**Teaching and Learning in General programs (TALG)**
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**Lecture – 14**
**Taxonomy Tables**

Greetings and welcome to unit 14 of module 1. This is related to Taxonomy Tables.

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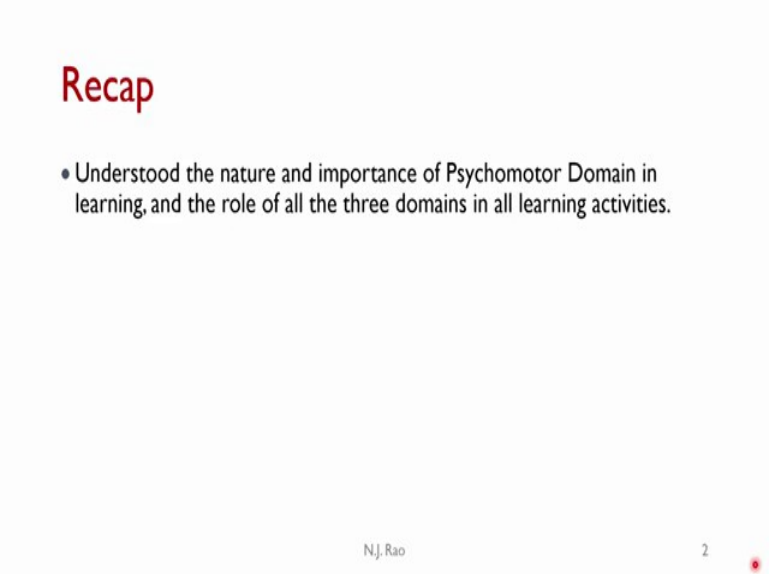


In the earlier unit, we spent some time in understanding the nature and importance of psychomotor domain in learning and also, we looked at the role of all three domains in all learning activities. We stated that when you look from the neuroscience point of view or from the brain point of view, activities in all the three domains are simultaneously present; depending on the nature of the activity, one particular domain maybe more dominant than the other one.

But any mental processing activity that you do, there is a role for all the three domains; there is cognitive processing, there is affective processing and there is also psychomotor processing. And the way we looked at these three domains as per Pierce- Gray taxonomy, the brain processes in 3 stages; it receives sensory information; you process and then produce some output.

So, the taxonomy that was proposed recognizes these three elements of processing by the brain and all the three domains are correspondingly looked at. And another thing that we noted is that as you keep going higher up in the higher levels of affective and psychomotor domains, the level of cognitive activity also keeps on increasing with it. So, these are the points that one needs to remember when you are dealing with the three domains.

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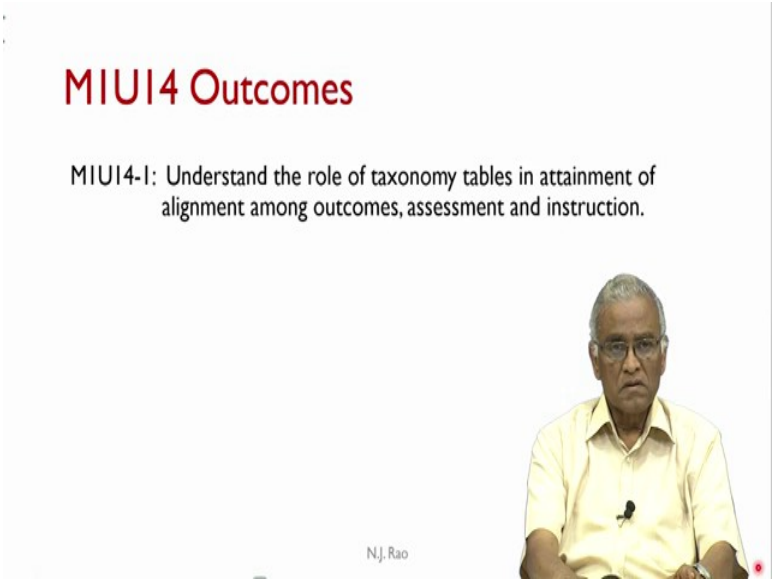


In the present unit related to taxonomy table, we try to understand the role of taxonomy tables in attainment of alignment among outcomes, assessment and instructions. As we noted, there are three elements in any teaching learning process. There is an outcome which we are trying to attain and to what extent we attained is measured by the assessment and we conduct instructional activities to facilitate students to attain these outcomes. These are the three elements of any teaching learning process.

