TALE - 2 Course Design and Instruction of Engineering Courses

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Lecture - 03
ISD and ADDIE

Greetings and welcome to TALE module 2, unit 3.

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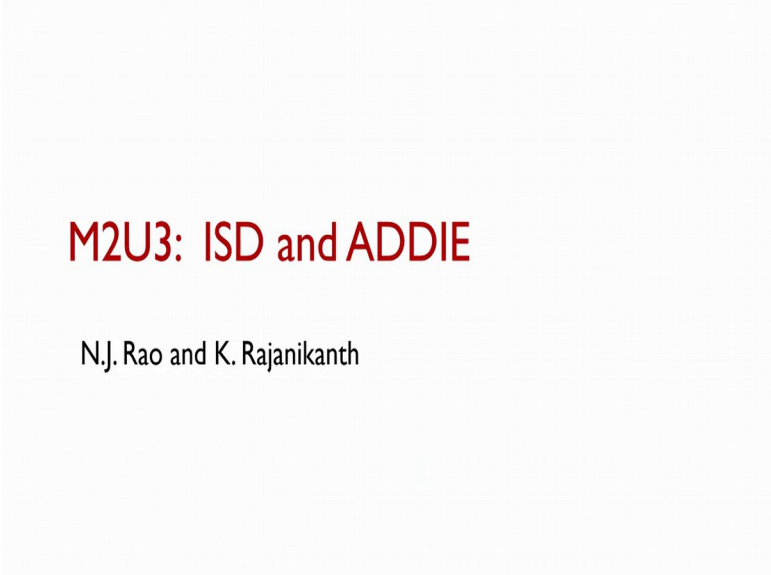

We are going to look at ISD - Instructional System Design model of ADDIE which will be the focus of this unit.

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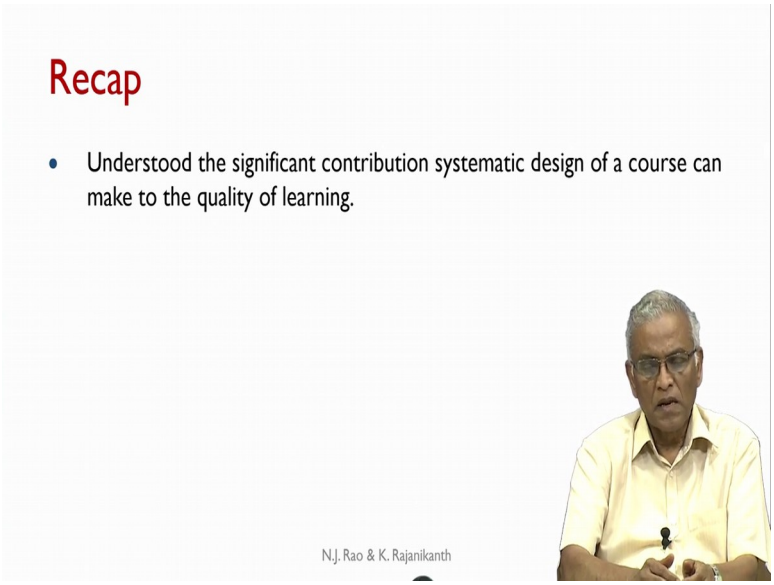

In the previous unit we understood the significant contribution of systematic design of a course can make to the quality of learning. We have repeatedly said the quality of learning can be significantly enhanced, if you go through a systematic design of a course.

If you do it once, then you need to only incrementally modify every time you offer the course. That is the advantage. Based on the experience that you have when you offered a course, you can offer next time making the incremental modifications. Only when the content or the syllabus significantly changes, you may have to go through the complete redesign of the course.

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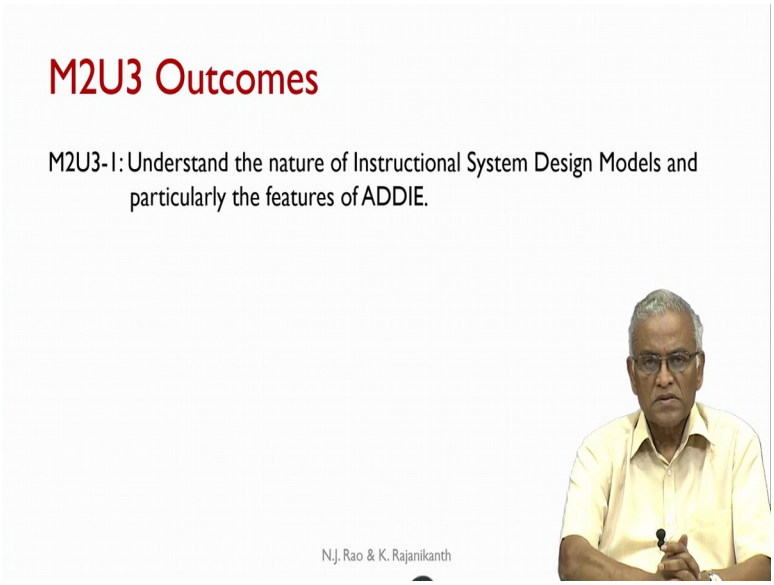

In this unit we try to understand the nature of instructional system design models and particularly features of ADDIE model.

