Work System Design
Dr. Inderdeep Singh
Department of Mechanical and Industrial Engineering
Indian Institute of Technology – Roorkee

Lecture - 33
Critical Examination Techniques

Namaskar Friends. Welcome to session 33 in our system on Work System Design. And today we are going to discuss the critical examining or examination techniques which help us to develop a better method for doing the task or for performing an operation. If you remember we are currently in our 4th week of discussion related to method study and in total, we are in the 7th week of discussion.

So the first week was just an introductory aspects of work study then 2 weeks on productivity. Then we have focused our attention on work study or work content determination. 4th week of discussion is going on now on method study. And if you remember in the last 4 weeks primarily we have discussed what are the various graphical tools that can be used to record, examine, analyze the current method of doing the job.

And in that we have already learnt that we can improve the current method and compare the current method with the proposed method. How the improvements can be done we have just seen the output only. Output means that we have seen that if we draw outline process chart or an operation process chart this is the current method and we have directly jumped to the final method that this is the final improved method.

Because our purpose of learning was to understand that how operation process chart is drawn, what are the steps involved in the construction of the operation process chart, what are the various type of symbols used in the different types of charts and then we have seen that it is useful why because it helps us to develop a better method. And we have taken an example that this is the current state of affairs or the current method and this chart is depicting one particular sequence of operation.

How it can be improved we have shown that now this is the improved method and if you compare the current and the improved method there is huge savings in terms of number of operations, number of inspections, the movement of the material is reduced, the effort of the

worker is reduced. In some cases, the number of workers required is reduce. So basically we have learnt all the techniques or the graphical tools as well as certain principles which are used for developing a better method.

So for developing a better method first we have to represent, we have to depict, we have to illustrate, we have to draw the current method of doing the job and then we must know that for which particular situation which method is going to be useful or which technique is going to be useful. So if we can just revise or memorize what are the various techniques available for analyzing the current method of doing the work all of you can just now tell me or maybe in your mind you can just revise we have seen.

Operation process chart, flow process chart, different types of flow process charts we have seen then multi activity chart, 2 handed process chart, string diagrams, flow diagrams then we have also seen the use of SIMO chart then memo motion study we have seen. So different techniques we know by now. So now for critical examination point of view we have to first depict the current method using any of these techniques depending upon what is our object of investigation or what is our subject of investigation.

If we want to do our work study analysis on a larger scale, we may use operation process chart. If we want to do it on the micromotion level, we may follow a SIMO chart. So the tool and technique may vary, but the critical examination will remain same because we will question each and every aspect related to the work being done and from there we will try to formulate different alternatives which seems to be better than the current method.

And then we will analyze, compare these alternatives in comparison to what is currently being done and then try to select the best method which is giving us the desired results and desired results for method study all of you know are focused on reducing the unnecessary movement of man and material, reducing the fatigue of the workers, reducing the accidental prone work content from the total job content.

In nutshell, we can say make the workplace safe for the workers. So safety is important, time is important, cost involved for doing the work is important, effort being put by the workers in doing the work is important, the environment that we are providing to the worker is important. So with all these objectives or criteria we will like to develop the better method.

So today's topic that we are going to discuss is critical examination techniques.

Now depending upon the level at which we are doing the analysis we will chose a particular graphical tool. It may vary from the higher order or higher level of analysis or maybe broader level of analysis, operation process chart to micromotion analysis that can be depicted with the help of SIMO chart. Now what is usually done in critical examination that we are going to understand today.

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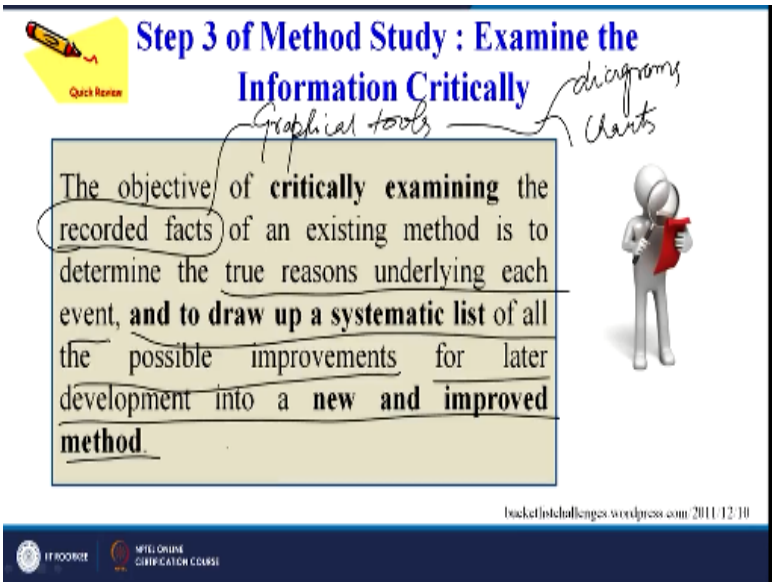

The objective of critically examining the recorded facts. Now whatever graphical tools we have learnt will help us to record these facts. How they will be recorded using the graphical tools. What are these graphical tools? These can be different type of diagrams and charts that we have learned till today. So the objective of critically examining the recorded facts of an existing method is to determine the true reasons underlying each event.

