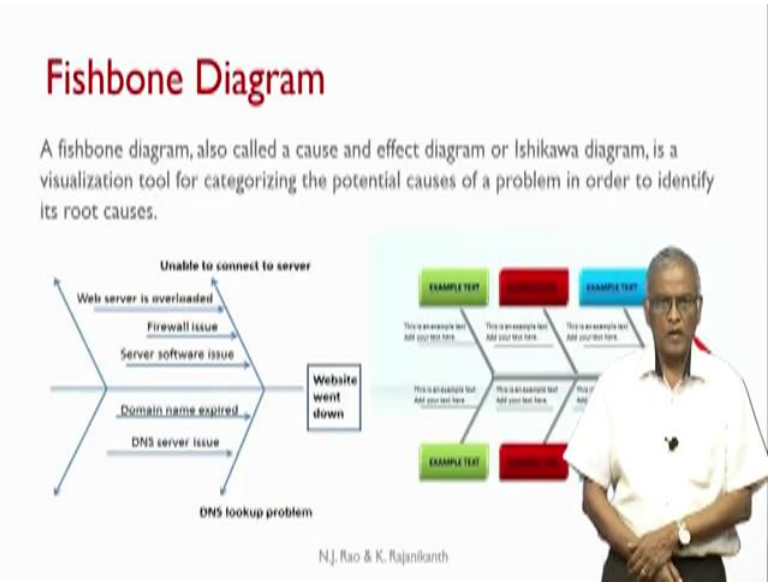

Now, this is another one which is used by several, it is called fishbone diagram and also called Cause and Effect diagram, or it is attributed to Ishikawa, it is called Ishikawa diagram.

So what do you have here? It is a visualization tool for categorizing potential causes of a problem in order to identify the root causes. So, here if you look at the example is website went down, and then you start identifying the major causes, unable to connect to server or DNS lookup problems.

And this can happen because of several possibilities, same way, this can happen because of several, these are the all possibilities. Besides these two, if you have other issues, again, you can keep adding it like this. So your fishbone diagram can be expanded this way. Is it a generic one, and you can start filling it up and make it look like this. Then you know to organize based on this, either you follow certain sequence of steps or develop your software tool for that.

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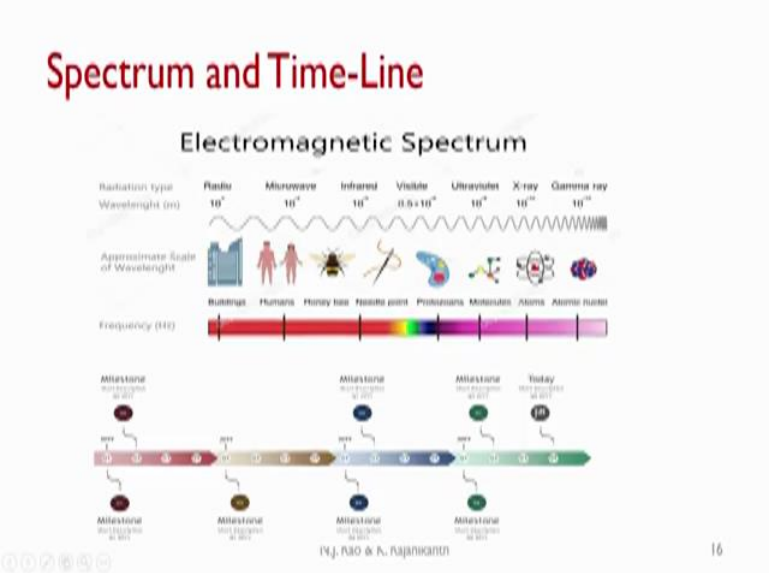

Another way, what we call spectrum or timeline that you want to do, it is a little graphical method, it makes it look interesting, electromagnetic spectrum from one end to the other. And similarly, here a similar timeline kind of thing can be drawn here, that is you have series of activities and then you have milestones. When you say milestone, you write in that what is a milestone that you are expected to achieve.