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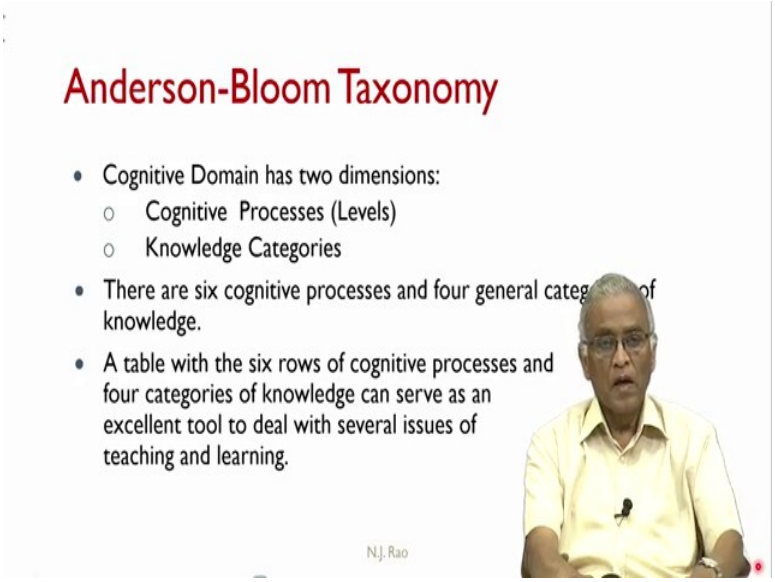


To recapture, in Anderson-Bloom Taxonomy, Cognitive Domain has two dimensions. Namely, Cognitive Processes; sometimes we call them as Cognitive Levels as well and we have Knowledge Categories. We identified six cognitive levels or six cognitive processes and 4 general categories of knowledge. Both the cognitive process and knowledge categories can be integrated together in the form of a table because they are two dimensions and you cannot mix them. So, we have it in the form of a table. This table will have six rows of cognitive processes and 4 categories of knowledge which can serve as a tool to deal with many issues related to teaching and learning.

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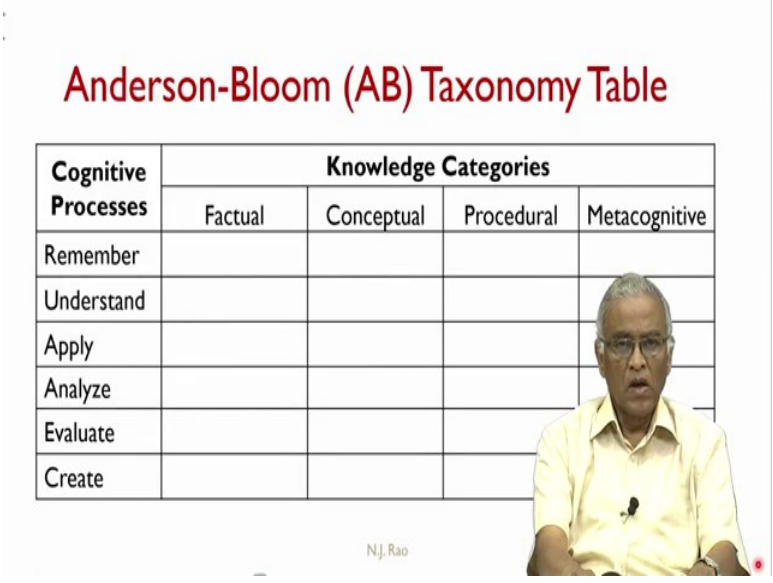

Let us take a look at the table; we call it Anderson-Bloom Taxonomy Table or AB Taxonomy Table. The cognitive processes as we put them in the particular hierarchy is Remember, Understand, Apply, Analyze, Evaluate and Create and the knowledge categories are also organized as Factual, Conceptual, Procedural and Metacognitive. Now, there is no particular hierarchy as such with regard to the knowledge categories, but with regard to cognitive processes, we have hierarchy. The taxonomy table as presented by the book written by Anderson, Krathwohl and few others, they interchange the rows and columns; the cognitive processes is presented as columns and knowledge categories are presented as rows.

Here, why we interchanged these rows and columns is because when we are going to write outcome of any learning activity, we start with the action verb related to one cognitive process (one identified cognitive process and we start with an action verb related to that) and then, and it is followed up by the knowledge elements. Because of that sequence, we felt this would be a better representation of the taxonomy table rather than the original one that was proposed. But both can be used; there is no particular distinct advantage of one over the other. It is just we felt it is a little more convenient to represent the cognitive process a process as a row rather than the column.

