Work System Design
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Lecture - 31
Memo-Motion Study

Namaskar friends. So we are going to start the discussion for the 7th week today. Already we have done with 6 weeks of discussion and the course is for 12 weeks as all of you know. We have to have 30 hours of discussion on this topic of work system design and each session will be of half an hour, so we have a 60-session course on work system design that is 30 hours of course.

In 7th week, our target will be to understand the steps that are followed for doing the method study. So we have already seen the recording and examining some of the steps we have already covered and some of the remaining steps we will cover and the most important part that we have to learn in case of method study is that how to analyze, how to compare the 2 different methods.

And for comparison purpose first we need to plot, first we need to draw, first we need to illustrate, first we need to graphically represent the current method of doing the job and for the graphically representing the current method of doing the job, there are number of tools and techniques or the graphical tools available with the method study engineer which can be used depending upon the application.

As already we have seen that if the work is being done on a broader scale and we want to analyze the complete operations or processes being done in the organization, we will follow an operation process chart. If we want to do a more detailed analysis, we will go for a flow process chart. We will draw a flow diagram and based on that we will make a flow process chart.

Then, if we further want to analyze how a person is performing the task, how the various limbs for example the left and the right hand are working, we will go for a 2-handed process chart. When we want to see that if a person is operating one machine or 2 machine or 2

persons are operating 2 machines we want to find out the idle time as well as the working time for men and the machines, we will have to go for multi-activity or a man-machine chart.

So when we have to do a micro motion study, we want to understand that what are the various micro motions, micro movements of the body of the person who is performing the task, we will go for a micro motion study with the help of therbligs. Then, we will prepare a simo chart and if you remember in our previous session we have concluded the discussion for the 6th week with the simo chart.

So depending upon the application, depending upon the analysis level, depending upon the level of the work being done maybe at a broader level or at a micro level we decide that which graphical tool we are going to use for analyzing. So first thing is we have to depict, we have to illustrate, we have to graphically represent the current method of doing the job and for that we have all these tools which I have already revised for all of you.

Now once we are able to depict the work then the next stage begins. The next stage is we have to critically examine that why this work is being done in this manner only, why only X person is doing this job, why not Y and Z, why this job is being done at this particular time only, why cannot we do it at any other time, what is the purpose or basic purpose of doing this job, why only this method is being employed, why the material is travelling in this direction only, why cannot it travel in the opposite direction.

So then we will try to find out means and mechanisms of improving the method which we have already depicted using any of the tools which I have just mentioned. So once we have depicted then we will start our questioning technique. We will start critically examining that how this work is being done and why this work is being done in this particular manner only, why there cannot be a better method of doing this job.

And after questioning automatically we will start developing solutions, we will start developing alternatives and then we will analyze those alternatives and we will be able to develop number of alternatives which may seem better to us as compared to the current method and then we can compare, we can draw the other or the revised form for example the operation process chart or the revised form of the flow process chart.

And try to compare the current method of doing the job and the revised or proposed method of doing the job and then we can make a tabular calculation or we can make a tabular comparison that how many operations were being done in the current method or the method being followed today, how many operations are being done in the proposed method whether there is a saving.

Similarly, we can compare for inspections, transportation, delays, storage. We can compare for each of the process chart symbols that what are the advantages of the proposed method, what are the benefits that we derive out of the proposed method. Also we can see the distance covered by the men and material, also we can see the number of people involved in doing the work.

So basically these charts or graphical tools will help us first to depict the process and then to compare the process with the revised method and our critical examination technique that we will cover in this week through the questioning will help us to develop a better method but prior to that we must learn all the techniques which can help us to depict the way the work is being done.

And if you remember the simo chart, we have 2 important inputs to the simo chart. The first input is the therbligs or the micro motions of the limbs and the second one is the time in terms of winks or the units of time being winks, so we depict the movements of the left hand, the micro motions of the left hand, the micro motions of the right hand and then we are able to plot them on a common time scale.

And this once we have plotted for the current method, we can think, we can eliminate, we can substitute, we can simplify some of the micro motions and try to develop a better method of doing the job. In same line only today we are going to discuss memo motion study which is slightly a higher version than the micro motion. So we have directly jumped from a higher order that is may be 2-handed process chart to a micro motion study.

