NBA Accreditation and
Teaching – Learning in Engineering
(NATE)
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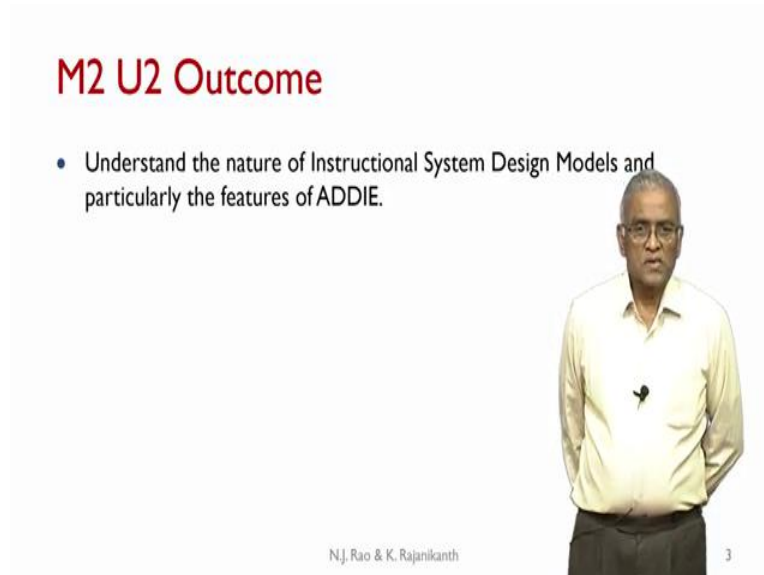**Lecture 23**
ISD and ADDIE Models

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Greetings and welcome to module 2, unit 2 on ISD and ADDIE. ISD is Instructional System Design. In the earlier unit we understood the significant contribution systematic design of a

course can make to the quality of learning. So if you systematically design your course following a certain process when it will have a great impact on the quality of learning by the students.

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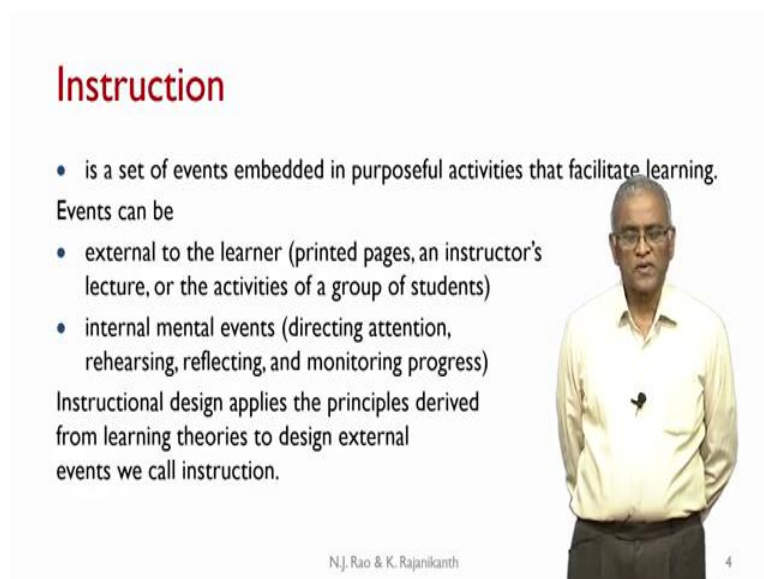And in this unit we will try to the nature of instructional system design models and particularly the features of ADDIE.

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Okay, first we have to understand various terms in this area. The words are one is instruction, the other one is instruction design, the third one is instruction designer and fourth one is instructional

system design. And other words are like learning theories, so what is instruction? Instruction is a set of events embedded in purposeful activities that facilitate learning, this is a formal definition. That means the instructor or whom we call the teacher arranges certain events, organizes certain events which will facilitate learning.

And these events can be external to the learner and some are internal mental events of the student. External events are like printed pages that is the student is asked to read something or instructors lecture or the activities of a group of students and so on. There can be several external events that can be organized by the instructor.

And internal mental events includes directing the attention of students, making them rehearse, reflecting and monitoring the progress. Now instructional design, what does it do? It applies the principles derived from learning theories to design external events we call instruction. There a whole host of learning theories and in a particular instructional design I may be taking the help of some of the available learning theories based on that I plan my external events which we call instruction.

