Human Factors Engineering

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Lecture - 26
Work Postures and Related Complaints, Work Postures for Different Tasks, Task Analysis

Dear students and participants welcome you all to the lecture sessions of 6th week, for the course Human Factors Engineering. This particular week we are going to discuss industrial applications. And there are many industrial applications. So, our core issue is the work posture analysis for different types of tasks.

So, when you refer to the industrial workplaces you come across varieties of tasks and jobs and there will be interface and there will be work postures. And what are the factors determining the work pressures So, we will be discussing work postures for the task and another very important issue is these days we use varieties of hand tools, including power hand tools every everywhere.

So, whether all these hand tools are ergonomically designed or not. So, if not then how to assess and once you assess design of different kinds of hand tools. Obviously, there is always scope for improvement and how to improve the hand tool designs.

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There are 5 lecture sessions, so let me just quickly the tell you what are the subtopics in each the lecture session.

Lecture-1: Work Postures and Related Complaints, Work Postures for Different Tasks, Task Analysis.

Lecture-2: Power Law of Practice, Learning Curve, Numerical Problem.

Lecture-3: Work Posture Assessment, Rapid Entire Body Assessment (REBA), MSDs/RMIs.

Lecture-4: Hand Tool Design, Usage of Hand Tools, Types of Injuries and their Prevention.

Lecture-5: Design Guidelines for Hand Tools.

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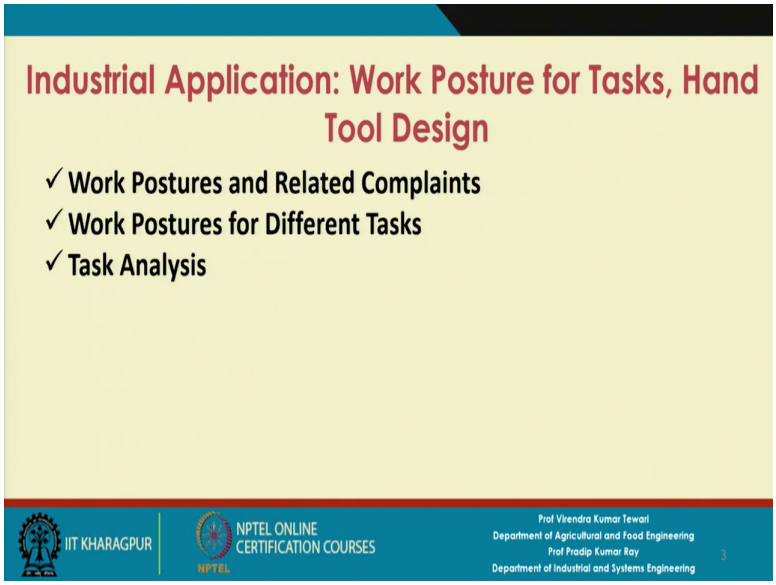

Now, during this lecture session I will be discussing the work postures and the related complaints, will take up several examples and work postures for different tasks and the third topic is called task analysis.

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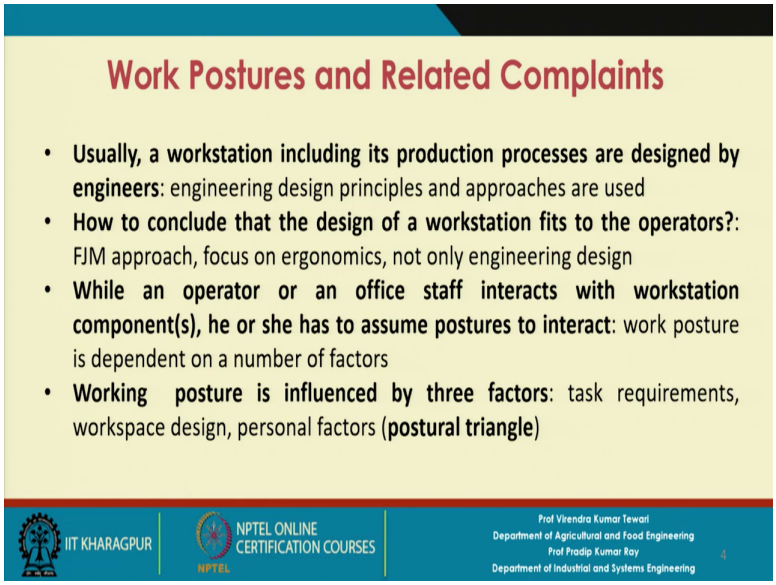