And how to draw up a systematic list of all the possible improvements for the later development into a new and improved method. So we have to draw a systematically list of all the possible improvements. So there can be number of improvements in one alternative or one advanced method or one better method or there can be number of better methods. So for one method also there can be number of improvements in the current technique being followed or the current method or sequence of operations being followed.

So we will try to develop different alternatives for doing the same work by critically analyzing the recorded facts and how these facts will be recorded with the help of various

diagrams and charts that we have learnt by now.

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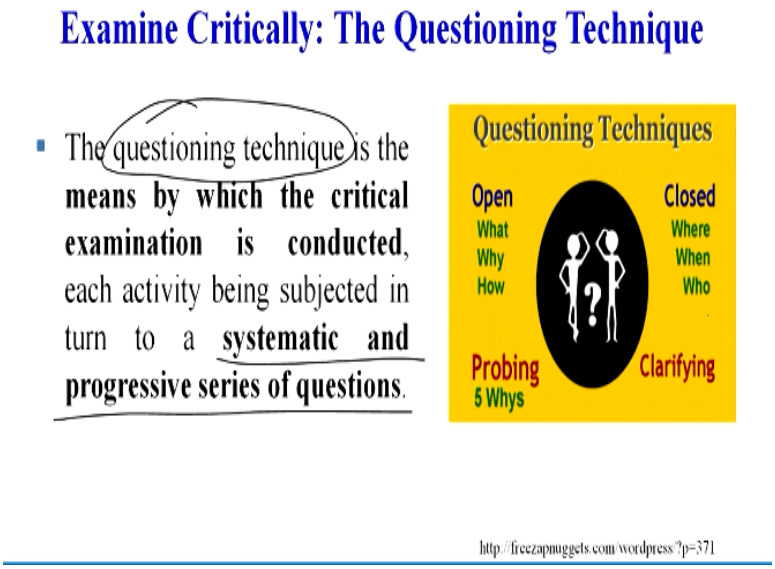

The questioning technique so this is something which we have to understand today. The questioning is the means by which the critical examination is conducted. Each activity is being subjected in turn to a systematic and progressive series of questions. So one by one we will question the various events that are happening or the various operations or processes being done that why these processes are only being done.

What can be the other processes to achieve the desired objective who is doing it, why he is doing it by which means he is doing is. So number of questions we can ask so number of questions we can ask and these questions we will help us to find out the basic purpose of doing the work and then we can think of looking at alternatives that why this work cannot be done in another machine or by another technique or by another method or by following another sequence.

So we will try to look for alternatives when we question each and every aspect related to the current method of doing the job. So we will ask different types of questions like what, why, how where, when who then probing the 5 whys different techniques we will use. This is basically it is to ask questions related to the current method of doing the work.

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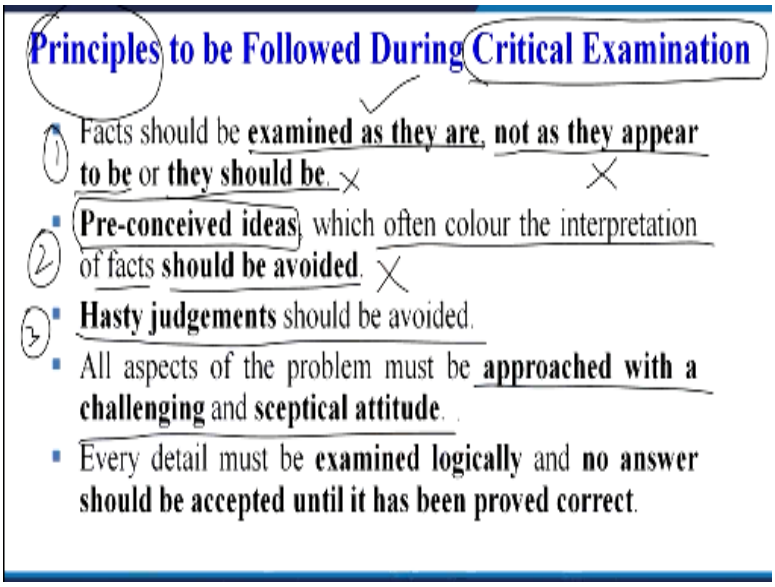

The principles to be followed during the critical examination let us see what are the principles to be followed you can see. These are important things to be kept in mind because normally when we ask questions related to a particular task or a particular work where we have some preconceived notions. So we have to be free from any kind of preconceived notions. We must approach the problem with a fresh mind without any prejudices.

