NBA Accreditation and teaching- Learning in Engineering (NATE)
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Indian Institute of Science, Bangaluru
Lecture 41
Direct Instruction – 1

Greetings, welcome to module three, unit one on Direct Instruction.

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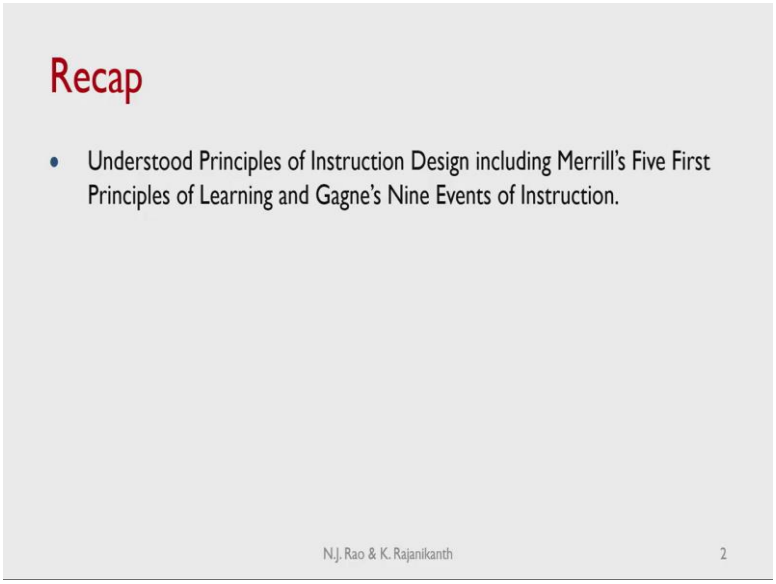

In the earlier unit, we understood the principles of instructions design including Merrill's five first principles of learning and Gagne's nine events of instruction.

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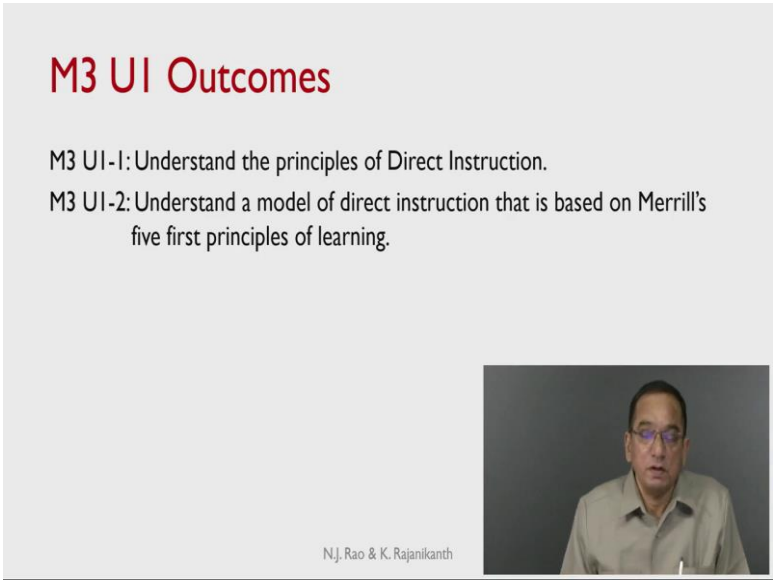

The outcomes for this unit are: understand the principles of direct instruction. Understand a model of direct instruction that is based on Merrill's five first principles of learning.

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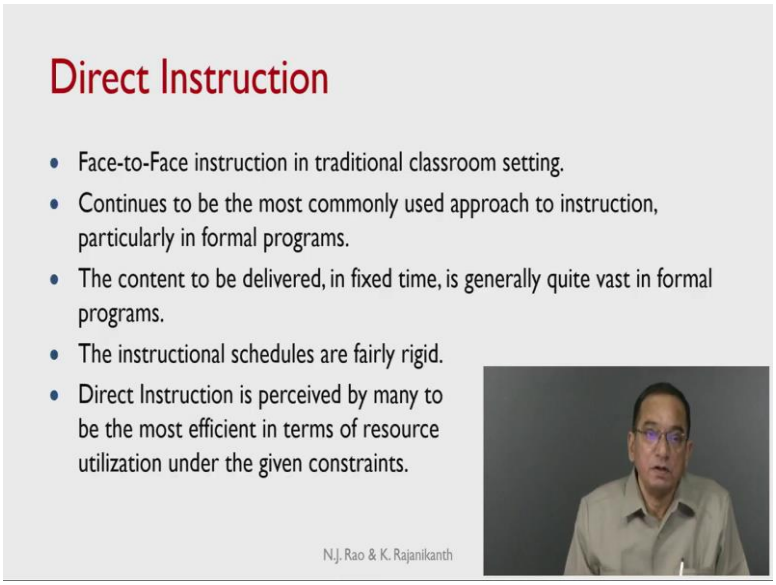

Direct instruction is face to face instruction in traditional classroom settings. Direct instruction continues to be the most commonly used approach to instruction particularly in formal programs. The content to be delivered in a formal program is generally quite vast. Further, this vast content has to be delivered in fixed time. The instruction schedules are fairly rigid.

These are the characteristics of a typical formal program, vast content, rigid schedules and fixed time in which the content is to be delivered. Direct instruction is perceived by many to be the most efficient in terms of resource utilization under the given constraints. Thus, direct instruction continues to be the most common and popular approach used by most of the teachers.

