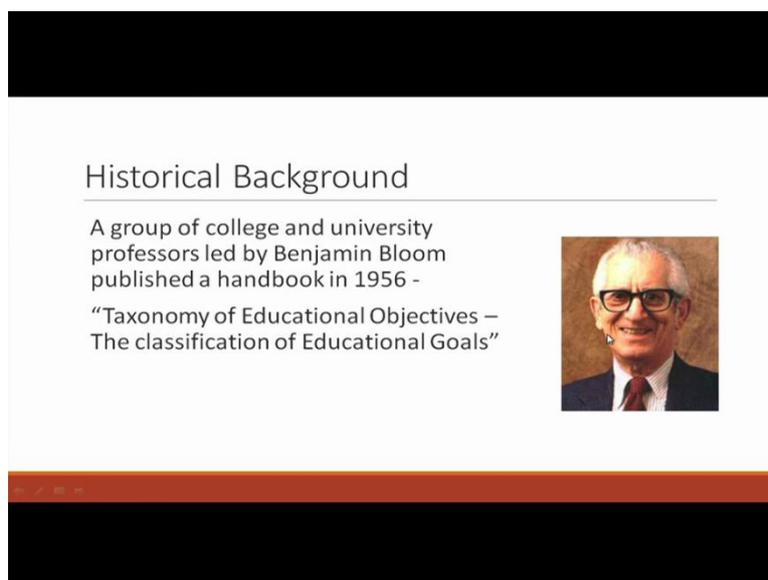


Course on Outcome based Pedagogic Principles for Effective Teaching
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Centre for Educational Technology
Indian Institute of Technology Kharagpur
Module 2
Lecture No 11
Taxonomy

Good evening, today I will teach you the taxonomies and instructional objectives. Now what we will cover, I will cover mainly the taxonomies of learning and the Bloom taxonomy. Now before that what I want to tell that what is taxonomy? Taxonomy is nothing but the classification that is known as the taxonomy. Now, the taxonomy is a logical classification where every term is defined precisely and consistently; that is taxonomy, so it is based on the psychological principles. And it is the classification of goals for our education system that can provide constructive help in developing curriculum and testing. For developing the curriculum and for the developing for the evaluation of the curriculum, the taxonomy is very important. So it helps in specifying learning objectives so that learning experience can be built appropriately.

In that case, it means that how to write the learning objectives. In that case, taxonomy has a very important role here; we will explain the Bloom taxonomy. And it allows, you know, the clear communication amongst the educators regarding learning goals and the experiences. So that is the taxonomies of learning. Just see here, this is a...In this picture, umm this here is Benjamin Bloom.

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The slide features a white background with a black header and footer. The title 'Historical Background' is centered at the top. Below it, a paragraph of text describes the origin of the taxonomy. To the right of the text is a portrait of Benjamin Bloom. At the bottom left of the slide, there are small navigation icons.

Historical Background

A group of college and university professors led by Benjamin Bloom published a handbook in 1956 -
"Taxonomy of Educational Objectives –
The classification of Educational Goals"

