Effective Engineering "Teaching" in Practice
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Lecture – 05
Writing Learning Outcomes for a Course

Hello. Welcome to the course on best teaching practices in engineering education. This course is jointly offered by Professor G.K. Suraish Kumar, department of biotechnology IIT Madras, and teaching learning centre IIT Madras. My name is Edamana Prasad, I am currently working as associate professor in the department of chemistry, IIT Madras, as well as heading the teaching learning center in this institute. Welcome to this module where we are trying to help you to design learning outcome for your course.

So, this particular session is about writing learning outcome for a course.

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I would like to acknowledge a few people's contribution towards making the slides of this particular module. Professor Jeffrey E Froyd from department of education, Ohio state university, teaching learning center core team members in IIT madras, professor Ajith Kolar, professor Pramod Mehta, doctor Nandita Madhavan and doctor Smita Srivastava. They helped me immensely in designing the slides.

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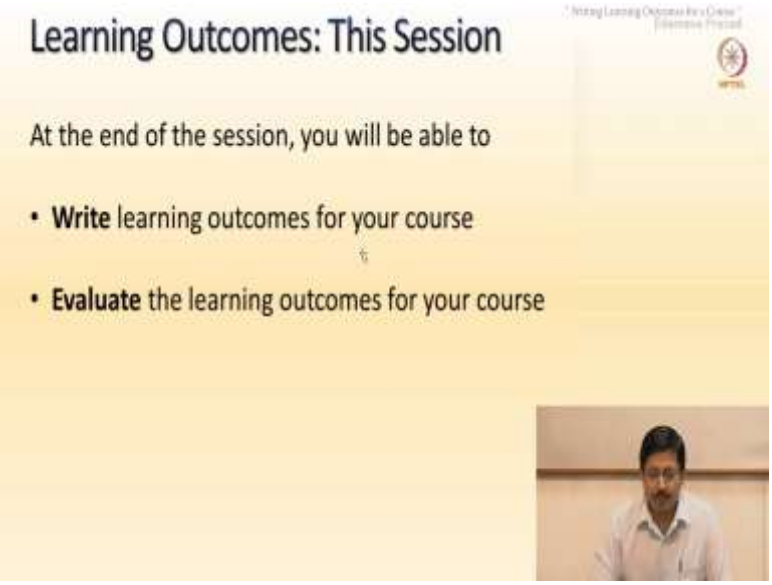

The expected learning in this module are listed here. At the end of this session you will be able to write learning outcome for your course, and also you will be able to evaluate the written learning outcome for the courses.

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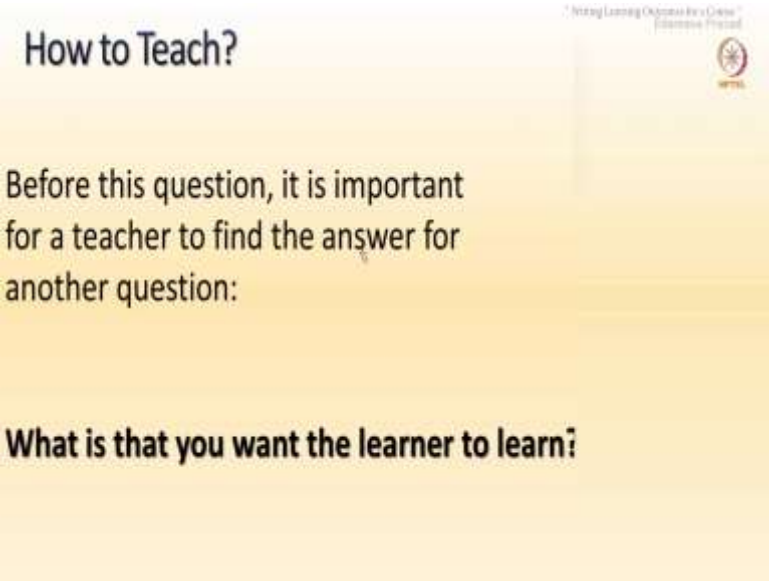

One of the interesting question to all teachers is how to teach? However, in my opinion before teachers ask this question, there is another important question that teachers may want to pay attention. And that is what is that you want the learner to learn. If teachers address the second question first, probably the answer for the first question will

automatically come. Because how to teach entirely depends upon what you want to teach. And what you want to teach is, the same thing is written as what is that you want the learner to learn.

So, unless and until the faculty address, what is the intended learning? How to teach question cannot be answered. So, this module is basically addressing this question what is that you want the learner to learn from your course. So, I will pose this question to you.