If you remember in the last session, the last figure that we have seen in that it was giving a clear indication of the difference between the 2-handed process chart and the micro motion or the simo chart. So you have seen that if we write one activity by the 2-handed process chart

point of view, the activity is slightly on the higher scale but when we depict it in the form of a therbligs or in the form of a micro motion.

It is may be for one activity which we use for the 2-handed process chart, there are 2 or 3 therbligs which are involved in completing that activity. So maybe micro motion is at a very lower level may be at the basic fundamental level of the body motions. So this memo motion is in between we can say roughly may be for a layman we can say that here we are going to record those cycles which are longer than those we record for the micro motion study.

So let us start our discussion with the memo motion study.

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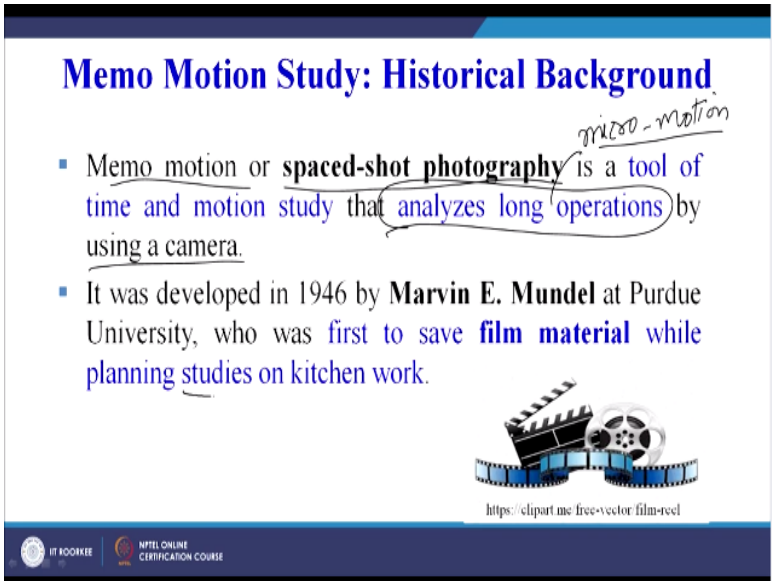

In memo motion study, let us look at the historical background. Memo motion study or a spaced-shot photography is a tool of time and motion study that analyzes long operations. So this differentiates it from the micro motion study that we have already discussed in the previous week. So here it analysis the long operations whereas micro motion is specifically suited for very short cycle operations only by using a camera.

And if you remember in micro motion study also, we try to first film the whole operation and then frame by frame try to analyze it and then divide the work being done into the therbligs and then plot those therbligs in time scale for the left and the right hand to prepare a simo chart. That already we have discussed in the previous week. So here also filming technique is common but the scale at which we are doing the recording will be different.

So once again I will read it for you. Memo motion or spaced-shot photography is a tool of time and motion study that analyzes long operations by using a camera. It was developed in 1946 by Marvin E. Mundel at Purdue University who was first to save film material while planning studies on kitchen work. So application area is also specified in the historical perspective of memo motion study.

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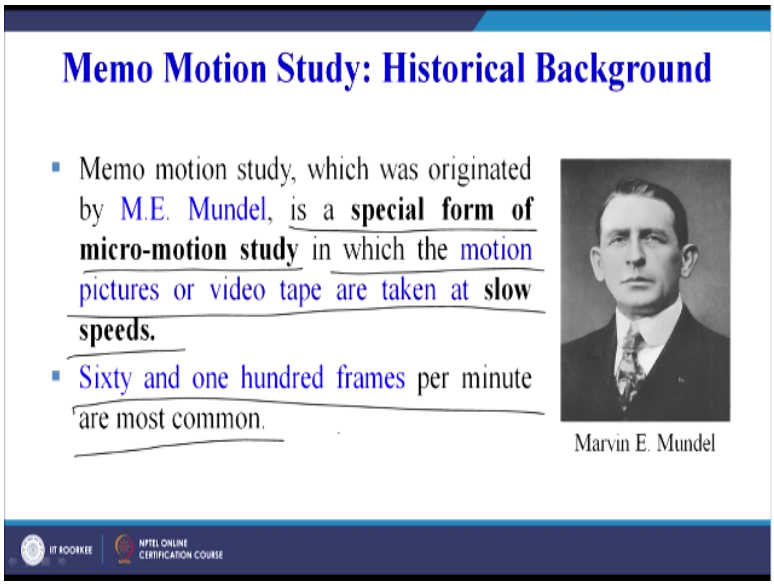

Memo motion study which was originated by M. E. Mundel is a special form as I have already told it is a special form of micro-motion study in which the motion pictures or video tape are taken at a slow speed, 60 and 100 frames per minute are most common, so the photography is done at a slow speed in case of memo motion study. In micro motion study, we have seen that we can record it at the normal pace of doing the work.