So this is just one thing that we must keep in mind. Now you can see once we are doing the critical examination what are the principles to be followed. Principle number one is given on your screen. Facts should be examined as they are. So we must be very, very particular about what are the facts that we are going to examine. We must not use our own intuition to see that how they appear or how appear or how they should be. How they should be we will focus later. We want to develop a better method.

We will look for alternatives, but once we are analyzing the facts during the critical examination we must be very, very particular that all the additional information that we have must not come into our decision-making. So facts should be examined as they are not as they appear or as they should be. So we must concentrate only on the facts without any additional information or without any hazy information.

Preconceived ideas I have already told this is principle number 2 which often color the interpretation of facts should be avoided. So we must avoid any preconceived idea because it may make or it may bias our opinion related to a way that the current method is being done or related to the sequence of operations being done. So we must focus primarily on the facts

rather than our own preconceived ideas playing our role in our decisions.

Hasty judgements very easy should be avoided this is the third principle we must have patience and perseverance to analyze using the different questions. We must not make hasty judgements. All aspects of the problems must be approached with the challenging and skeptical attitude. We must be very, very inquisitive, we must like to find out that why this work is being done, why this person is only doing it by a challenging mindset.

Why this way, why not a better way, why there cannot be a better way of doing the same job because if we accept the things as they are change cannot happen and if we want to bring the change we must be the change that we want to see. So basically when we want to change something regarding the current method of doing the work we must be ready to challenge the way the work is being done currently.

Then only we will be able to have our creative (()) (12:48) is playing our role in defining designing, implementing a new method, a better method of more efficient, more effective, more productive method for doing the same job. If we accept the way the work is being done then there can be no change, no betterment of the method. So all aspects of the problem must be approached with a challenging mindset and a skeptical attitude with the element of doubt in your mind you must attack with different types of question.

That why this being done, who is doing it, where it is being done, when it is being done. So then only we will be able to find out the problems which we can tackle to develop a better method. Every detail must be examined logically. We must be logical in our approach and no answer should be accepted until it has been proved correct. So if we are getting the answers to our questions that we are asking in the questioning techniques we must not accept the answer as they are.

They must be logically proven that the answers are correct. If logically it cannot be proved, then we must not accept the answer and we must put that questions in a doubtful or that answer in the doubtful category and try to work on that particular answer to develop a better method. To challenge that answer by the way we have put the question and try to list it as one of the scopes for improvement because we are not convinced logically by the answer given to that particular question.

Now ways of critical examination we have seen principles, but we must keep in mind when we are using the questioning techniques we must not have preconceived ideas, we must not make hasty decision. The answers to the questions must be logical if they seem to be illogical we must work on those answers so that we are able to set an objective that these are the areas where we can improve the current method of doing the job.

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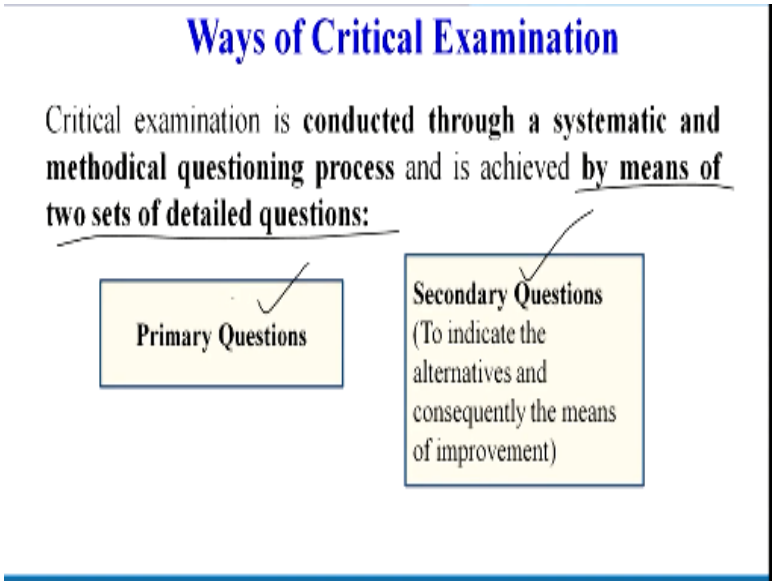

Now critical examination is conducted through a systematic and methodological questioning process and it is achieved by means of 2 sets of detailed questions. 2 sets of questions usually are asked the primary questions as well as the secondary questions. In primary questions, normally we will see in the subsequent slides what are the primary questions and what type of answers we try to look at.