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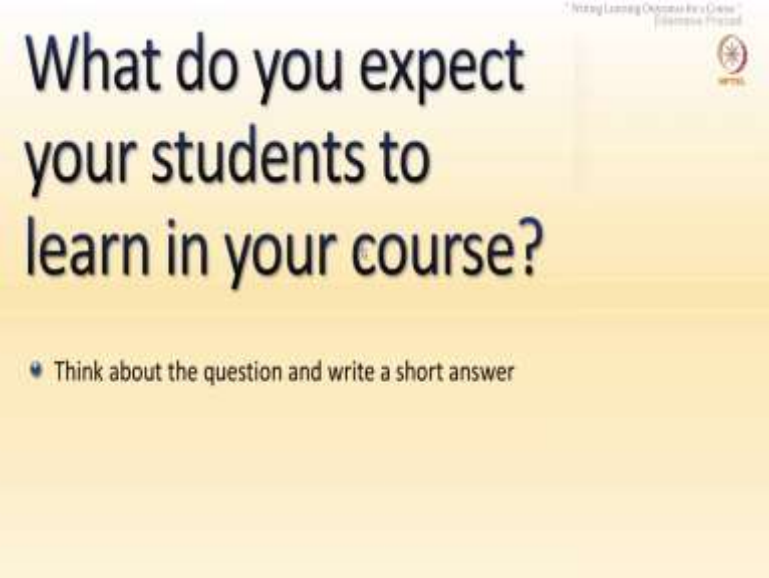

What do you expect your students to learn in your course? Think about this question. And I request you to take a piece of paper and pen, and briefly write down your thoughts.

So, what you have written now is nothing but learning outcome for your course. Because the question was what is the expected learning in your course. And that is called learning outcome, the outcome of learning.

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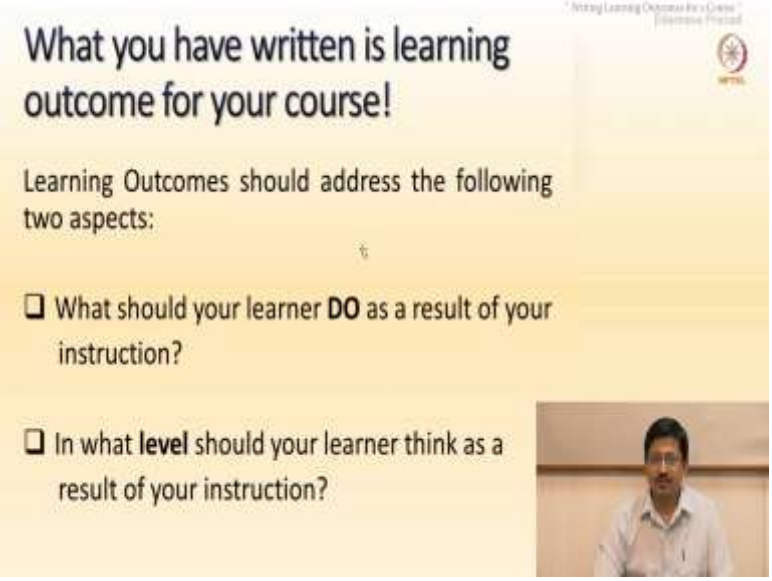

So, faculty write the intended learning in various formats. However, there are certain guidelines suggested across the globe for writing learning outcomes. So, in the coming slides, what we are trying is to help you to fine tune, what you have already written as the outcome for your course, intended learning in your course. Learning outcome design should address the following 2 questions. These are important questions that faculty may want to ask for designing learning outcome. Question number one, what should your learner do as a result of your teaching?

Question number 2, in what level should your learner think as a result of your teaching? So, the first question the do is written as bold and capital letters, which means that lot of emphasis is given for that do part, which is basically what learner does as a result of teaching. And the second one is - in which level the learner is expected to think, what cognitive challenge the course is offering to the learner. Unless these 2 things are reflected in the designed learning outcome, the design is not going to be serving its purpose.

