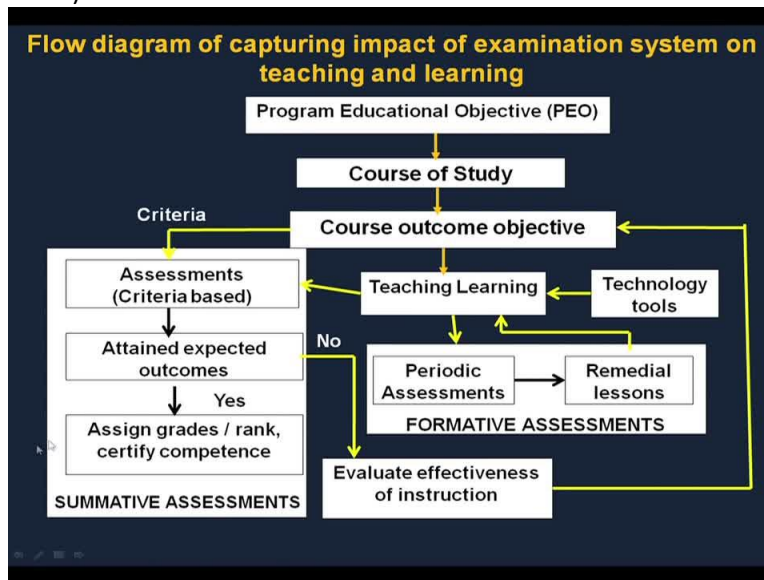


**Course on Outcome based Pedagogic Principles for Effective Teaching**  
**Professor Shyamal Kumar Das Mandal**  
**Centre for Educational Technology**  
**Indian Institute of Technology Kharagpur**  
**Module 3**  
**Lecture No 15**  
**Lecture 15: Assessment and Evaluation (Contd)**

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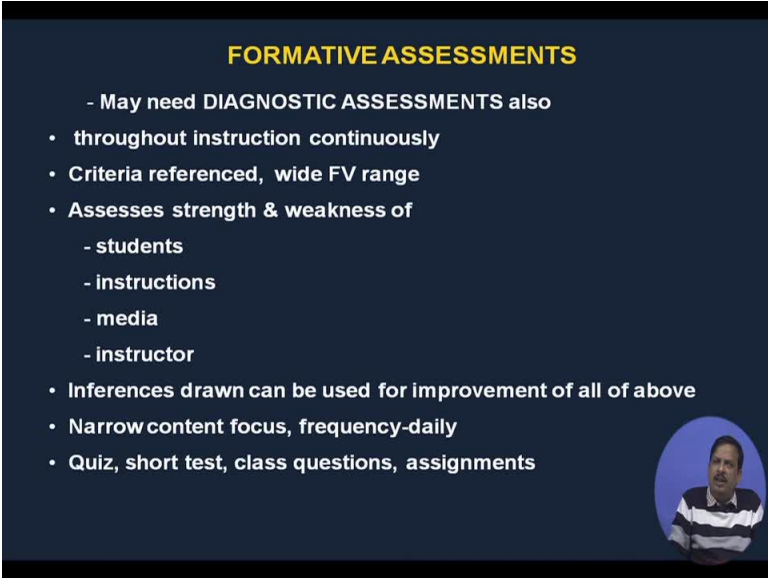
Okay, so we have discussed about that criteria based assessments systems and we have said that that criteria based assessment system for summative assessment and then we have given that example of non-reference and criteria reference. Now we go for the formative assessment, in formative assessment basically use for diagnostic analysis of the student misconceptions. So if you see that any kind of formative assessment is required in periodic, this is the periodic assessment, that means formative assessment.

Suppose you define your course outcome, now during the teaching learning process the students are attaining one outcome at a time. So they have suppose you have six or seven outcome course, then you have a module outcome, lecture outcome all outcomes are written down, then you have to say test whether the student has attain those outcome or not. Periodically I have to test whether they have reached understand the first module 1 outcome or not, then course or maybe the course objective 1 is related to the module 1.

So how did the module 1 after completion of the module 1, whether they understand the course level outcome or not. So that kind of test we have to perform periodically during the teaching learning process. And that process is called formative evaluation, this may be (diagnost) is a formative evolution may be may need the diagnostic assessment also. So as I said the purpose of the assessment is to find out whether the student achieve the intended skill or not.

So periodically, suppose you thought the students are achieved the skill and the end of the semester you find none of the student is achieve those skill. So at the time is gone, so that time there is no (( ))(2:16) can be provided to the students.

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**FORMATIVE ASSESSMENTS**

- May need **DIAGNOSTIC ASSESSMENTS** also
- throughout instruction continuously
- Criteria referenced, wide FV range
- Assesses strength & weakness of
  - students
  - instructions
  - media
  - instructor
- Inferences drawn can be used for improvement of all of above
- Narrow content focus, frequency-daily
- Quiz, short test, class questions, assignments

So instead of doing that, I can take the formative assessment for each and every outcome during the teaching learning process, that means that is periodic and that may be a diagnostics, what do you mean by diagnostics? The purpose of this test is to find out there misconception regarding the topic.

I can give a simple example. Suppose if I taught let us I have given a simple example which is very simple even if this primary level may be in not class five level,  $2$  to the power  $3$  is equal to what? So you want to your outcome is that students should know  $a$  to the power  $b$  calculation what is the value decimal value that kind of things you want to taught.