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Principles of Instructional Design

Would help
- Teachers/Instructors to decide
  - when it would benefit students to be put into groups,
  - when practice and feedback will be most effective,
  - the pre-requisites for problem-solving and higher-order learning skills
- Producers of instructional materials
- Curriculum material developers
- Web-based/e-learning course designers
- Knowledge management system designers

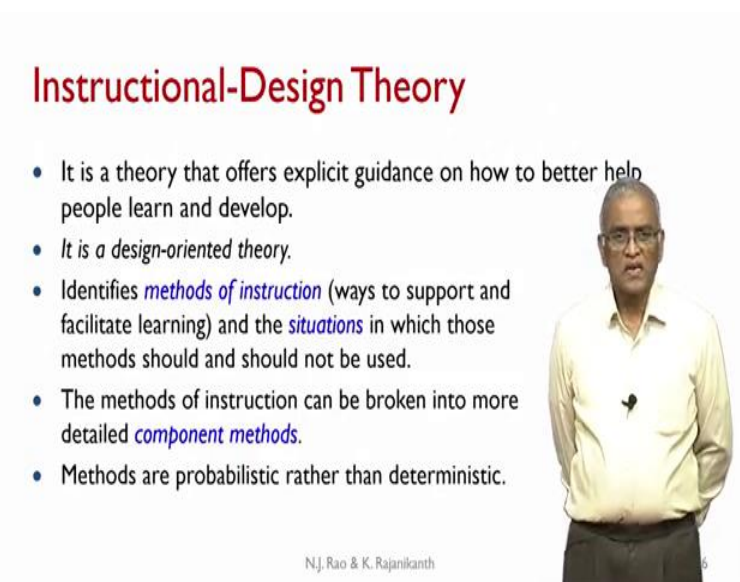N.J. Rao & K. Rajanikanth   5

Now principles of instructional design, what do they do? If you derive some principles of instruction they would help teachers or instructors to decide these are only some examples when it would benefit students to be put into groups, when practice and feedback will be most affective. And the prerequisites for problem solving and higher order learning skills. For

example, you can also decide in what sequence should I instruct so that the students learn the higher order a thinking skills.

And there is a whole host of things that can be done following various instruction design theories we will not be going through that. We appeal to you as a teacher we request you to kind of explore various instructional design theories. You may like some of them or you may find them a particular design theory useful to is more meaningful with respect to your course and so on. And these principles have instructional design would also help producers of instructional materials.

See there are some agencies which full time focus on developing instructional materials, especially at the school level or at the cooperate educational level. Curriculum, it will also help curriculum material developers, web based, e-learning course designers and sometimes knowledge management system designers. So any of these people or any of these activities can greatly benefit from instructional design theories.

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Instructional design theory is a theory that offers explicit guidance on how to better help people learn and develop. Actually we are re-wording whatever we have stated in the previous slide we are stating a little more formally. And it is a design oriented theory we have explained earlier in module 1, what is a design oriented theory but let us restate that a design oriented theory what it does it tells you it is a prescriptive theory that is if you do things in one particular way it is likely to lead to better learning that is what it is.

But it is not a unique one, so based on the instructions designers or instructors knowledge of the subject and is experiences and so on they will make use of the instruction theories or learning theories to define a series of activities, instructional activities that are likely to lead to a better learning. And that what design oriented theory is. So it identifies methods of instruction, methods of instruction would mean ways to support and facilitate learning.

And the situations in which those method should or should not be used. All types of methods of instruction cannot be used in all situations, the way you would handle let us say very top of the lines students the way you instruct them you cannot use a same method for students who do not have that level of cognitive ability, one should not use also.

So the instructional design theory will also tell you under what conditions can you use a certain method of instruction. And these methods of instruction can be broken into detailed component methods and there is a certain sequence and how do you organize my component methods in what sequence I try to use this components to achieve my the level of outcome will also be part of instruction design theory.

And any method that you suggest are probabilistic rather than deterministic. In the sense there is no guarantee that all 100 percent of your students will achieve the stated outcome because the number of factor that influence learning are so many you can only say these are probabilistic rather than deterministic.

As we mentioned instructional situations, what are they? Instructional situations are the nature of what is to be learned. It can be mathematics subject or it could be descriptive subject like material science or it could be an engineering science subject or it could be engineering subject and so on. So you cannot apply the same method to all that means instructional situation is different. And instructional situation is also characterized by the nature of the learner which I have just mentioned little while ago.

The nature of the learning environment, what kind of environment do you have and the nature of the instructional development constraints. For example, you may have a certain systems are done by the university or by the accreditation agency or by the college management there are certain constraints that are imposed and you have to operate within that. So, your instruction will have to get adjusted to the ID constraints that you have in your situation.