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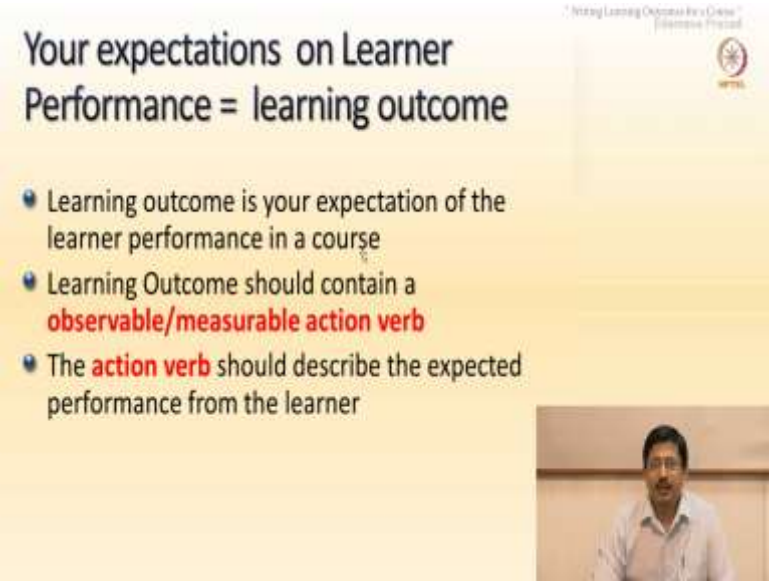

So, formally if you want to define learning outcome. This is one way of defining the learning outcome. Learning outcome should contain a verb. This is one of the fundamental criterion for writing learning outcome. That verb should be either observable or measurable. And why it is a verb? Because we said learning outcome is the expected performance from the learner.

So, when learner cognitively does a performance, it should be observable or measurable. So, that the teacher can identify that the intended learning happens. So, unless the learner's performance is observable or measurable, a teacher or a third party cannot assure that the intended learning is happened. That is the reason why we say that learning outcome must contain an observable verb.

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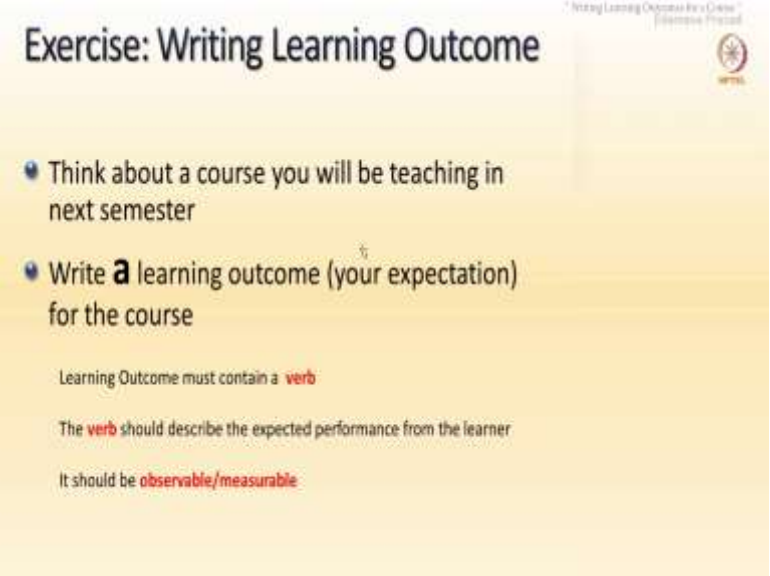

So, based on this definition, I request you to now think about a course that you are going to teach in the next semester. I want you to write one learning outcome for your course. And the slide contains the definition of the learning outcome; which means it contains a verb and the verb should be observable or measurable. Please go ahead.

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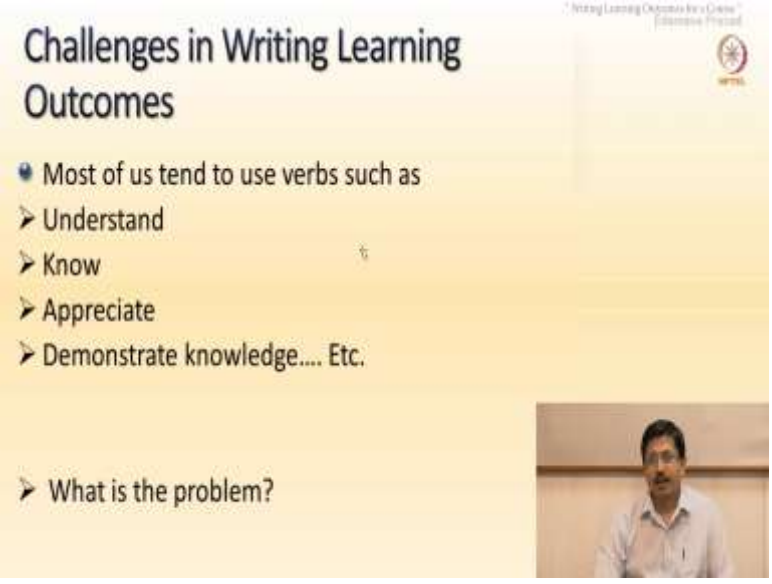