If you are starting here, then you keep on identifying these milestones and go over to this and finally you reach your goal. This is another simple graphic tool that one can use.

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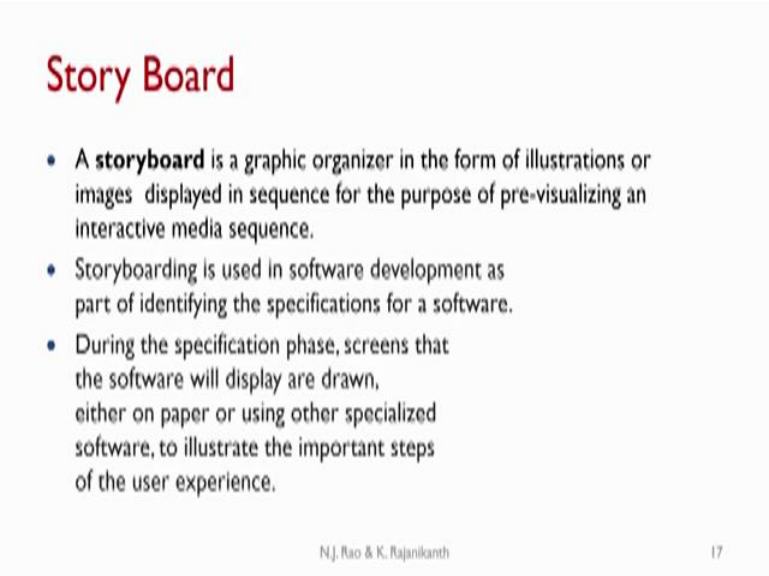

Yet another instructional component is storyboarding. A storyboard is a graphic organizer in the form of illustrations or images displayed in sequence for the purpose of pre-visualizing an interactive media sequence. And storyboarding is used extensively in many of the corporate training programs or even at a lower end, what you call, training the mechanics or somebody who is required to do a kind of a routine type of activity, they can be effectively utilized.

Storyboarding is also used in software development, as part of identifying the specifications for software. So what you do, during the specification phase, screens that software will display are drawn. Mostly, obviously, when you are working for a software on the screen, and using other specialized software to illustrate the important steps of the user experience. So storyboarding is also fairly standard one, if you are even getting trained for corporate training itself.

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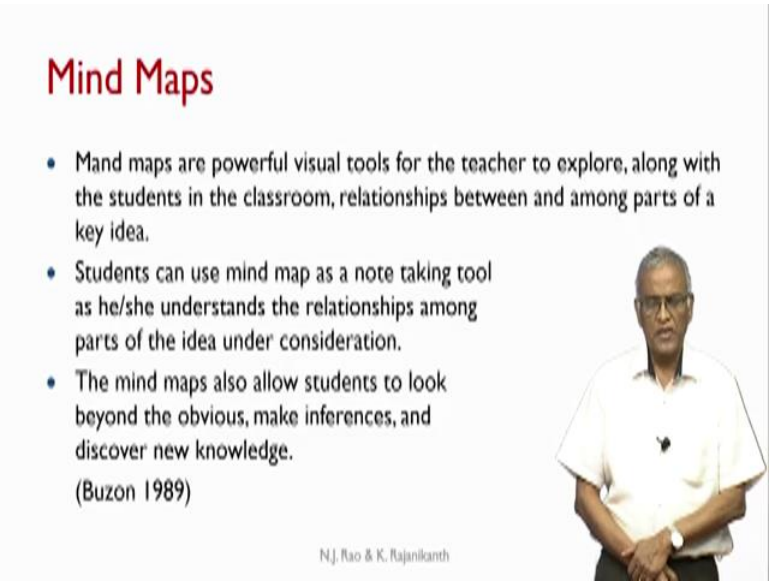

Then you have another tool called Mind Map. Mind Maps are powerful visual tools for the teacher to explore along with the students in the classroom. Like if you want free association, and explore all kinds of implications about it, many of them may not be exactly fall into the same category. So it is a kind of a free exploration of a relationship of one to the other. And students also, what can as a teacher explains something, they can write their own mind map the way they understand the relationship between one entity to another entity.