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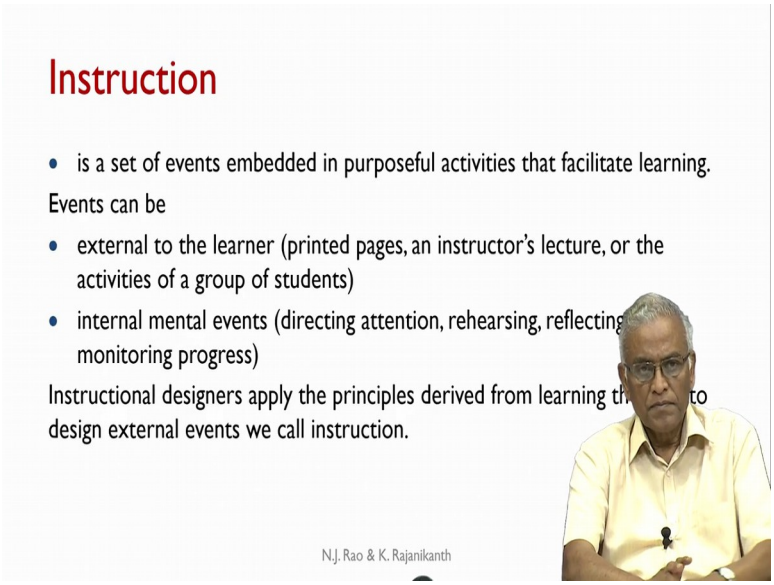

We have to be clear about, what is instruction, what are instructional principles, what is instruction design or instructional design theory, and so on. Instruction is nothing but a set of events embedded in purposeful activities that facilitate learning; that means, when you are instructing you are going through a series of events. Events could be just

lecturing, or it could be a tutorial session, or it could be a group discussion. All such events are being organized to facilitate learning.

Obviously, there is no unique way of doing or the only way of doing instruction. Each one can based on its own logic, and one can come with a slightly different instruction. And, these events can be external to the learner, that is you have printed pages made available to the student or an instructor's lecture. For example, I can ask the students to read in advance, and come to the class. The material can be certain identified pages in a printed textbook, or it could be material that is available on the internet. It could be instructor's lecture, or the activities of a group of students. They all are external to the learner.

There could be internal mental events. Like, the teacher will direct the attention of the student, or they make them rehearse something, or reflect on what has happened, or like metacognitive activity i.e., monitoring one's own progress. Internal events and external events are combined in some sequence to create instruction. There are persons called instructional designers who apply the principles derived from learning theories to design external events we call "instruction".

So, here one should be familiar with this- instructional designer possibly can come from psychology background or from any subject background does not matter, but he would spend lot of time in understanding the learning theories, sociology of learning, various, educational psychology principles, and is aware of the technologies that are used. There is even a profession called instructional designer, and there are even masters degrees and PhD degrees given in the area of instructional design.

Instructional designer can work with a teacher from any subject for that matter. He can work with schoolteachers, with a teacher teaching economics, engineering or medicine. The actual instructional design becomes a kind of a group activity. There are generally three key groups; one is instructional designer, the other one is subject matter expert(s) or the teacher(s) who is (are) teaching the course. And, the other group is - one or two more depending on the requirement- the technology group.

If you want to create a course, using any of the technology in terms of either animations or web pages, you require people who are specialists in using those technologies. But there is a bit of a problem. Generally, subject matter experts would like to be considered

that they are the decision makers, because they are the teachers who are teaching. And, generally instructional designers find it very hard to talk about their suggestions on how the course should be instructed. Because, they are not looking at the content, depending on the context of teaching and learning they might suggest that. So, there is always a bit of tussle between who should be the decision maker in designing a course.

I would only suggest this - if and ever you as a participant or teacher, who would want to participate in an instructional design activity, do not get into the problem of deciding who should make the decision, it should be treated as a group activity. And, the instructional designer has the specialist knowledge where as a normal teacher very rarely gets to have all the knowledge related to instructional design.

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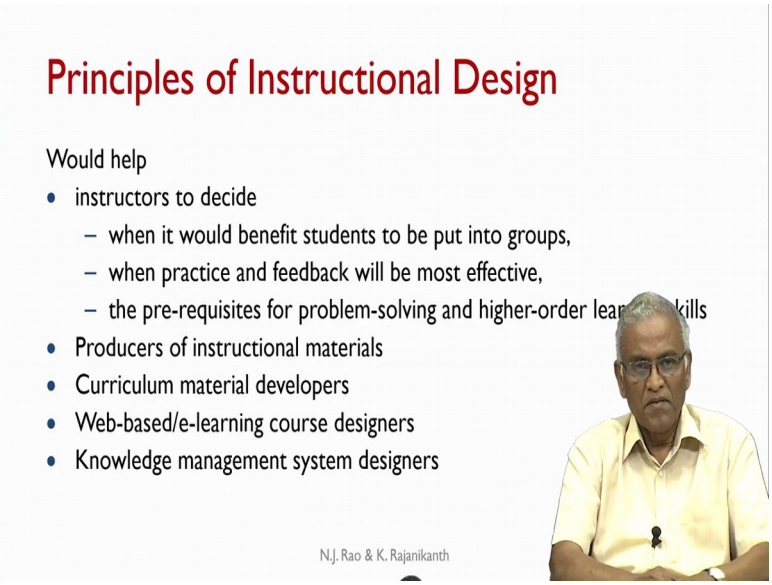

The principles of instructional design: For example they can help instructors to decide when it would benefit students to be put into groups. An instructor, somewhere during your course design, would want to introduce some group activity. Under what conditions should you introduce group activity? Can it be done for anything and everything? At least the principles of instructional design would give some indications on when it would benefit students to be put into groups.