So, let us talk about the work postures and related complaints. Usually, a workstation including its production processes are designed by engineers: engineering design principles and approaches are used.

How to conclude that the design of a workstation fits to the operators? FJM approach, focus on ergonomics, not only engineering design.

While an operator or an office staff interacts with workstation component(s), he or she has to assume postures to interact: work posture is dependent on a number of factors.

Working posture is influenced by three factors: task requirements, workspace design, personal factors (postural triangle).

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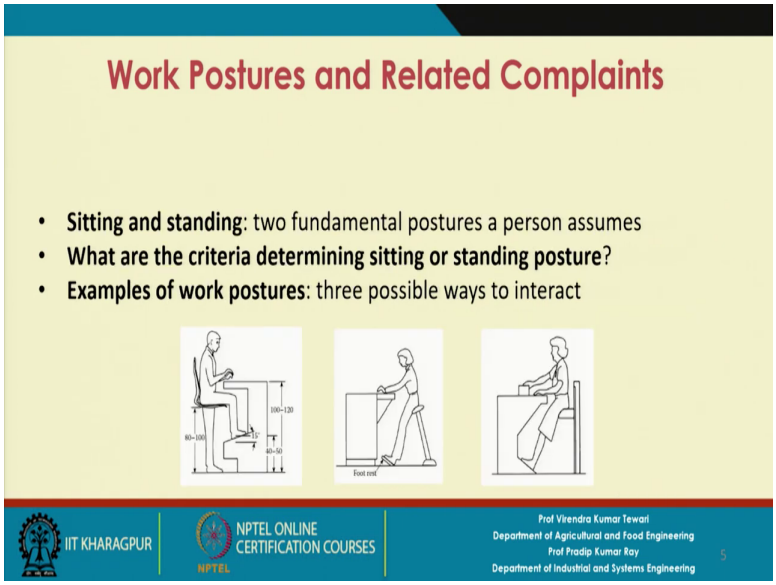

And these are an example like normally these postures are grouped under three categories, I am not referring to the squatting postures. There are many jobs you carry out, either with a sitting posture or standing postures, constantly suppose the work cycle is 5 minutes, constantly you assume or you have one posture. But there are jobs where you have to assume a standing postures, you will find you just there the sieve or you look at many the jobs being carried out at the shop floor.

So, you will find that those jobs are being carried out in the standing postures constantly for the entire work cycle. The person is assuming the same posture, there are jobs where we are sitting posture you assume all the time. Next you assume standing posture. So, which is referred to sit standing posture. So, these are sitting and standing, they referred to as two fundamental posture a person assumes usually. Examples of work postures have three possible ways to interact. The first one is just look at the first figure. So, here there are cases someone is working on the work table. So, you if you have a chair, this sort of the chair you design. So, you assume the sitting posture or suppose you are facing certain problems as I have already mentioned, that the same posture you cannot continue for continuously. you will find that the constantly you are changing your work postures.

Even if it is sitting posture, but it is a dynamic one, it is not static, constantly you have to adjust it, So, the adjusting sometimes become uncomfortable, uncomfortable in the sense that the chair is designed in such a way that if you continue working in this sitting posture for about, at that particular height the sitting height for about 5 minutes you feel pain in the back side.

So, you say fine let us assume a standing posture, So, this is just one example, second example is very common. The second one the foot rest, here we must have a foot rest may be the person is a short height and this is another say alternatives you have, here in most likely sometimes you in all these three cases what we will find that sometimes you assume sitting posture and sometimes you assume a standing postures.