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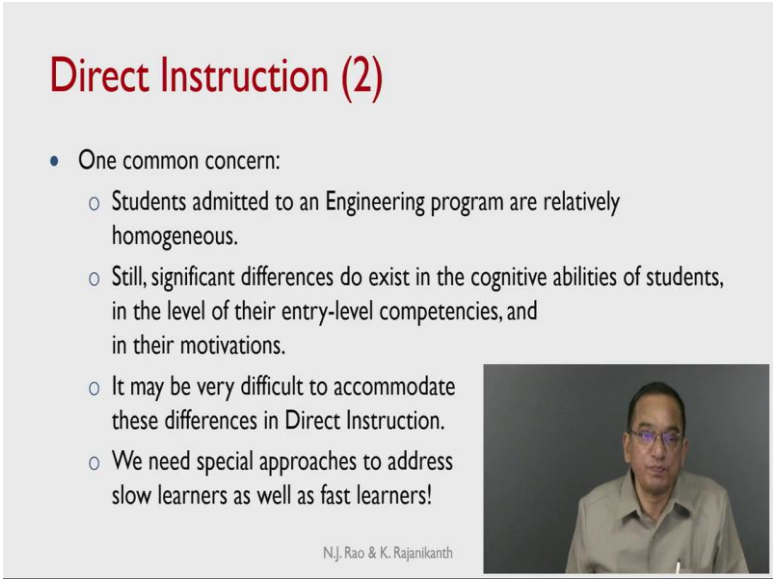

One common concern with direct instruction is as follows: Students admitted to an engineering program are relatively homogeneous. They are relatively homogeneous in the sense that they all have gone through similar kind of school programs. They all have completed the plus two education with specialisation in maths, physics, chemistry kind of subjects. At least they include these subjects and they have gone through similar kind of qualifying entrance examinations.

To that extent, the students are homogeneous. Still significant differences do exist in the cognitive abilities of the students in the level of their entry competencies and in their motivations. And direct instruction may not be very convenient way of accommodating such differences. It may be very difficult to accommodate these differences in direct instruction. Because direct instruction operates under very severe constraints of time and other resources. We may need special approaches to address slow learners as well as fast learners.

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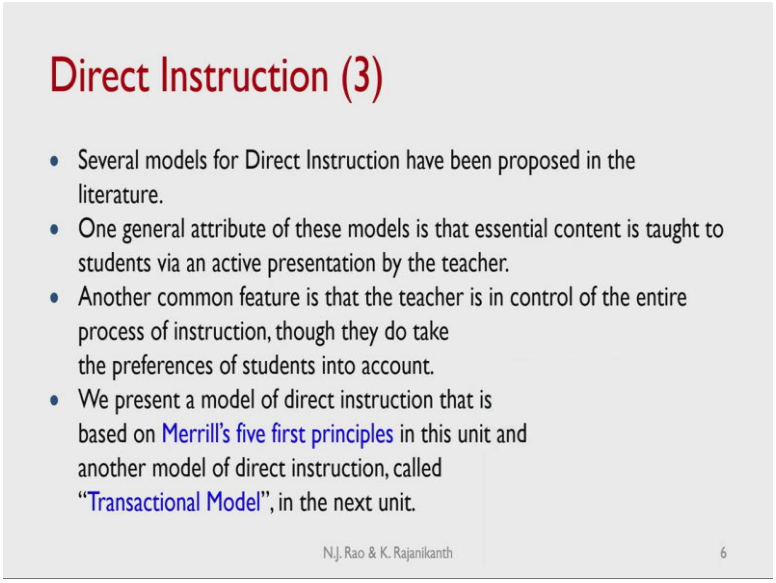

Several models for direct instruction have been proposed in the literature. One general attribute of these models is that the essential content is taught to students via an active presentation by the teacher. Teacher makes the presentation of the essential content to the students. Another common feature is that teacher is in control of the entire process of instruction, though the teacher may take the preferences of the students into account.

Teacher is in control of the entire instructional activity. We present a model of direct instruction that is based on Merrill's first five principles in this unit and another model of direct instruction called transactional model in the next unit.

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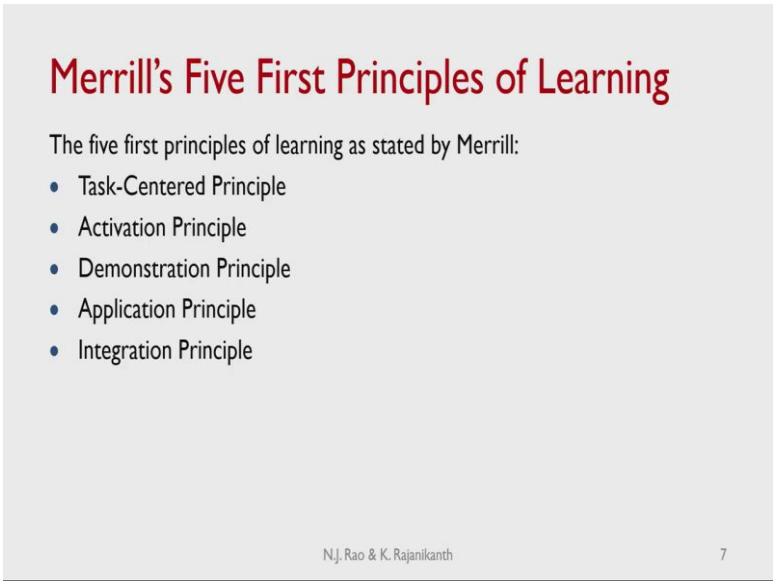

Recall that the five first principles of learning, as stated by Merrill are: Task-centred principle, activation principle, demonstration principle, application principle and integration principle.