And in secondary questions they indicate the alternatives and consequently the means of improvement. So maybe for example we can say regarding the person we have a question why this person is doing this job or why he is the only person who is doing this job this is the question this is the primary question. From secondary point of view what we can say? From secondary point of view what we can say that who else can do this job.

Who are the other people capable enough to this job so that is a secondary question which is slightly hinting towards the solution that we can make different alternatives that who are the other people who can do the same job. So we have a primary question then we have a secondary question which is helping us to develop a better method for doing the job. Now

slightly busy slide.

This is we can see so many things are mentioned here, but we will be able to understand then if we have a close look at the slide. In the first stage of the questioning technique, we have 2 stages if we go to the previous slide we have primary questions and the secondary questions.

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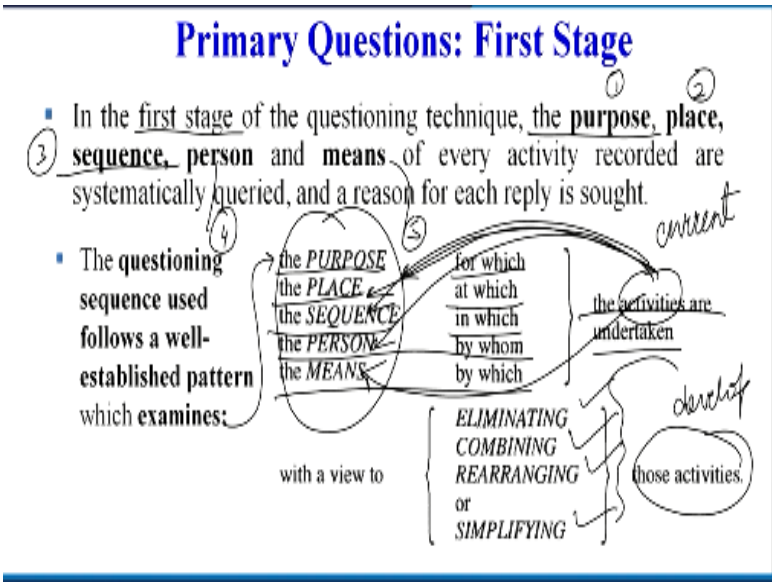

So in first stage of the questioning technique the purpose number one. What is the purpose the place? where the work is being done, the sequence in which the work is being done, the person who is responsible for doing the job and means that is the technique he is following or the methodology he is adopting for doing the work are questioned. So in the first stage of the questioning techniques, the purpose, place, sequence, person and means of every activity they are recorded or systematically queried and a reason for each reply is sort.

So these are the 5 target areas. So the questioning sequence used follows a well-established pattern which examines. Now what we need to examine the purpose and it is a sequence wise. So the questioning sequence used follows a well-established pattern which examines the purpose for which, the place at which, the sequence in which, the person by whom, the means by which the activities are undertaken.

So for activity we are trying to focus on the activity, we are trying to focus on the place of the activity, we are trying to focus on the sequence of the activity then on the person who is responsible and then on the means by which the activity is being done. So we are trying to focus on the current method of doing the activity along with the person responsible for doing

that activity, along with the location where the activity is being done.

Now why do we ask all these questions in order to eliminate, combine rearrange or simplify the activities. So this is the current method that we are challenging and we are trying to develop a better method which will be developed using these 4 steps. That is, we can eliminate some of the unnecessary movements or motions or maybe operations then we can combine certain set of operations if possible or certain set of activities if possible rearrange or simplify.

So we can see that for each and every activity we will subject it to a variety of questions related to the purpose of the work, related to the place where it is being done, related to the sequence in which it is being done, related to the person who is responsible for doing it, related to the means or the mechanism or the technique by which the work is being done. So once we subject it to different questions we will try to develop the better method.

And we can say the hints that how a better method can be developed is also given that is elimination, combination, rearranging and simplification of the current activity. So if we are able to simplify, rearrange, combine the current activities we will be able to develop a better method of doing the job. So this is I think the explanation of the questioning technique.