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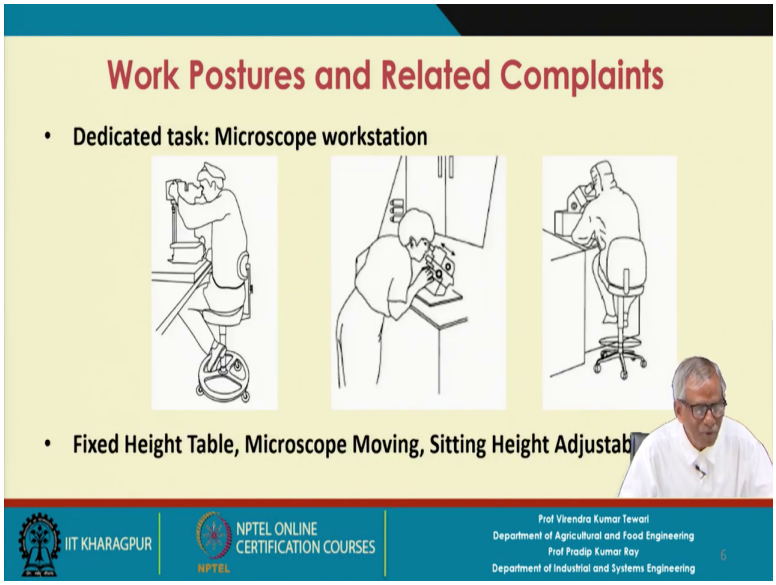

This is another example, like someone is working on microscope workstation these are the three ways you are handling a microscopic work. Now, in the first figure if you look, fixed height table is there. So, one person's he uses this particular chair and the next person he has to adjust the chair height, because you cannot adjust the table height that is fixed.

Similarly, the next the posture what you find that the microscope is moving So, it is a dynamic posture. This is very common and the third one is sitting height adjustability here, there is a possibility sitting height adjustability.

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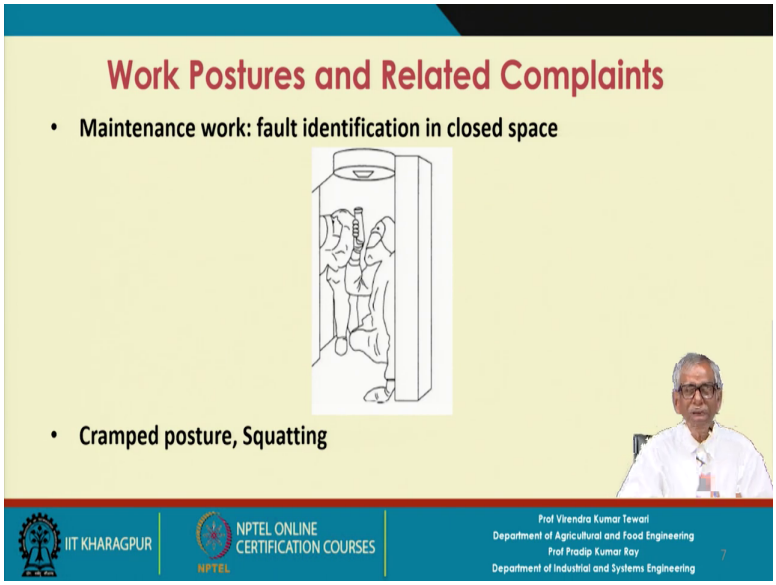

Another example this is another case- the maintenance work. So, maintenance work is fault identification and the troubleshooting, first you have to identify the fault and it is a manual work and while you carry out this maintenance work. So, usually in many cases you have to work in closed space.

So, this is the fault identification is closed space and even while you carry out maintenance work, then troubleshooting is actual work. So, you have to assume in many cases is the cramped postures or entire body you have to rest on the ground, that sort of posture you have to assume.