But later on using the sophisticated equipments that are available these days or softwares that are available with these days for image analysis or video analysis, we can analyze them frame by frame by frame and try to locate the various therbligs and try to identify the various therbligs being done or the micro motions being done by the human who is performing the task.

So here it is a slow motion picturization or video filming of the operation being done.

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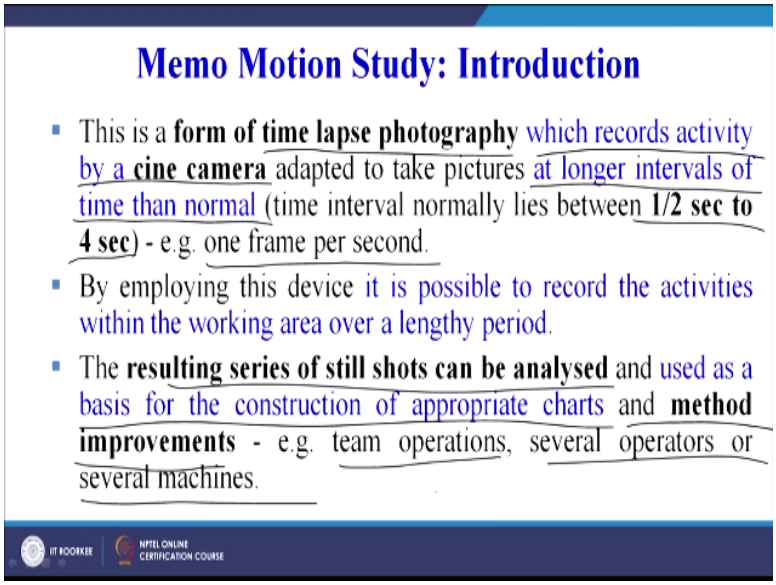

Now this is the introductory part of the memo motion study. This is a form of time lapse photography which records the activity by a cine camera. So this is the first thing from where we will have our input. What is our target of doing all these graphical representation or video representation of the work being done? We want to develop a better method, so we need to have some input, we need to understand that how the work is being done.

And for that we have now learnt so many graphical tools and graphical aids as well as in micro motion study we have seen that we can film the whole operation to identify the various micro motion. So in memo motion study which is a special form of micro motion study, filming technique is common, the only difference being that here we are quite slow in recording and the speed is also mentioned in the previous slide that is 60 to 100 frames per second.

So here we are recording at a slow pace, so here also we have to photograph. So the basic input remains same. This is a form of time lapse photography which records activity by a cine camera adapted to take pictures at longer intervals of time than normal. So may be time lapsed means maybe we will be taking the picture after a time gap, so time lapse photography.

Time interval normally lies between half a second to may be 4 second for example one frame per second. So maybe we can have 60 frames per minute which is already highlighted 60 frames per minute. By employing this device, it is possible to record the activities within the working area over a lengthy period of time. As we have seen that where long cycle times are

there, there in that case we can take the pictures maybe one picture every second and 60 pictures per minute we can take and then we can analyze them.

There maybe a situation where there is no physical movement happening for maybe a 15-second period or for a 30-second period. So therefore there is no need to have a continuous recording for the whole operation. So in that case this memo motion study may be helpful that we are recording the pictures at time lapse or at a time gap. The resulting series of still shots can be analyzed and used as a basis for the construction of appropriate charts and method improvements. For example, team operations, several operators or several machines.

So basically what we are doing in memo motion study, we are trying to record the work being done but it is not a continuous filming of the operation with the time lapse photography and we will get our still shots and these can be analyzed at a later stage to see that what improvements can be done.

Or what method improvements can be done where we are not following the protocols, where we are not following the principles which are already established and wherever we are digressing or we are diverting or we are deviating from the basic established motions or basic established principles, we will try to identify them after analyzing these still shots and we will be able to figure out the method improvements.

And the new method can also be then filmed and can be used as a training aid for the workers that this is the current method here we are going wrong. In this case, this is the right method so the right method can also be filmed and can be used to show to a large number of workers who can get trained by the right method of doing the work.