So, I assume that you have written one learning outcome for your course. Faculty faces a couple of challenges when they are asked to write learning outcomes. Challenge number one, is written in this slide. Most of us tend to use the verbs such as I want my students

to understand what I am teaching. I want my students to know the concepts that I am teaching. I want them to appreciate what I am teaching. I want them to demonstrate the knowledge. Even though they are verbs, some of them or most of them are not observable or measurable.

So, there is a problem in using certain verbs. In other words, all verbs may not be suitable for writing your learning outcome.

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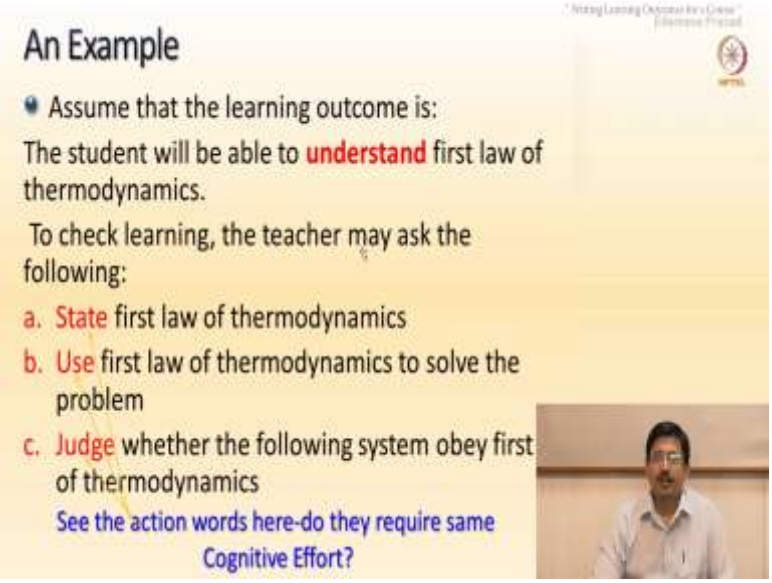

So, let us take one example. Assume that the learning outcome is written like this. The student will be able to understand first law of thermodynamics. To check the learning, the teacher may ask the following questions. Question number 1, state first law of thermodynamics. And if the student answers that question, teachers say that she understands first law of thermodynamics. The question can be like, use first law of thermodynamics and solve a problem. In that case, suppose she uses first law, and then finds out the answer, then teacher says yeah, she really understands first law of thermodynamics. The question can be even like judge whether the following system obeys the first law of thermodynamics. And the student suppose she is able to judge it, teacher says that she really understands the first law of thermodynamics.

However, in the designed learning outcome, we write the student will be able to understand first law of thermodynamics. Now let us go back and check learn these 3 questions, even though we use verbs they are not at the same difficulty level. Or in other

words, these questions are not in the same cognitive level, or the cognitive effort, the thinking effort that a person has to put is different for these 3 questions, even though we have one intended learning outcome. This is one problem when we use understand as a word for writing learning outcome.

The communication, the expectation of a teacher, at which level he or she wants the learner to think is not properly conveyed. That is one of the reasons why teaching learning center IIT madras in our workshops, we request faculty to avoid the word understand for writing learning outcomes.

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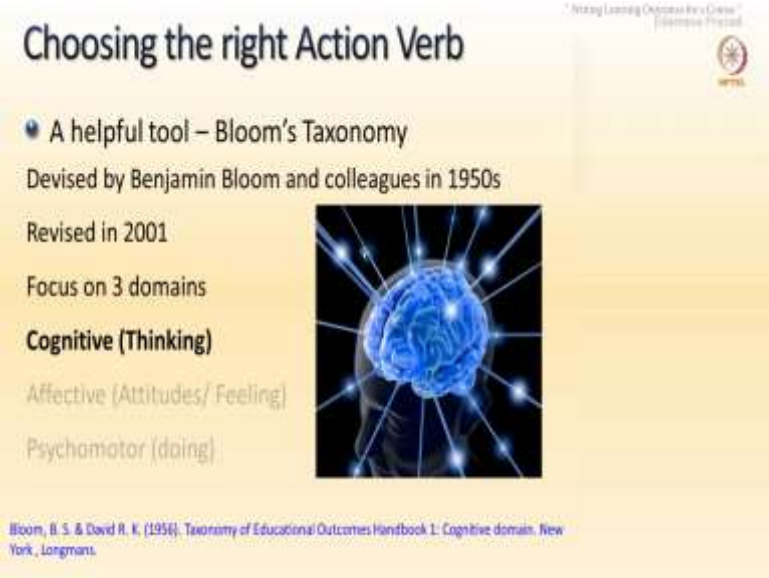