When practise and feedback will be most effective appropriate? When do you actually give feedback? Identify the pre-requisites for problem solving and higher order learning skills provided our goal is always to train our students for problem solving and higher

order of learning. So, how do you prepare the students for that, and identify the prerequisites. There is a sequence in which you prepare the student to be able to become problem solver or acquire higher order learning skills.

That is what the principles of instructional design will help the instructor to decide on. It can also be useful to producers of instructional materials andhow to organise the material, curriculum material developers, web-based or e-learning course designers, and knowledge management system designers.

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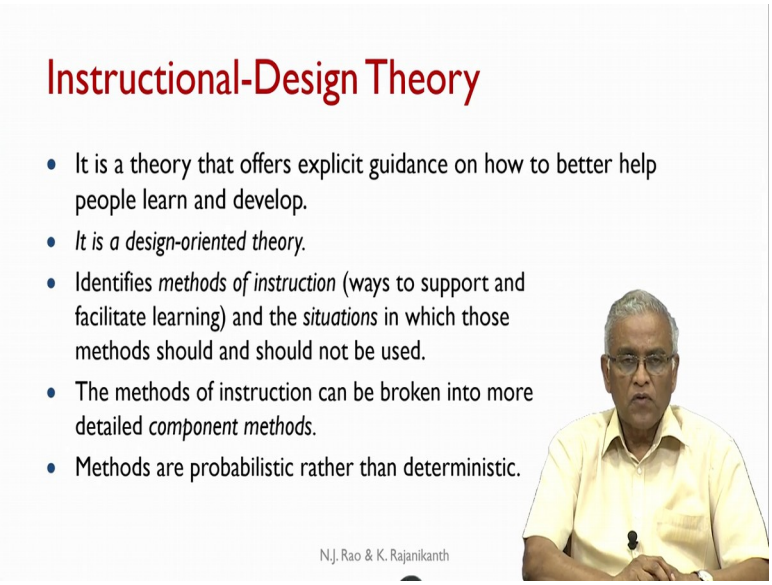

What is an instructional design theory? It is a theory that offers explicit guidance on how to do? How to better help people learn and develop? It provides some guidance broadly. It is a design-oriented theory. What is a design-oriented theory? (We have explored a little bit of that in the earlier module.)

Design oriented theory means, you are suggesting, or you are proposing that if you follow this procedure, you are likely to get a better result – it is not a descriptive theory where most of the subject based research goes on. It is a design-oriented theory; that means, as an individual if I suggest you follow a, b, c, d steps, then the student is likely to learn. You may do that decision intuitively or following some theory. But it is not unique, i.e., the solution is not necessarily unique, and you need to establish the preferability of that particular sequence of steps, in making the students learn better.

In today's world both in terms of NAAC and NBA accreditation ,one of the things that the department or the institute has to answer the question - what are the best practices you are having? For example, did you create with respect to some subject that, if you followed some practice the students have learned something better

If a teacher is aware of a little bit of these instructional design principles, then one may be able to explore one practice which led to better learning. We can then record that as a good practice. Providing good practices today is one of the requirements of accreditation.

Instructional design theory identifies methods of instruction. There are endless number of methods of instruction that are ways to support and facilitate learning, and the situations in which those methods should and should not be used. You do not want to use one method for everything. Depending on the situation you would want to select a method.

There are methods and there are situations. Instructional design theories can help matching them and sequencing them. Any method that you take can also be broken into detailed component methods. For example, in a group discussion what are the components? When you want to form a group, you have to identify different roles to the people, who coordinates the discussion, and how do you summarise the discussion. There can be whole set of components like that. Any method of instruction can be broken into more detailed components.

One thing should be remembered - methods are probabilistic rather than deterministic. Just because you applied a method it does not mean that every student automatically will learn. Despite whatever you do, some students may not learn. The reasons for that we may not even know, it is not necessarily due to lack of participation by the student, but it can be a variety of other background reasons why something did not work with some students.

You can always say it is only probabilistic. On the average we can say if there is an improvement of 15 percent in the performance of the students, but that 15 percent will not apply to all the students. So, the methods are probabilistic and not deterministic.

