Tale – 2 Course Design and Instruction of Engineering Courses

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Lecture –26
M3U8: Merrill's First Principles of Learning

Greetings. Welcome to module 3 Unit 8 on Merrill's First Principles of Learning.

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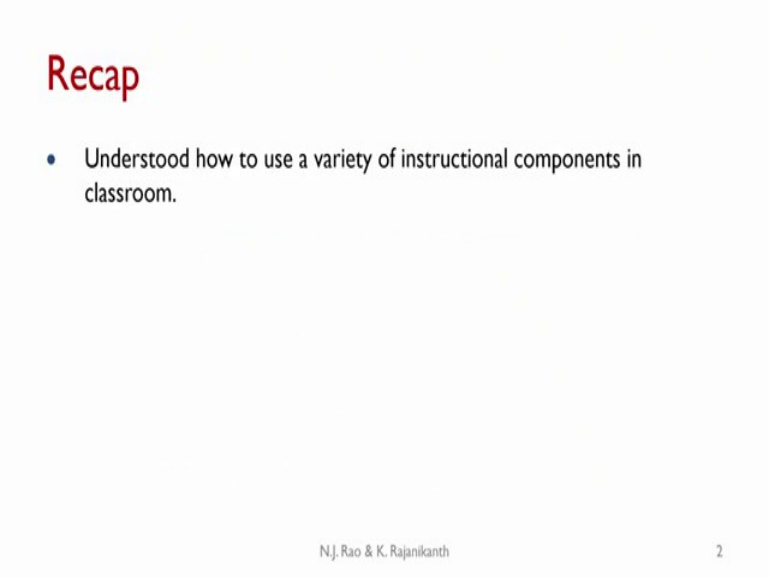

In earlier units we referred to Merrill, but in this unit we will try to explore Merrill's principles in greater detail. In the previous unit we saw how to use a variety of instructional components in classroom.

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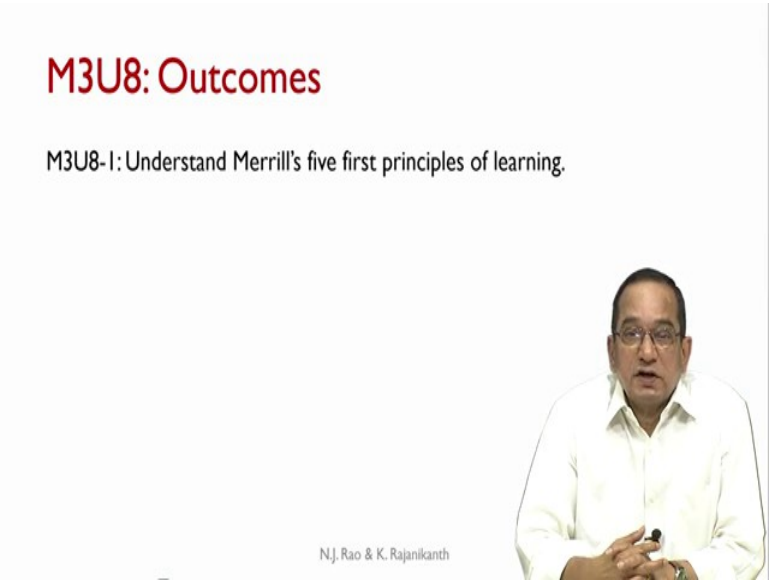

In this unit we will understand Merrill's five first principles of learning.

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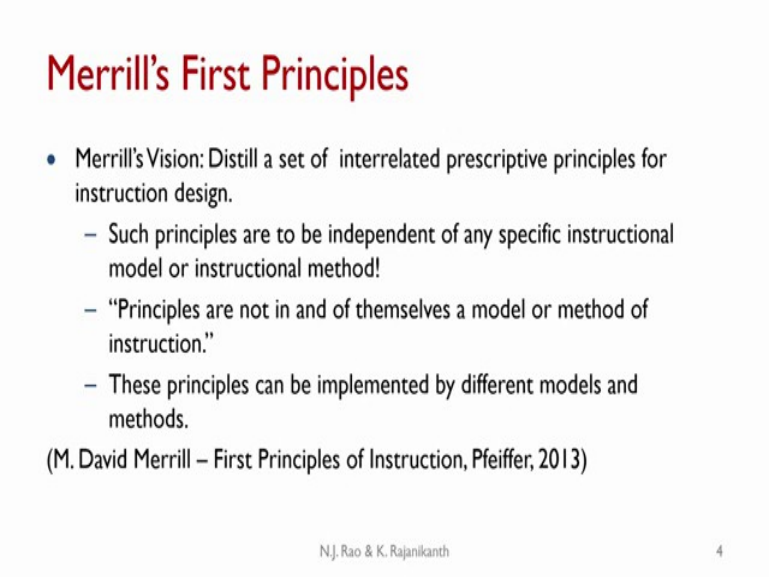

We know that we have a wide variety of instruction approaches, instructional methods, instructional architectures that are being used across the world. The research into the educational technology, instructional design theory has produced a wide variety of instructional models. Is there something that is common to most of these models - that was Merrill's vision! Distill a set of interrelated prescriptive principles for instruction design.

These principles are to be independent of any specific instructional model or instructional method. That means that these principles must be the ones followed in most of the instructional models or instructional methods, either explicitly or implicitly, by this name or by some other name. But Merrill wanted to extract such principles which are common across most of the successful instructional models or instructional methods. And he is very clear that these principles are not, in and of themselves, a model or method of instruction. These principles can be implemented by different models and different instructional methods.