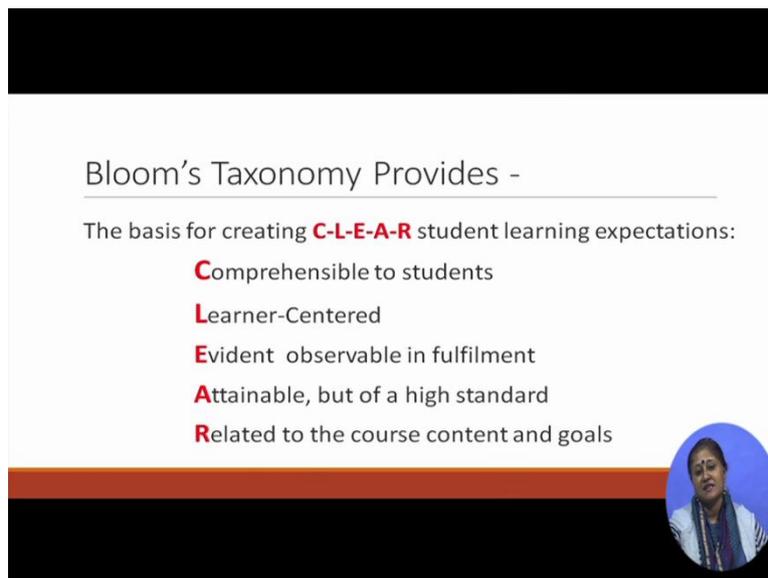


You know, his book is, he published in the year of 1956, Taxonomy of Educational Objectives – The Classification of Educational Goals okay. Here, the Benjamin Bloom's taxonomy is used extensively for planning in a teaching and learning activities, so he is the father, so why we need Bloom taxonomy? Why? The first thing it consider it is a classy and the thing is that it is a solid theoretical base for systematic planning, for the planning of the education or the curriculum, the systematic planning this Bloom taxonomy is very important for teaching and for evaluation okay both of the bases, at the macro level and the micro level, so in that case so Bloom taxonomy is very important.

Now, why we use the Bloom taxonomy? Okay. The first, if I write the curriculum of any course, you know, in terms of observable student performance, we call it specific instructional objectives. We will teach you that how to write the specific instructional objectives, so for that the Bloom taxonomy is very important. If the objectives, then it is easy to plan the teaching and learning strategy. If objective is clear, teaching and learning strategy, it is clear. So it helps, the Bloom taxonomy it helps in the teaching and learning strategy in keeping with our instructional objectives. If in the instructional objectives, we give importance in our course to the analysis level, so in the teaching and learning strategy also we will think that okay, we will give more focus in that phase.

So and if the teaching and learning strategy, so Bloom taxonomy, it help you to plan the assessment and the evaluation strategies to match the instructional objectives. So Bloom's taxonomy provides the, you know, the basis for creating clear, C L E A R student learning expectations. So what is CLEAR? In the C, it is comprehensible to students. C for comprehensible to students, okay?

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Bloom's Taxonomy Provides -

The basis for creating **C-L-E-A-R** student learning expectations:

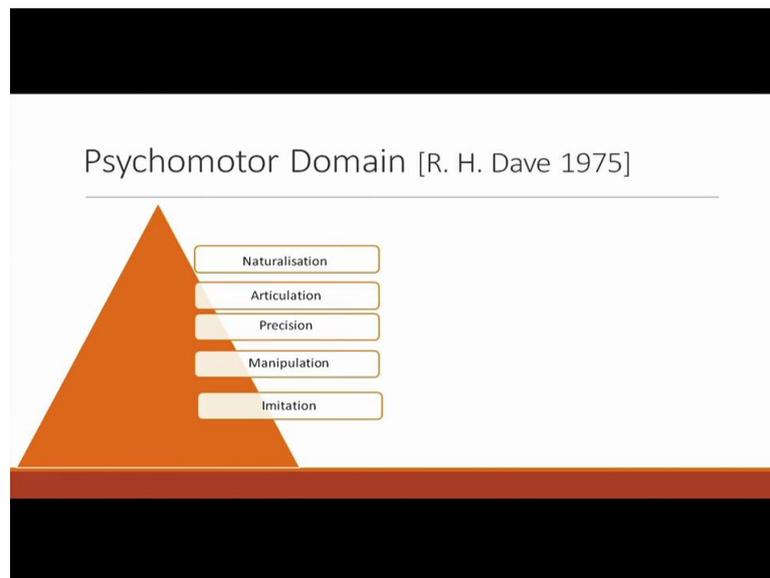
- C**omprehensible to students
- L**earner-Centered
- E**vident observable in fulfilment
- A**ttainable, but of a high standard
- R**elated to the course content and goals

L, it is learner-centred, we have not considered the teacher-centred, and the approach should be the learner-centred approach, so L for the learner-centred. E evident observable in fulfilment, so that is for E. A, it is attainable, right? So but the attainable but it is of a high standard, the attainable up to a high standard. And R is related to the course content and the goal. So that the Bloom taxonomy, it is clearly the CLEAR student learning expectations, right?