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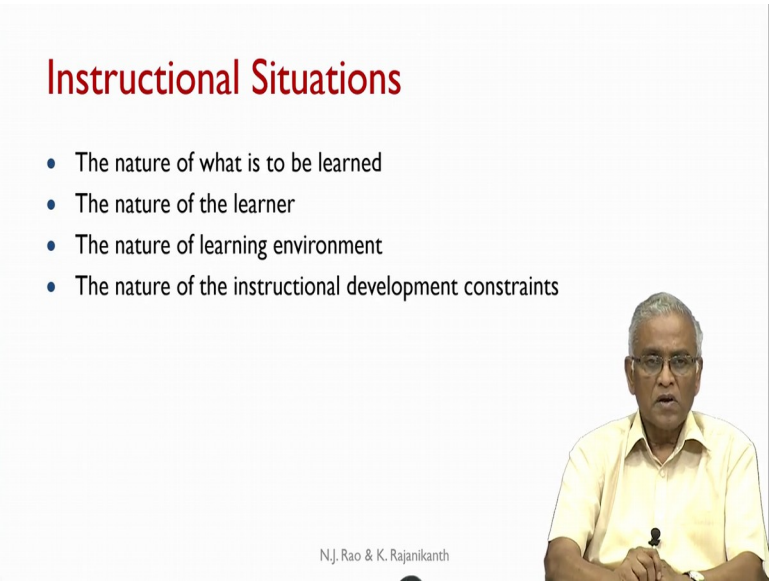

Instructional situations: all institutes are not the same. The kind of infrastructure that each one has is different, you can have a classroom with the fans on and the person at the backbenches can hardly hear, or the kind of boards that one has on which you write, it may or may not be legible to students. So, you have endless variations in the instructional situations.

Broadly the situation is decided by the nature of what is to be learnt. Is it a mathematics course or is it a descriptive course on material science? It depends on the nature of what is to be learnt, and the nature of the learner himself, the nature of learning environment that is available to you, and the nature of the instructional development constraints.

If you want to perform something you have other constraints like monetary constraints, time constraints, equipment constraints and so on. The instructional situation is characterized by all these factors.

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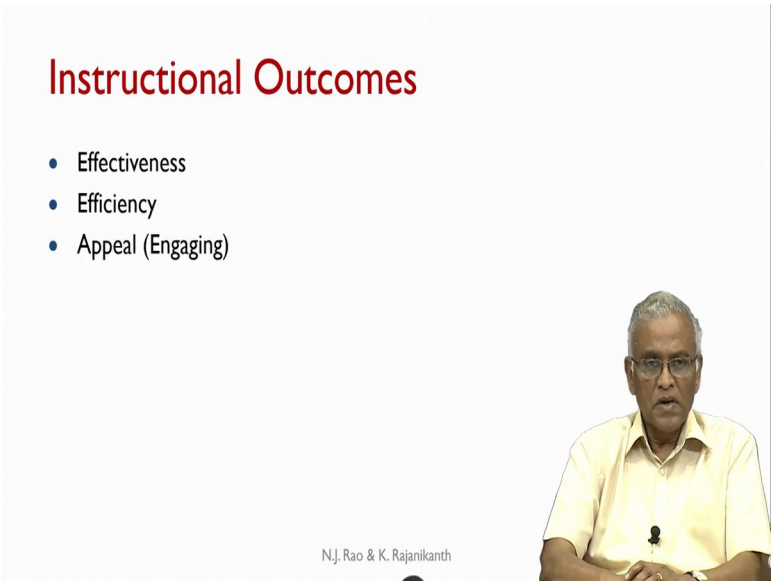

What are its goals of Instruction? It should be effective; you are giving instruction to facilitate the students to attain certain outcome, that is the basic requirement. Through my instructional method, if the students have been able to attain these outcomes to a better extent, then it is effective. I will measure the effectiveness based on the performance of the students in whatever kind of tests, assessments that I use.

The other one is - it should be efficient; any instructional method should be efficient in terms of time and other resources. I can ask for all kinds of resources for it to be effective, but it may not be efficient. For example, some people conduct workshops for a few days to emphasize one particular concept. And, it can be very effective, because of the resources that you have used and the competence of the teacher and so on. But we cannot call it efficient, because in a regular class with respect to one concept you are not likely to have this resource nor the time available for it.

The third one is it should appeal, any method that you do, people should feel like participating or engaging. We can call it instructional outcomes are effectiveness, efficiency and engagement. Sometimes we call this instruction should be E3 instruction- Effectiveness, Efficiency, and Engaging.

Sometimes you may have to forgo one of these factors in a situation. For example, I may not be able to make it efficient. In the sense with the given time, I am not trying to optimize the time because of the importance of the concept. So, I do not mind being not

that very efficient with respect to this. Sometimes depending on the situation, you may have to sacrifice one of these elements.