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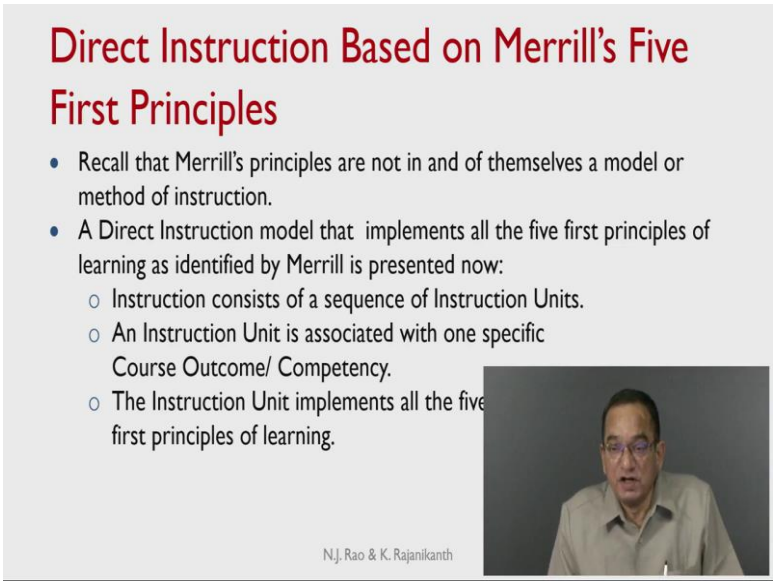

A model of direct instruction based on Merrill's first five principles of learning can be like this: Instruction consist of a sequence of instruction units. An instruction unit is associated with one specific course outcome or competency as the case may be. The instruction unit implements all the five first principles of learning. So, the basic unit of this model is instruction unit. One instruction unit is focused around one course outcome or one competency.

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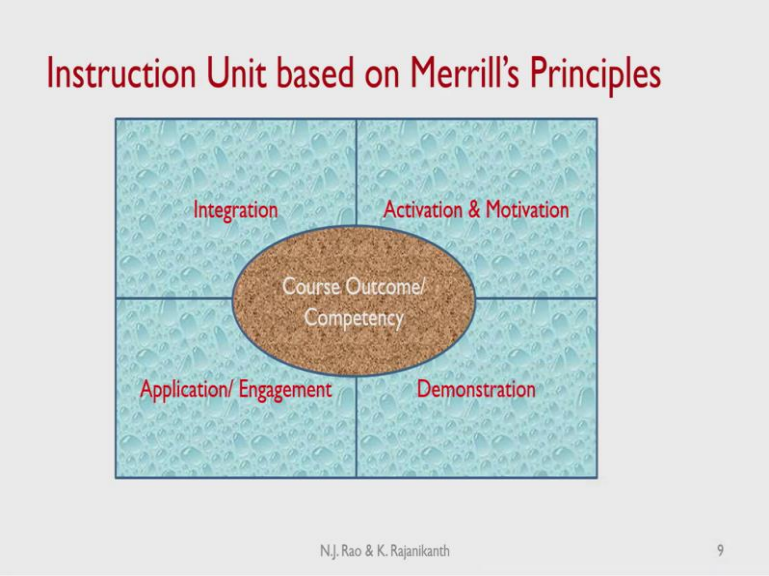

This graphically deputes this model. The course outcome are competency plays the role of the task. Around that the remaining four phases of the instruction are linked. The activation and motivation phase followed by demonstration phase, followed by the application or engagement phase, followed by the integration phase.

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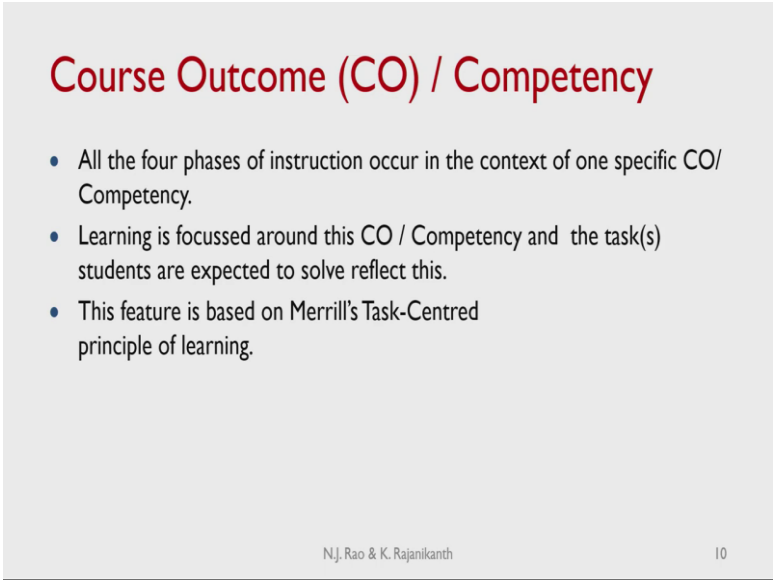

All the four phases of instruction occur in the context of one specific course outcome or competency. Learning is focused around this CO or competency; competency and the task or tasks students are expected to solve reflect this. This feature implements Merrill's task-

centred principle of learning. Here the tasks focused around the CO or competency with which the instruction unit is concerned.