And these as claimed, it can be also effectively used. They allow the students to look beyond the obvious. If something strikes, if you are able to put it on to the, in a form of a mind map, yes you can explore that, you can think beyond what has been presented to you by the teacher.

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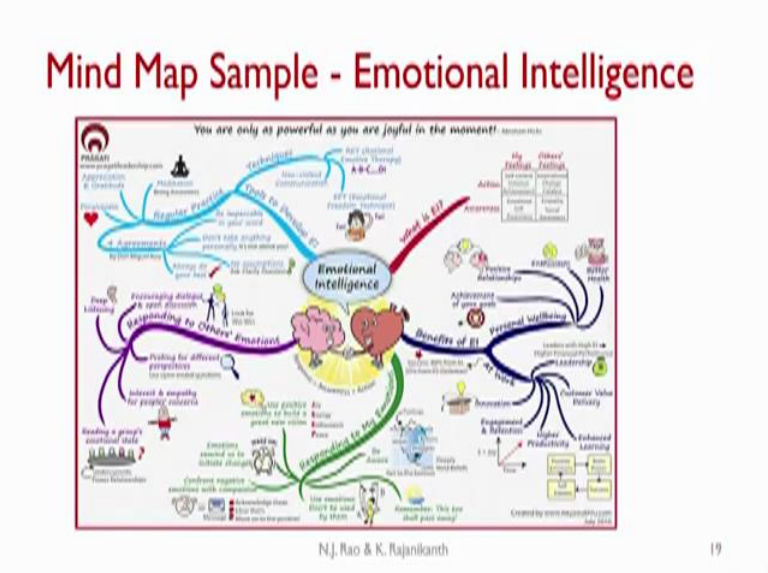

Now, this is one what you call sample that is available on the Internet. If you look at that, this is related to emotional intelligence, we will, we do not get much chance, we are going to look at the emotional intelligence that is belongs to the affective domain. Here emotional intelligence here, for example, we are looking at how do I respond to others' emotions, and how do I manage my own emotions, what are the benefits of emotional intelligence, and what is emotional intelligence at all.

What is EI and tools to develop EI? See, first level, you are trying to say what is the EI. And why should I, why am I concerned with benefits of EI? And then how do I develop my emotional intelligence? Once I develop, how do I manage my emotions and how do I understand others emotions? And in that, you keep thinking about it, you keep discussing about it and keep on building the various tracks of this. So, this is one powerful way of identifying all the issues related to emotional intelligence.

So, mind map is a powerful tool to kind of identify all the issues related to either one concept or an issue.

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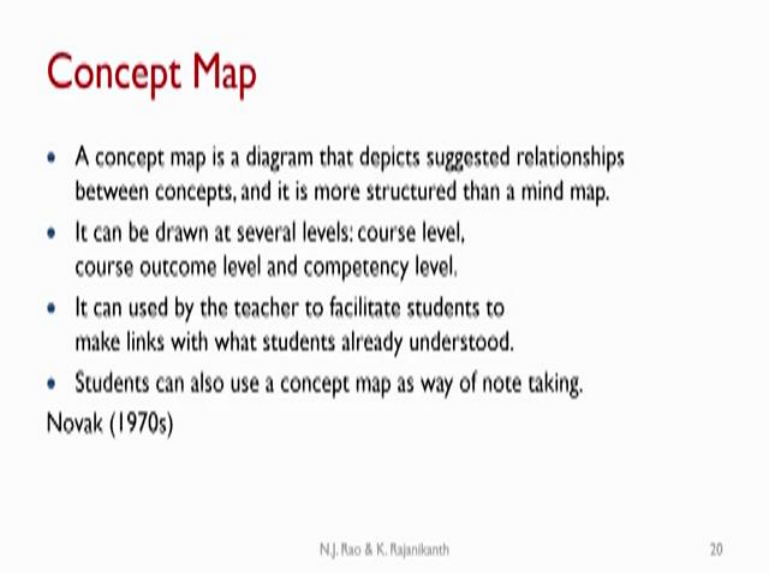