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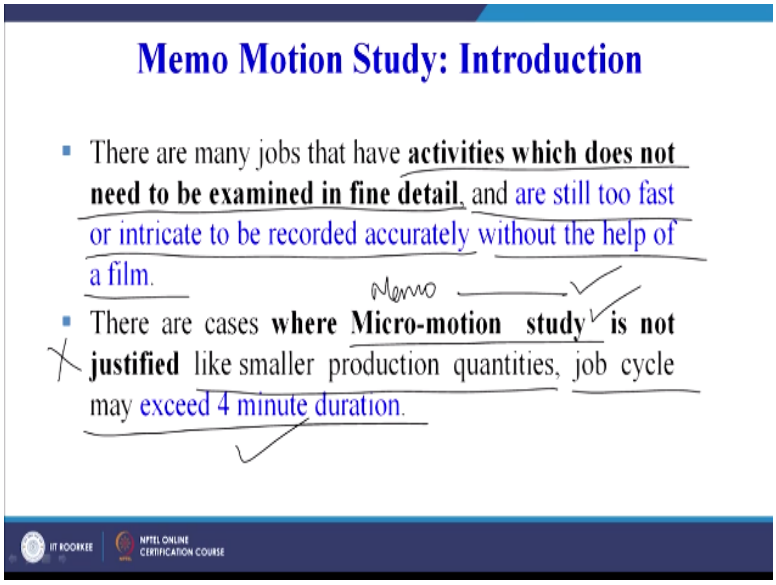

There are many jobs that have activities which does not need to be examined in fine detail which I have already explained in the beginning of today's session only that activities which does not need to be examined in fine detail and are still too fast or intricate to be recorded accurately without the help of a film. So therefore we can maybe focus on time lapse photography in such situations.

Because it is not going to give us a complete film, it is going to give us a time lapse shots of the whole operation being done. Again I will read it for you, there are many jobs that have activities which does not need to be examined in fine detail and are still too fast or intricate to be recorded accurately without the help of a film. So the second part is clearly depicting that why the time lapse photography is important.

Because they are too fast to be analyzed by human judgment or human eye, therefore time lapse photography is important. They may not be important but still to record them we are not able to record them manually or with the help of human judgment or human vision therefore we can record them with the help of time lapse photography. There are cases where micro motion studies not justified like smaller production quantities, job cycle may exceed 4-minute duration.

So this is giving us a difference between the micro motion study and the memo motion study that where we must go for memo motion study and in which cases we must go for a micro motion study. So there are cases where the micro motion study is not justified. Where it is not

justified? Where the job cycle may exceed 4-minute duration or the production quantities are very small maybe the very less number of parts have to be made.

There we may not like to go for a detailed micro motion study, only a memo motion study may help us to find out the better method for doing the job. Memo motion study now if we have understood the difference between the micro motion study and the memo motion study, we have understood the justification for conducting a memo motion study, we can now suggest that where we must use a memo motion study.

Now let us quickly see that how to conduct a memo motion study scientifically.

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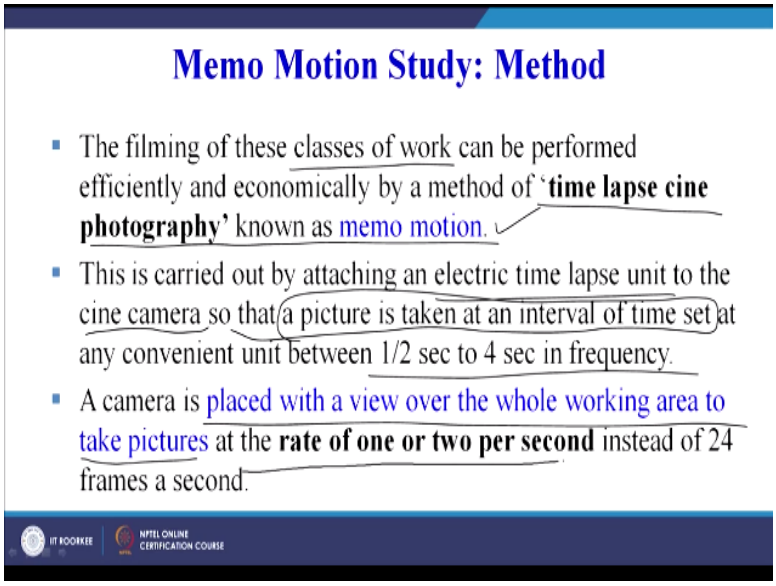

The filming of these classes of work, now what is the classes of work? We have seen where the production quantity is less or the work if we can refer back the job cycle may exceed 4-minute duration so these are specific class of work where memo motion study is advisable. So when the job cycle exceeds 4-minute duration, so for these classes of work.