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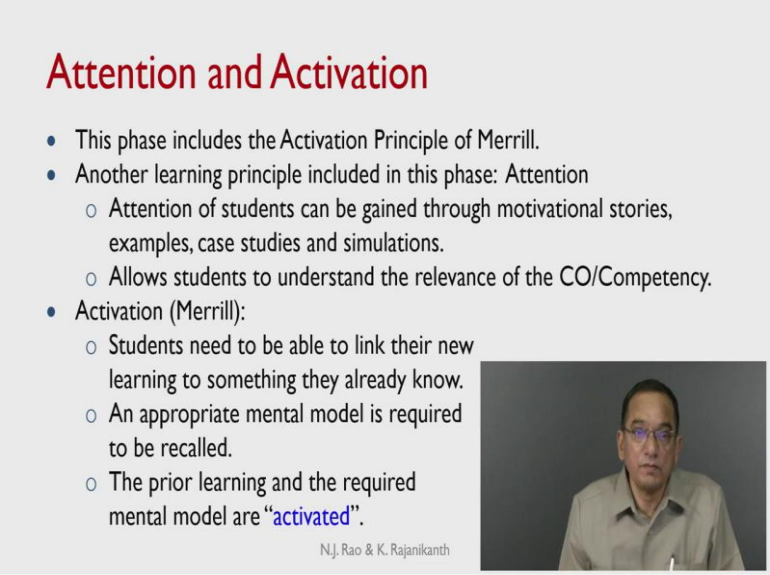

The first phase of instruction proper commences with the attention and activation phase. This phase implements the activation principle of Merrill but it also includes another learning principle called attention. If you remember, attention was one of the instruction events in Gagne's model also. Attention of students can be gained through motivational stories, examples, case studies and simulations.

Sometimes teacher can ask some questions which excites the students and that is another mechanism for gaining the attention of the students. Allows students to understand the relevance of the CO or the competency. Allows students to see the significance of this CO or competency for their professional career. So, this phase includes the attention activity.

This is followed by the activation principle of Merrill; students need to be able to link their new learning to something they already know. It must build on something which they already know. An appropriate mental model is required to be recalled. The prior learning and the required mental model are activated. Teacher help the students recall the appropriate mental model based on their prior learning.

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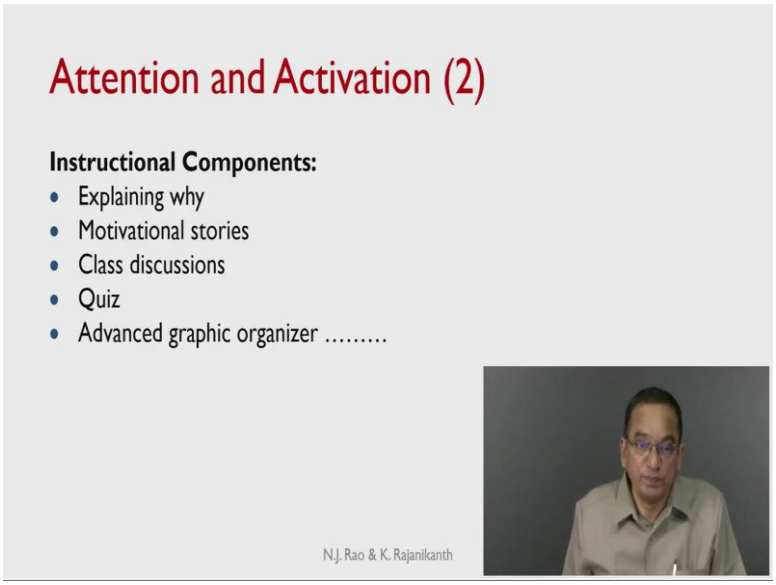

The instructional components which can be used for this phase of the instruction can be as follows: The teacher can explain why students must be concerned with this particular course outcome or competency. Teacher can explain the relevance of this competency for their professional career. Teacher can narrate some motivational stories. Teacher can organise a classroom discussion involving the particular CO or competency.

We can also conduct a quiz which makes the students recall their prior relevant knowledge. We can have an advanced graphic organizer which shows the structure of the prior learned content to the current competency. There can be several such components and in an earlier unit we already have seen the wide variety of components which are available to a teacher. Teacher can select appropriate components to implement this phase of attention and activation.

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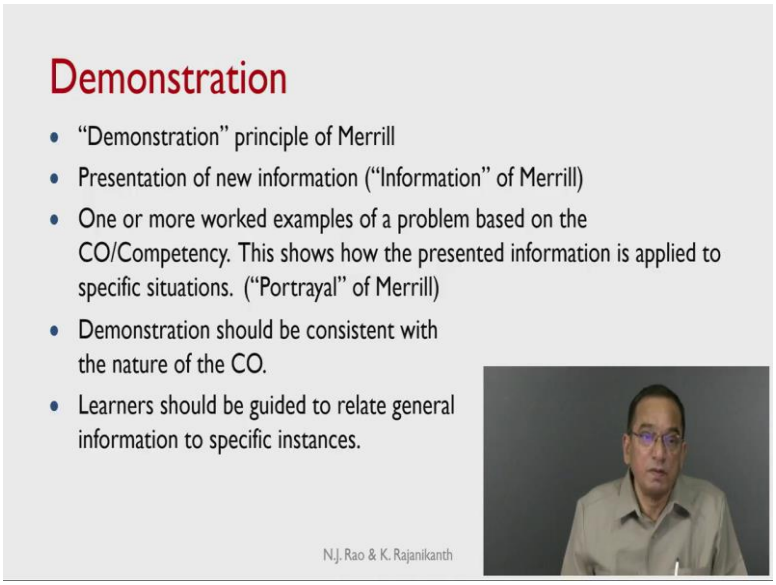

The next phase in this model is demonstration, this is the demonstration principle of Merrill. Presentation of new information what Merrill calls us information. One or more worked examples of a problem based on the CO or the competency. This shows how the presented information is applied to specific situations. This is what Merrill called us Portrayal. So, we have both the information and portrayal as presented by Merrill.