So  $2$  to the power  $3$  correct answer is  $8$ , okay. Now if I design a formative assessment and what are the misconception as a teacher I know. If I give  $2$  to the power  $3$  the student misconception is either they can add this two number  $2 + 3$  is equal to  $5$  or they can multiply these two number, or they can give the correct answer.

This three are possible, so both I have to now after the class suppose I have a I take a one hour class, let us one hour lectures and you said that within this one hour students should achieve this outcome  $1$ ,  $2$  and  $3$  let us three is the your lecture outcome. Just before the end of the five minutes of the lecture you should spend to test whether the student has achieved that outcome or not.

Now teacher may say that I have a  $400$  students, how can I test whether the student has achieved the outcome or not? Give me one problem  $400$  students in my class, so I am unable to test whether the student has achieved the outcome or not. How do I test it? Now that is possible. We are developing that software let us the I have a multiple just question answering software where you everybody know the clicker technology or some other multiple choice answer kind of technology is there.

Now as a teacher, I create the question paper which is multiple choice, but the all choice are not arbitrary. There is a correct answer and there will be a choice which related to a possible misconception. So if I say  $2$  to the power  $3$ , the choice is not  $8$ ,  $7$ ,  $6$ ,  $5$  I have to give the choice  $6$ ,  $7$ ,  $8$   $2$  to the power  $3$  means one choice is may be adding the two number  $5$ , other choice is multiplying two number  $6$ , other choice is  $8$ . So if a students, so I make that question to all the  $400$  students from my laptop and everybody let us there is a smartphone or there may be a everybody has a mobile phone now as student.

So give the answer. Was the click the answer choice a let that is  $5$ , then you know what is their misconception then you can whether they have by chance give this answer or not, you can again make a question paper which is less  $3$  to the power  $5$ , then give the choice, again you have given the question answer is  $8$  that means you are ensure that his misconception is he is adding these two number.

Now you identify those students because roll number you know and you call them that since you have a misconception like this, so please read this material to overcome this misconception. So I can design a diagnostic test that formative assessment system which can be used for formative assessment of the students to test whether they achieve the skill and if they does not achieve the skill, what is there misconception.

But the role of the teacher is very important, what is the role of the teacher? To design a question paper and find out what should be the possible misconception of this question paper. So testing a student you asking a question to the student is not to (( ))(6:45) embarass the students. You are asking a question to the students to find out what is the possible misconception of the students.

So to do that, today ICD can help greatly to find out the possible misconception and provide their remedial lesson this can be done, even right now the many peoples know the modules. Modules can be used to find out the misconception but that is not diagnostics. We are developing one software which will be diagnostic test based formative assessment so that as a teacher I can find out what is the possible misconception of the student, okay?

(Refer Slide Time: 7:31)

**ASSESSMENTS – Selected sample of uses**

**ITEM ANALYSIS**

Three Important Characteristics of Test Items

**FACILITATION VALUE : (FV)** How easy is it?

- Everyone answered it right, FV = 1
- No one answered it right, FV = 0
- Half the students answered it right, FV=0.5

Ru = Right answers of upper group  
 RI = Right answers of lower group  
 n = Number of students in each group

$$\therefore FV = \frac{R}{N} = \frac{\text{Total right answer}}{\text{Total no of students}} = \frac{Ru + RI}{2n}$$

**DISCRIMINATION INDEX : (DI)** How good is it in separating the top scorers from the bottom scorers?

$$DI = \frac{Ru - RI}{n}$$

Now, there is another question is come that is called item analysis, many of you know the assessment the, suppose I want to make a question, I test item analysis test item analysis question

test item whatever I have make the question paper, I want to analyze whether this questions is appropriate to the students or not.

So what I said? If it is criteria based, then question paper will be designed based on the criteria. What I want to test, it is already communicate to the students and I will test only that things, that is called criteria based. So once I designed the criteria based test item, let us say I want to find out the test item analysis that whether this test item is suitable for finding out the skill of the students or not.

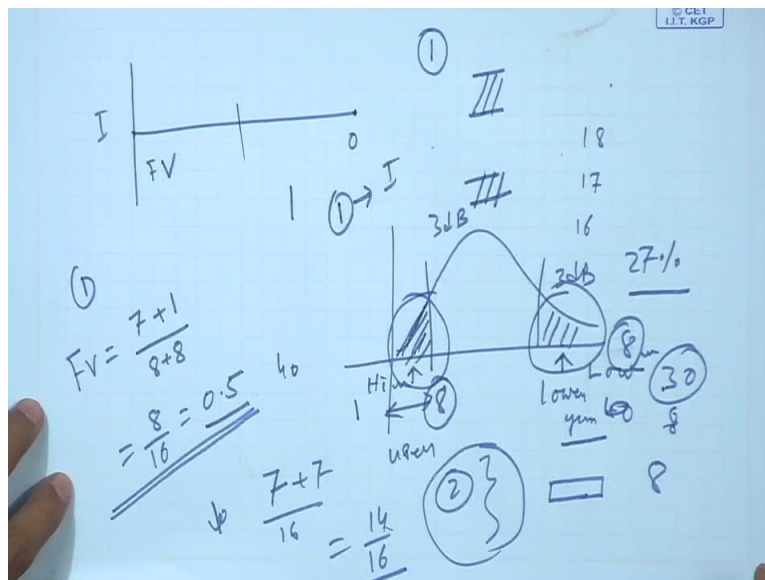
Now, there is a test item analysis with different component, one is called facilitation value. What do you mean by facilitation value? That is how easy is that question. So I design a question and I want to test how easy is this questions. How do I test it? it is not that I can test it for the present students, so suppose this type of question paper I have already defined designed and I have the result of the previous last 10 year student result.