So, the cramped posture is very common and the squatting posture is also very common you cannot think of carrying out these kinds of jobs, many times, you have to go underground and there is a very close space, the limited space. So, you have no other alternative, but to have or to assume the cramped postures

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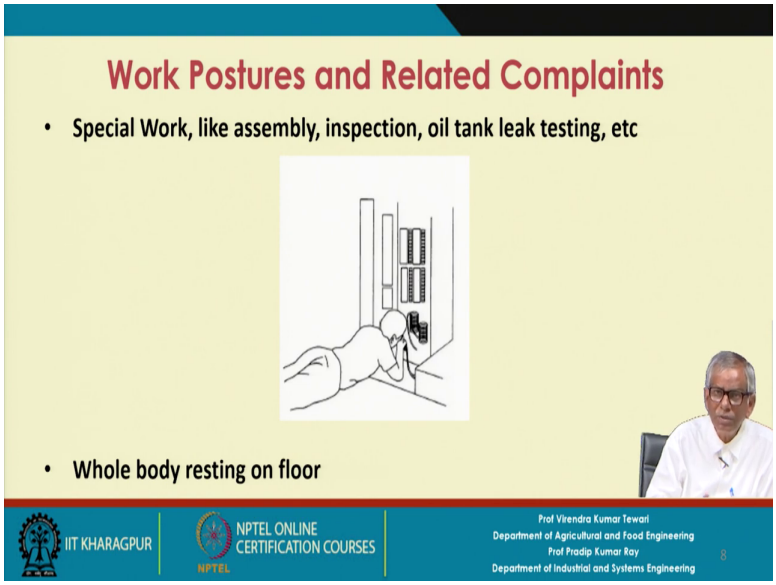

So, and then when there is squatting postures for special work like assembly inspection these are considered to be special work, Oil tank leak testing, this is very common. Whole body is resting on floor. If you look at the construction site varieties of the work process you come across, in an open space.

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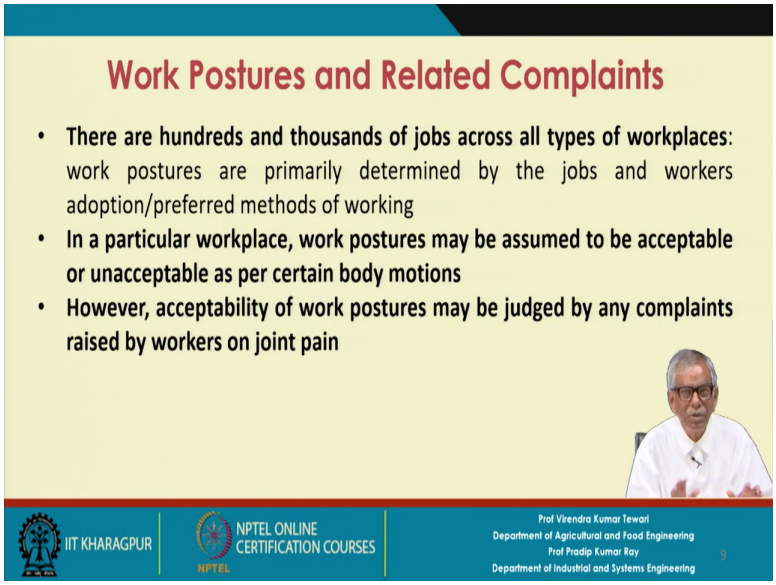

There are hundreds and thousands of jobs across all types of workplaces: work postures are primarily determined by the jobs and workers adoption/preferred methods of working.

In a particular workplace, work postures may be assumed to be acceptable or unacceptable as per certain body motions.

However, acceptability of work postures may be judged by any complaints raised by workers on joint pain.

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In many countries, like India, Indonesia, etc. workers while performing jobs may sit hunched/squatting on the floor, swing their knees to manipulate items and work with their hands: they do not have any problems with their knee joint (joint pain): dynamic biomechanical modelling, further research necessary to ascertain causes.