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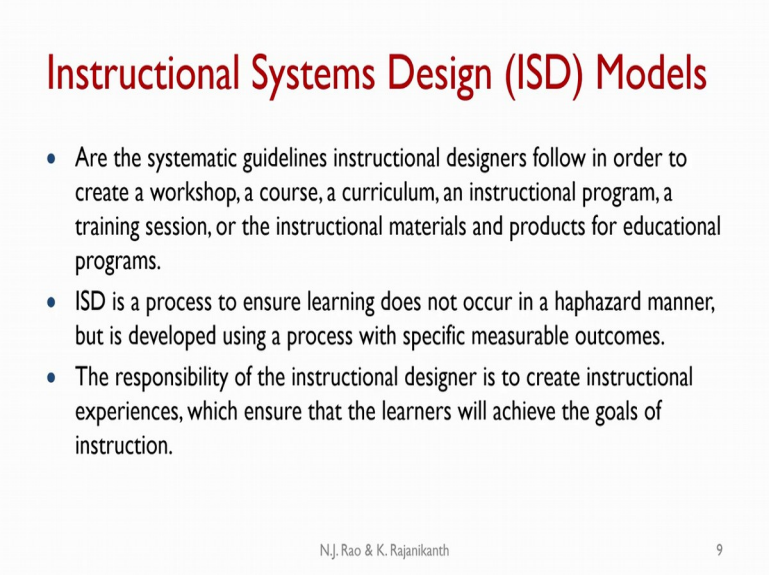

Instructional System Design Models: There are whole bunch of models, they are the systematic guidelines instructional designers follow in order to create a workshop, a course, a curriculum, an instructional program, a training session, or the instructional material and products for educational programs.

Essentially ISD model is a set of guidelines that you follow, and it is nothing more than that. That is, you do according to a sequence. Then it is likely to result in a better learning. ISD is a process to ensure learning does not occur in a haphazard manner and is developed using a process with specific measurable outcomes. The responsibility of the instructional designer is to create instructional experiences, which ensure that the learners will achieve the goals of instruction or create E3 instruction.

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ADDIE model - an ISD model: ADDIE is an acronym for Analysis, Design, Development, Implement, and Evaluate. ADDIE is a process for development of a learning product. Learning product is what the student should be able to do, and it could also be some content that you are generating. This ADDIE concept can be applied for constructing outcome based learning. Right now, let us say our context is not designing a

1-week program or a short term program or a workshop, our goal is to design one semester course.

This course is to be designed to meet certain outcomes. ADDIE is a concept that can be applied for constructing outcome based learning. ADDIE evolved since 1975 into a framework that facilitates active, multi-functional, situated and inspirational approach to learning.

Let us look at all the elements of this. It all started way back in 1975, when the word ADDIE was coined. It facilitates active learning and multifunctional learning. It is situated, there is always a situation, that is situation specific instruction can be created, and it can also be inspirational learning.

Sometimes when you participate in one experience or listen to a lecture, it could be quite inspirational, and that can also be one of the elements of ADDIE. Just because you are following a process, it does not mean that it is not inspirational.

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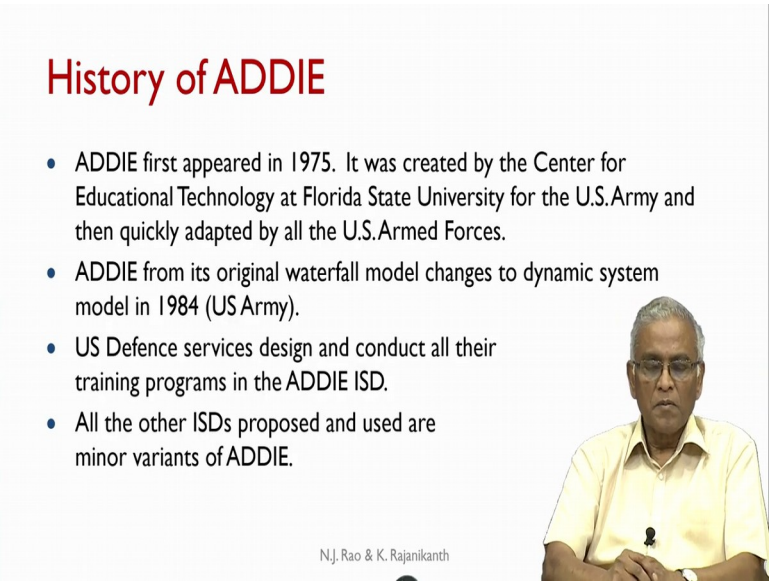

A little bit of history of ADDIE. ADDIE first appeared in 1975, and you should remember it was created by the Centre for Educational Technology at Florida State University for the U.S. Army, and then quickly adopted by all the U.S. Armed Forces. Today, all training programs for US armed forces continue to be created using the ADDIE model. So, it is not something that is outdated as some people claim.

Originally ADDIE started with the waterfall model; that means, it is a sequence of steps you complete one step and then go to the next step. Unfortunately, some people only remember that, and start attacking that ADDIE is irrelevant. But ADDIE from it is original waterfall model changed to dynamic system model in 1984. From 1984 it is truly a system model.

U.S. Defence services design and conduct all the training programs in the ADDIE – ISD (Instructional System Design). Surprisingly, many people have attacked the ADDIE and they have created their own, (we will presently see the list). All the other ISDs are minor variants of the ADDIE model; I would consider these are cosmetic changes of the ADDIE model.