From that result I can find out what is the facilitation value of this type of question paper, means how easy it is? How you do it? Let us I have a students of 40 students in my class, I make a test item and I test take the test. Out of 40 students, all students give the correct answer, which I intended if it is criteria based, my purpose is solved all students know the skill.

But if I want to say that rank the students, then all students if give the answer I cannot rank them 1 to 100. So facilitation value is that question paper is how easy it is if all the students give the correct answer, that means everybody give the correct answer facilitation value is 1, facilitation value is 1 everybody gives the correct answer. I make a test item where out of 40 student, none of them give the answer, that means facilitation value is 0, none of the student can give the answer, so facilitation value is 0.

(Refer Slide Time: 10:38)

| Rank | A | B | C | D | O/E |
|------|---|---|---|---|-----|
| 1    | C | A | C | B | 10  |
| 2    | C | A | C | D | 10  |
| 3    | C | A | C | B | 9   |
| 4    | A | A | C | B | 9   |
| 5    | C | A | C | B | 8   |
| 6    | C | A | C | B | 8   |
| 7    | C | A | C | B | 8   |
| 8    | C | B | C | D | 9   |
| 9    | C | A | C | B | 6   |
| 10   | B | A | C | A | 6   |
| 11   | C | A | C | D | 7   |
| 12   | C | A | C | A | 7   |
| 13   | B | A | C | C | 6   |
| 14   | C | A | C | D | 5   |
| 15   | C | A | C | D | 7   |
| 16   | C | A | C | B | 7   |
| 17   | C | A | D | A | 7   |
| 18   | C | A | C | B | 7   |
| 19   | C | A | C | D | 7   |
| 20   | C | A | C | C | 4   |
| 21   | B | A | C | C | 5   |
| 22   | B | B | C | C | 5   |
| 23   | A | A | C | A | 5   |
| 24   | A | D | C | B | 5   |
| 25   | A | C | A | A | 5   |
| 26   | A | C | A | B | 4   |



So now if I have a question paper of 40 questions and all students give that correct answer, then the facilitation value is 1 FV and if none of the student can give the correct answer facilitation value is 0. So FV varies from 1 to 0. Now in between value how do I find out? So suppose I have a 40 students if you see this I have 40 students let us talk about multiple choice question first, then I come to the summative type question paper. So let us I have a 10 questions 1, 2, 3, 4, 20 questions I have and the correct there is multiple type questions there is a 4 choice A, B, C, D and correct answer is C.

Now out of 40 students, let us test item 1, I found some of the students choice is B, some of them C, some of them are A all kind of things are there. So now after taking the test, let us I rank the students that I know that those are the students I take that 20 test item is there I take the test and then I find out the best on the total score, I rank the students.

Somebody get 18 let us every question is 1 mark, somebody 17, somebody 16 so I rank them 1 to 40. So once I rank them 1 to 40, then there is a you know everybody knows that first portion of the good students and least last portion of the bad students who not performed well. So generally, the marks distribution of the students should be a Gaussian marks, Gaussian distribution marks of the student should follow a Gaussian distribution.

Everybody know what is upward down 3db down, what do you mean by 3dB? Is 27 percent is the 3dB. So if I say those are the highest marks and this is the low students so this is 1 this is 40 rank students, so if I rank them and up to this portion, this portion is called upper group and this portion is called lower group, okay. So if I want to find out how easy is this question let us test item 1, I have to know how many students of upper group give the correct answer, and how many students of the lower group give the correct answer, okay or not?

So now, if it is 27 percent so 40 students roughly if I say 8 students is come 40 students means or if it is 30 students ohh here is 30 students. So if it is 30 students if I have the 30 students, then roughly 8 students is the upper group and 8 student is the lower group. If it is 40 students, so you need to find out how many students in upper group and how many students in the lower group.

So let us 40 students, then 8 students is in upper group, 8 students is in lower group, okay. I said the facilitation value FV is how many students of the upper group give the correct answer and how many students of the lower group give the correct answer and divided by the group size, is clear or not.

So if I say out for test item 1 out of upper 8 students only 7 student give the correct answer and for the lower group I found 1 student give the correct answer C. So 1 student give the correct answer divided by the group size  $8 + 8$ , so it is  $8$  by  $16$  so it is  $0.5$ . So facilitation value of the test item 1 is  $0.5$  is clear or not.

I said if I want to find out the facilitation value of a test item I have a class size and rank them after the taking the test I rank them 1 to 100 or maybe 1 to 40, 1 to 400, then I take the upper group and lower group of the 30 percent of the students and lower 30 percent of the students. How many students of the upper group give the correct answer + how many students of the lower group give the correct answer divided by the group size if each test is each each test item test item is corresponding to 1 marks, is clear? clear? So facilitation value is 0.5 in test item 1.