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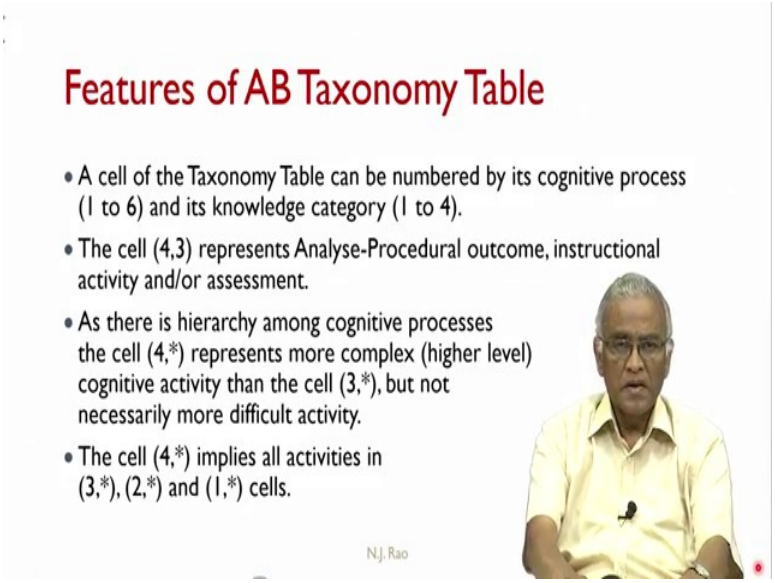


Some features of the taxonomy table - As you can see there are 24 cells are there in this. Every cell has an address; it can be numbered by the cognitive process and the

knowledge category. That means, it can have 1 to 6 cognitive levels and 1 to 4 knowledge categories. For example, the cell (4, 3) represents analyze- procedural outcome or instructional activity or assessment. The cell itself has an address (4, 3) and another thing is there is hierarchy.

As we acknowledged, there is a hierarchy among the cognitive processes. All the cells representing the cognitive process analyze; that is (4,*) where * can be any of the knowledge elements, they represent more complex or higher level cognitive activity than the cell (3,*), but not necessarily a more difficult activity. One needs to be very clear about complexity and difficulty. Complexity is strictly defined in terms of cognitive levels; that means, if I am doing an analyze activity; it is more complex than an apply activity. If I am doing evaluate activity, it is more complex than analyze activity. So, complexity should only be understood in terms of higher level cognitive activity.

But difficulty is completely a different parameter altogether. I can have a remember activity which is the lowest level, but I can have very difficult activity in that. For example, we can ask somebody "what is the capital city of Karnataka state?" It is easy to remember. But if I ask "What are the capital cities of all North Eastern States?" it is a little more difficult activity; one may or may not remember all the capital cities of North Eastern States. Or even come back to Karnataka state; "What is the district headquarters of Bangalore north district?" It would be easy to remember. But if you say list all the districts of Karnataka state which is certainly more difficult activity than just listing or just listing headquarters of a particular district. What can happen is the difficulty is a different parameter compared to complexity. These two should not be mixed with each other. Many people consider complexity is more difficulty.

Another issue with regard to complexity and difficulty is many faculty take a position that because the students come from a weaker academic background; they cannot handle a complex cognitive activities. While the subject has the required syllabus, but my assessment is more constrained to lower cognitive activities and that is where the mix up between complexity and difficulty comes.

One can sacrifice some level of difficulty, but one should not sacrifice the relevant complexity. The moment you sacrifice complexity, I think we are doing disservice to the students, because you are preventing them from truly learning. And when they do not

learn to perform relevant higher cognitive activities, then they are less prepared for a placement. That means, we are denying them the opportunities to get proper placements by restricting the assessment to lower and lower levels of cognitive activities. So, this is a very important facet of a complexity and difficulty.

Though it does not directly get reflected in the taxonomy table, if one wants they can add another dimension of difficulty to that. Complexity is incorporated as we keep going down the rows; that mean, you are making the level of complexity higher and higher. If the rows the bottom rows are not populated at all at any level, that means, we are constraining the quality of learning of the students.

Now, the (cell 4,*) because of the hierarchical nature of cognitive processes, implies all the activities in (3,*), (2,*) and (1,*) cells; that means, I do not have to keep mentioning the lower cells at the lower cognitive levels once I have identified (4,*)

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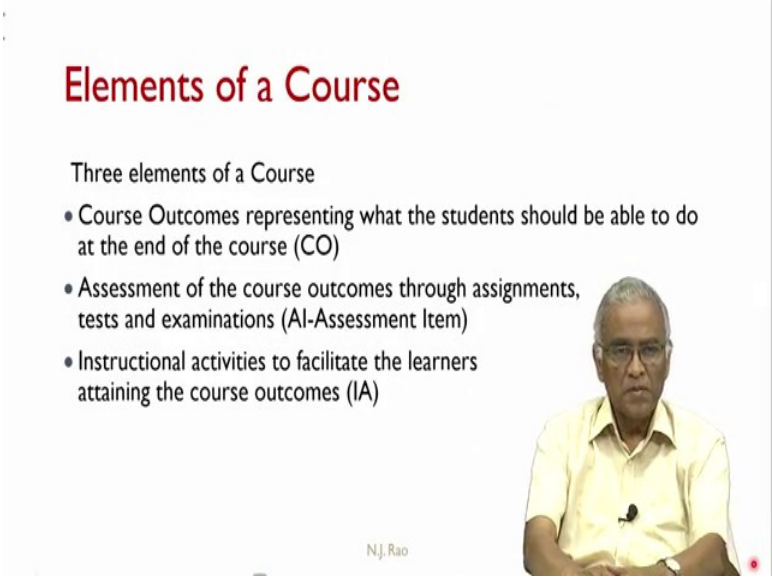