The filming of these classes of work can be performed efficiently and economically by a method of time lapse in a photography known as memo motion study. So for special classes of work only we will go for a memo motion study. This is carried out by attaching an electric time lapse unit to the cine camera so that a picture is taken at an interval of time set at any convenient unit between half a second to 4 second in frequency.

So we will automate the clicking of the photo, so the picture will be taken after a time gap and it is given the time can be set at any convenient unit between half a second to 4 second in frequency. A camera is placed with the view over the whole working area to take the pictures and at a rate of one or 2 per second instead of 24 frames a second. So normally maybe when we take a continuous picture or a continuous film or a continuous movie we may be using even in these days more than 24 frames a second.

But in this particular case our target will be to take pictures at the rate of one or 2 per second. So as we have already seen 60 pictures per minute or 60 frames per minute can be the rates for doing the memo motion study or capturing the operations using the memo motion study.

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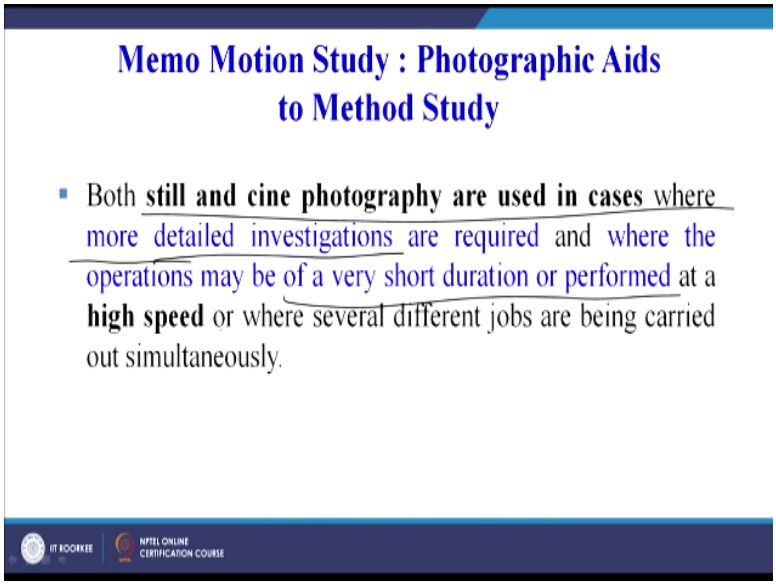

Both still and cine photography are used in cases where more detailed investigations are required. So it is our choice in case we want to have a more detailed investigation, we can go for a combination of still and cine photography also where the operations may be of a very short duration as in the case of micro motion study or at high speed, duration is performed at a high speed or where several different jobs are being carried out simultaneously.

So depending upon the situation, we will focus on the filming of the whole operations but most specifically or more specifically we will focus on a time lapse photography in case of memo motion study and we will go for a continuous filming of the operations in case of micro motion study but here also if we want a much more detailed in-depth investigation we may still go for a higher rate of recording the pictures or higher rate of taking the picture or sometimes in special cases may even go to the cine photography also.

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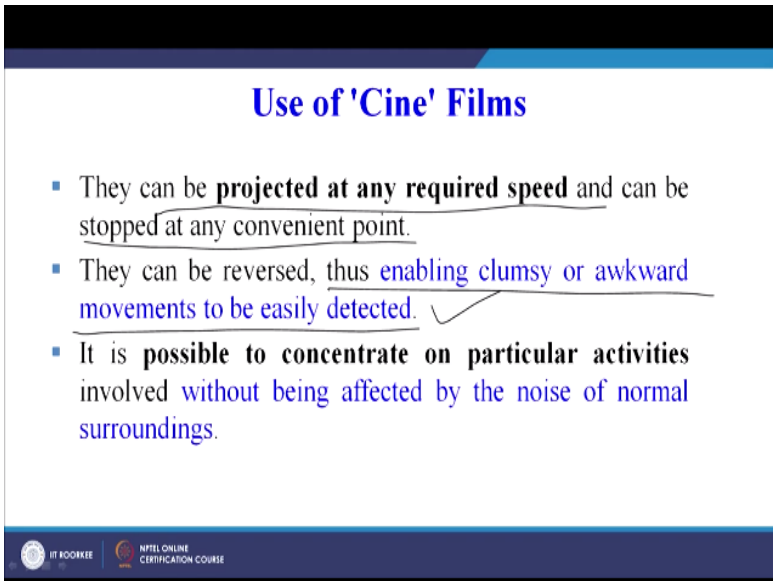