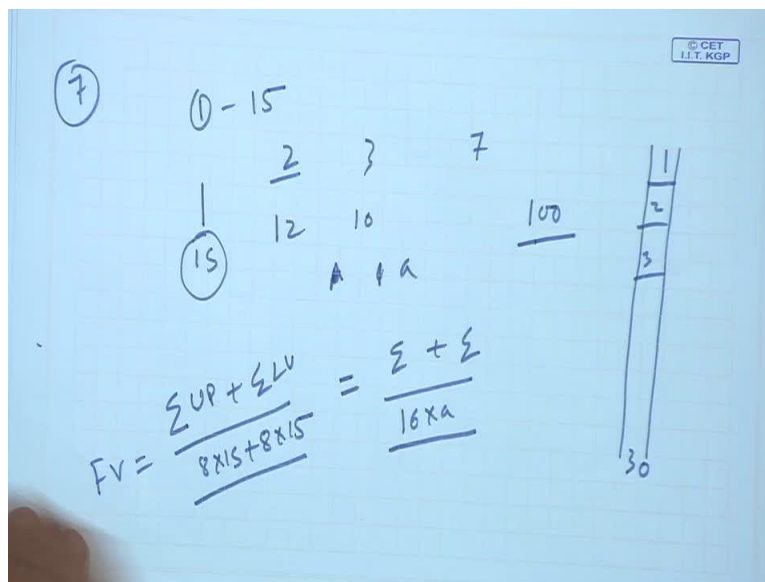
Now similarly, if I see the test item number 2, correct answer is A, in upper group is up to 8 is 1 upper group student give the correct answer, sorry 7 upper group student give the correct answer and 7 lower group student give the correct answer,  $7 + 7$  divided by 16 so 14 by 16 almost 1 close to 1. So that means test item 2 is very easy even the lower group student can give the answer, is clear.

But in our cases, since it is criteria based assessment system, this kind of test item analysis is not that much required because I want to test whether the student achieve the skill or not. But if I want to assign them a rank, then I have to do the test item analysis and I have to design the question paper such that I can rank the students 1 to 40, okay. So that is called facilitation value. Similarly, let us instead of 1 marks multiple choice questions.



(Refer Slide Time: 17:22)

| R  | 1  | 2  | 3  | 4  | 5 | 6 | 7 | Odd | Even | Total |
|----|----|----|----|----|---|---|---|-----|------|-------|
| 1  | 15 | 11 | 13 | 14 | 8 | 8 | 7 | 43  | 33   | 94    |
| 2  | 15 | 11 | 13 | 14 | 8 | 8 | 7 | 43  | 33   | 94    |
| 3  | 14 | 11 | 13 | 14 | 7 | 8 | 7 | 41  | 33   | 92    |
| 4  | 12 | 11 | 13 | 13 | 8 | 8 | 7 | 40  | 32   | 89    |
| 5  | 13 | 11 | 12 | 14 | 8 | 7 | 7 | 40  | 32   | 88    |
| 6  | 13 | 11 | 13 | 13 | 8 | 8 | 6 | 40  | 32   | 88    |
| 7  | 12 | 11 | 10 | 12 | 7 | 8 | 7 | 36  | 31   | 82    |
| 8  | 15 | 10 | 10 | 10 | 7 | 7 | 6 | 38  | 27   | 80    |
| 9  | 13 | 10 | 8  | 10 | 8 | 8 | 7 | 33  | 26   | 79    |
| 10 | 12 | 10 | 10 | 10 | 7 | 7 | 7 | 36  | 27   | 78    |
| 11 | 16 | 11 | 13 | 8  | 8 | 8 | 7 | 34  | 29   | 78    |
| 12 | 10 | 8  | 12 | 7  | 8 | 8 | 6 | 36  | 23   | 74    |
| 13 | 8  | 8  | 13 | 9  | 7 | 7 | 7 | 35  | 24   | 72    |
| 14 | 8  | 8  | 12 | 8  | 8 | 8 | 7 | 35  | 24   | 72    |
| 15 | 7  | 8  | 10 | 8  | 8 | 8 | 6 | 31  | 24   | 68    |
| 16 | 7  | 8  | 11 | 7  | 6 | 7 | 6 | 30  | 22   | 65    |
| 17 | 7  | 7  | 10 | 8  | 6 | 8 | 6 | 29  | 23   | 65    |
| 18 | 5  | 8  | 8  | 7  | 8 | 8 | 6 | 27  | 23   | 63    |
| 19 | 9  | 8  | 8  | 8  | 6 | 7 | 6 | 30  | 23   | 65    |
| 20 | 8  | 8  | 8  | 8  | 6 | 8 | 6 | 23  | 24   | 63    |
| 21 | 7  | 7  | 8  | 11 | 6 | 8 | 5 | 26  | 26   | 63    |
| 22 | 7  | 6  | 8  | 10 | 6 | 8 | 5 | 26  | 24   | 61    |
| 23 | 7  | 8  | 8  | 8  | 8 | 8 | 8 | 29  | 21   | 61    |
| 24 | 7  | 8  | 7  | 7  | 8 | 7 | 5 | 27  | 19   | 57    |



Suppose I have a question paper which let us there is a 7 question in the paper, each question has 15 marks each question is 15 marks. So let us 7 into or I can say I have a 7 question number 1 is 15 marks, question number 2 is maybe 12 marks, 3 is maybe 10 marks like that and within 7 question I have a total 100 marks question paper, is okay or not, okay? So 100 marks question paper.