The actual terminology may differ in some of those models (we will see in the subsequent units.) But the underlying principle, the spirit of it is same and further Merrill wanted these principles to the prescriptive in nature. That means, they are design oriented; just they do not describe what is, but they are prescriptive and give guidelines for designing the instructional method or instructional model. These are interrelated prescriptive principles. Merrill came out with five principles as the first principles. He calls them as first principles, because they are very basic to the design of any instructional model or instructional method.

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These five first principles of learning are:

Programs and practices use some or all of these first principles as we noticed and Merrill's thesis is that effectiveness, efficiency and engagement of a particular model or

method of instruction is a function of the degree to which these principles are implemented. That means, the more extensive the implementation of these principles the more effective, efficient and engaging will be the instruction. As all the five principles get implemented, Merrill's thesis is that the instruction is likely to be very highly effective, efficient and engaging.)

Of course it is not that there are no situational principles involved, (instruction situations - we have touched upon in earlier units); they might slightly modulate the effectiveness ore efficiency or engagement. But broadly these are universal principles. The three Es of the instruction would be enhanced if these five principles are implemented into the instructional method - that is Merrill's thesis.

We do not have too much of empirical evidence to back it up, but intuitively all of us teachers would see that these principles make sense; they appear to be universal in nature. Learning from a given instruction method will be facilitated in direct proportion to the implementation of these five first principles of instruction. What we will do in this unit is, present Merrill's five first principles of learning and then in the next unit, discuss one model that implements all these five principles.

A variety of models can implement these principles as we have already noted. In the subsequent units, when we look at other instruction approaches, we will try to see where they correspond to these Merrill's five first principles of learning also.

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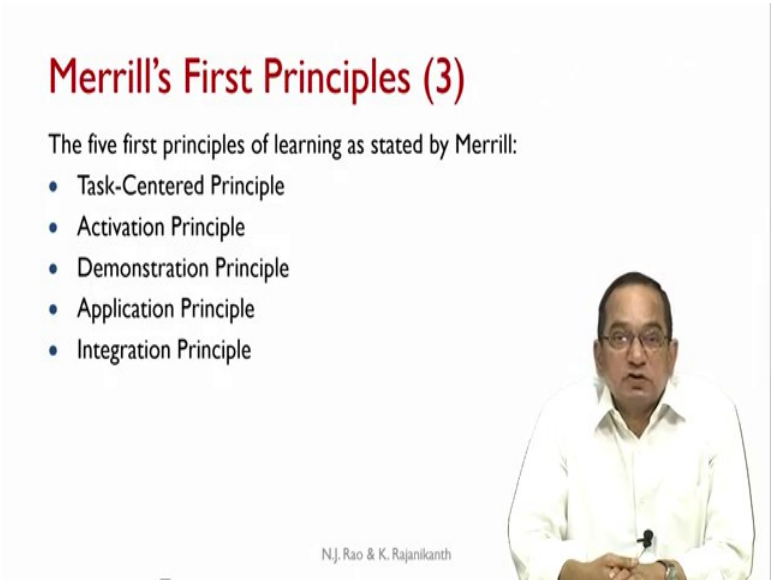

The five first principles of learning as identified and stated by Merrill are: task-centered principle, activation principle, demonstration principle, application principle, and integration principle.

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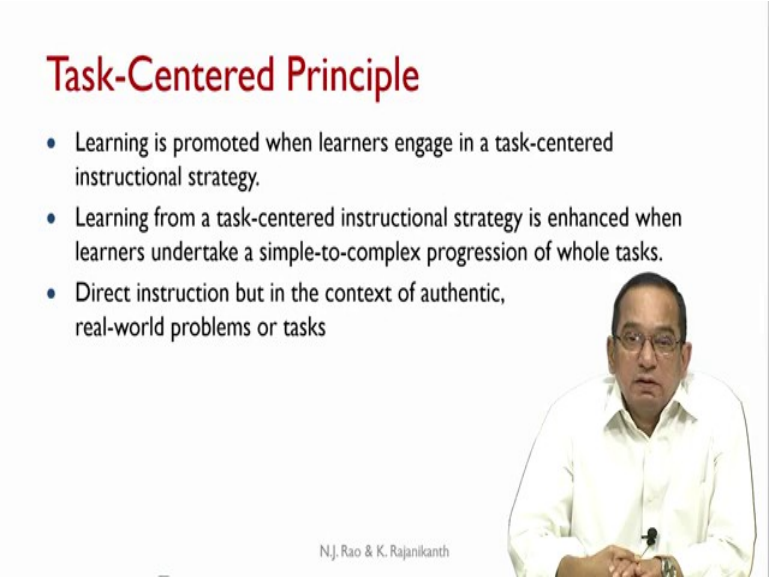

The first one is Task Centered Principle. Learning is promoted when learners engage in a task-centered instructional strategy. When Merrill says 'task', it is not like an exercise, problem that we give at the end of the class. Merrill really wants the students to engage with the whole task, a task whose nature is quite similar to the kind of tasks that the students would have to face when they really start practicing the profession.

Learning from task-centered instructional strategy is enhanced when learners undertake a simple to complex progression of whole tasks. It is quite obvious that at the very beginning they learners may not be very comfortable with highly complex tasks. So, we can start with a fairly simple task, but the task must be a whole task - that is Merrill's thesis. Gradually we can increase the complexity of the whole tasks which are presented to the learners and initially the support of the instructor in the form of direct instruction, hints, suggestions etc can be quite extensive.