Presentation of new information and working out of examples based on the new information. Demonstration should be consistent with the nature of the CO. Learners should be guided to relate the general information to specific instances. The students must be able to remember the general information and also must have the competency to apply the general information to specific cases.

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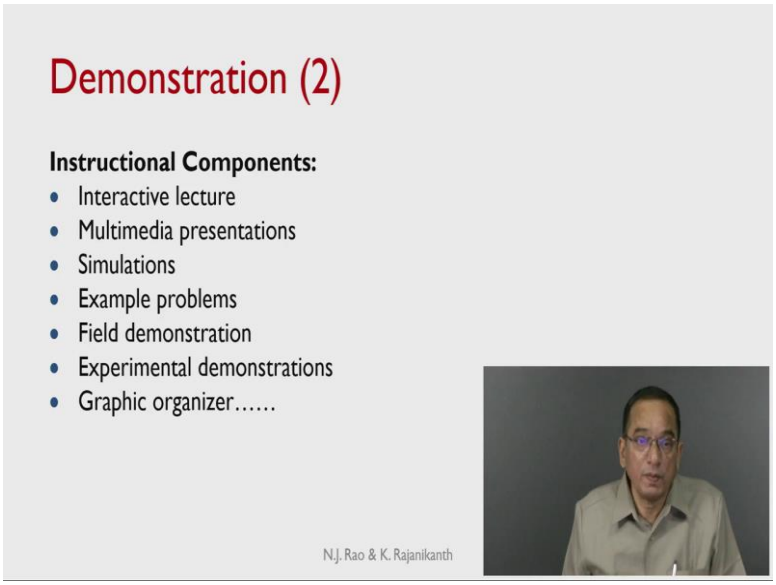

The instructional components that can be used for the demonstration phase are as follows: Plain lecture in a classroom, it can be an interactive lecture. A multimedia presentation is possible. Simulations can be used in the classroom. Example problems can be demonstrated. Students can be taken on a field trip to understand the new knowledge or competency that they are supposed to acquire and demonstrate. It can be an experimental demonstration. It can be graphic organiser. There are several other components which can be used during the demonstration phase.

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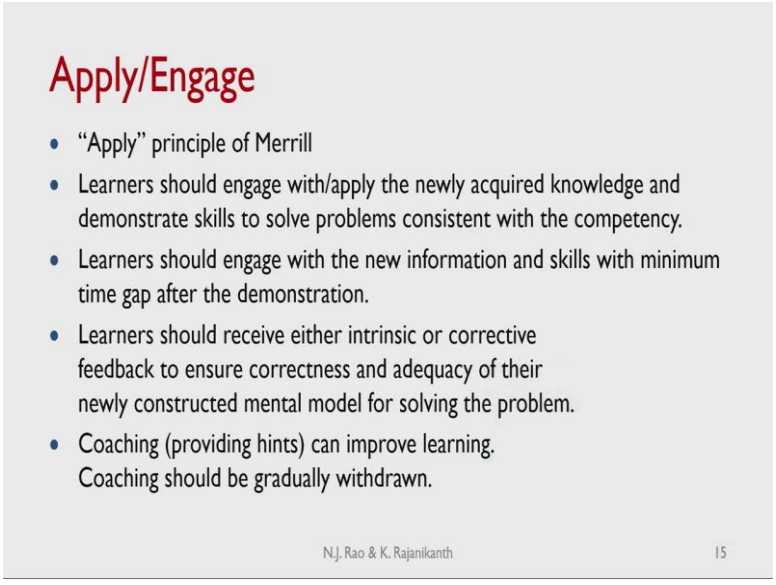

The next phase is the apply or engage phase. This corresponds to the apply principle of Merrill. Learners should engage with or apply the newly acquired knowledge and demonstrate skills to solve problems consistent to the competency. Learners should engage with the new information skills with minimum time gap after the demonstration. The time gap between the demonstration application should be as small as possible. So, learners should engage with the new information and skill with minimum time gap after the demonstration.

Learners should receive either intrinsic or corrective feedback to ensure correctness and adequacy of their newly constructed mental model for solving the problem. As noted in the earlier unit, providing corrective feedback is an extremely important activity to ensure good learning by the students. So, during this phase, teacher must provide corrective feedback to ensure the adequacy of their newly constructed mental model.

Coaching can improve learning, teacher can provide hints, teacher can provide some assistance while the students are applying or engaging with the new knowledge. Coaching should be gradually withdrawn. During the initial stages, when the students are using their new acquired knowledge to solve a problem, teacher can provide construable assistance. But as students' progress with the tasks in a sequence, teacher should gradually withdraw the coaching. Ultimately the students must be able to solve the problems all by themselves.

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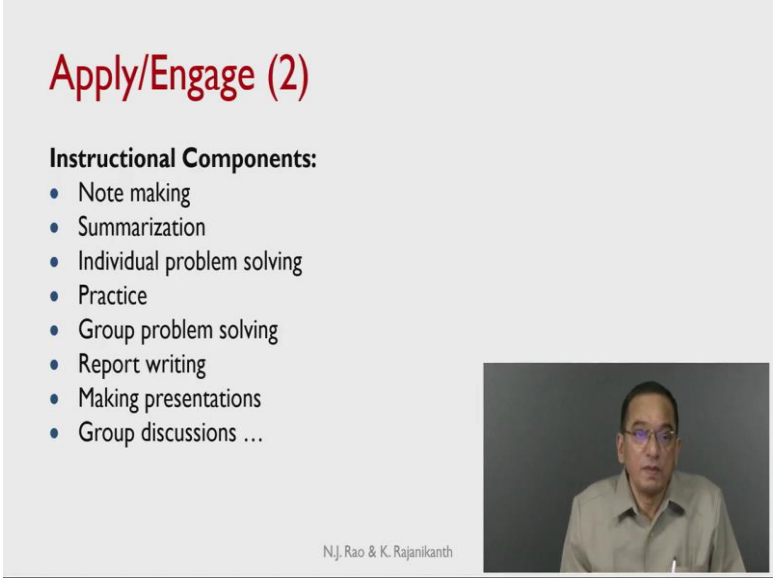

The instructional components can be: Note making, summarization, individual problem solving, group problem solving, report writing, making presentations, engaging group

discussions or practicing at home. A variety of instructional components are possible during this phase of apply or engage.