Let us take a look at this in detail with respect to the table. There are 3 elements of a course which we have mentioned earlier. Course outcome represents what the student should be able to do at the end of the course and we call it CO. Assessment of the course outcomes through assignments tests and examinations. How do we assess the students? We give them some assignments which carry some marks and we conduct midterm test and end semester examination. And each assignment, test or examination will have a

series of items in that because an examination does not contain one question or one assessment item, it will have multiple assessment items and multiple questions.

When you look at each element of an assessment instrument, namely, examination paper that can belong to any of the cognitive category depending on how you have asked that particular question. That is why our focus will be on an individual assessment item rather than assessment instrument which is a collection of assessment items, namely the questions. We will represent that by AI - Assessment Item. Once we identified a course outcome, we have some teaching- learning activities - instructional activities to facilitate the learners to attain that outcome. That is we may lecture, we may have quizzes in the class, we may have discussions in the class; how we organize those instructional activities is the choice of the teacher and it depends on the nature of the subject as well.

These instructional activities, we represent them by IA. The three elements of any course are outcome, assessment items and instructional activities.

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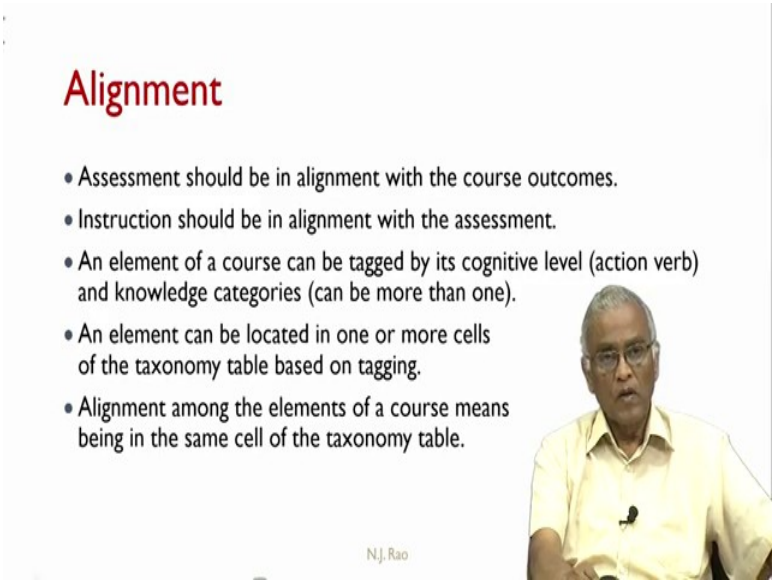


The key concept in the area of teaching and learning is that the assessment should be in alignment with the course outcomes; that means, if I want the student to be able to solve a problem, that is the goal, then my assessment should also ask the student to solve such problems. You cannot merely say describe that concept or can you list some properties of this material; one cannot constrain or restrict himself or herself to lower cognitive levels.

When it is done at lower cognitive levels, we consider the assessment is not in alignment with the outcomes.

Similarly, instruction also should be in alignment with the assessment as I must prepare the student to perform cognitive activities corresponding to the course outcome. Or I must perform instruction activities to facilitate the students to answer questions related to the course outcome. Assessment, instruction and course outcome should be in alignment with each other. An element (an element here would mean the assessment, instruction and course outcome) of a course can be tagged by its cognitive level, that is action verb and knowledge category can be more than one as well; that means, the number of knowledge elements can be more than one in a given outcome statement.

So, an element (CO, AI or IA), can be located in one or more cells of the taxonomy table based on how we have tagged it. So, all the elements of a course should be located in the same cell of the taxonomy table and that is what we mean by alignment.