So the domains of learning Benjamin Bloom asserted that all learning activity can broadly be classified into 3 domains. One is the cognitive domain, one is the psychomotor domain and the other is the affective domain. So what is cognitive domain? It is a knowledge based domain cognitive, right. It is knowledge based domain and it involves intellectual and the thinking skills, what we will think these things, these are only in the cognitive domain umm. The second one is the psychomotor domain; psychomotor domain is mainly skill based domain. It is mainly the skill based domain and it involves the physical skills of performance or action, so this is the psychomotor domain. And affective domain, it is what your feeling is, is encompassing you the attitudes, the values all this is in the affective domain.

So we will explain one by one, let us come to the psychomotor domain. The psychomotor domain Simpson in the 1972 includes physical movement, coordination, and the use of the motor-skill areas. So what is that? The development of in these skills require practice; in the psychomotor, you need practice as it is measured in terms of speed, precision, the distance, procedures, or techniques in execution, so if you practice and you have to execute it, right? So this is in the psychomotor domain.

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The psychomotor domain that skills if suppose you are digging a ditch or washing a car, from there the more complex task you can do. What is that? Suppose operating a complex piece of machinery, so from digging a ditch or washing a car to the complex piece of the operating a machinery, so this is the change in the psychomotor domain. In the psychomotor domain, there are 6 stages. The first one is imitation, umm the second one is manipulation, third one is precision, fourth articulation and then naturalization. So there are five stages in the psychomotor domain. It is not 6 it is 5 stages, so it is imitation, manipulation, precision, articulation and naturalization, right?

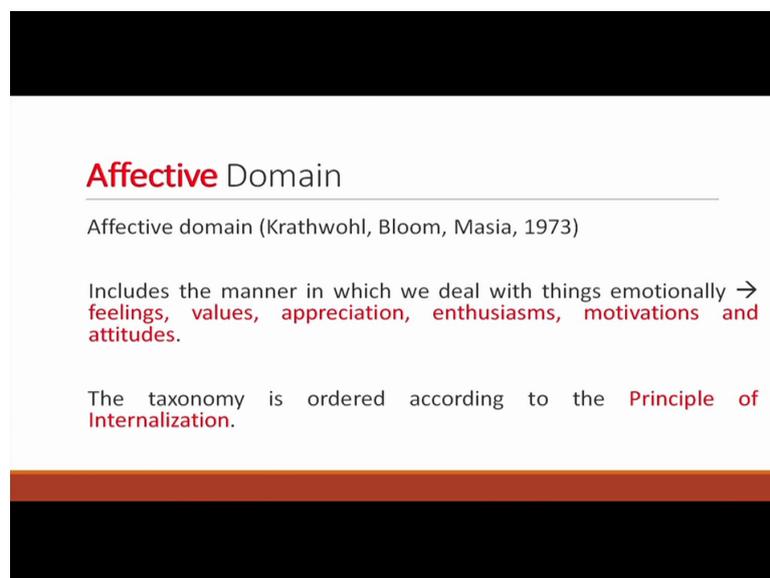
Now what is precision? Precision is nothing but if you observing and patterning behaviour after someone else right for example, trying to operate equipment by observing someone else. Suppose I do not know how to use umm how to use umm a fax machine or how to use photocopy machine, so in that case I am observing it. They are doing this, so I am doing in that way, so observing it and doing it so that is the imitation. The children, the small kids, they you know, they learn from their imitation. What the another kid is doing they are doing in that way, so it includes you know, the trial and error and until an appropriate response is achieved, so this is the first part; that is the lower level, imitation.

After that we call the manipulation, Manipulation is higher level than imitation, so being able to perform certain actions by following instructions and practicing, that is the called as the manipulation until you know, it becomes habitual right? So learner still is not sure that whether himself or herself right, but they are trying to do it. For example, trying to operate an equipment on one's own after taking lesson or reading about it. Suppose I do not know how

to use Microsoft Excel, I am reading a book or anything that help, and I am learning it, I am doing it, so this is is the manipulation. The third level is being known as the precision. I will give first example; working and reworking something, so it will be just right so it is it is nothing but refining become more exact, so few errors sieves apparent but this is third level that is the precision level.

Then the articulation level, what is that? Using one machine or equipment skillfully that is the articulation level. So coordinating series of actions, achieving harmony and internal consistency, so it is the skills are so well developed that the individual can modify movement patterns to fix special requirements or to meet the problem situation. So that is the articulation, it is nothing but the coordinating of the series of action and achieving the harmony and internal consistency, so this is articulation. And the top level, it is nothing but the naturalization. The example is that suppose I can use the equipment without thinking even in novel way. Suppose, that is means you know, automatically you can do that, you do not have to think automatically we are doing this, so having high speed performance.