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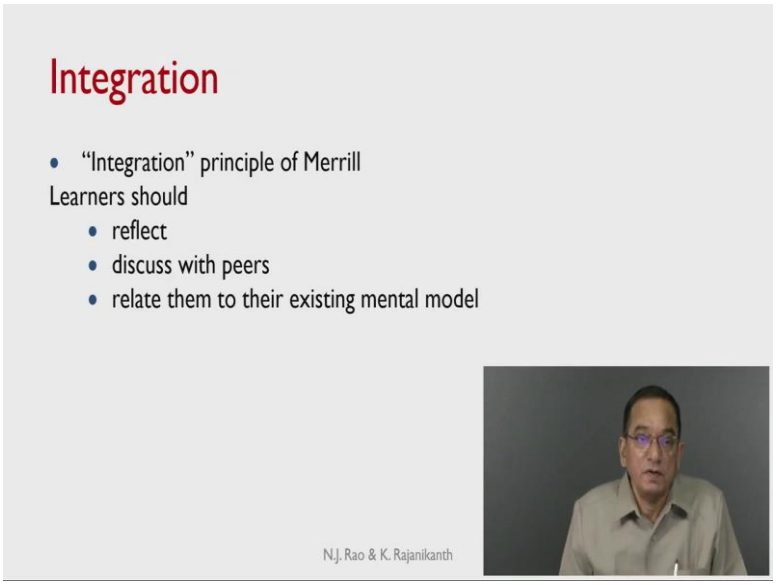

Then we have the phase of integration which is essentially the integration principle of Merrill. Learners should reflect on their newly acquired knowledge. Learners can discuss with peace about their newly acquired knowledge. Learners must be able to relate the newly acquired knowledge to their prior knowledge and integrate the new knowledge into their existing mental model. So, their mental model gets enriched with the integration of the newly acquired knowledge.

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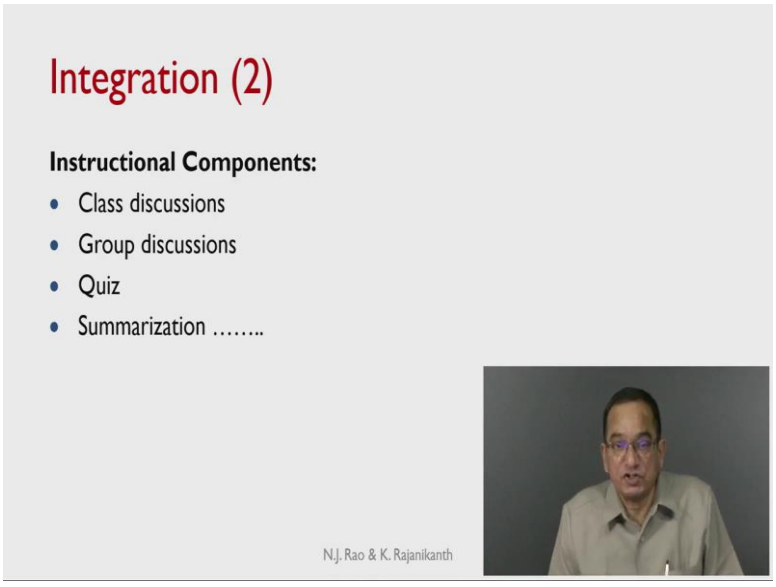

The instructional components can be again: Discussions in the classroom, there can be group discussions, teacher can conduct a quiz and students can try to summarise the entire leaning experience from the instruction unit.

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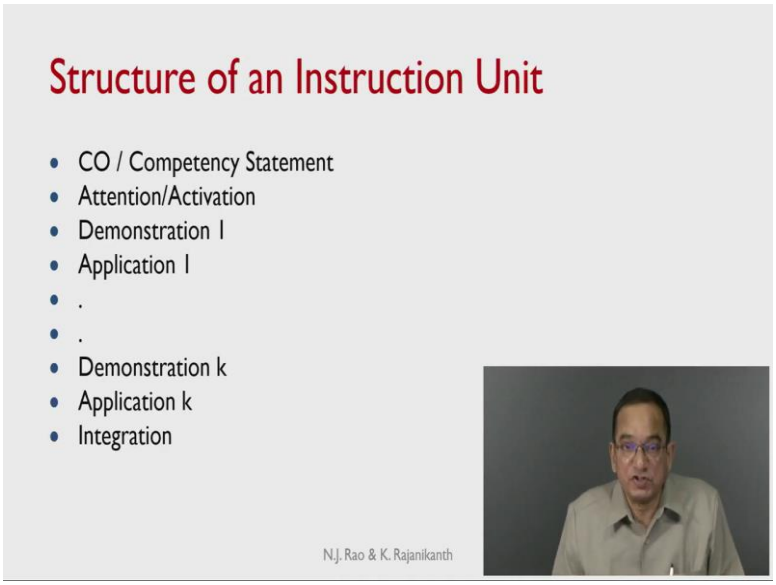

So, the structure of an instruction unit would be as shown here. Initially, we have a clear statement of what the students are expected to do at the end of the instruction unit that is an explicit statement of the course outcome or a competency. This is followed by a phase in which these students' attention is gained and their prior leaning is activated. The activation of the prior learning that is relevant to the current competency is an extremely important step.