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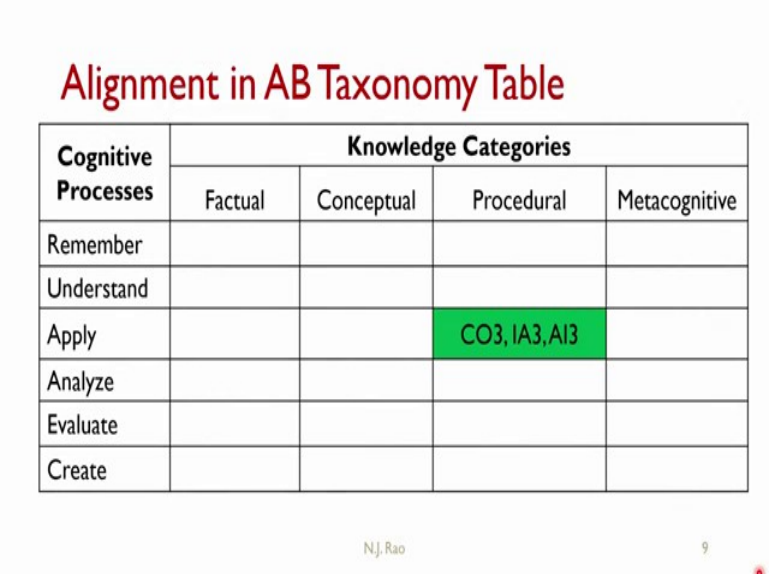


For example, CO 3 is a course outcome (is just a number ). Course outcome 3 is related to apply and procedural. So, it is located in cell (3, 3). When the assessment and instructional activities are in full alignment with CO3, then they should be located in the same cell. That is why we located IA3 and AI3 in the same (3, 3) cell that is what we really mean by a true alignment. This is 100 percent alignment. It may not always happen this way.

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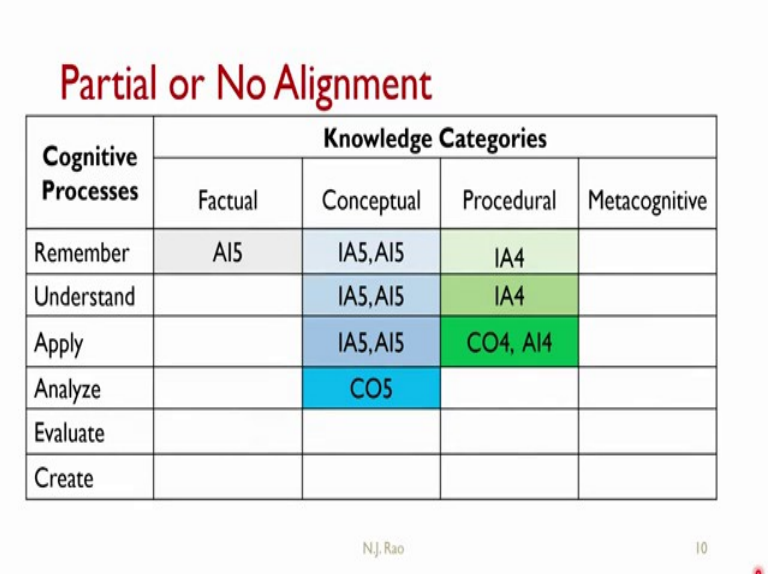


Let us take CO4. CO4 is apply and procedural; so I am putting AI4 also in the same cell; that means, all the questions that I am going to ask in any form whether it is 1 mark question or 10 mark question, it is internal test or end semester exam, all my assessment instruments are located in the same cell (3, 3). But what may happen is while preparing the student; I may go through activities which are somewhat like introduce terminologies. In that case, instructional activity related to CO4 can be located in cell (1,3) or sometimes I spend time understanding, explaining things and comparing them with other things and have IA4 instructional activities related to CO4 can also be located in (2, 3) cell, it is something that is possible. Any instructional activity is likely to go through that. But notice that AI4 that is assessment instruments are 100 percent located in the cell (3,3) that is one property of this CO4.

I can have another situation. CO5 is the another outcome course outcome that is located in (4, 2) – analyze and conceptual. But my assessment instrument as well as instructional activity can be any of the three lower cognitive levels IA5, AI5 can be in (1, 2) or (2, 2) or (3, 2). But you will notice that there is no AI5 in the cell (4, 2); that means, I am not asking any questions related to analyze. My questions are related to either some calculations (apply), some understanding related or merely remember related questions and that is totally unacceptable way of conducting your instruction. If something is not at all available under CO5, if there are no assessment items in that cell, Then, it is not an acceptable way of doing. Then I can have another extreme situation extreme one, AI5

belongs to (1, 1); that means, it is neither analyze nor conceptual, it is only some kind of a remembering some definitions or some factual information and it is total in misalignment with the CO5. This is what one needs to understand when you talk about using taxonomy table to understand the alignment.

There should be some AI5 with respect to CO5. As we said in the CO4 case 100 percent of assessment items are in cell (3, 3); whereas, here AI5 is totally absent in the cell (4, 2). What is the compromise? One is at one extreme the other is another. So, we have to come to some common understanding about what should be the percentage of assessment items that belong to the required cell namely in the case of CO5, it is (4, 2).

When we asked several teachers, they all said that it should be a minimum 50 percent or sometimes they say more than 50 percent. That means, 50 or more percentage of questions should belong to that particular cell represented by CO5 and we have been recommending that it should be at least minimum 60 percent. If one wants to have more percentage of questions in that corresponding cell they are quite welcome.