As learners progress through a succession of more complex whole tasks, gradually, the instructor must withdraw her support so that learner can solve those tasks, work on those tasks, in a more or less independent fashion - direct instruction but in the context of

authentic real world problems or tasks. What really we mean by the authentic real world problems?

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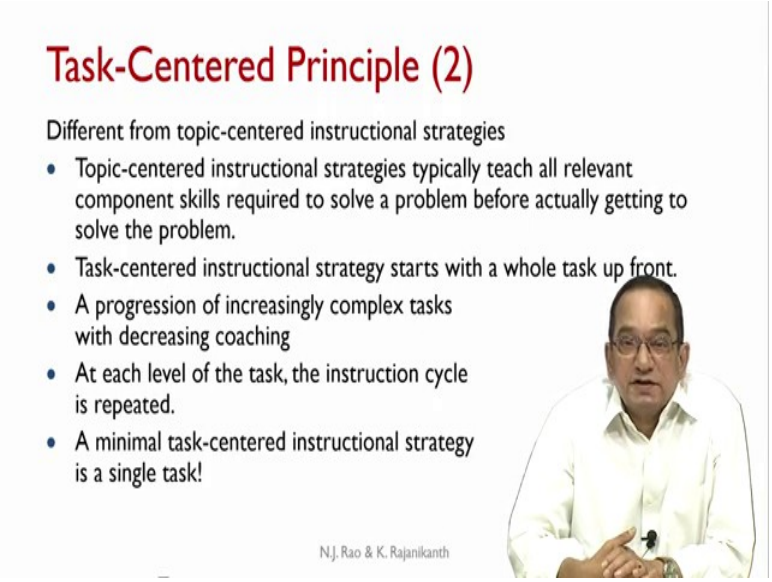

This is different. In general, this approach is different from topic-centered instruction strategies which are probably more popular than task-centered strategy. In a topic-centered instructional strategy what typically happens is that all the relevant component skills required to solve a problem are actually first presented - before actually getting into solve the problem. It is a kind of a bottom-up approach where the different skills sets are first imparted; may be with a caveat; “you may not realize its importance initially, but will see this in a subsequent lesson”. We present first all the basic skills; then we try to solve a task based on these competencies.

The task-centered instructional strategy starts with a whole task upfront. We start with the task, the complexity maybe low, but the nature of the task is quite similar to the nature of the tasks that the learners would have to solve when they become professionals. The kind of task that they encounter during their later profession - that becomes the model for presenting the whole tasks. At each level of the task, the instruction cycle is repeated and then we move to a more complex task.

A minimal task centered instruction strategy would be a single task. But Merrill very strongly advocates that unless there are situational constraints, it is better to have a progression of increasingly complex tasks rather than a single task. He suggests that

initially, the instructor's supports can be extensive, but gradually instructor must withdraw her support, so that the students/learners can engage with the problem independently. As the complexity increases from low to high, the support of the instructor actually becomes less and less, so that the learners can become comfortable attacking a more complex problem. If there are situational constraints, a minimal task centered strategy can be a single task, but it should be a whole task.

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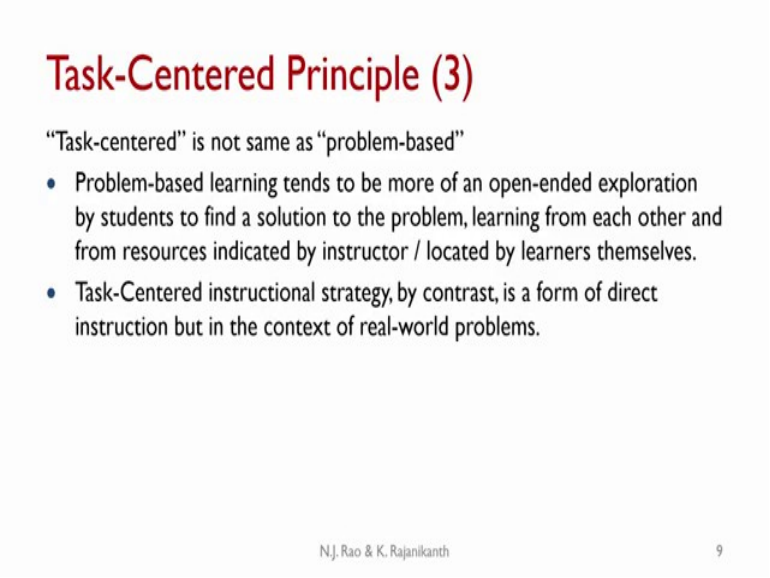

This is not same as problem-based. Problem-based learning tends to be more of an open ended exploration by students to find a solution to the problem. They learn from each other; from the resources initially provided by the instructor; and from the resources subsequently explored by the students as they proceed with the solution of the problem.

It is a more open ended exploratory nature. (In fact, in a later unit, we will study the problem based approach to instruction in greater detail.) Task-centered instructional strategy, by contrast, is actually a form of direct instruction, but in the context of real world problems. The instructor essentially controls the pace of the class. It is a form of direct instruction, but it occurs in the context of real-world problems.