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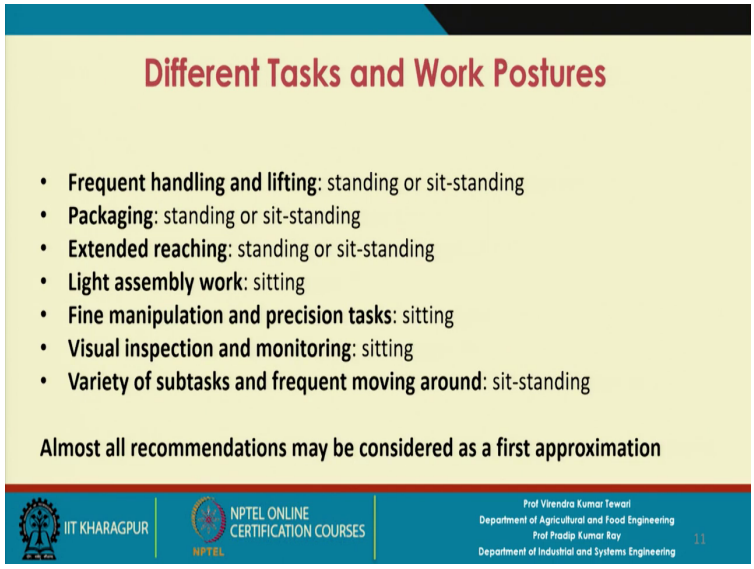

And so now, you check whether your posture is acceptable or not. So, the different tasks and the work postures such as:

1. Frequent handling and lifting: standing or sit-standing
2. Packaging: standing or sit-standing
3. Extended reaching: standing or sit-standing
4. Light assembly work: sitting
5. Fine manipulation and precision tasks: sitting
6. Visual inspection and monitoring: sitting
7. Variety of subtasks and frequent moving around: sit-standing

This is a set of the guidelines you have variety of sub tasks and the frequent moving around. So, sit or standing, visual inspection and monitoring; your preferred posture is sitting postures Almost all recommendations may be considered as a first approximation.

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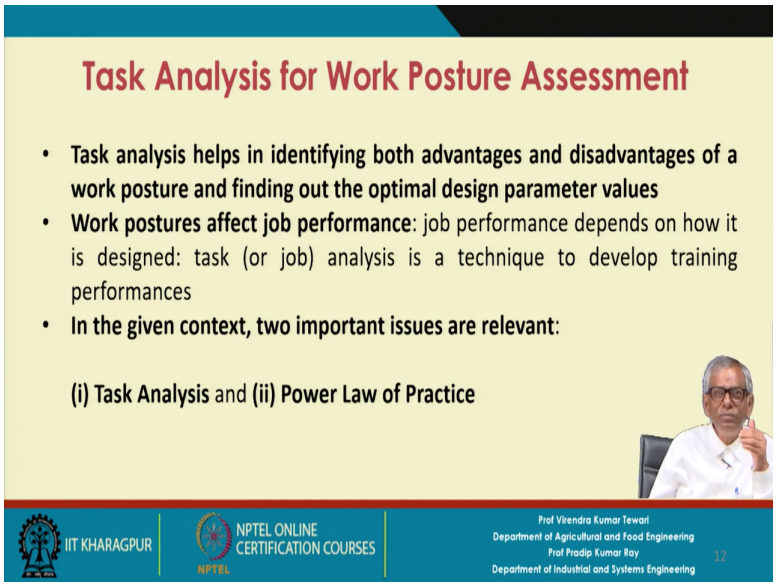

Task analysis helps in identifying both advantages and disadvantages of a work posture and finding out the optimal design parameter values. Work postures affect job performance and job performance depends on how it is designed: task (or job) analysis is a technique to develop training performances. In the given context, two important issues are relevant: (i) Task Analysis and (ii) Power Law of Practice.