Now, it comes to another challenge, challenge number 2. How do I pick up a verb? If certain verbs are not appropriate for writing learning outcomes, how do I select an appropriate verb. And the answer is Bloom's taxonomy. Bloom's taxonomy acts as a helping tool or a technology for faculty to decide what will be the appropriate verb to represent the intended learning.

And Bloom's taxonomy is put forward by Benjamin Bloom and his coworkers in 1950's which is a popular taxonomy in the education field. Although there are other taxonomy is available, Bloom's taxonomy gets popularity because it is very simple and straightforward. So, across the globe teachers still use Bloom's taxonomy to classify the learning levels. Bloom's taxonomy focuses on 3 domains - cognitive domain, affective domain and psychomotor domain. And as far as a classroom is concerned, the most

important domain is cognitive domain. Even though affective and psychomotor domains are important as far as a classroom is concerned, most of the things that happen between a teacher and student in a classroom is involving cognitive levels.

So, we are going to focus on this particular domain in Bloom's taxonomy, which basically enables the teachers to design learning outcomes.

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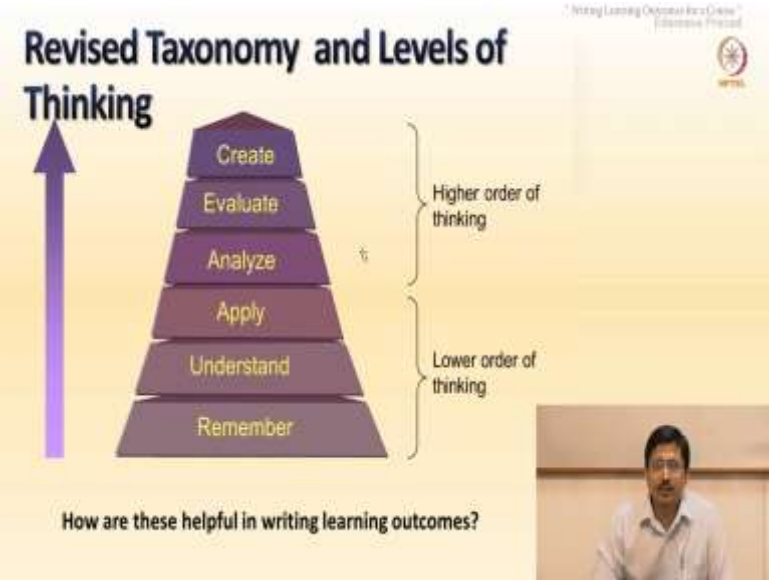

So, this is the Bloom's taxonomy which is a revised version in 2001. According to Bloom's taxonomy, there are 6 levels of thinking which are shown in this slide from bottom to top. Remember, understand, apply, analyze, evaluate and create. I think most of the faculty are now aware of that there is a classification of learning levels, and these are the levels. The below 3 levels are called lower order thinking, and above 3 levels are called higher order thinking.

Now, the question is how do we use this classification for writing learning outcomes. For that we need to go back to the 2 questions we asked in the beginning. Question number 1, what is it that the teacher wants the learner to do as a result of the teaching? For that we already answered there should be a verb, which represent that 2 part. Question number 2 - in which level the teacher wants the learner to think, and these are the levels. Bloom's taxonomy indicates the levels of thinking. What actually taxonomy suggests is, as we go from lower level to higher level - the cognitive challenge experienced by a learner will increase. In other words, remembering something relatively involves

relatively less cognitive challenge than coming up with a new information which is at the create level.

So, many faculty when we present this taxonomy in the hierarchical order, come to the conclusion that remember or understand is not a, it is not very important, but create or evaluate is the only thing that learners are supposed to do. That is a misnomer, that is a misconception, that is a misconcept. Bloom's only suggest that as we go up in this ladder the learner experiences more and more challenge, cognitive challenge.