But unfortunately in survey of university papers in various subjects indicates, somehow the percentage of questions belong to, say (1, 2) becomes extremely large (much higher percentage of questions keep going). Part of the reason would be - sometimes it is unintentional, or you just go by what is convenient rather than intentionally avoiding the CO5 cell. Sometimes you may take even a position yes, CO5 is what is required by the students, but I do not think I can ask questions in that area because too many of my students are likely to fail.

Once the students understand this mechanism, they will not even make an attempt to answer questions that belong to cell (4, 2). This is the basic dilemma in several institutions depending on the nature of the students or the views of the faculty member or management as well. So, this is a major issue right now, but one can really debate these issues among concerned faculty and the department with the help of this taxonomy table.

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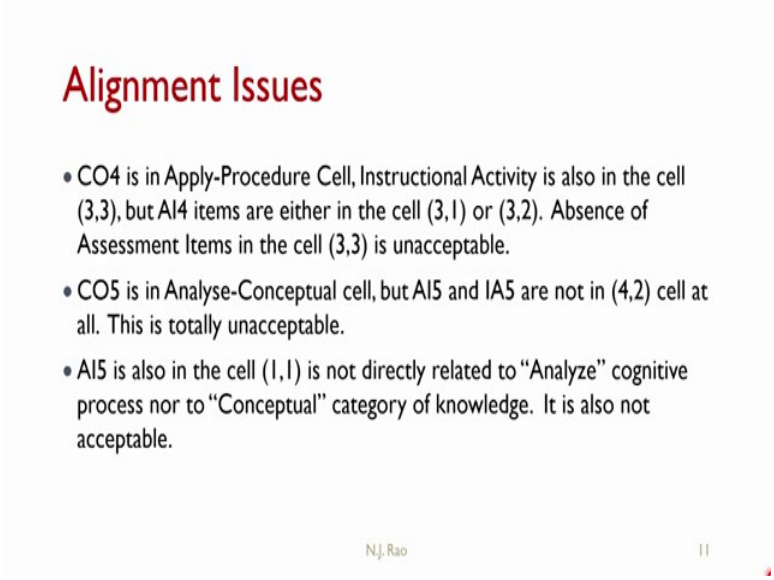


Now, this is what we have explained about all the cells the way in the sample that was presented:

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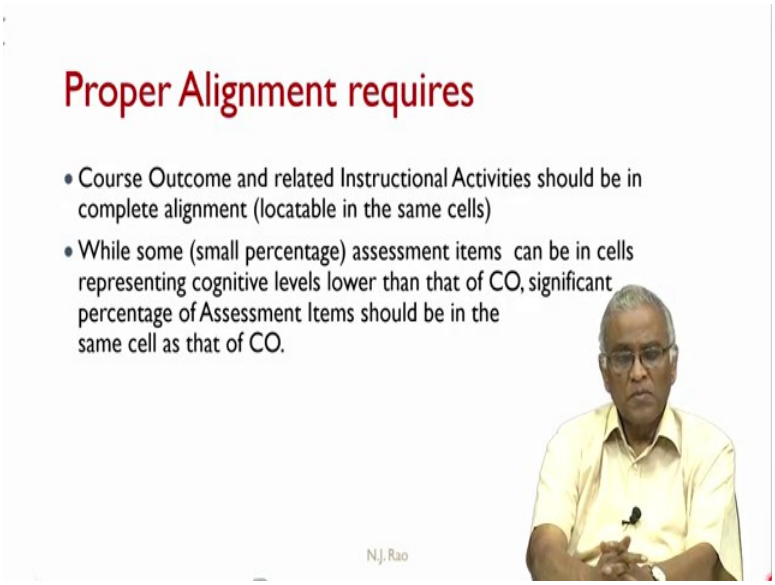


First thing is course outcome and related instructional activity should be in complete alignment, should be locatable in the same cell. While small percentage of assessment items can be in cells representing cognitive levels lower than that of course outcome, significant percentage of assessment items should be in the same cell as that of the CO.