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Now we call it instruction should be E3, the what are the goals of instruction? It should be effective, what do you mean by effective? You must, it must lead to attainments of the course outcomes. That is effectiveness if I have attain my outcomes then I am effective and it should be efficient that means I cannot I have to operate I have to do my instruction with limited time and other financial resources.

I cannot say that I need more number of lectures, I need more amount of resources, I need more number of books and you can on putting many other constraints on the resources. So it should also be efficient. Though we may not be able to achieve efficiency in all situations and more importantly it should be engaging or in other words appealing. That means the student should be wanting to interact with the new knowledge they are required to acquire. They should be engaged with the new knowledge that is being imparted to them.
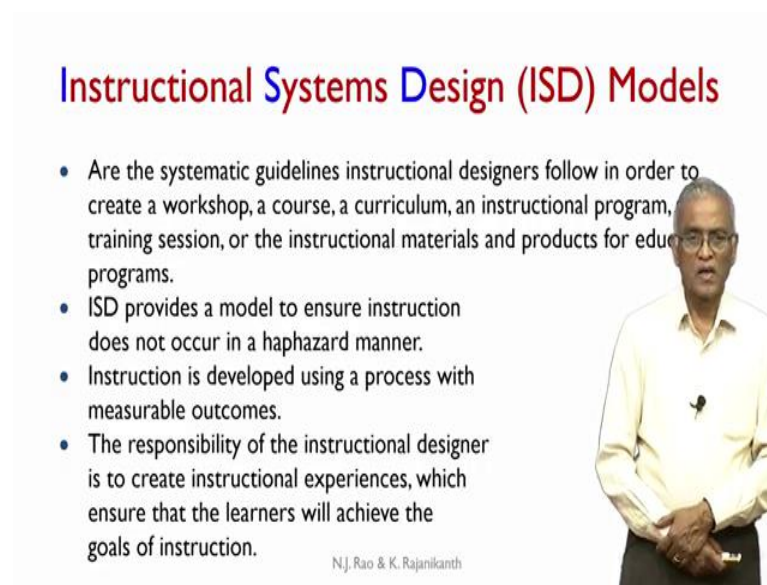
So effective and engaging are two most important thing and sometimes if it is also efficient it is good I may not be able to achieve the efficiency all the time okay. So, as we call it E3 instruction these are the 3 goals of any instructional methods that you want to use. Sometimes people conduct a workshop for 3 days, 4 days just to emphasize one particular concept, so certainly such a workshop will be effective and engaging but certainly not efficient.

And you cannot afford such inefficient methods all the time in your classroom because whenever you teach a course in a semester you have limited numbers of hours available to you and you

cannot also take it for granted that the student is available to you 100 percent of the time throughout the semester. So the kind of exercises, kind of preparation you want your student to do should take the these constraints.

For example in a semester, a student have, takes about 5 to 6 courses and may be 2 laboratories and he still have to get involved in some curricular and co-curricular and extra-curricular activities and so on. So, the instructor needs to pay attention to efficiency while being effective and engaging.

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Instructional Systems Design (ISD) Models

- Are the systematic guidelines instructional designers follow in order to create a workshop, a course, a curriculum, an instructional program, training session, or the instructional materials and products for educ programs.
- ISD provides a model to ensure instruction does not occur in a haphazard manner.
- Instruction is developed using a process with measurable outcomes.
- The responsibility of the instructional designer is to create instructional experiences, which ensure that the learners will achieve the goals of instruction.

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Now, we look at now what you call Instructional Systems Design models, ISD models. First of all what are these models? There are systematic guidelines instructional designers follow in order to create a workshop, a course, a curriculum, an instructional program a training session or the instructional materials and products for educational programs. So, ISD models provide you guidelines for doing any of these activities.

ISD provides a model to ensure instruction does not occur in a haphazard manner it gives you a structure to be followed. That way if several people are involved in designing a course, let us say two teachers are trying to design a course together which is a desirable thing and they can interact effectively with each other if they follow one of the ISD model.

Instruction is developed using a process with measurable outcomes that is one of the purpose of ISD model. So, the responsibility of the instructional designer is to create instructional experiences which ensures the learners will achieve the goals of instruction, so the goal is to, goal is to attain the outcomes or goals of instruction what we are calling it, effectiveness. The instruction should be effective, so following an ISD model will make the instruction effective.

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ADDIE- An ISD Model

- ADDIE is acronym for Analysis, Design, Development, Implement and Evaluate.
- ADDIE is a process for development of a learning product.
- The ADDIE concept can be applied for constructing outcome-based learning.
- ADDIE merely serves as a guiding framework.
- ADDIE evolved since 1975 into a framework that facilitates active, multi-functional, situated and inspirational approaches to instruction.