So, in this phase, activation and attention happens. Then we have a series of (())(16:50) of activities. There is a demonstration by the teacher, followed by application by the students. And this sequence can be repeated as many times as required. That would depend on the specific competency or the outcome of this particular instruction unit. At the minimum, there will be one single demonstration by the teacher, followed by one single session of practice by the students.

But, if the competency requires that there be multiple cycles of demonstration followed by application, teacher can implement them in the instruction unit. So, there would be demonstration followed by application, repeated certain number of times. Then finally there in an integration phase where the students integrate the newly acquired knowledge with their prior mental model to develop an enriched mental model.

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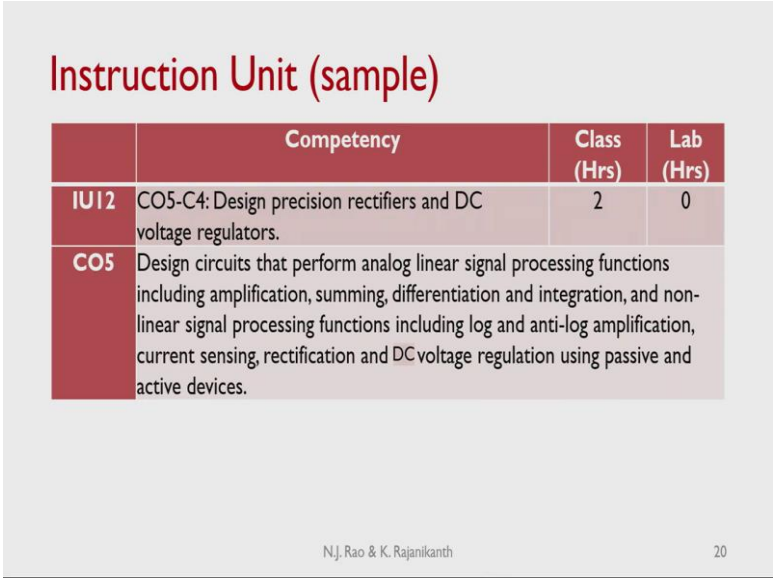

As an example, one sample is presented here, it is the particular instruction unit one and the course outcome with this specific competency is designed precision rectifiers and DC voltage regulators. The planned number of classroom hours is 2 and there are no laboratory hours planned for this particular instruction unit.

The relevant course outcome itself is design circuits that perform analogue linear signal processing functions including amplification, summing, differentiation and integration and non-linear signal processing functions including log and anti-log amplification, current sensing, rectification, and DC voltage regulation using passive and active devices.

It looks like quite a heavy CO, so this is split into multiple competencies. So, the specific competency with which the sample instruction unit is concerned is design, precision, rectifiers and DC voltage regulators.

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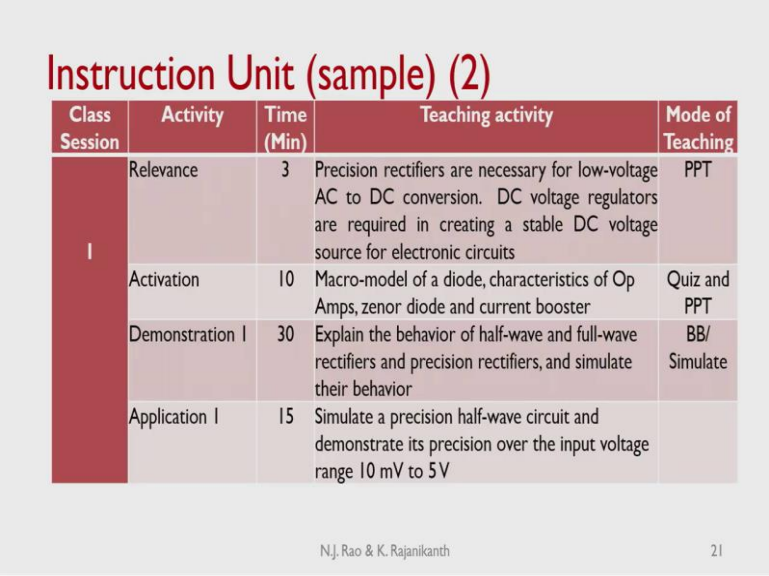

So, in the first classroom session, we first spend some time about 3 minutes explaining the relevance of this competency to the profession of the students. Teaching activity can be to make the students understand the importance of this competency for their professional career. Precision rectifiers are necessary for low voltage AC to DC conversion; DC voltage regulators are required in creating a stable DC voltage source for electronic circuits.

The mode of teaching can be to use PPTs. This is followed by the activation phase, for which the allocated time is ten minutes. The teaching activity would consist of presenting a macro-model of a diode, characteristics of Op Amps, zenor diodes and current boosters. The mode of teaching would be a PPT and also a quiz administered at the appropriate time. The time allocated is ten minutes.

Then the first pale of demonstrate application activities takes place. Demonstration is for thirty minutes and application is for fifty minutes. The teacher explains the behaviour of half-wave and full-wave rectifiers and precision rectifiers, and simulates their behaviour. This is based on assimilation model as well as aboard.

Then, immediately after this demonstration by the teacher students engage with the newly acquired knowledge, they apply this knowledge to a specific case study. So, the time allocated is fifteen minutes, students have to work with a precision half-wave circuit and demonstrate its precision over the input voltage range to ten millivolts to five volts. This can be through a simulation study.