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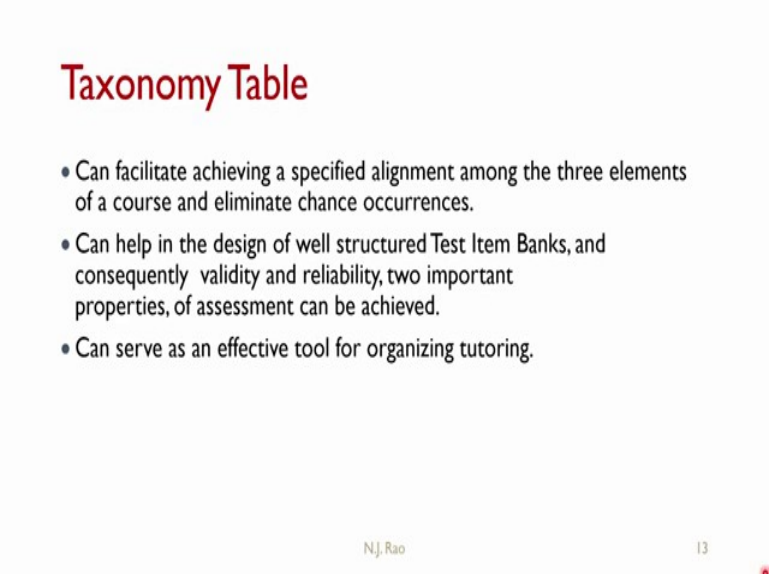


What can a taxonomy table do for us? It is a simple table, but it can facilitate achieving the specified alignment among the 3 elements of a course and eliminate chance occurrences. Both in the university type of exam where you have affiliated institutions and even in autonomous institution, where the teacher is likely to design the assessment instrument; in both the cases, there is a possibility of chance occurrence and thus not achieving the right kind of alignment.

So, one can make use of this taxonomy table and we will spend more time in module 2 of this course or TALG with regard to designing assessment appropriately. And taxonomy table can also help in the design of well structured test item banks and consequently the two important properties of any assessment instrument "validity and reliability" can be achieved.

And the most important thing is the assessment should be valid and should be reliable. That is I am testing what I am expecting my students to be able to attain. Reliable means the performance of a student in my course this year and the performance of the same course next year by another student are comparable. That means, if I say this year a student has achieved 65 percent in this course, another student who achieved the same 65 percent next year, we can say they have approximately same abilities.

It can also serve as an effective tool for organizing tutoring; which is one to one instruction. So, one can even organize tutoring by using the taxonomy table.

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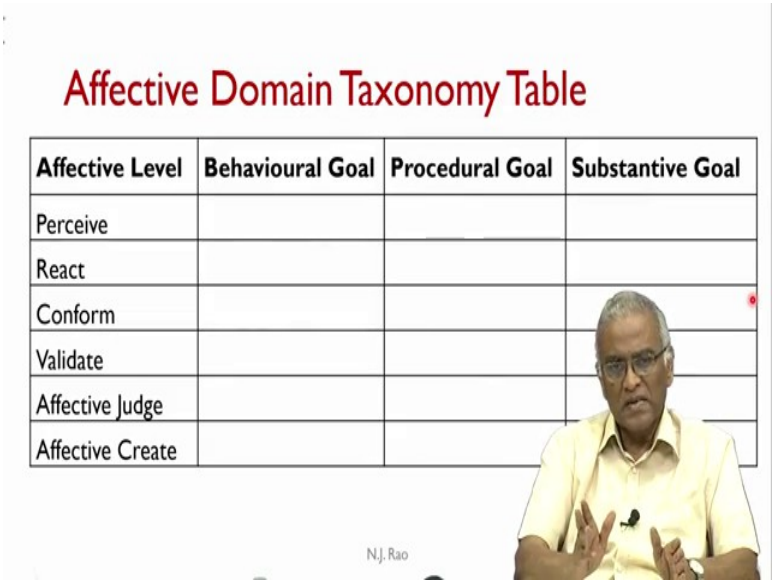


We have another type of taxonomy table for affective domain. So, you have affective levels, perceive, react, conform, validate, affective judge and affective create. There is a same level of hierarchy that we had with cognitive domain and here there are three levels of goals; behavioural goal, procedural goal and substantive goal. The procedural goal is at a higher level than the behavioural goal and similarly, substantive goal is at a higher level than the procedural goal.

So, it is not strict a kind of hierarchy, but that is a one say it is more difficult to achieve. So, this affective domain taxonomy table also can be effectively used by the faculty who want to address the affective domains simultaneously along with the cognitive domain. We have not come across such a taxonomy table for psychomotor domain.

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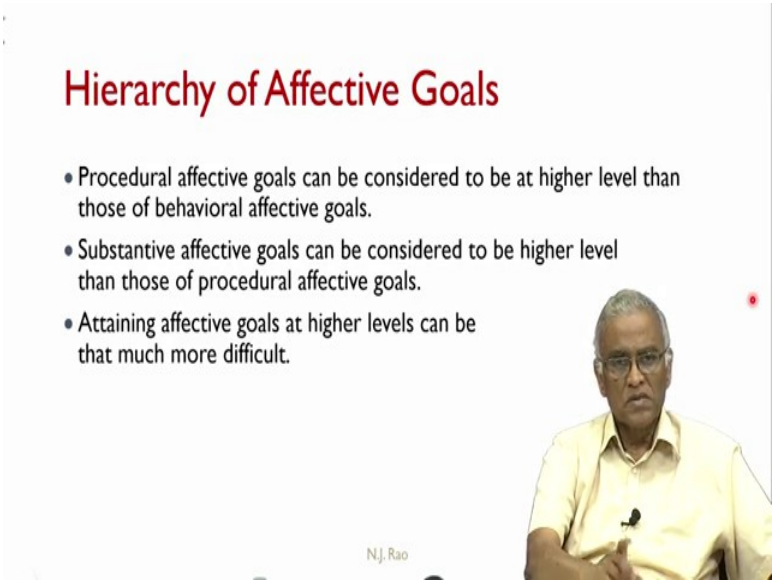