The other one is also a concept map, is also another graphic tool. The concept map as we have already dealt with it in the course design part of this course, it is a diagram that depicts suggested relationship between concepts and it is more structured than the mind map. And these concept maps can be drawn at several levels, at course level, course outcome level, or even a competency level. It can also be used by the teacher to facilitate students to make links with what students already understood.

I can draw the concept map in such a way, I bring some concepts from the earlier lessons or earlier course outcomes and whatever I have learned there, in what way the present one is linked to that I can show that linkage in a concept map. And students also, like mind map, they can use it as a way of note taking. This is due to Novak and it is still it is an open source tool as we have mentioned, it can be used to really draw your own concept maps.

If you like this, I personally like this tool very much. And it can depict all aspects of a course from a conceptual concept perspective.

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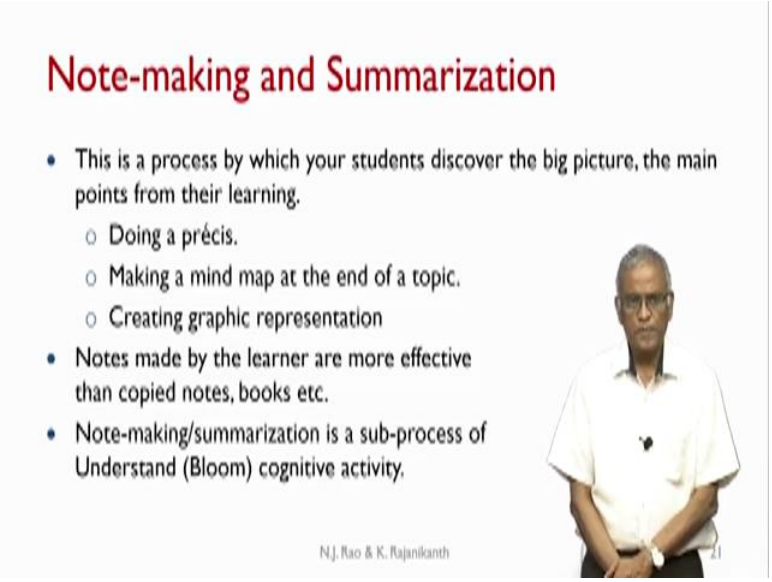

Now, another instructional unit is note-making and summarization. This is a process by which students discover the big picture, the main points from their learning. Let us say instead of copying what the teacher is writing on the board, you can write your own summary. Or you can not, while the teacher is teaching, teacher can ask them to draw a mind map of what they have understood or create your own graphic representation at the end of a presentation rather than while the teacher is teaching.

Or you make the notes, you can ask the students to make their own notes in a small way than copied notes or books. Like you listen, when you have your memory is fresh from what we have learned, can you write a few sentences about what we have learned, that is what we call note-making. And note-making or summarization, if you recall, is one of the sub-processes of understand cognitive activity as per Bloom.

So if you are able to effectively make notes on your own without copying what is already given on the board, then you are going, you are moving towards understanding. So it is also a fairly powerful tool to improve your understanding of the subject.