Use of cine films, they can be projected at any required speed and can be stopped at any convenient point which is a point which we have already seen in case of micro motion study also that if you have a continuous film we can use it at a later stage also as a data to analyze the way of doing the work or to show to our worker that this is not the right way of doing the work.

And then after training the worker with the right way of doing the work we can have another cine picture and that can be shown as the right method for doing the work. So this can help us as a training aid also. So if it is recorded and stored it can be projected at any required speed and can be stopped at any convenient point why? When we are examining that how the work is being done and when we need to propose a better method of doing the work these recorded items or these recorded things can be helpful for us.

They can be reversed thus enabling clumsy or awkward movements to be easily detected. Now what is the purpose, this is very important point, why we are doing all these, why we are taking so much of labour to record the operations being done by the workers in order to improve them, in order to optimize them, in order to economize them and therefore we need to trace that what are the clumsy movement, what are not the right movement, what are against the body motions if a person is working.

So all those things can easily be traced by reversing the film, looking the film again and again and when we are able to identify the movements which are not proper, which are not optimal,

which are not economic from the ergonomics point of view, we can detect these problems and then try to advise the workers with the right way of doing the work. It is possible to concentrate on particular activities involved without being affected by the noise of normal surroundings.

This is a very general point. Now what are the advantages of the photographic aids?

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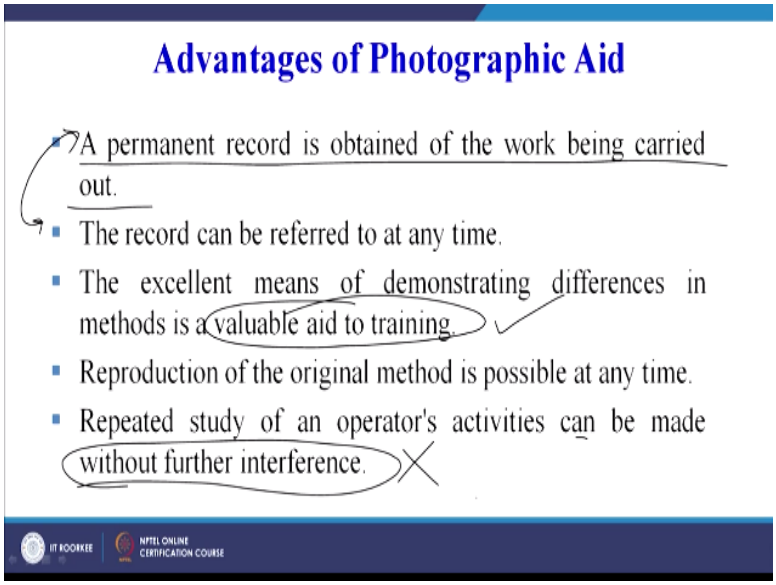

A permanent record is obtained of the work being carried out which I have already highlighted I think we must not go to this again. A permanent record is obtained to which can be a part of our library, these films can be a part of our video library, we can take them out and we can use them as a reference at any given or later stages. The record can be refereed to at any time which is linked to this point only.

The excellent means of demonstrating differences in the method is a valuable aid to training. Now we can have one may be time lapse photography film for current method of doing the job, we have identified the wrong movements, we have identified the wrong sequence of movements, we have identified the clumsy movements, we have identified the unnecessary movements.

Or sometimes we have combined some of the movement, we have simplified some of the body motions, so all those things when they are improved, they become a better method of doing the job. So for the training as a valuable aid for training we can show the new workers

who are joining the company that this is the tendency of the workers to do the job in this particular sequence of operation.

At this particular body motion, this is a human tendency but this is not the right way. It may lead to cumulative trauma, it may lead to musculoskeletal disorder, it may lead to failure of the tendons, so we can train them in the very beginning only that as per the human tendency this is the tendency to do the work in this particular manner but this is not the right sequence of operations or right sequence of body motions that we must do.