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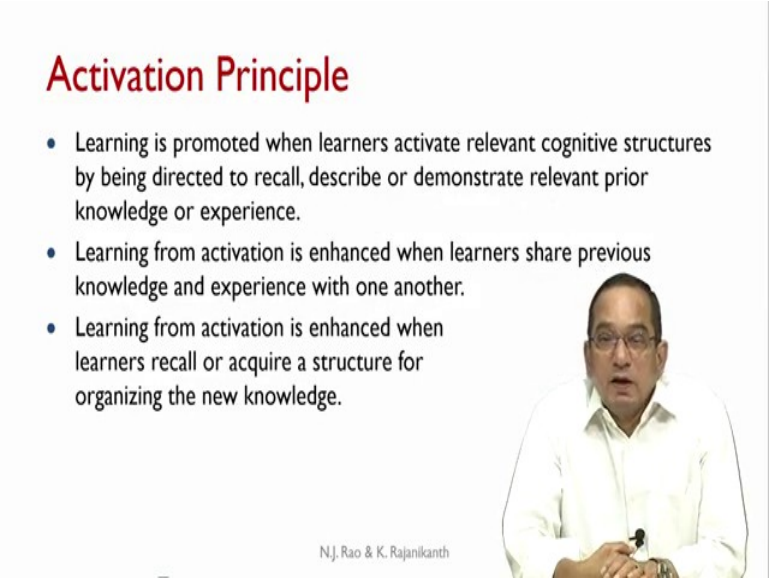

Next principle is Activation Principle. What Merrill says is that "most of the instructional models that are effective, efficient and engaging have this component." Learning is promoted when learners activate relevant cognitive structures by being directed to recall, describe or demonstrate the prior knowledge or experience that is relevant to the current competency. What essentially this means is that "knowledge is constructivist kind of theory". Knowledge is built upon the previous knowledge that the learners already have. That becomes the foundation on building their new knowledge and the learners integrate the new knowledge into what they already have, that is how learning proceeds - that is the thesis.

Before commencing with new knowledge to be imparted to the students, instructor must ensure that learners recall the relevant previous knowledge base. (Relevant, because the model that they already have built up from the previous knowledge must help the students in absorbing the new knowledge that is being imparted.) So the relevant framework must be recalled by the students. Learning from activation is enhanced when learners share previous knowledge and experience with one another. In the process of the activation of the previous knowledge this would be a good strategy to ensure that all the students really recall their previous knowledge background which is relevant.

By sharing these experiences, peers can recall their own individual experiences, previous knowledge background, mental models; compare them and if there are differences, they

can discuss. So the students can engage in a kind of a collaborative effort whereby they reinforce each other's recollection of the previous knowledge base. Learning from activation is enhanced when learners recall or acquire a structure for organizing this new knowledge. It is very important that there is a structure into which the knowledge gets integrated. Randomly trying to pick up pieces of information would not really contribute to any deep learning by the students.

The learners must have a correct mental model/a structure which can accommodate the new learning. Instructor must help the learners in invoking or recollecting the proper mental model by trying to extract from the students, what they currently have, the idea, and then making them discuss with each other, present the ideas and then ensure that they start with an appropriate mental framework.

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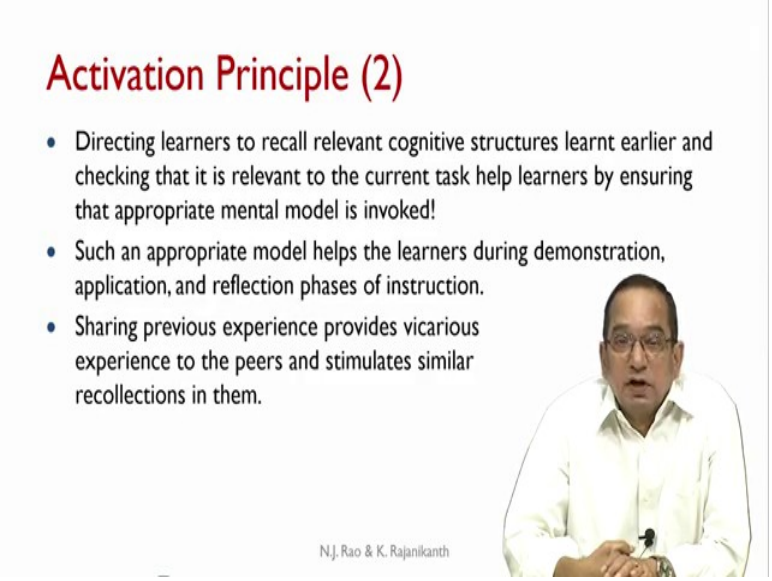

Directing learners to recall relevant cognitive structures learnt earlier and checking that it is relevant to the current task, helps learners by ensuring that appropriate mental model is invoked. By themselves, learners may not be able to recollect a proper model from the earlier knowledge which is relevant and appropriate for the current knowledge. Instructor must guide them /help them. Let the students recall the model, let them engage in a discussion and instructors can help them correct the picture of the mental model if necessary.

Learning is enhanced when they recall appropriate mental model. Such an appropriate model helps the learners during the subsequent phases of the instruction i.e., during demonstration, application and reflection. This is a very important step and in some instructional models this plays a dominant role. But, in some experiences Merrill has noticed and some of us also would have noticed that instructor skips this phase; then the learners are really not prepared properly for receiving the new knowledge.

Sharing previous experiences provides vicarious experience to the peers. Others can actually experience what someone who is presenting the model describes and it stimulates similar reflection in them, which helps the entire class to be ready with proper requisite mental models invoked in the minds of all the learners. This is extremely important principle before the commencement of the delivery of the new content.