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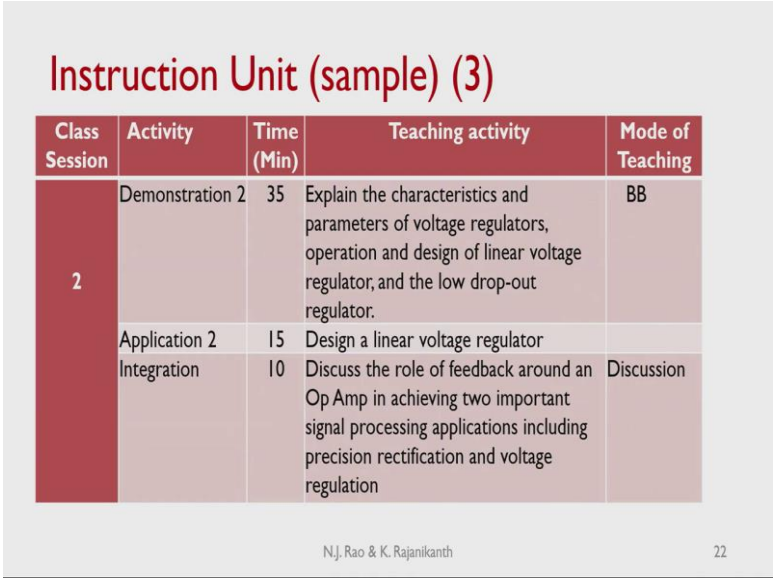

This is followed by another cycle of demonstrate and application. So, in this particular instance, the teacher has decided to use two cycles of demonstrate and applicate. So, two cycles of demonstration followed by application. So the second demonstration is for thirty-five minutes and here the characteristics and parameters of voltage regulators are explained.

Their operation and design of linear voltage regulator and the low drop-out regulator is also explained. This is through traditional black board. Then the second application phase commences, the time allocated is fifteen minutes and the students are expected to design a linear voltage regulator. This is followed by their final integration phase of the model. This is executed for about ten minutes and the mode of teaching is primarily classroom discussion.

Discuss the role of feedback around an Op Amp in achieving two important signal processing applications including precision rectification and voltage regulation. It is during this phase, but the students are expected to integrate their newly acquired knowledge into their earlier mental model. This is a sample design of an instruction unit.

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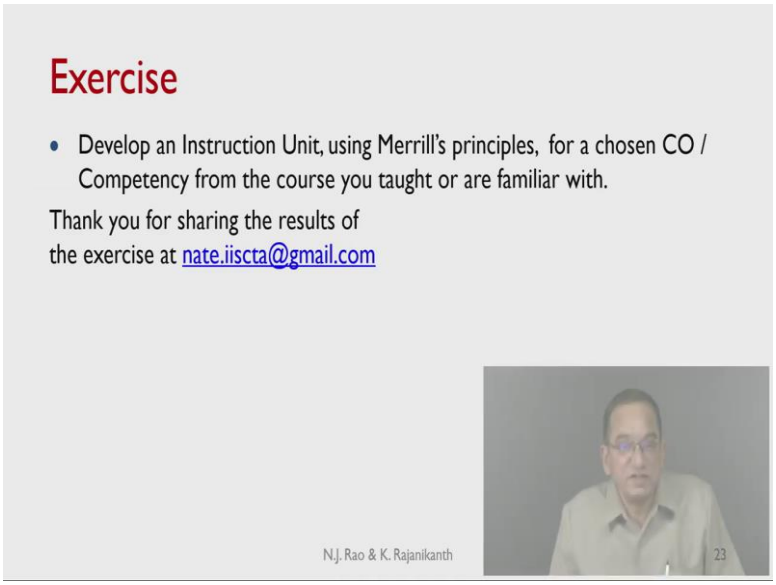

An exercise: Develop an instruction unit using all the five first principles of learning of Merrill for a chosen course outcome or competency from the course you taught or are familiar with. Please ensure that you are instruction unit implements all the five first principles of learning. Thank you for sharing the results of the exercise at nate.iiscta@gmail.com.

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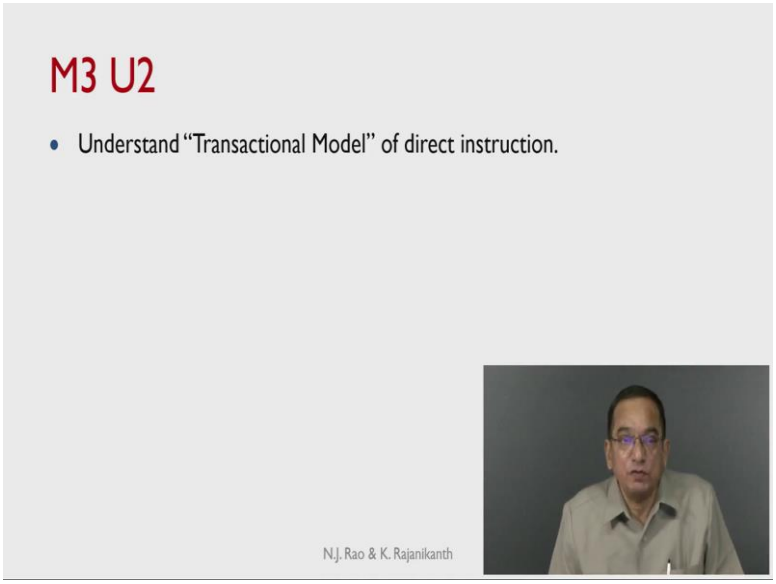

In the next unit we will understand another model of direct instruction called transactional model. Until then, we wait. Thank you. Thank you.