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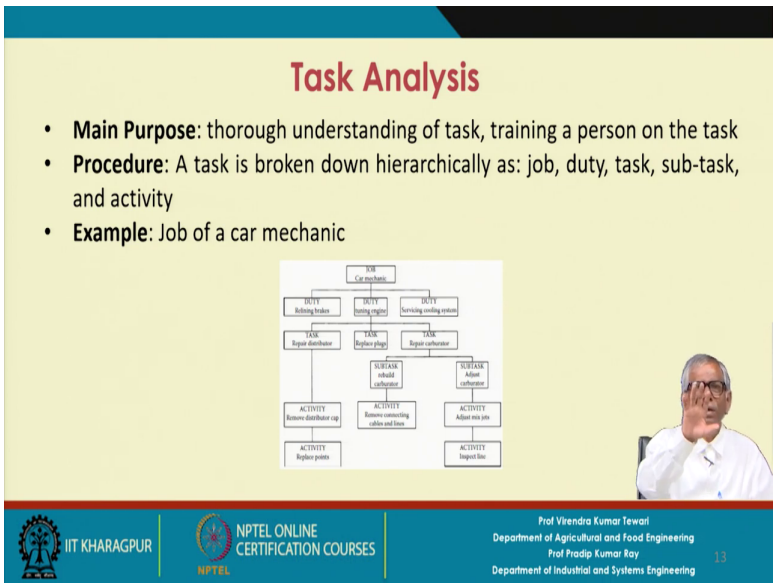

So, here just one example I have given, like say in the task analysis what you have to do, you have to write down the main purpose. I have just mentioned the points the while you

write the main purpose unless the task in detail, or you understand the task properly you cannot write the purpose correctly. Procedure task is broken down hierarchically as they just you make a note, first is the job, then you go to the next level duty, then you go to the next level task.

Task is divided into subtask and activity. So, normally this 5 the levels you have and this is just one example, so the job of a car mechanic. So, just you go to the with the text books you will get all these details in fact. So, at different levels, job then the duty then the task then subtask, then what are the activities you carry out. So, all these are to be defined.

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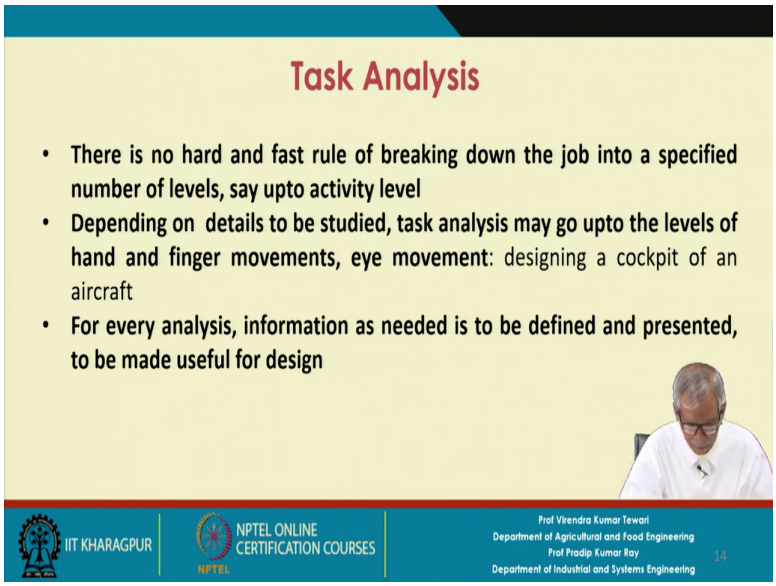

There is no hard and fast rule of breaking down the job into a specified number of levels, say upto activity level.

Depending on details to be studied, task analysis may go upto the levels of hand and finger movements, eye movement: designing a cockpit of an aircraft.

For every analysis, information as needed is to be defined and presented, to be made useful for design.