So, this is the hierarchy of affective goals that I have explained.

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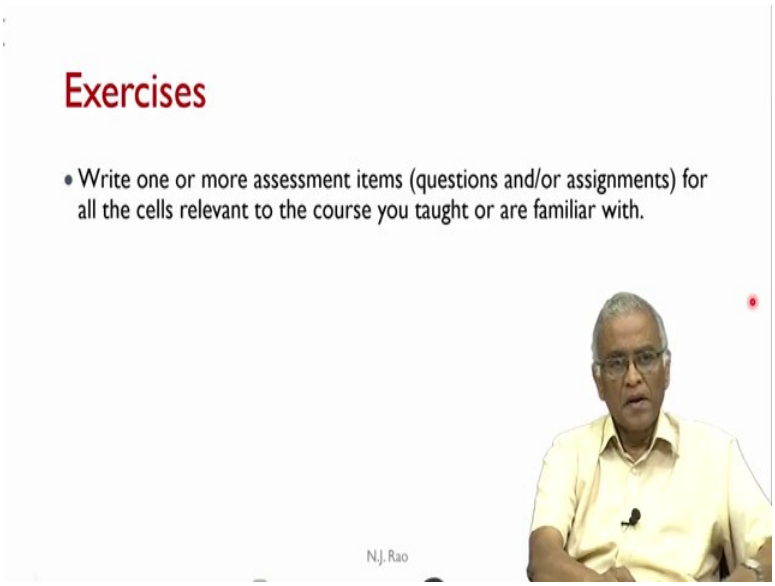


Write one or more assessment items, questions and or assignments for all the cells relevant to the course you taught or are familiar with. Let us go back and see what is meant by relevant. If you take the taxonomy table, depending on the nature of the course, all cognitive processes are not relevant to a particular subject. Let us say I am eliminating, create, evaluate, analyze; those cognitive processes are not relevant to my course at all.

Though metacognitive knowledge is important and related; I may or may not have the required resources to address the metacognitive level. So, what may happen is I am restricted to a 3 by 3 table rather than 6 by 4. In fact many courses in many areas they stop with the cognitive process understand; that means, you are only restricting yourself to the only the top two rows.

So, it depends on the nature of the course and the way the faculty member wants to handle the course. Write one or more assessment item. This is more for practice, how do I write an assessment item; that means, a question or assignment and based on the statement that you make, you should be able to identify the cell address of that. So, in each one of the relevant cells is it possible for you to write at least one or more questions for that.

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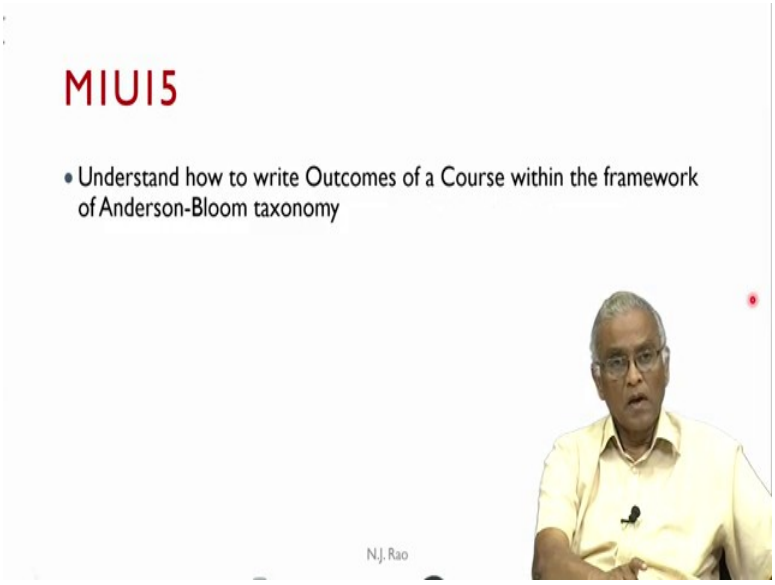


And in the next unit; unit 15, we try to understand how to write outcomes of a course within the framework of Anderson-Bloom Taxonomy.

Thank you very much.