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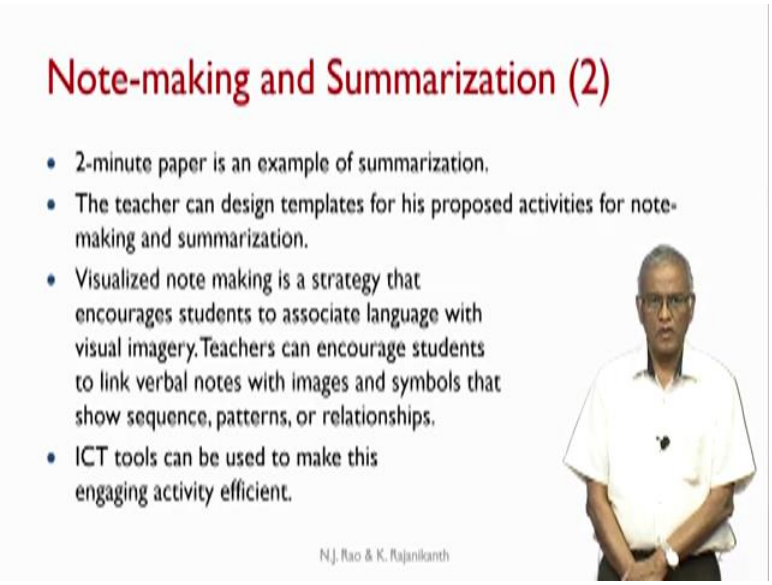

So what are the types of thing? 2 minute paper is an example of summarization. The teacher gives just 2 minutes to students to write something, whatever they have understood, not more than that. And teacher can also design templates for his proposed activities for note-making and summarization, give a template and ask them to fill it up. So you are structuring, you are kind of forcing certain method of doing it.

And visualized note-making is a strategy that encourages students to associate language with visual imagery. That is, you give a template, half finished template, and then start writing the text inside the template. And for all this, you have plenty of ICT tools, if you can use them. And teacher can explore whatever ICT tools that are appropriate for his subject and as per his preference, then you can make the engaging, students' engagement with the knowledge a lot more effective. And tools make the engaging activity more efficient.

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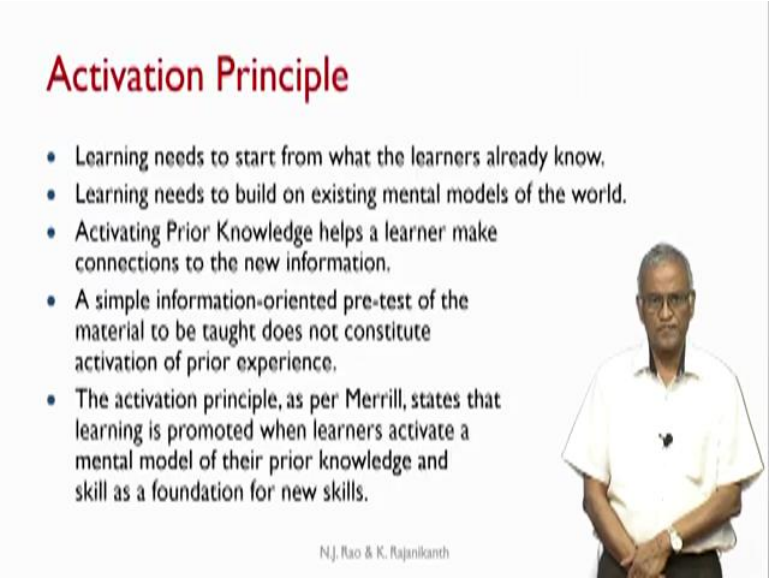

Then there is another important one, which will be explored more later, it is called activation principle. The learning needs to start from what the learners already know. So the starting point for teaching anything is to start from what the students already know and build on that. So, learning needs to build on existing mental models of the world. But what happens, existing mental models of the students are not the same for all. So the teacher will have to slightly elaborate on this, that means you have to start at multiple starting points.

And hopefully, a few of them will kind of subsume mental models of all your students. And by activating this prior knowledge, activating this prior knowledge is you have to really make the student, make connections to the new information. How do you do this? Simple information oriented pretest of the material to be taught does not constitute activation of prior experience. So, you have to bring your prior experience, debate about it and then see that you are building from what you have already understood.