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Affective Domain

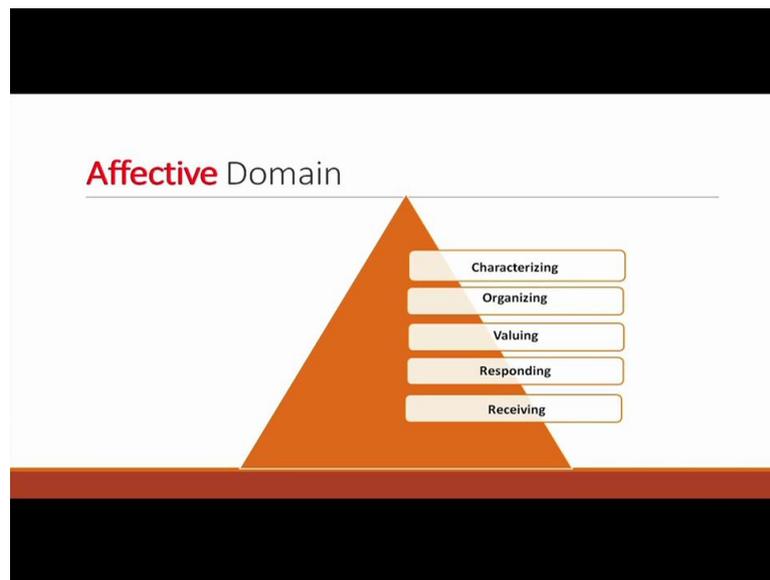
Affective domain (Krathwohl, Bloom, Masia, 1973)

Includes the manner in which we deal with things emotionally → feelings, values, appreciation, enthusiasms, motivations and attitudes.

The taxonomy is ordered according to the Principle of Internalization.

So in that, naturalization becomes natural and without needing to think much about it, so we just response it automatically, so this is the top level. So in the psychomotor level, imitation, manipulation, precision, articulation and naturalization, okay? So now we will come to the affective domain. Affective domain, it is by Krathwohl, Bloom in the year of 1973 but what it includes, the manner in which we deal with a range of things which is emotionally, the emotional thing, what was that? Was the feelings, the values, you know, the appreciation, enthusiasm, motivations and all these attitudes that is in the affective domain.

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So the taxonomy is ordered according to the principles of internalizations, internal thing right, so that is the affective domain. So in this affective domain there are also five levels just like psychomotor domain, what are those? One is receiving, responding, valuing, operating and the organizing and characterizing. Now first I will call what is the receiving thing, right? Receiving in the class sometimes you listen to others with respect receiving it, so listen for and remember the name of the newly introduced people. Some newly introduced people, you listen their name so that is receiving things or listen to others with respect hello like that, so this is the receiving thing. So it is the awareness, the main keyword is awareness or willingness to hear so or the selected attention, so that is the receiving part.

The next part, above the receiving, that is called the responding. if you are responding in the class right, Participations in the class discussion umm or gives a presentation. You are responding, that is why you are giving a presentation. Or you are questioning some new you know, that ideas, concepts, these you are questioning in order to fully understood that, so in that case this is the second part, you are responding it with active participation right, In the part of the learners attend and react to a particular phenomenon, so that is the responding part. The third is the valuing thing, Valuing is, suppose example I will better to give, propose a plan to social improvement and follow through with commitment, so that is the valuing things, or inform management, you are informing management on matters that one feels strongly about, so that is the valuing.

So the hope or value or person attaches to a particular object valuing. Phenomenon or behaviour, so this ranges from the simple acceptance to the more complex state of

commitment, right so that is the valuing thing. The fourth part is the organizing, Organizing is means suppose organizes values right, into priorities by contrasting different values, resolving conflicts between them and creating an unique value system.