Now, let us come back and ask this question. Think about a course the same course that you are teaching next semester. And I want you to write a learning outcome for that course, and see that the verb that you use in the learning outcome is mapping with which level of the taxonomy, whether it is falling in the remember level, or whether it is falling in the understand level, or in apply level, analyze level, evaluate level, or create level? Which level the verb that you use in the learning outcome design is falling? I will give you 1 minute to map it.

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So, the mapping exercise basically involves the following. Suppose, you want them to remember what you teach. Remembering is basically recalling the information. So, you can use any of these words: recognize, list, describe, retrieve, name, find. A list is not exhaustive, we can think in this line which basically indicate that your intention of

teaching that particular topic is that, at the end of that teaching the learner should be able to remember the content.

And suppose you want them to understand a particular concept, then instead of using the word understand, which as we saw earlier, can lead to different expectations. We encourage you to use word such as interpret, summarize, paraphrase, classify, explain, even though some of these words are not measurable, they are all observable.

So, you can use these words to substitute the word understand. And suppose you want them to apply what you teach, use the words apply is nothing but using information in another familiar situation. So, you can use implement, carry out, use, execute, solve. If faculty wants a students to analyze, analysis mostly involves breaking information into parts to explore understandings and relationships.

So, we can use compare, organize, deconstruct, interrogate, find. And faculty, suppose they want to generate the evaluation ability of a learner; evaluation ability is the ability to justify a decision based on a few criteria. So, mostly in that level what learners are supposed to do is generating criteria which justifies the decision. So, we can use word check, hypothesis, critique, experiment, judge to represent that the learning outcome is falling in the evaluation level. And the top level is creating level, where we can use design, construct, plan, produce, invent. So, all these things are indicating that within that content of the topic the learners are supposed to come up with new piece of information, which does not exist or at least an element of novelty should be there in the answer.

So, these are the levels, and these are the corresponding action words. And one of the things that faculty may want to be careful about using these verbs and levels is; you may see that one verb appearing in more than one level; that is, is an allowed practice, and that is seen all over the world; it means, that for example, you may see that identify - a particular element.

So, the level it may come can be remembering or even analyzing. It depends upon the context, it depends upon the intended effort learning effort that you want the learners to put. So, you can ask identify something in a context where the learners can recall and identify or you want the learners to do some analysis and identify.

So, a lot of context will come into the play before we jumping and concluding that this word correspond to this particular level. And faculty is the best judge to see the mapping because they are the subject experts. So, within the subject, within that topic, within that module, what is that you want the learner to really achieve? And if we can get that clarity writing learning outcome becomes a little bit easy.

Now, once you write a set of learning outcomes then the next question is how to evaluate the written learning outcomes.

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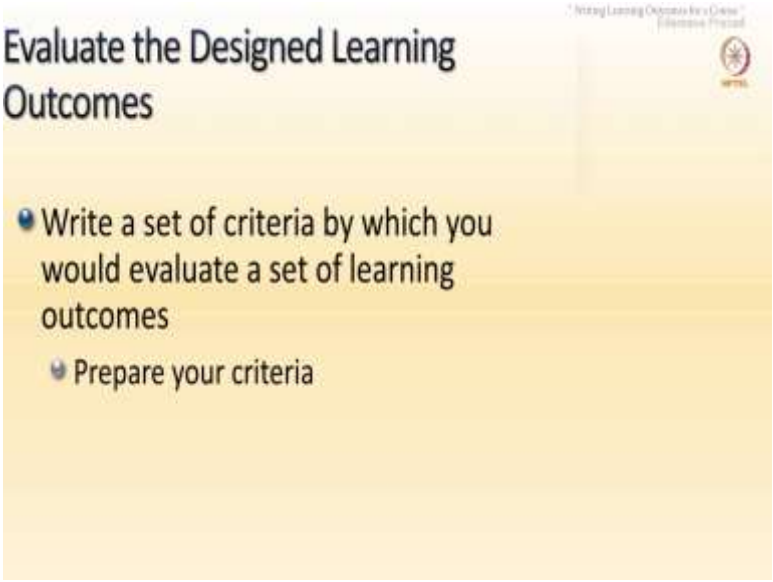

So, I want you to write a set of criteria which can be used to evaluate the learning outcomes that you have written. Take a couple of minutes and then write down based on what criteria, you will be able to evaluate the written learning outcomes.