So, simple quiz kind of thing may or may not help this particular activation principle. Now, activation principle as per Merrill, which will be, will be explored in the following units, states that learning is promoted, well, learners activate a mental model of their prior knowledge and skill as a foundation for new skills. So, they have to be able to activate their mental model, that is if it is dormant and they have done something either several weeks ago or maybe several courses ago, you have to somehow bring it into the active state from which you are building the links to the new knowledge.

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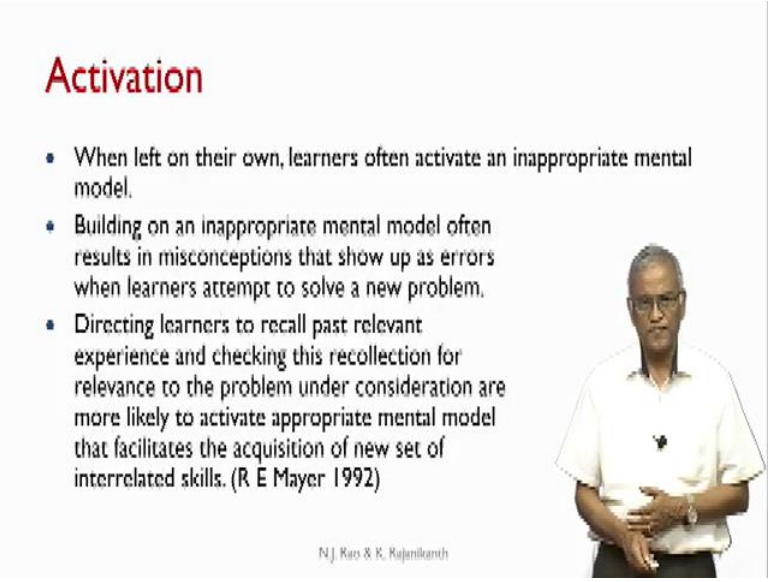

When left on their own, sometimes the students may activate in inappropriate mental model. He may be bringing something wrong and try to build on top of that. So, building on an inappropriate mental model will also lead to misconceptions and show up as errors when learners attempt to solve a new problem. So there is a possibility that the students do activate an inappropriate model. And directing learners to recall past relevant experience and checking this recollection for relevance to the problems under consideration, are more likely to activate appropriate mental model.

So the teacher not only has to make sure that the students do activate their prior mental model, but they also make sure that they are activating an appropriate mental model. You have to ensure that, that is what activation is all about.

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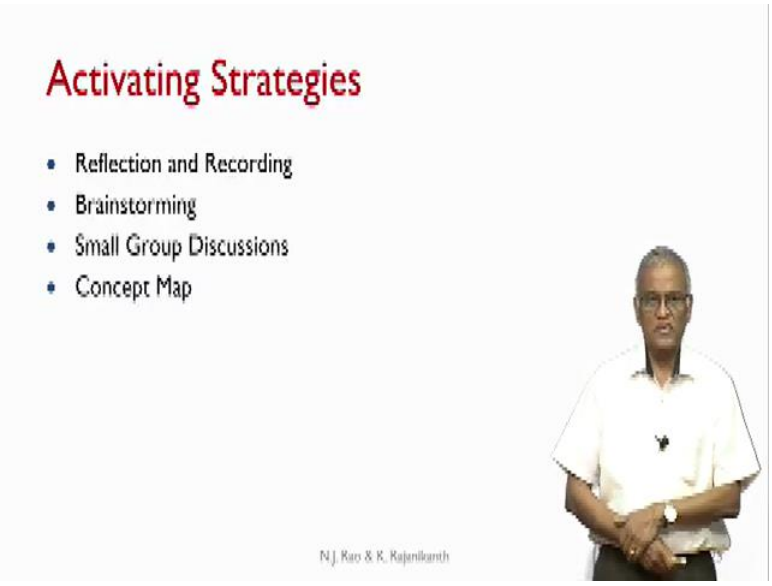

And some of the strategies for activation; reflection and recording, brainstorming, small group discussions, concept map. You can say all these 4 are also, you can call them as instructional components. So one instructional component can be part of another instructional component.