So now question number 1 15 is the highest, so within the 100 marks question paper first after the test I rank them rank the student 1 to 30, 1, 2, 3...to 30. Now I find that (ques) for question

number 1 the upper group is up to 8 and question number 1 lower group is 27 to 30. So I will sum up the total marks of the upper group, what is total marks?

Question paper full marks obtained by the individual students of the upper group. So sum of upper group marks + sum of lower group marks divided by total marks in upper group 8 into 15 + 8 into 15. So generalized formula is that if the question marks is A, let the (ma) marks of the question is A and upper group student sum of upper group student marks + sum of lower group student marks divided by 16 into full marks of the question paper, is a facilitation value, okay this is a facilitation value?

(Refer Slide Time: 19:14)

**ASSESSMENTS – Selected sample of uses**

**ITEM ANALYSIS**

Three Important Characteristics of Test Items

**FACILITATION VALUE: (FV) How easy is it?**

- Everyone answered it right, FV = 1
- No one answered it right, FV = 0
- Half the students answered it right, FV=0.5

Ru = Right answers of upper group  
RI = Right answers of lower group  
n = Number of students in each group

$$\therefore FV = \frac{R}{N} = \frac{\text{Total right answer}}{\text{Total no of students}} = \frac{Ru + RI}{2n}$$

**DISCRIMINATION INDEX: (DI) How good is it in separating the top scorers from the bottom scorers?**

$$DI = \frac{Ru - RI}{n}$$

⑦

① - 15

2 } 7

12 10

15

A + A

100

11

2

3

30

$$FV = \frac{\sum UP + \sum LV}{2 \times 15 + 8 \times 15} = \frac{\sum + \sum}{16 \times a}$$

$$FV = \frac{R_U + R_L}{2 \times n} \quad \left. \begin{array}{l} \sum R_U + \sum R_L \\ 2 \times n \times a \end{array} \right\}$$

So I can generalize in theory that facilitation value is nothing but a total right answer by upper group + total right answer by lower group or  $\frac{1}{2} \times \text{total marks}$  divided by 2 into group size  $n$ , okay if it is multiple one marks question paper. If it is summative question paper then I just only multiply sum the upper group marks sum the lower group marks divided by  $n \times 2$  into  $n$  into full marks of the question paper, okay.

So if I give you the data for any test item, then you can easily calculate what is the facilitation value of the test item. In assignment I will supply some data and you will solve calculate the facilitation value of those test item, is clear? So this is called facilitation value. Then there is another terminology we call discriminative index, how good is the test item to differentiate between the good students and bad students.

So if I say I am design a question paper for JEE, my discriminative index value of that question should be very high so that only top students can answer that questions and lower students cannot answer that question so that I can choose the good students from the large pool of students. If I give the discrimination is very low question paper all everybody is give the answer thethat question does not create any value to the JEE question because JEE is the non-reference examination.

So suppose I in JEE there is a one question everybody 5 lakhs students everybody give the correct answer, what is the value of that question? No value because using that question I cannot

differentiate the good students to bad student because JEE exam is only find out the good student from the among the 5 lakhs student who are the top good student who are the less top like that way I have to run them, okay.

So discriminative index is nothing but a how good is my test item so that it can differentiate between the good students and bad students, okay.

(Refer Slide Time: 22:06)