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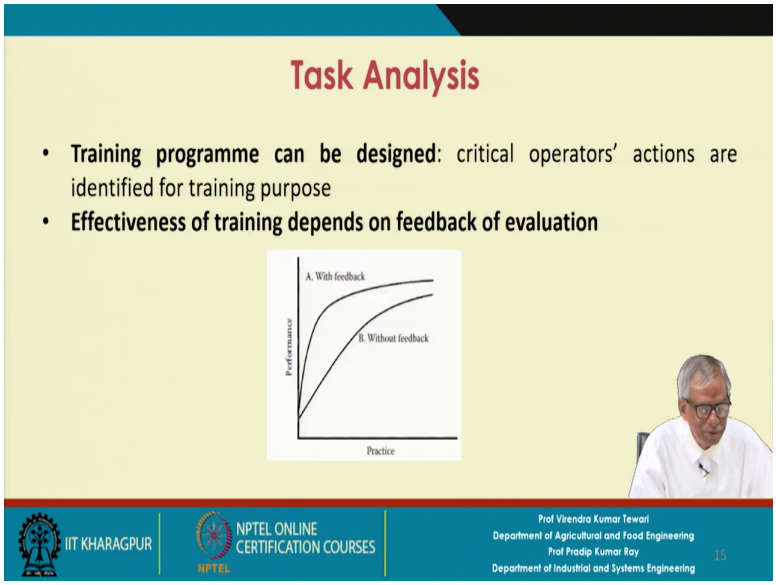

You train the operators and after he or she gets the training then you engage him or her to work on a particular task. So, now you observe their postures. While you go for the training, (on-the-job training), the critical operator's actions are identified for training purpose. So, that is why the job analysis or the task analysis is required.

So, what kind of activities you have identified? For one particular activity you find that there are certain problems he or she is facing. Those are the critical activities and you have to take some collective actions or the preventive measures. So, effectiveness of training depends on feedback of evaluation, how you must have a feedback system.

So, without feedback you will find that even if he carries out the task for a long time the performance is improving, but not at a higher rate whereas, if you get the feedback what you will find is that the performance is improving at a very fast rate,

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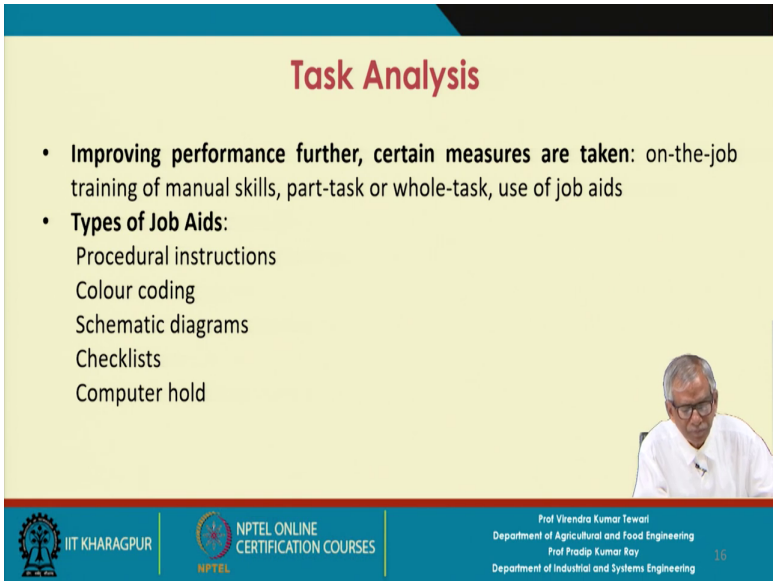

There is a possibility to improve the task performance. Improving performance further, certain measures are taken such as on-the-job training of manual skills, part-task or whole-task, use of job aids

Types of Job Aids are as follow:

i) Procedural instructions

ii) Colour coding

iii) Schematic diagrams

iv) Checklists

v) Computer hold

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List of Reference Textbooks

1. Sanders, M. S. and McCormick, E. J., Human Factors in Engineering and Design, McGraw-Hill, Sixth Edition

2. Bridger, R. S., Introduction to Ergonomics, Taylor and Francis Group, Third Edition

3. Helander M, A Guide to Human factors and Ergonomics, Taylor and Francis Group, Second Edition