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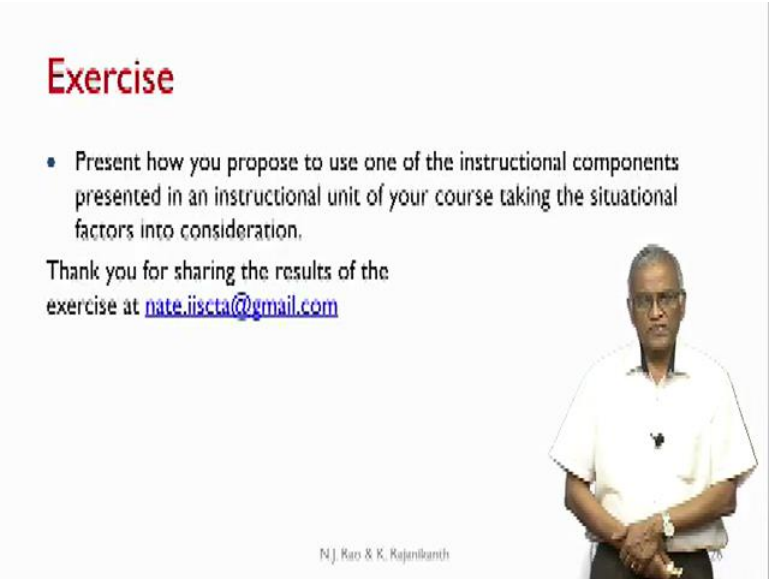
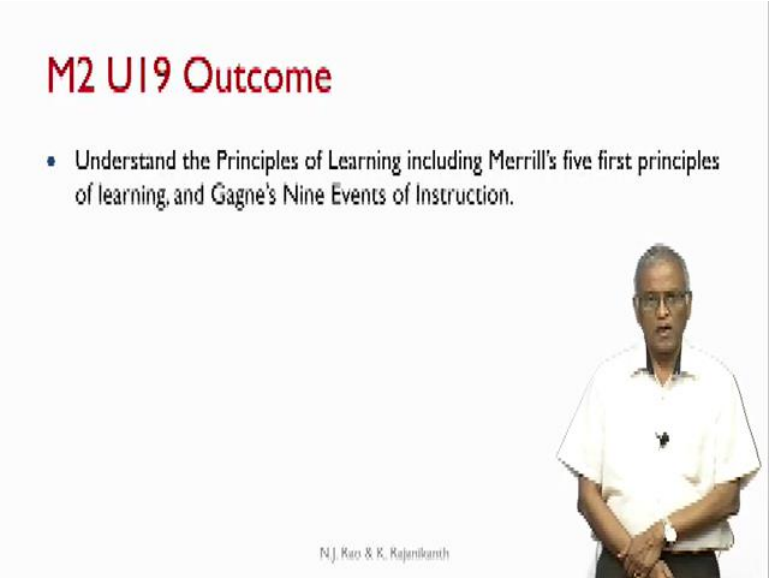


So we have seen a few of them, not all the instructional components. There is plenty of literature on the Internet. And we encourage you to kind of explore these instructional components and make or select your own, where you feel comfortable. And that to with respect to the subjects that you are teaching and with respect to the students you have. If you

can internalize and incorporate these instructional components into your teaching, you are leading to better, you are facilitating your students to learn better.

So as an exercise, we request you to present how you propose to use one of the instructional components which were presented in an instructional unit of your course taking the situational factors into consideration, your own situational factors, not hypothetical. Okay.

(Refer Slide Time: 33:08)



And in the next unit, we attempt to understand the principles of learning, including Merrill's five first principles of learning and Gagne's nine events of Instruction. Thank you very much.