| Q. No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|--------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 4      | A | A | C | C | B | A | C | A | B | D  | D  | C  | C  | A  | C  | D  | C  | B  | C  | A  | 9  | 8  |    |    |    |    |    |    |    |    |
| 5      | C | A | C | C | B | A | C | A | C | B  | D  | D  | C  | C  | A  | C  | A  | C  | B  | A  | 8  | 8  |    |    |    |    |    |    |    |    |
| 6      | C | A | C | C | B | A | C | A | B | D  | D  | C  | -  | -  | C  | A  | D  | A  | C  | 8  | 8  |    |    |    |    |    |    |    |    |    |
| 7      | C | A | C | C | B | A | A | A | B | B  | B  | C  | C  | B  | C  | A  | C  | B  | C  | 8  | 7  |    |    |    |    |    |    |    |    |    |
| 8      | C | B | C | C | D | A | C | A | B | D  | D  | C  | C  | B  | C  | A  | C  | C  | C  | A  | 9  | 6  |    |    |    |    |    |    |    |    |
| 9      | C | A | C | C | B | A | C | A | B | B  | A  | A  | C  | D  | C  | A  | C  | B  | C  | D  | 9  | 6  |    |    |    |    |    |    |    |    |
| 10     | B | A | C | C | A | A | C | A | C | D  | D  | C  | C  | A  | C  | A  | C  | B  | D  | A  | 6  | 9  |    |    |    |    |    |    |    |    |
| 11     | C | A | C | C | D | A | C | A | B | C  | B  | C  | C  | -  | C  | A  | C  | B  | C  | A  | 8  | 7  |    |    |    |    |    |    |    |    |
| 12     | C | A | C | C | A | A | C | A | C | D  | D  | C  | C  | A  | C  | B  | C  | B  | A  | A  | 7  | 8  |    |    |    |    |    |    |    |    |
| 13     | B | A | C | C | C | A | C | A | B | D  | B  | C  | C  | -  | -  | C  | B  | C  | D  | 6  | 7  |    |    |    |    |    |    |    |    |    |
| 14     | C | A | C | C | D | B | C | C | B | B  | B  | A  | C  | A  | C  | A  | C  | B  | C  | A  | 8  | 5  |    |    |    |    |    |    |    |    |
| 15     | C | A | C | C | D | B | C | A | C | B  | D  | C  | C  | A  | A  | A  | C  | B  | C  | A  | 7  | 6  |    |    |    |    |    |    |    |    |
| 16     | C | A | C | C | B | B | C | D | B | B  | B  | C  | A  | C  | A  | C  | B  | A  | A  | 7  | 6  |    |    |    |    |    |    |    |    |    |
| 17     | C | A | A | D | A | A | C | A | A | B  | B  | C  | C  | B  | C  | A  | C  | B  | C  | A  | 7  | 6  |    |    |    |    |    |    |    |    |
| 18     | C | A | C | C | B | B | A | B | B | B  | C  | C  | A  | A  | D  | C  | B  | C  | A  | 7  | 6  |    |    |    |    |    |    |    |    |    |
| 19     | C | A | C | D | C | A | C | C | C | D  | D  | C  | C  | B  | C  | A  | C  | A  | B  | A  | 7  | 5  |    |    |    |    |    |    |    |    |
| 20     | C | A | C | C | B | B | C | B | B | B  | A  | C  | B  | C  | A  | C  | B  | C  | A  | 7  | 4  |    |    |    |    |    |    |    |    |    |
| 21     | B | A | C | D | C | A | C | C | C | D  | B  | C  | C  | A  | A  | C  | A  | C  | A  | 5  | 6  |    |    |    |    |    |    |    |    |    |
| 22     | B | B | C | C | C | A | C | A | A | C  | D  | A  | A  | B  | C  | A  | C  | B  | C  | A  | 6  | 5  |    |    |    |    |    |    |    |    |
| 23     | B | A | C | C | A | A | C | B | B | B  | A  | C  | A  | C  | B  | C  | B  | C  | Y  | 8  | 5  |    |    |    |    |    |    |    |    |    |
| 24     | B | A | C | C | D | B | B | C | B | D  | D  | C  | C  | B  | A  | C  | B  | C  | Y  | 5  | 5  |    |    |    |    |    |    |    |    |    |
| 25     | B | A | C | C | A | A | C | B | B | A  | C  | B  | A  | C  | B  | C  | B  | A  | C  | 5  | 5  |    |    |    |    |    |    |    |    |    |
| 26     | B | A | C | C | D | A | C | B | B | B  | A  | C  | B  | A  | B  | C  | B  | C  | Y  | 4  | 5  |    |    |    |    |    |    |    |    |    |
| 27     | B | A | C | C | A | A | A | B | B | B  | A  | C  | B  | C  | B  | C  | B  | A  | Y  | 5  | 4  |    |    |    |    |    |    |    |    |    |
| 28     | C | C | C | D | A | B | B | C | B | A  | C  | B  | C  | A  | C  | C  | C  | Y  | 5  | 3  |    |    |    |    |    |    |    |    |    |    |
| 29     | B | A | C | B | B | D | C | B | B | A  | C  | A  | C  | D  | B  | A  | Y  | A  | Y  | 4  | 3  |    |    |    |    |    |    |    |    |    |
| 30     | B | A | B | B | A | C | D | B | B | C  | B  | C  | C  | A  | B  | C  | A  | B  | Y  | A  | 2  | 4  |    |    |    |    |    |    |    |    |

Now same things, if I say I take a test for next 30 students and again I found next item number 1 correct answer is C and upper group students give the correct upper group all 7 students of upper group give the correct answer and 1 student give the wrong answer, in the correct answer in the lower group student. So I said how good it is differentiate between the upper group and lower group.

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Handwritten mathematical formulas on a whiteboard:

$$DI = \frac{R_u - R_l}{n}$$
$$DI = \frac{7-1}{8} = \frac{6}{8}$$
$$DI = \frac{8-8}{8} = 0$$
$$\frac{\sum R_u - \sum R_l}{n+15}$$

A circled '15' is also present.

So that means correct given by upper group minus correct answer given by lower group divided by the group size. That means that is equal to DI, how good is the question paper to differentiate between the good students and bad students? That means the correct answer, the number of student give the correct answer of the upper group number of student give the correct answer in the lower group minus divided by n.

So in case of question number 1, in this example I can say the 7 students of the upper group give the correct answer, only one student of the lower group give the correct answer and divided by group size is 8. So it is 6 by 8 is the DI, okay. So discriminating index is nothing but a 7 minus 1 by 8. Similarly if it is summative type question paper if it is a long answer question paper if instead of multiple choice, let us my question number 1 highest marks is 15, then the sum of the upper group students sum of the marks of the upper group students minus sum of the marks of the lower group students divided by the total marks n into 15, is okay or not?

I will upload this power point presentation when some something is already calculated you can go through it, but you have to understand the theory first. That what is what do you mean by discriminative index? Now you see, If the facilitation value is 1 what should be the DI? All students are give the correct answer, that means facilitation value FV is equal to 1.

So DI will be upper group correct minus upper group lower group correct divided by correct is equal to 0 discriminative index is 0. So that means if I provide a question paper in case of a ranking the student and every student give the correct answer that question does not use or does not know does not have any effect on the ranking of the students.