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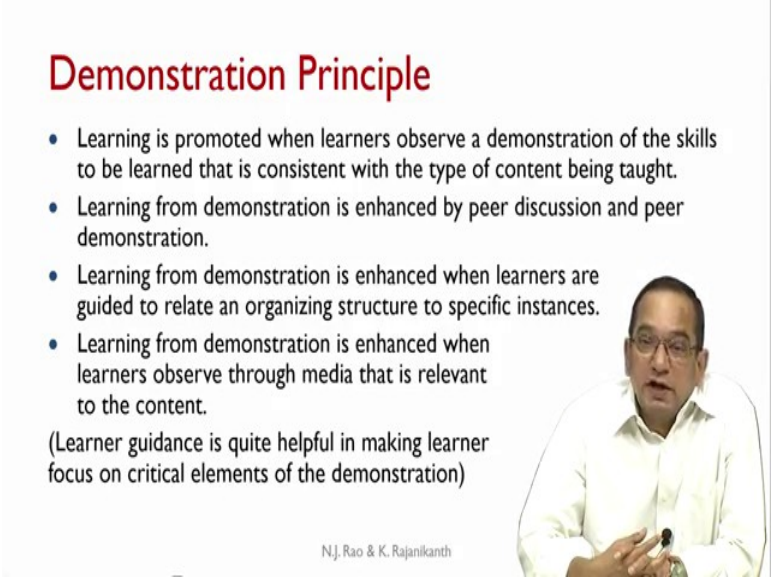

The next important principle is Demonstration. Learning is promoted when learners observe a demonstration of the skills to be learned that is consistent with the type of content being taught. Merrill uses a different terminology. The content - he categorizes that as the classification type or following a procedure type or answering ‘what if’ kind of questions. But we are following Bloom’s taxonomy. Therefore we can say that what essentially is meant by this principle, is that the demonstration must be consistent with the course outcome or the competency that is being taught in this particular session. The demonstration must be consistent with the course outcome.

Depending upon the level at which the cognitive process of the relevant CO is situated, demonstration must happen at the same cognitive level. If the CO is at 'analyze' level, the instruction/the demonstration must be at the 'analyze' level. Very broadly, what Merrill is trying to say is that the demonstration of the skills to be learned must be consistent with the type of content being taught. Learning from demonstration is enhanced by peer discussion and peer demonstration. The learners must not be passive absorbers of whatever is being presented, but they must actively participate. They can discuss among themselves and they can also demonstrate their skills where required. But an active interaction between the learners and the instructor would promote learning. Learning from demonstration is enhanced by peer discussion and peer demonstration.

Learning from demonstration is enhanced when learners are guided to relate an organizing structure to specific instances. The very broad principles must be related to specific instances of the application of those principles. The demonstration would include the general principles as well as specific instances where these principles are being applied and learners must be able to have an organizing structure relating the previous knowledge and current knowledge to the general principles as well as the specific instances.

Learning from demonstration is enhanced when learners observe through the media that is relevant to the content. Depending upon the nature of the content, the type of the CO, one may have to use text or graphics or simulations or actually working models. Whatever media that we are using - that must be consistent with the competency that we are trying to promote in the learners. That essentially means that the media must be consistent with the course outcome or the competency.

Learner guidance is quite helpful in making learner focus on critical elements of the demonstration. While demonstration is happening, instructor can point out to the critical elements and guide the learners into observing, reflecting-on and using those critical elements of the demonstration. The learner guidance is quite essential or relevant as even with invocation of a mental model of prior learning, it is possible that sometimes, in the early phases, learners miss some of the critical elements of the demonstration.

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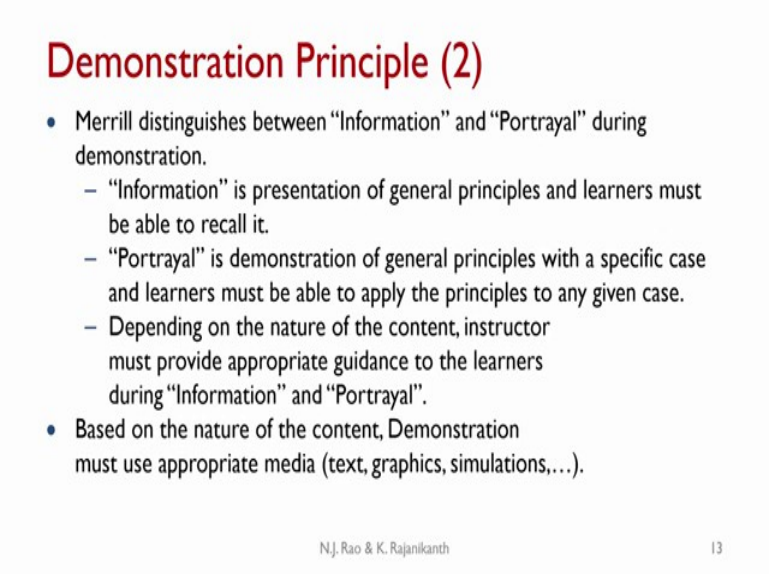

Merrill distinguishes between information and portrayal during the demonstration. Essentially what it means in terms of the Blooms taxonomy is something like remember, understand and apply levels.

Information is presentation of the general principles and learners must be able to recall it. Portrayal is demonstration of the general principles with specific cases and learners must be able to apply the principles to any given case. Depending upon the nature of the content, instructor must provide appropriate guidance to the learners during information and portrayal. Based on the nature of the content, demonstration must use appropriate/ relevant media like text, graphics, simulation etc.