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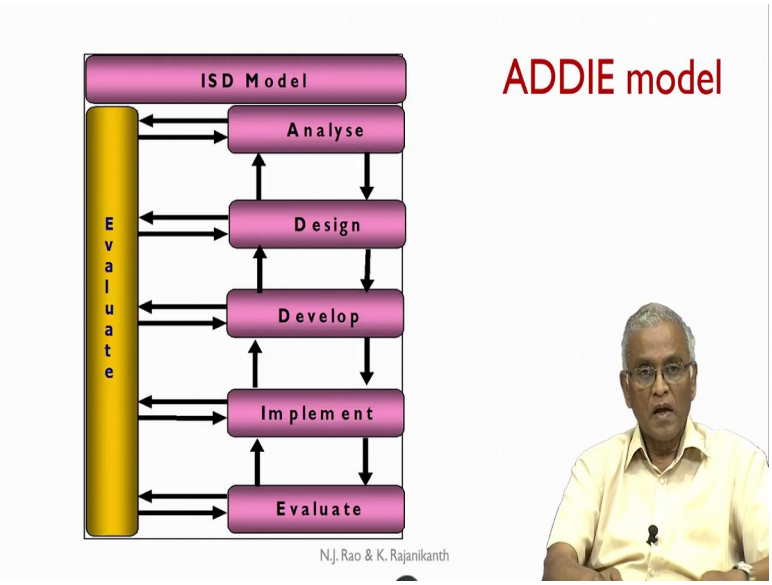

ADDIE model: There are 5 stages which we have already identified Analyse, Design, Develop, Implement, and Evaluate. And, then we have put another evaluate on the left side.

How does the designing a course evolve as per ADDIE model? You start with analyse, whatever be that we will presently see. After doing the activities related to analyse phase, you get it critiqued or evaluated by somebody, it could be peers or it could be stakeholders, you get it evaluated after doing this. They may give some inputs, you take that and again redo your analysis. There is a kind of a feedback mechanism here.

Having done analysis phase, after going through (if necessary) multiple iterations here (Analyse-Design – Phase), generally what happens in real world, course is being designed by a group of people, they continuously discuss; that means, this process will keep on going continuously before you get to finalize the outputs of activities of analysis phase. From there you come to design, there are some activities related to design, there also you go through this kind of evaluation (we can call it formative evaluation.) Sometimes you may be required to go back and modify the activities of the analysis phase.

Remember that there is always this feedback happening, and then the same procedure will continue - output of the design phase - you go to the development, if necessary you go back and sometimes all the way to analysis phase, and then implement, you again do this; we will presently see what each phase is doing, and then you have finally, evaluate phase. This is a kind of (I can call this) summative evaluation, and I can call this evaluate process on the left side as formative evaluation. So, that is why evaluate word appears twice in this model.

This is certainly not a waterfall model, I will do something, and keep doing that, and I come back, and possibly travel all the way back to analyse and keep modifying that. There is continuous feedback, back and forth and it is not necessary to freeze the activities of outputs of analyse phase before you move to the design. Somehow many other people have considered that ADDIE is a waterfall model or a linear phase model.

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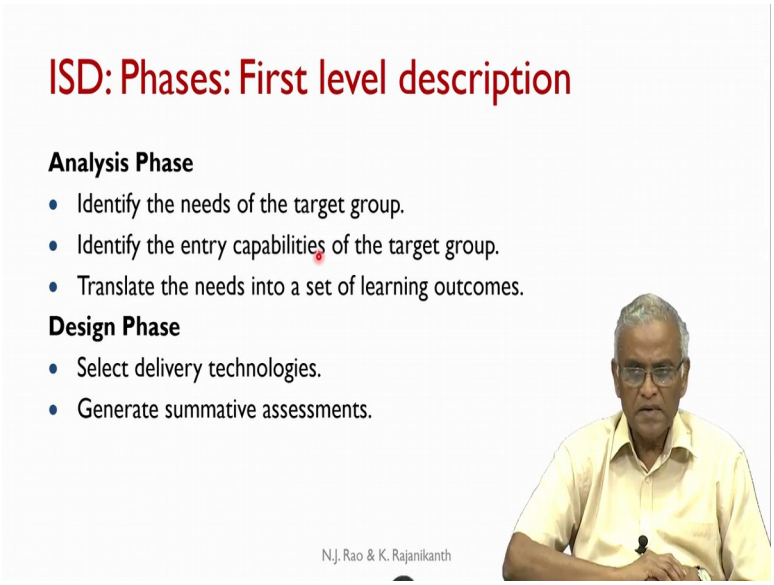

Let us look at a little bit of first level description of the phases (we will do in much more in detail later.) The analyze phase as per ADDIE identifies the needs of the target group, identifies the entry capabilities of the target group, and translates the needs into a set of learning outcomes.

For example, if you look at this - in a formal program like in engineering program the needs of the target group are already identified through a curriculum design. Whereas, if you try to design a program for a company you will have to look at what the target group is. And, similarly as courses are sequenced, and the prerequisite courses are supposed to have been already conducted before you come to this course.

So, the entry capabilities of the target group are also of minor concern in a formal engineering program, but the main activity is, creating a set of learning outcomes or what we are calling as course outcomes here. And, that is what we will look at when we look at specifically performing analyze phase in the context of engineering program. Design phase: you select a set of technologies that you want to use for delivering the course and generate summative assessments; the main activity of design phase is generating summative assessments.