So I should not use that type of questions to ranking the students, but yes I will use that type of questions if it is criteria based evaluation I want to test whether the student achieve this skill or not in case of our semester examination, I should provide the question paper which can every student give the correct answer because every I want to test the criteria not the discriminating them to provide the rank, okay.

So I can use this kind of formula to test that item which is called item analysis to find out the hardness and how easy is the question paper from the previous year data set, okay. So there is lot of workout problem.

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| Item 1                                    | A      | B      | C* | D |
|-------------------------------------------|--------|--------|----|---|
| Higher 27%                                | 1      | 0      | 7  | 0 |
| Lower 27%                                 | 0      | 7      | 1  | 0 |
| Whole Group                               | 1      | 11     | 18 | 0 |
| Effectiveness of Distractors              | -0.125 | +0.875 | *  | 0 |
| Facility Value = $(7 + 1) / 16 = 0.50$    |        |        |    |   |
| Discrimination Index $(7 - 1) / 8 = 0.75$ |        |        |    |   |

| Item 7                                    | A      | B     | C* | D     |
|-------------------------------------------|--------|-------|----|-------|
| Higher 27%                                | 1      | 0     | 7  | 0     |
| Lower 27%                                 | 2      | 2     | 2  | 2     |
| Whole Group                               | 3      | 4     | 21 | 2     |
| Effectiveness of Distractors              | +0.125 | +0.25 | *  | +0.25 |
| Facility Value = $(7 + 2) / 16 = 0.56$    |        |       |    |       |
| Discrimination Index $(7 - 2) / 8 = 0.50$ |        |       |    |       |

If I say that this is this group that item number 1 effective discriminative index facilitation value is 0.5 and discriminative index is 0.75 6 by 8, okay. So some workout problems are already there, you can go through this slides and see that discriminative value and facilitation value. Now there is another point is called effectiveness of the distractor. Designing of multiple choice question paper is not that so easy.

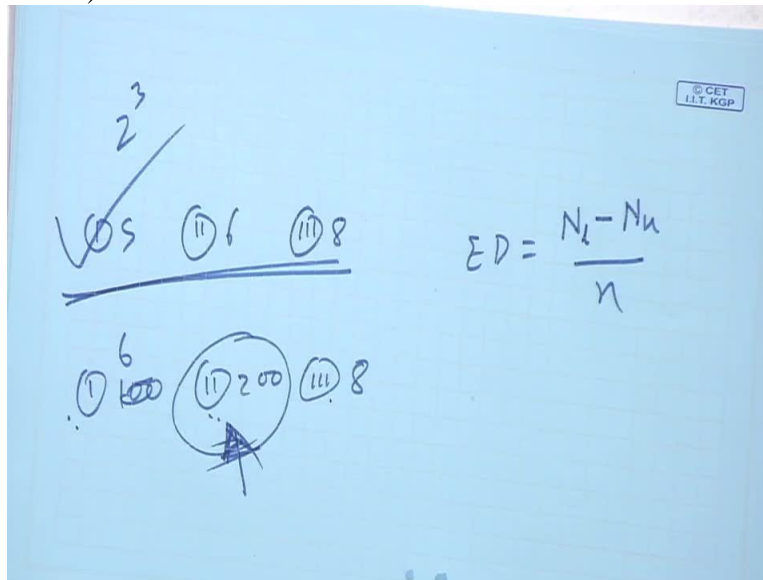
When you design a multiple choice question paper and if you have a 4 choice the choice is not arbitrary, even I seen that my daughter is preparing for Olympiad exam in maths and I found he is giving the choosing the correct answer of a three digit number multiple by a three digit number within a fraction of second, then I asked how do you select the correct answer without doing the multiplication, he said it is very simple if you see the four choice, let us there is given a number whose last digit is 5 and another 3 digit number whose last digit is 5 so he said that what should be the result last digit will be the 5.

Now if you see the four choice only one answer has the last digit 5, so obviously that will be the correct answer. So if I said I want to test whether a student is able to multiply a three digit number by a three digit number using multiple choice questions and I give this kind of option, then without doing the multiplication or without doing the correct multiplication of three digit number students can give the correct answer.

Then my purpose of the evaluation is totally lost. If you see many of the cases that our JEE exam all our coaching center are try to do this this only. They want to prepare the students how good are they using minimum time can find out the correct answer or they can reject the wrong answer so that they can distinguish the correct answer. So that is mechanized practice and mechanized, this does not test the student deep knowledge or deep understanding about the subject.

So this does not develop the skill set of the student, this kind of mechanism is used. In training you see that all JEE coaching center several test they have taken and several kinds of test they have taken to only facilitated the students how do you select that answer quickly. So if I want to really design a very good multiple choice questions, my each of the choice should not be arbitrary.

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So suppose if I want to design a multiple choice option for 2 to the power 3 what are the possible misconceptions I have to find out? misconception 1 is 5 adding the number, 2 is multiplying the number 6, and 3 is correct. So only three options are there. So choice should be only three. Out of three if anybody choose option 1, I know his misconception is he is adding the two number. So purpose of the evaluation is to find out whether the student has that skill or not.

If I want to find out so I have to know what are the possible misconception if I this give this kind of question paper. So if I 2 to the power 3 and I give a choice is 100, 200 and 8, then none of the students or let 100, 6 and 8 none of the students choose this 200 option 200, what is the meaning?