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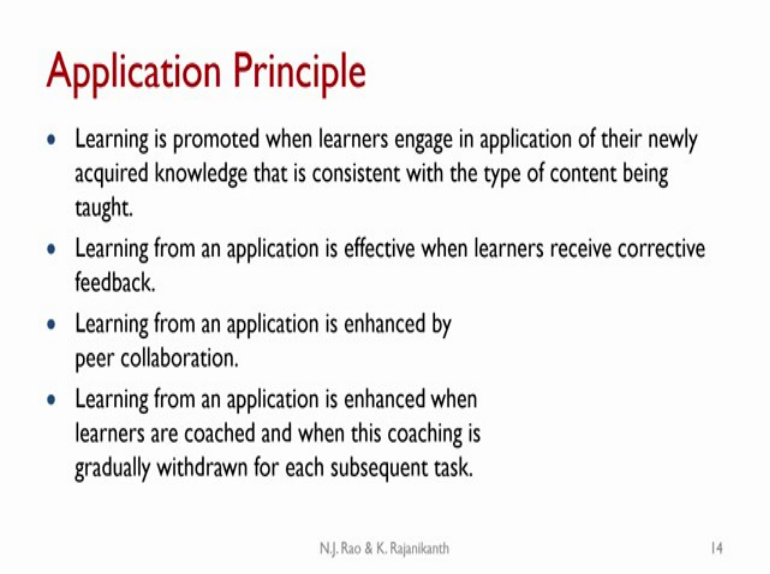

Application principle: Learning is promoted when learners engage in application of their newly acquired knowledge that is consistent with the type of content being taught. Once again, in terms of Bloom's taxonomy, the application must be consistent with the cognitive process level of the concerned CO or competency. So, if it is a competency that is at the level of analyze, students must engage in an activity that is at analyze level; if it is at apply, it is at apply level.

The application principle of Merrill is used in a very broad sense. That essentially is not the 'apply' of Bloom, but basically it is engaging with a problem at a cognitive level that is consistent with the cognitive level of the CO or the competency. When learners engage in application of their newly acquired knowledge that is consistent with the type of content being taught, which essentially means consistent with the CO or competency.

Learning from an application is effective when learners receive corrective feedback. It is very important that learners receive corrective feedback, when they are engaged in the application. Learning from application is enhanced by peer collaboration. It has been recognized in almost all the instructional situations that peer collaboration promotes learning.

Learning from an application is enhanced when learners are coached and when this coaching is gradually withdrawn for each subsequent task. As we mentioned, we have a progression of increasingly complex tasks. In the initial stages, the coaching - the help

from the instructor, can be quite substantial. But as learners proceed with more complex problems, the coaching - the support from the instructor, must be gradually reduced, withdrawn and finally the learners must be able to engage with the task completely on their own. These cycles are repeated until the learners are able to engage with a whole task all by themselves. This is another important principle of Merrill - application principle.

Merrill also actually notes that the learning is promoted when the time gap between demonstration and application is as small as possible. That means, as the learners see the demonstration, they must be able to engage in the application as quickly as possible.

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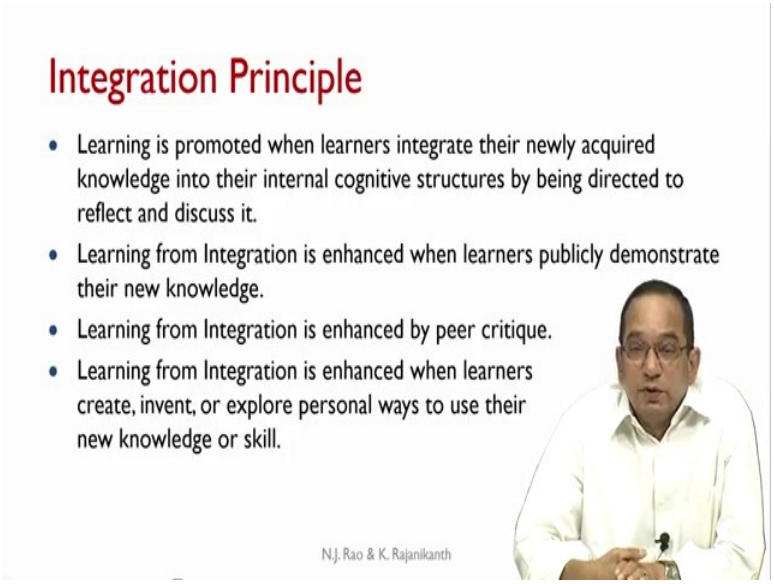

The last important principle which probably is ignored in most of the instructional situations is integration principle. Learning is promoted when learners integrate their newly acquired knowledge into their internal cognitive structures by being directed to reflect and discuss it. Quite often the instructors do say- “think about it” - and leave it at that. Actually that “think about it” is nothing but this integration principle. It requires conscious effort from the instructor to engage the students in the reflection process.

Integration of the newly acquired knowledge into the existing knowledge is an extremely important aspect of deep learning by the students. Learners can use a variety of techniques to integrate this knowledge and to ensure that it stays with them. One of the things can be that learners can publicly demonstrate their new knowledge. When they are

able to publicly demonstrate this new knowledge in it is application it is likely that it stays with them for much longer periods. Some of the specific details, they may not be able to recollect after a long gap, but the general application context would stay with them.

Learning from integration is enhanced by peer critique. When you are trying to defend your own newly acquired knowledge or defend your own point of view if the peers can review, critique and if we are defending it in a sense we are playing the role of the teacher, because the learner is now demonstrating his or her newly acquired knowledge. In some sense it is the role of the teacher, as we all know in most of the cases the teacher learns more than the student. That is because you are trying to defend/argue a position, apply a skill; so that the learning will be stronger when students play that role.

Learning from integration is enhanced when learners create, invent or explore personal ways to use that new knowledge and skills. The more the opportunities for the learners to apply their newly acquired knowledge in real-context that are relevant to them, the stronger will be the learning and the longer will be the retaining of this new knowledge. So, this principle is a very important principle where the students, the learners, are encouraged to integrate their newly acquired knowledge with the existing knowledge.