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Now we come to a specific model called ADDIE. As we said ADDIE is an acronym for analysis, design, development, implement and evaluate. ADDIE is a process for development of learning product its a learning product. The ADDIE concept can be applied for constructing outcome based learning because that is the constraint that we have, NBA accreditation and OBE framework and ADDIE merely serves as a guiding framework.

We will see following an ADDIE it does not constraint you at all, we will be elaborating on that and ADDIE evolved since 1975 into a framework that facilitates active multifunctional situated and inspirational approach to instruction. It can meet all the requirements of instruction it could be a multi-disciplinary course and as we said every course is situated in a particular environment, so you have to take instructional situation into consideration.

And it also engages the student it can engage the student and it can also be inspirational, it need not be excluded that such a constraint one is not inspirational.

History of ADDIE

- ADDIE first appeared in 1975. It was created by the Center for Educational Technology at Florida State University for the U.S. Army and then quickly adopted by all the US Armed Forces.
- ADDIE from its original waterfall model changed to dynamic system model in 1984 (US Army).
- US Defence services design and conduct all their training programs in the ADDIE ISD.
- All the other ISDs proposed and used are minor variants of ADDIE.

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Now, as you can see ADDIE is not a very what you call very recent one it has gone through there is a lot of experience that is gained. ADDIE first appeared in 1975 it is not attributed to any single individual or a group of people it was created by the center for educational technology at Florida State University for the US army and then it was quickly adopted by all the US armed forces.

Even today all programs of US armed forces are designed and conducted in the framework of ADDIE. The first model in 1975 is what you call waterfall model, if you are familiar with that, that means anything that you have a certain number of stages after you complete the work in the first stage then you go on to the second stage. After you complete the second stage you move onto the third stage and so on.

But that was as you can see quickly given up and it is got shifted to the dynamic system model in 1984. But somehow some authors seem to keep on referring to the 1975 model rather than 1984 model. So US defense services design and conduct all their training programs in the ADDIE-ISD. And if you look at all the presently available ISD frameworks though they have different names they are minor variants of ADDIE.

Because ADDIE this 5 stages seem to be natural to any kind of instruction design. Though some people consider that we greatly differ from ADDIE essentially it is a minor modification of

ADDIE. That is why we choose the generic version of the ADDIE and it can be adopted to any situation.

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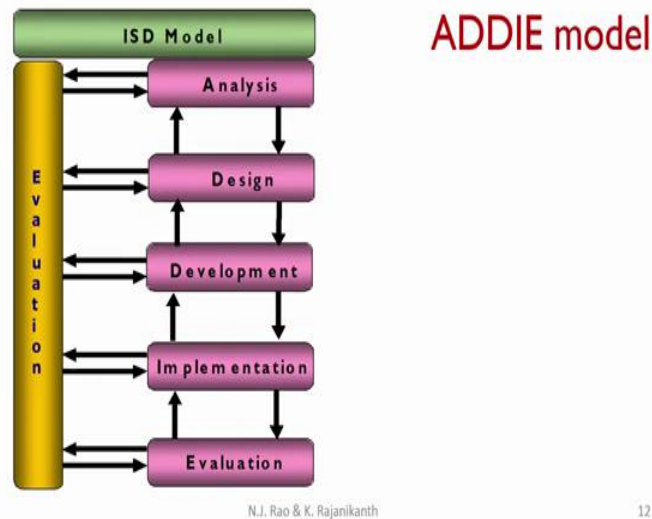
Now, this is a model let us look at some features of this. So, ISD model it has the 5 phases, this is analysis, design, development, implement and evaluation. Evaluation appears here as well as here as you can see, why is it so? The vertical part this evaluation is what we call formative evaluation whereas this is summative evaluation. We will presently come to that and another major feature of this is after you do the analysis you come to design.

But it does not mean that the work in analysis phase is over and it is final, no, actually after you do any activity in a phase you get it evaluated by your peers or some stakeholders and based on their comments and inputs you may want to redo your activities of the analysis phase that is one kind of a feedback. The other one is when you are doing the design phase work, design phase work you feel that you need to go back and redo some parts of the analysis phase.

So there is a feedback to this, okay. So, similar process happen at all the five stages of ADDIE. In the end after you complete all this you kind of evaluate what you have done and see if you want to do any next time you do your instruction whether you want to make any fundamental changes as you can see anything that you do anywhere has impact on all the other phases of ADDIE.