The effectiveness of the distractor so choice of the distractor each and individual choice are the distractor so **so** that the students I want to test the misconception of the students. So if the distractor choice is 0, none of the student if choose the distractor 2, then the effectiveness of the distractor 2 is 0. So whether I give that choice or not does not matter, so the effectiveness of the distractor is that how effective is each of the choices.

So effective of the distractor in mathematics I can say number of student of the lower group choose the distractor minus number of students of the upper group choose the distractor divided by the n.



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|    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |   |   |
|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|
| 1  | C | A | C | C | B | A | C | A | B | D | D | A | C | A | C | A | C | B | C | D | 10 | 8 |   |
| 2  | C | A | C | D | B | A | C | A | B | D | D | C | C | A | C | A | C | B | C | A | 10 | 8 |   |
| 3  | C | A | C | C | B | A | C | A | B | D | D | C | C | C | A | C | C | B | A | 9 | 9  |   |   |
| 4  | A | A | C | C | B | A | C | A | B | D | D | C | C | A | C | D | C | B | C | A | 9  | 8 |   |
| 5  | C | A | C | C | B | A | C | A | C | B | D | C | C | A | C | A | C | B | A | 8 | 8  |   |   |
| 6  | C | A | C | C | B | A | C | A | B | D | D | C | - | - | C | A | D | A | C | 8 | 8  |   |   |
| 7  | C | A | C | C | B | A | A | A | B | B | B | C | C | B | C | A | C | B | C | B | 8  | 7 |   |
| 8  | C | B | C | C | D | A | C | A | B | D | D | C | C | B | C | A | C | C | A | 9 | 6  |   |   |
| 9  | C | A | C | C | B | A | C | A | B | B | A | A | C | D | C | A | C | B | C | D | 9  | 6 |   |
| 10 | B | A | C | C | A | C | A | C | A | C | D | D | C | C | A | C | A | C | B | D | A  | 8 | 9 |
| 11 | C | A | C | C | D | A | C | A | B | C | B | C | C | - | C | A | C | B | C | A | 8  | 7 |   |
| 12 | C | A | C | C | A | A | C | A | C | D | D | C | C | A | C | B | C | B | A | A | 7  | 8 |   |
| 13 | B | A | C | C | C | A | C | A | B | D | B | C | C | - | - | C | B | C | D | 6 | 7  |   |   |
| 14 | C | A | C | C | D | B | C | C | B | B | B | A | C | A | C | A | C | B | C | A | 8  | 5 |   |
| 15 | C | A | C | C | D | B | C | A | C | B | D | C | C | A | A | A | C | B | C | A | 7  | 6 |   |
| 16 | C | A | C | C | B | B | C | D | B | B | B | C | A | A | C | A | C | B | A | A | 7  | 6 |   |
| 17 | C | A | A | D | A | A | C | A | A | B | B | C | C | B | C | A | C | B | C | A | 7  | 6 |   |
| 18 | C | A | C | C | B | B | B | A | B | B | B | C | C | A | A | D | C | B | C | A | 7  | 6 |   |
| 19 | C | A | C | D | C | A | C | C | C | D | D | C | C | B | C | A | C | A | B | A | 7  | 5 |   |
| 20 | C | A | C | C | C | B | B | C | B | B | B | A | C | B | C | A | C | B | C | A | 7  | 4 |   |
| 21 | B | A | C | D | C | A | C | C | C | D | B | C | C | A | A | C | A | C | A | 6 | 6  |   |   |
| 22 | B | B | C | C | C | A | C | A | A | C | D | A | A | B | C | A | C | B | C | A | 6  | 5 |   |
| 23 | B | A | C | C | A | A | C | B | B | B | B | A | C | A | C | B | C | B | C | A | 8  | 5 |   |
| 24 | B | A | D | C | D | B | B | C | B | D | D | C | C | B | A | C | B | C | A | 5 | 6  |   |   |
| 25 | B | A | C | C | A | A | C | B | B | B | B | A | C | B | C | B | C | B | A | C | 5  | 5 |   |
| 26 | B | A | D | D | A | C | B | B | B | B | B | A | A | B | C | B | C | B | C | A | 4  | 5 |   |
| 27 | B | A | C | C | A | A | A | B | B | B | B | A | C | B | C | B | C | B | A | 5 | 4  |   |   |

So if I say question number 1 I have a four choice A, B, C, D. C is the correct answer. So A, B and D are the possible distractor, now if you see none of the student is choose D as a (de) distractor. That means that effectiveness of the distractor choice D is 0, so effectiveness of the distractor A is how much? Number of students of the lower group choose A, how many student choose A? Nobody. Nobody choose A minus number of students of the upper group choose A only 1 divided by the n.

Effectiveness of the distractor choice B, number of student of the lower group choose B 1, 2, 3, 4, 5, 6, 7. So 7 minus upper group student how many? None, 7 minus 0 divided by 8.

So B is the good distractor from the item analysis item number 1. So designing a multiple choice question paper is not that easy. Each of the choice should be test the possible misconception of the tudents, okay. So effectiveness of the distractor how to calculate? how to calculate facilitation value? how to calculate discriminative index? I have covered in this class, next class I will say how to design or there is another one guessing problem and then I go for go to the validity and reliability of the evaluation, okay, thank you.