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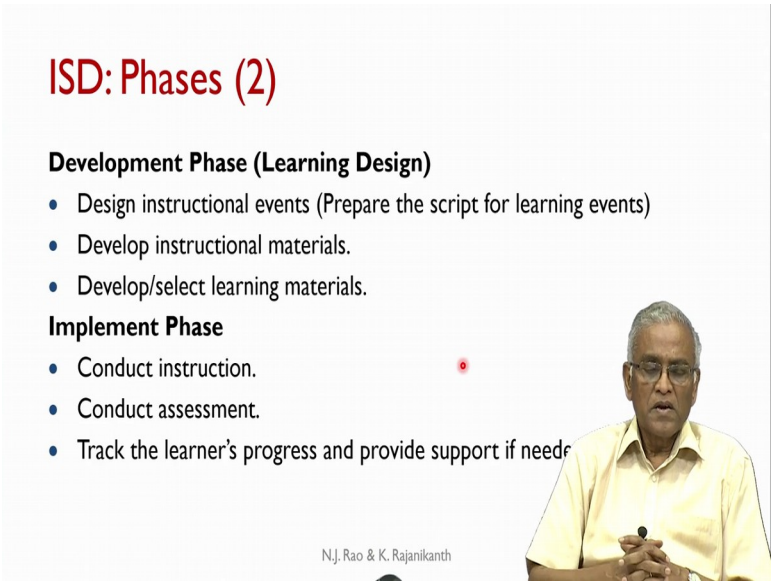

Development phase is being called learning design as well, but we will stay with development phase word, design instructional events or prepare a script for the learning events. Script in the sense who will do what, and in what sequence you will be doing it. It is not the filling the details, but writing a script like script for a drama or a movie.

Developing instructional materials and developing or selecting learning materials is the main activity of development phase. Implement phase: you conduct actual instruction and assessment, that is, you take the classes, conduct the tutorials, conduct the test, get the marks, and so on. In that process you also track the learner's progress and provide support if needed.

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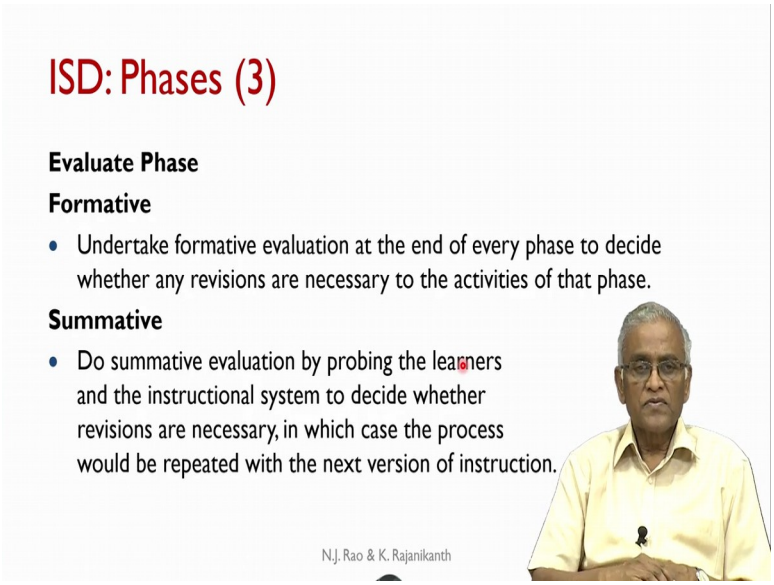

As we have seen in the diagram, evaluate phase shown, the left hand vertical one, we call formative evaluation, and the last one is called summative evaluation. In formative evaluation we undertake the formative evaluation at the end of every phase to decide whether any revisions are necessary to the activities of that phase. Whereas, summative evaluation - we do it by probing the learners and the instructional system to decide, whether revisions are necessary in which case, the process would be repeated with the next version of instruction design.

In the language of continuous improvement or using the Deming cycle this comes completely under that. That is having done something, having found out to what extent they have attained the outcomes, if there is an attainment gap, what are the additional activities that you would like to do next time you offer the course. That is summative evaluation.

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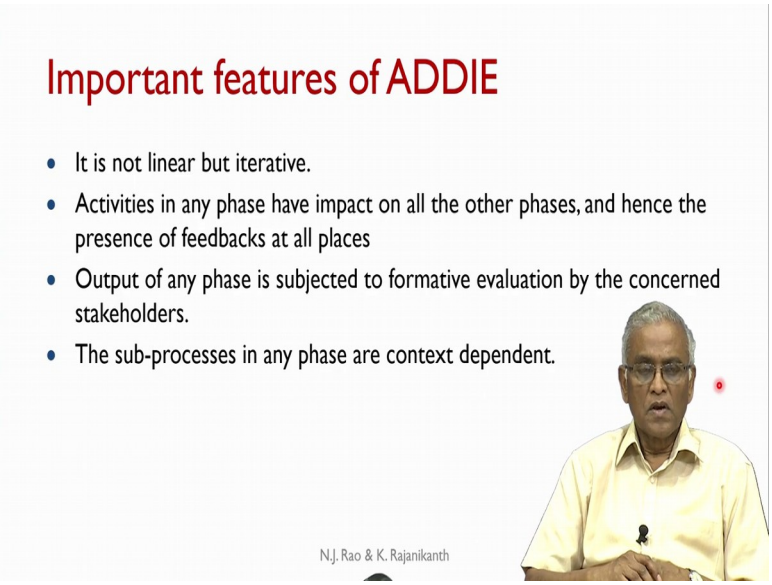

Important features of ADDIE: after 1984, it is not the linear process, but it is iterative. Activities in any phase have impact on all other phases and hence the presence of feedbacks at all places. Remember that anything that you change at any at any point, you will have to take a re-look at on all the activities in other phases. Whatever modifications you do, they will not remain local and it will have impact on the entire thing.