So you cannot say that it is a really waterfall model, if it is a waterfall model these feedbacks and these feedbacks will not be, should not exist, so it is not a waterfall model, it is a system design model and to their extent there are plenty of feedbacks and iterations that are involved. And it also tells you when you have such a model it is not necessary that I have to do analysis completely to my satisfaction before I move on to design or before I move on to development.

Based on some preliminary understanding of the analysis phase activity I may go to any of the stages and start working on it and keep adjusting it so there is no need to wait for the previous step to be completed before attempting a particular activity in a follow up phase.

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Now what we present is what are the activities in each phase at a first level, as per first level description these are not the final. Approximately these are the activities that need to be done in each phase. What are they? First in analysis phase you have to identify the needs of the target group, do not necessarily refer to your engineering program it can be any kind of training program that you want to organize you first have to find out what is the, what are the needs of the target group.

And identify the entry level capabilities of the target group. What do they know and what do they have and then translate these needs into a set of learning outcomes. Now when you particularize to our engineering program for example identify the needs of the target group, I do not have to

work because the curriculum is already designed and somebody has given me already the course and course contents.

And then identify the entry capabilities of the target group, so in a formal engineering program I have to consider approximately the students who come to my course have this a common background they may be differ in their abilities but they have the some common background like for example they are graduates of 12th standard if you are looking at the first semester course. If you are looking at the 3rd semester course we consider all the students have gone through the first 2 semesters before they come to the 3rd semester and so on.

So the specifics will differ depending on the situation that you have but these three activities need to be address in analysis phase. We will come later when we are working in the following units which what are the specific processes that we do when we apply the analysis phase to the design of an engineering course. And design phase we select delivery technologies and also generate summative assessments. Design of assessments will become the major activity of design phase.

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And in development phase which is also getting called these days as learning design in that we design instructional events, the term that you are more familiar with is the lecture schedule or instruction schedule and so on. Develop instructional material, instructional material is what the

instructor uses not necessarily completely shared with the students. What it is, we will see at the appropriate time and third activity either develop or select learning materials.

Learning materials are what learner uses to learn, it can be textbooks or it can be an internet source. Then in implement phase you actually conduct instruction and conduct assessment and track the learners progress and provide support if needed.

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Now we look at the next phase evaluate as we saw in the diagram, evaluate the term appears in two parts of the diagram. One is formative at the end of each phase we present our output to the concerned stakeholders and based on their evaluation and their feedback we may make some revisions to the activities of that phase. Summative part that is the last phase that we talk about we do summative evaluation by probing the learners and the instructional systems to decide whether revisions are necessary.

In which case the process would be repeated with the next version of instruction, what does it mean? One of the other things we do in summative evaluation is to compute the attainment of course outcomes and compare with them with the targets that we have set for our reasons.

And if you are falling short of the targets then what do you do you review the entire process of what you have done during the semester, based on that you identify specific steps that you want to take when you offer the course next time to improve the attainment. That means either you

come closer to the target or you may want to even increase the target levels as well. That is what the summative evaluation should be doing.

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Important features of ADDIE

- It is not linear but iterative.
- Activities in any phase have impact on all the other phases, and hence the presence of feedbacks at all places
- Output of any phase is subjected to formative evaluation by the concerned stakeholders.
- The sub-processes in any phase are context dependent.

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Once again what are the important features of ADDIE. It is not linear but iterative that somehow in the literature some books and some individuals keep complaining about the somehow attribute waterfall model to ADDIE which is not corrected at all. Activities in any phase have impact on all other phases and hence the presence of feedbacks at all places. Output of any phase is subjected to formative evaluation by the concerned stakeholders.

The sub-processes in any phase are context dependent this is where the specificity comes. It is not as if you have one universal solution for designing anything under ADDIE, the sub-processes will differ and what we are going to do we give one set of sub-processes in each phase and based on your experience if you find some of the sub-processes are not appropriate to your context or your course feel free to change them. But write a set of sub-processes for yourself and follow them.

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And some of the other ISDs used in the literature are rapid prototyping it is called and one of the most popular one is Dick and Carey systems approach model they do not even mentioned about ADDIE somehow it seems to have evolved on its own and it is also highly popular for training programs, especially where physical skills are involved.

And other things are instructional development learning system, object resources activities model, Smith and Ragan model, Morrison, Ross, Kemp model, understanding by design or what we call backwards design model and the most recent one is SAM Successive Approximation Model. And if you compare all of them and compare them with ADDIE they are all minor variants or rediscoveries of ADDIE.

And in the next unit we will perform the steps of analysis phase with respect to a specific course that is the goal of next unit. Thank you very much.