So what suppose the example, what is that, recognizes the need a balance between what is the freedom and the responsible behaviour, so that is the organization so that is the fourth level. So you have to you can recognize freedom thing and the responsible behaviour, right? The top level is the characterization it is just it shows self reliance when working independently, what is that? Uses an objective approach in problem solving or values people for what they are, not from their how they looks like that, it is not that. You can just value them from their they are, from that okay? So has a value system that controls their behaviour, so the behaviour is consistent, predictable, you can predict and most important characteristics of the learner, so these five things; receiving, responding, valuing, organizing and characterizing.

Now but here the one thing, the difficulty in this domain is that it is the internal or the covert thing. Feelings and emotions are the, are as important as overt behavioural manifestation, so but here we mainly focus to the cognitive domain. The cognitive domain involves knowledge and the development of intellectual skills right, so it includes, the cognitive domain, it includes the recall or the recognition of the specific facts, procedural patterns and concepts that serve in the development of intellectual abilities and skills.

So if starting from the simple thing that is the knowledge recall knowledge recall the lowest level and from the top evaluation, creation or the highest level, right? Suppose, first the knowledge and the comprehension, then the application, analysis, synthesis and evaluation. So each category must be mastered before proceeding to the next okay. You can go to the comprehension level if the knowledge. If you are in the comprehension level means you know the knowledge level.

The application level means the knowledge and comprehension you have. That is why you can apply. And in the analysis also you can, after application also only you can analyze, so it is like that, right? So first we will come one by one, the knowledge level: Knowledge is the recall of data, remembering previously learned material, knowledge of dates, events, essays, knowledge of major ideas, some keywords is that define, list, name, outline, points, state, identify, all these things.

So what do I know and do at this level? In the knowledge level, what do I know and do at this level? I can recall information about the subject, topic, I can recall it. I read material, listen to the lectures, what are the lectures I am listening it or watch videos or take notes, so all these things in the knowledge level. I learn the vocabulary or terminology as well as the conventions of rules associated with a subject, so this the knowledge level, where the testing in the knowledge level, how can I test?

What are the typical ways I can understand or I can demonstrate my knowledge? What is the typical? Answer true-false, yes-no, fill in the blanks, multiple choices, questions correctly. Define all the technical terms associated with the subject by their attitudes, properties and the relations, so suppose the example. The student will define the 6 levels of Bloom's taxonomy of the cognitive domain. So this is a knowledge level question, so these 6 levels: knowledge, comprehension, an application, analysis, synthesis and evaluation.

Types of knowledge: First is the knowledge of terminology, umm define technical terms, range of meaning of the words as in the dictionary, terms and concepts in the science, so this is the knowledge of terminology. Knowledge of specific facts that is also knowledge about the culture, major natural resources, properties of elements, compounds, data, so all the specific facts, the knowledge of that. Knowledge of conventions: Conventions symbols of the domain area, rules of social behaviour, forms of scientific papers, protocols standards, all these things in the knowledge of conventions. Knowledge of trends and sequences: so in that case, trends in data compression, sequence of a given process or operation, knowledge of classification or the categories, type that can be.

Knowledge of methodology: Different methodology, methods of enquiry, technique, procedures. Knowledge of principles and generalization: Recall of principles in learning, in biology you know, different principles, and knowledge of theories and structures: In that case, it is recalling major theories, suppose civilization and science, different theories, so all these in the knowledge level. So after the knowledge level, we will come to the comprehension level. So the comprehension level, in that case the ability to grasp the meaning of the previously whatever you learned, the material. The ability to grasp the meaning, this may be demonstrated by translating material from one form to another, you are translating this or interpreting material or explaining this, explaining or summarizing this or by predicting consequences or effect, so that is the comprehension level.

Example, suppose the student will explain the purpose of Bloom's taxonomy of the cognitive domain, so here the keywords explain, summarize, describe, illustrate types of comprehension. Suppose translation into other language, so the first one is the translation, translation into other language, into other forms of communication suppose that data to graph or state in own words or explain so that is the translation. The second one is the summarization or the generalization, the third is the extrapolation, so that means making the predictions, right? So based on understanding or trends, consequence or actions described in a case of the communication, so what is the extrapolation, so this is the second part, second level.

The third level is the application level, Application it refers to the ability to use, learn material in new or concrete situation. Whatever you are learned, so you are applying this, only in the 21st century, engineering education mainly we are focusing that they can apply, not the knowledge of comprehension, if they know it okay where they can apply that is very important right, where they can they analyze that is important.