Output of any phase is subjected to formative evaluation by the concerned stakeholders. The sub processes: will be proposing a set of sub processes in each phase and they are context dependent. (We will explore that in the next unit when we look at the sub processes of analysis phase.) If you want, you can differ with the processes that are presented to you and you may want to modify them, and you are welcome to do so. But you have to keep track of their impact. We will present you one sequence of sub processes in the next unit.

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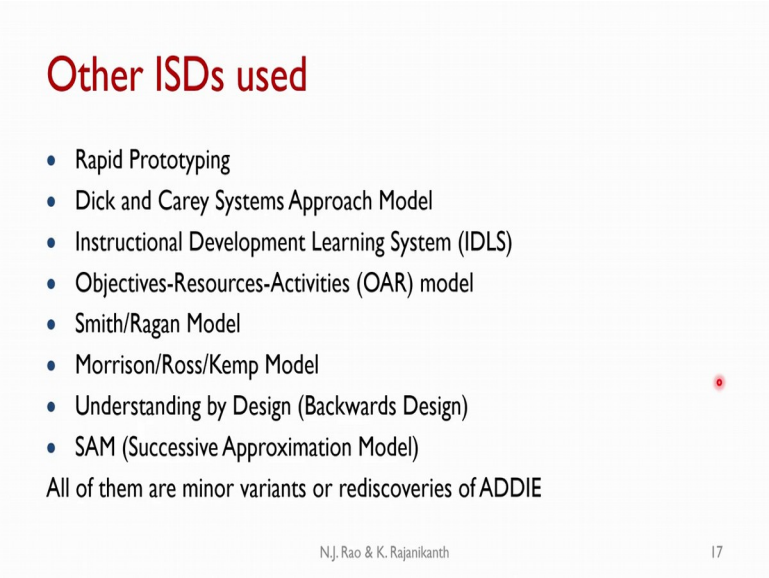

You have a whole bunch of other ISD models we will only list. For example, Rapid Prototyping. There is Dick and Carey Systems Approach Model. That is one of the very popular models, and the eighth edition of the book Dick and Carey Systems Approach Model is in print. It is dominantly used for training programs, the language used is specifically related to training programs. But when you look at Dick and Carey model it is only a rehashing of ADDIE model, though in Dick and Carey book they do not mention the word ADDIE.

Instructional Development Learning System (IDLS); Objectives Resource Activities-OAR model, Smith and Ragan Model, Morrison/Ross/Kemp Model, Understanding by design- it is a backward design model, and the most recent one is called SAM - Successive Approximation Model. For some reason he has put the title like how to get away from ADDIE, which I consider ridiculous to put in a title because what he finally, produced is ADDIE model, with some minor variations.

All these models are minor variants or rediscoveries of ADDIE model. ADDIE can be considered as a generic model into which I can keep on putting details in terms of sub processes of each phase.

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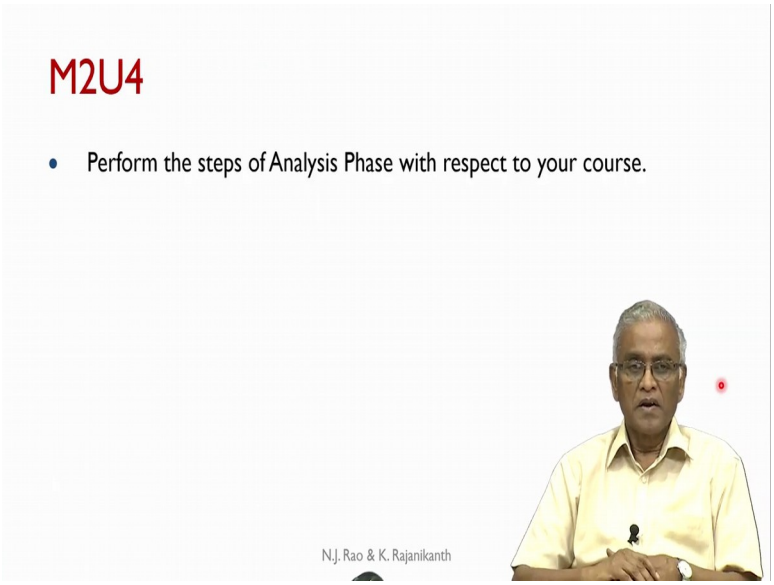

In next unit we will look at the steps of analysis phase with respect to one's own course. ADDIE context will be one of the engineering courses that we design, it could belong to the category of humanities, social sciences, sciences and so on, or it could be pure engineering course. We will be looking at the sub processes involved in analysis phase. We will propose a set of sub-processes, if you wish, you can create your own variations of that and implement them for yourself.

Thank you very much for your attention.