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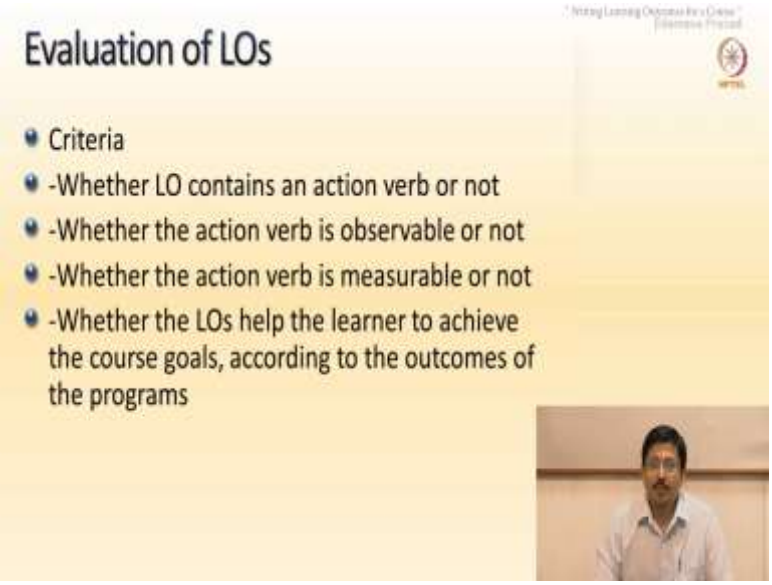

So, perhaps you might have come up with this following criteria. The basic element to check whether the LO is properly framed or not is to check whether LO contains an action verb or not. And if the verb action verb is present, then the next question is whether the action verb is observable or not, or measurable or not. And we can also ask questions like whether the LO helped the learner to achieve the course goals according to the outcomes of the programs.

So, these are the criteria that we normally use to evaluate whether the learning outcome design is proper or not.

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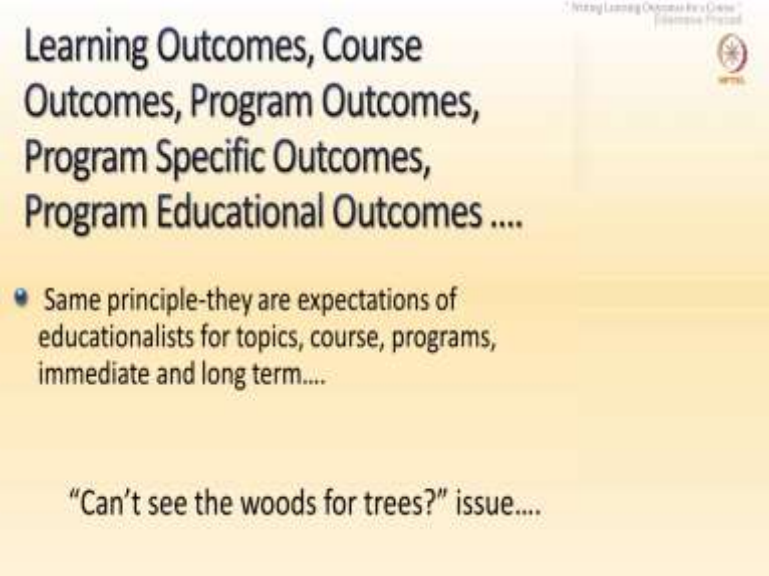

Engineering institutes especially in India, are now trying to write learning outcomes, course outcomes, program outcomes, program specific outcomes, program educational outcomes as a part of the accreditation process. So, all these outcomes, the basic principle remains the same. They are all teacher's expectations about learner's performance. We call it learning outcome if it is, if the expectation is about a topic, or a module, or a unit. And we call it course outcome if it is the entire course, suppose faculty want to say that these are my expectations on learning, we call it course outcomes. And the same thing extended to a program, suppose, M Tech in civil engineering, or btech in mechanical engineering, MSc chemistry, all these programs have some expected learning. And if you write that expected learning that will be the program outcomes.

And program outcomes we can again classify into some outcomes which is achieved, which is expected to achieve immediately after the course, or maybe after 5 years how these learnings, what expected learnings you want them to generate. So, based on these classifications, there are different terminologies in the educational research. However, one of the one other things that I have observed is, when I conduct faculty development program for engineering institute faculty, they are more worried to find out the difference between these different terminologies rather than what it actually means. So, it is like can not see the woods for the tree, issue is more prominent. And one of the suggestion is - it does not matter what is written, the concept of outcome-based education

is, designing the learning outcome is, write the expected cognitive challenge in a given topic in terms of a observable or measurable action verb.