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It helps learners in retaining what is learnt. Reflection is promoted through peer discussion and peer critique and opportunities for learners to publicly demonstrate their

newly acquired competency can be a great motivator. Learners, when they use their newly acquired competencies in their personal context, learning is likely to be more stable.

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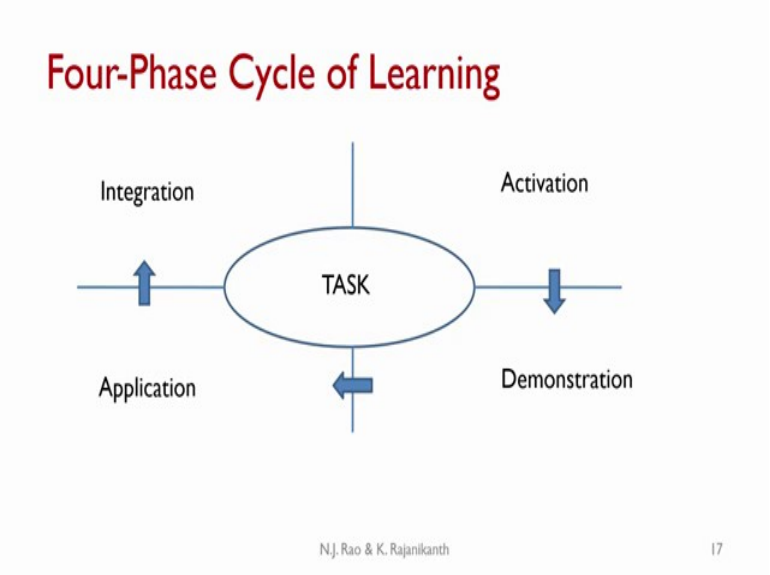

We can look at the Merrill's model as a four phase cycle of learning centered around a whole task/ a specific realistic task - a task whose nature is quite similar to the kind of tasks that the learners will face in their professional life. The first phase is activation where the prior mental models are invoked, preparing the learners to receive the new information. Then next phase is demonstration, where the instructor demonstrates the competency that is to be acquired and demonstrated by the students. Demonstration depends upon the cognitive process and knowledge category of the relevant CO or competency. This is followed by the learners engaging with the task, applying their newly acquired knowledge - application phase. At the end, very important integration phase where learners integrate their newly acquired knowledge into their existing knowledge and the whole thing is consolidated and appropriate activities are initiated like group discussion/ reflection / writing a journal which promotes retaining this competency for longer periods.

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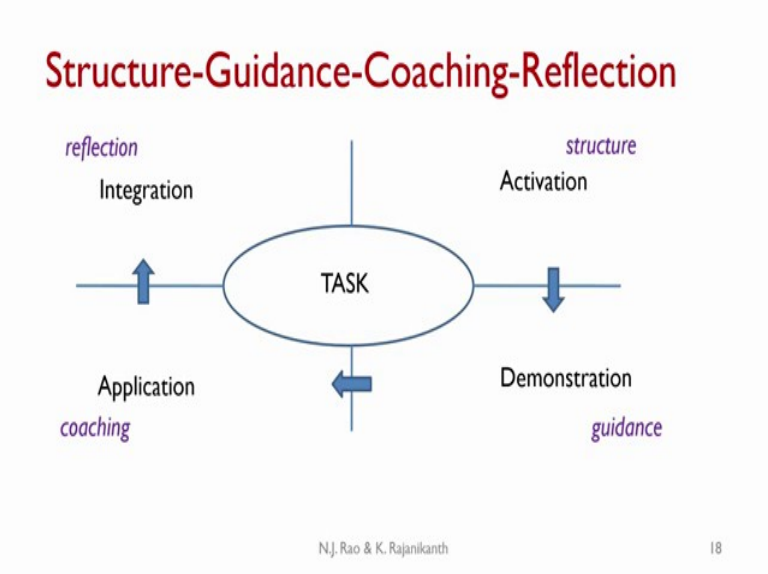

During this, there is a subtle "structure – guidance – coaching – reflection" cycle that goes on. During the activation phase, actually the instructor is promoting/helping the learners recall a structure; during the demonstration, the instructor is essentially providing guidance or playing the role of an expert; during the application phase, the instructor is actually playing the role of a coach, trying to help the students apply their newly acquired knowledge and as we notice the coaching is gradually withdrawn; and during the final (integration) phase, the instructor must promote reflection in the learners.

The four phase cycle of instruction has actually a sub-cycle of "structure – guidance - coaching – (and) reflection". The better the understanding of the instructor of this subtle cycle - the more effective the instruction can be.