So in that case, this may include the application; all the rules, method, concepts, principles, laws, what they learned, they are applying it right, or the learning outcomes in the area require a higher level of understanding than those under the comprehension level, so it is the higher level, so it solves problems using required skills or knowledge. Application; apply concepts and principles to new situation, apply laws and theories to practical situation, solve mathematical problems, construct graphs and chart, different these type of application they have apply it, right?

So in the testing application solve problems independently in new situation and without prompting by the teacher, so that is the application level. So suppose, one example, the student will write an instructional objective for each level of the Bloom's taxonomy, so that is the application. The keywords are apply, demonstrate, calculate, illustrate, examine, these all the application level action verbs.

Analysis the fourth level, analysis refers to the analysis is a synthesis, just the opposite. Analysis means ability to break down material into component parts. Synthesis means of the parts you are joining, but let us come to the analysis, means you just break down the material into small parts, analyze it so that the organizational structure may be understood. So this may include the identification of the parts, analysis of the relationship between parts, and recognition of the organizational principles involved.

So learning outcome here present a higher intellectual level than comprehension and application because they require an understanding of both the content and the structural form of the material. So some example, in the analysis level, the student will compare and contrast the cognitive and affective domain. What is the cognitive domain and affective domain if they can compare, so that is the analysis.

So the action verb is compare, analyze, contrast, separate, these, so types of analysis. Suppose analysis of elements, recognizing hypothesis, conclusions from the statements or analysis of relationship, distinguish the cause-effect relationship or check the consistency of the hypothesis with given information, so that is the analysis of relationship. An analysis of organizational principles, arrangements, structure, forms, pattern or the ability to infer what is the author's point of view; these are the analysis of organizational principles.

The fifth level is the synthesis level where the students originates, integrates and combines. They are combining it, ideas into a product or plan or a proposal, which is new to him or her. So synthesis, it refers to the ability to put parts together, parts together to form a new whole, so this may involve the production of a unique communication, right? Theme, a plan of operation, suppose research proposal or a set of abstract relations that is the scheme of classifying information.

Learning outcome in this area stress creative behaviours okay, with major emphasis on the formulation of new patterns and structures. Example, the student will design a classification scheme for writing educational objectives that combine the cognitive, affective and the psychomotor domain. So here combine, integrate, modify, rearrange, plan, design, invent, all these are the action verbs.

The top level is evaluation level; Evaluation means the ability to judge or the value of the material. Suppose, a statement, a poem or you have to you can judge it, right? Or any research report when you are judging it for a given purpose, so that is called the evaluation. Compare it and discriminate between ideas, assess the values of theories or the presentations, make choices based on the (())(31:39) argument, verify the value of evidence, all these things these are the evaluation level. So in that case, suppose an example, the student will judge the effectiveness of writing objectives using Bloom taxonomy. So what if they can judge it, so in that case it is the evaluation level Judge, critique, justify, all these things are the action verbs.

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Bloom's Ranking of Thinking Skills					
Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
arrange define describe duplicate identify label list match memorize name order outline Recognize	explain summarize paraphrase describe illustrate classify convert defend describe discuss distinguish estimate explain	use compute solve demonstrate apply construct apply change choose compute demonstrate discover dramatize	analyze categorize compare contrast separate apply change discover choose compute demonstrate dramatize employ	create design hypothesize invent develop arrange assemble categorize collect combine comply compose construct	Judge Recommend Critique Justify Appraise Argue Assess Attach Choose Compare Conclude Contrast Defend

Here, here the Bloom's ranking of thinking skills in the knowledge level: all, arrange, define, describe, duplicate, label, list, these are the action verbs. Comprehension: Explain, summarize, describe, illustrate, these. Application: Use, compute, solve, demonstrate, apply, change, choose, compute. Analysis level: Analyze, categorize, compare, contrast, apply, change, discover. In the synthesis level: create, design, you know, develop, arrange, assemble and in the evaluation level: judge, recommend, critique, justify, appraise, these are conclude, contrast, these are the action verbs. So this is for today. In the next class, we will explain the revised Bloom's taxonomy and how to write the instructional objectives. Thank you.