But as a company we have taken a stand, we have found out the better method and the next film that we are going to show you is the most optimal, most maybe safe method for doing the job. So we can show the as in method and as should method that this is as in this is the current and this is the better method that we have devised. So we can very easily train our workers to perform the work using a better method of doing the job.

So these photographic techniques can be helpful to us for improvising our work method in the long run, training our workers with the better work methods or the improvised work methods or sequence of body motions. Reproduction of the original method is possible at any time. These all points are interrelated so at any time we can refer back and show that this is the wrong method of doing the work.

Repeated study of an operator's activities can be made without further interference. So once we have recorded we need not go to the worker again and again. So repeated study of an operator's activities can be made without further interference. So once we have recorded, we are able to then do as analysis in the design room or in the work study room only, we need not interfere the worker again and again as it is highlighted here.

Repeated study of an operator's activities can be done without further interference, so we need not interfere with the worker again and again. Now what are the applications of memo motion studies? A study showed the following advantages or the applications of memo motion in regard to whether forms of time and motion study. So here what we are doing, basically there are 3 steps only.

The first step is recording in which we are using photographic equipment, we are doing a time lapse photography, there is a fixed number of pictures that we need to take in a minute or maybe per second. Once we have recorded all the way of doing the operations, we try to look at those photographs number of times, numerous times, we do it forward, we can look at reverse it and then again look that how the work is being done.

Once we have analyzed it properly, we will try to propose a better method by eliminating the unnecessary body motions by removing or by combining some of the body motions or by changing the sequence of body motions we will try to find out the better method and once the better method has been established, we will again record the better method for training purpose to our employees.

So what are the important application areas?

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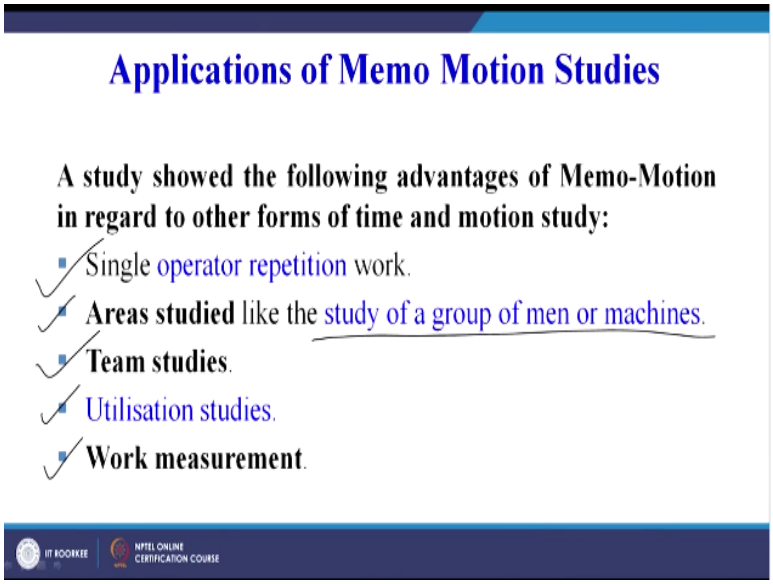

We can have a single operator doing repetitive type of work in those cases we can do a memo motion study, areas studied like the study of a group of men or machines. So if a group of people are 2 persons are operating 2 machines, in those cases also we can use the memo motion study. Team studies, a team of workers operating on a particular machine or a combination of machines or a combination of we can say equipment.

There also this can be used, utilization studies, work measurement. Work measurement we have not discussed till now but may be after the 7th week of our discussion, in 8th week we

will start focusing our attention on work measurement but currently our target is to develop a better method of doing the job.

And all these tools and techniques that we are learning in the form of graphical tools or sometimes the filming techniques, the micro motion in form of therbligs, the simo chart based on the therbligs and the time units in winks, the memo motion, all these will help us in devising a better method.

So once we have finished our discussion with all these graphical tools or these filming techniques we will then focus on the questioning technique or the critical examination technique where we ask a number of questions and try to develop a better method of doing the job. In this week only our target will be to focus on the critical examination technique also. In our next session, again we will focus on a different type of filming technique which is a cyclograph and a chronocycle graph.

And after that we will focus on the critical examination techniques followed by how to install and maintain the developed method which we have developed using all these techniques, with this we conclude the today's session. Thank you.