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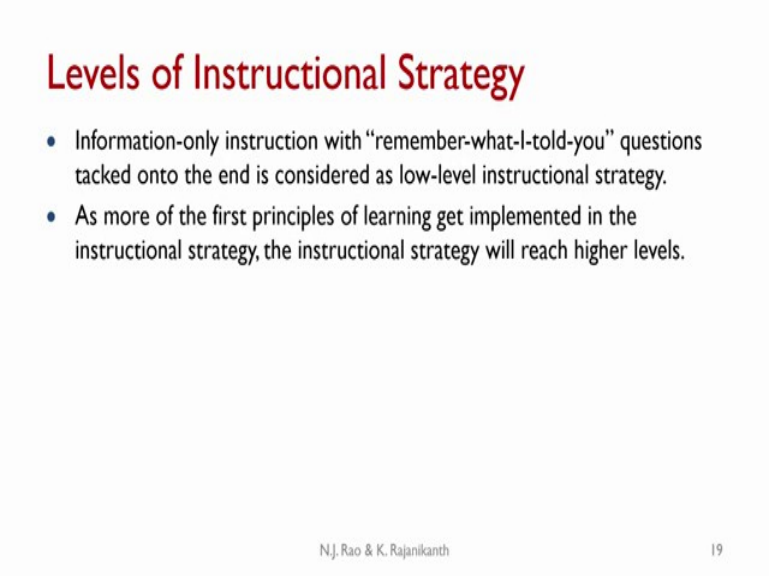

Merrill generally believes that information-only instruction with "remember what I told you" questions tagged at the end is considered as a very low level instructional strategy. That means, it is a one way flow and there is no activation phase/ application phase/ reflection phase. As more of the first principles of learning get implemented in the instructional strategy, the instruction strategy will reach higher levels.

For example, if the instructional strategy includes the activation phase then the learning will be one level higher. If it includes a task centered strategy where the entire learning happens around a realistic task - a whole task, then the learning reaches next higher level. If opportunities are provided for learners to apply their newly acquired knowledge the learning reaches still higher level. The instructional strategy becomes still higher level strategy if the strategy includes a conscious promotion of reflection on the part of the learners. Then, we will get the highest level of instructional strategy.

That is Merrill's thesis. We do not have too much of empirical evidence to support this. But intuitively it looks fairly clear and Merrill with his vast experience in the field of instructional design theory and with his vast experience with various models, feels confident that by and large this is true. Though the specificities of the instructional situations might slightly modulate these effects, by and large this philosophy that the instructional strategy becomes better and better with the adoption of more and more of these five principles is generally true.

If an instructional design model incorporates all these five first principles of learning, then it is likely to be quite effective, efficient and engaging and that is essentially the background behind the Merrill's principles.

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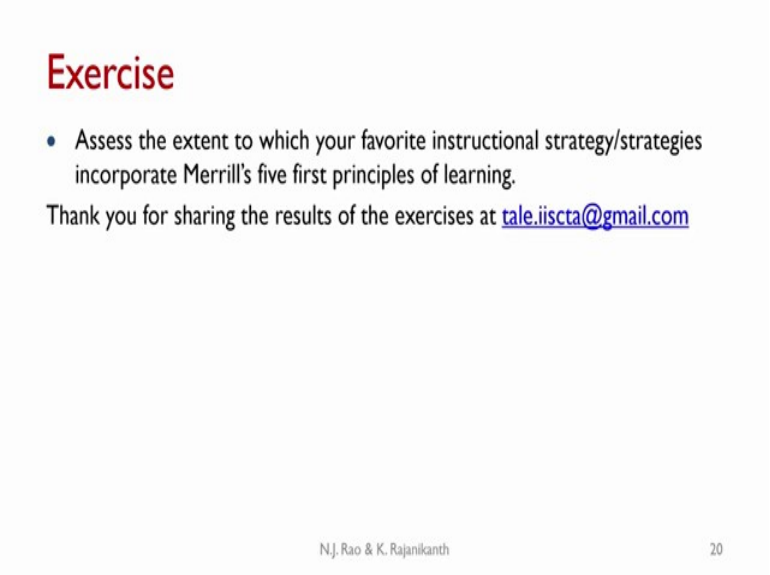

Exercise: Assess the extent to which your favorite instructional strategy/strategies (whatever you have been using over the years, in different courses taught by you; your favorite instructional strategy/strategies) incorporate Merrill's five first principles of learning. Assess the extent to which the Merrill's five first principles are present.

Thank you for sharing the results of the exercise at tale.iiscta@gmail.com.

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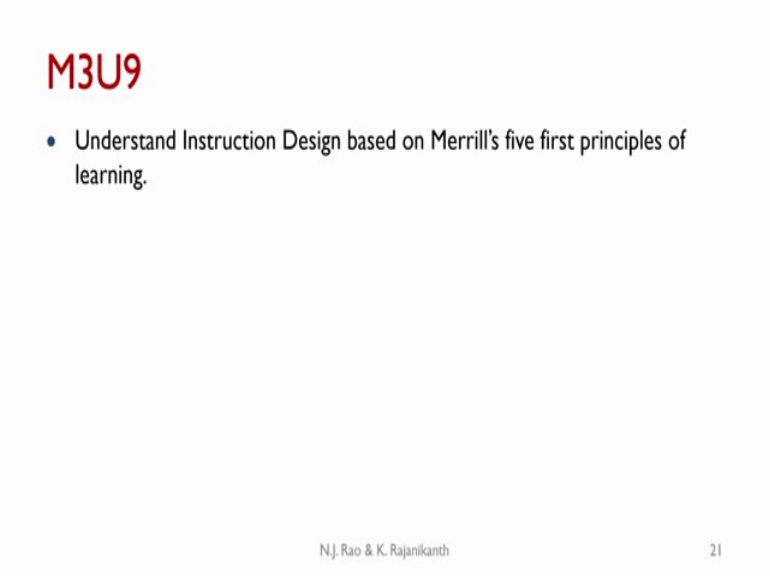

In the next unit, we will look at an instructional design based on Merrill's five first principles of learning. It will be a model which incorporates all the five first principles of learning. We have touched upon this model in the earlier units also. We will try to explore that model in a little bit more detail and see the correspondence between that model and Merrill's five first principle of learning.

Thank you and we will meet again with the next unit.