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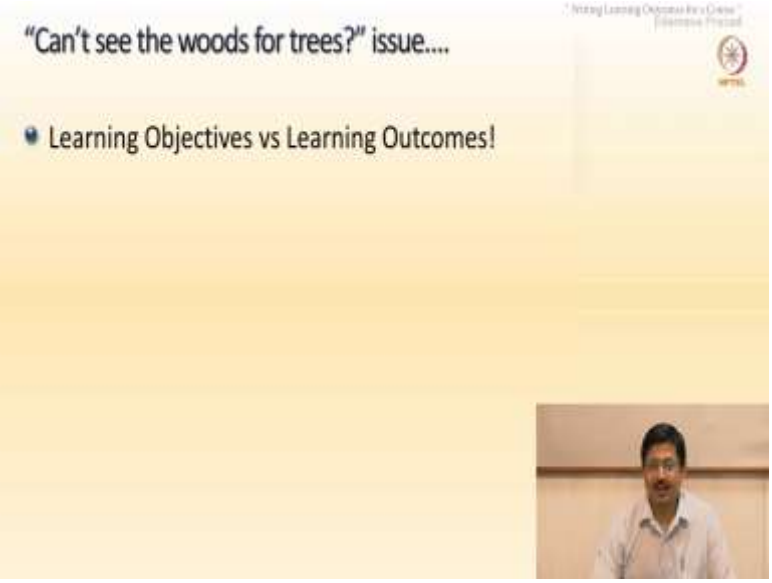

Another issue which is again pertinent in writing learning outcome is, many of the faculty asked this question, are learning outcome or learning objective are they different or same. So, one of the challenges that faculty may find is the difference between the English word objective versus outcome. There is a tendency that people think objective is something that we aim and outcome is something that we finally, achieve. However, in this particular context I would like to confirm that there is no difference between learning objective and learning outcome. Both are teacher's expectations about learning. And we are writing the learning outcome or learning objectives in the beginning of the course, not at the end of the course.

So, it is not like what is achieved in a course, which is come after assessment of the course. This is rather teacher's expectations about students learning in a course.

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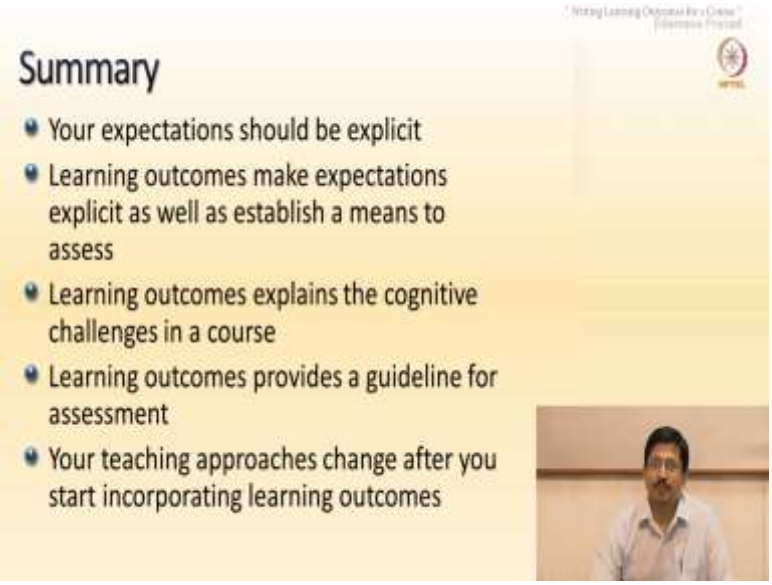

So, the summary of this module is shown in this slide. Teacher's expectations on learning should be explicit, and learning outcomes make expectations explicit as well as establish a means to assess it. Learning outcome explains the cognitive challenge offered by a course, and learning outcomes provides a guideline for assessment. And one of the most effective or impact of writing learning outcome is; faculty will slowly think how to change the way of teaching. Once you start putting a set of learning outcomes for the course, the teachers will realize slowly but steadily that the same method is not suitable to achieve all the learning outcomes for a course.

Perhaps that is the most desired outcome for writing learning outcome for a course. The best teaching practices involve a single mantra, to pluralize your teaching methods, and choose effectively which method is suitable for a particular learning outcome. As a last exercise I would like you to write down brief answers for the following 2 questions; what is most valuable or helpful about writing learning outcomes? And what is the most confusing aspect about writing learning outcomes? If you can write to me these 2 aspects I would be happy to respond to you.

Thank you.