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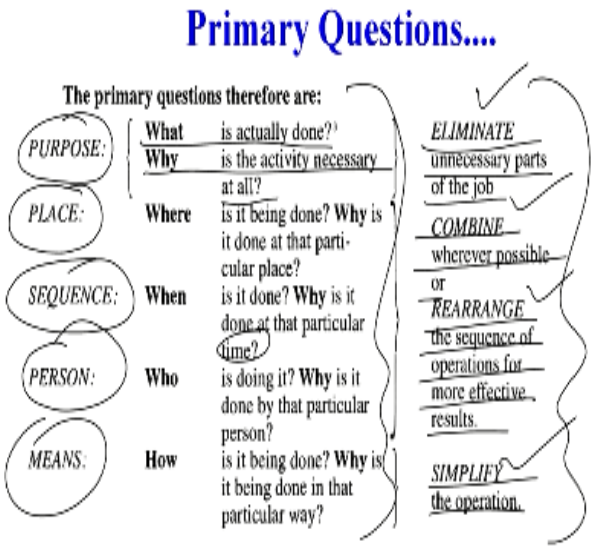

Now primary questions we can see related to the purpose what can be the question, what is actually being done, why is the activity necessary at all so that is something related to the purpose of doing the activity. For example, let us take the example why the lecture is being

recorded? So what is actually being done a lecture is being recorded, why is the activity necessary because it is under the MOOC schemes, there are number of learners who will get benefitted about attending this course.

So may be for this lecture recording of lecture this activity the purpose can be answered that what is actually done, why is the activity necessary at all. Then the place where it is being done, why is it done at that particular place only then regarding the sequence when it is done, why it is done at that particular time, who is the person doing it, why is it done by that particular person only, means how is it being done, why is it being done in that particular way only.

So these are the questions for every work if we subject. You can do it maybe in your free time you can try to identify some operation or some work being done in your neighborhood or in your office or maybe in your house and try to write all these questions and try to find out the answers to these questions. You will definitely feel that there can be a better way of doing the same work.

So how what can be the ideas or hints that can come out of this questions or the answers to these questions that can eliminate the unnecessary parts of the job, combine wherever possible or rearrange the sequence of operations for more effective results or simplify the operations. So when we write answers to all these questions, we will try to develop a better method using these techniques of elimination, combination rearrangement and simplification.

So once we find answers to these questions our next target will to develop a better method and for better method we will have a set of secondary questions we will slightly guide us towards the better method.

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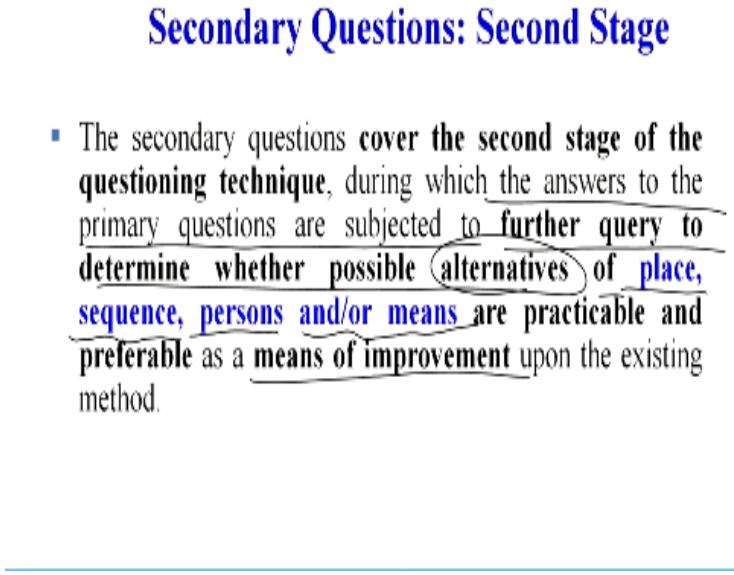

Secondary question that is a second stage. The secondary questions cover the second stage of the questioning techniques during which the answers to the primary questions are subjected to, the answers to the primary questions are subjected to further query to determine whether the possible alternatives. For example, primary question can be who is doing the job. Secondary question can be who else can do the job.

So answer to the primary question is giving us a hint towards the alternatives in the secondary stage that who can be other people who can replace person X. Alternatives in terms of I have taken an example in terms of person, but alternatives can be in terms of place. Why the lecture is being recorded in this recording studio, where else it can be recorded automatically the answer will go to the second studio or to the third studio where else it can be done.

So place point of view also we can focus on alternatives, from sequence point of view also, from person point of view also and or means point of view also. Our practicable and preferable as a means of improvement upon the existing method. So I think I will read this sentence once again. I have tried to explain the things. The secondary questions cover the second stage of the questioning techniques during which the answers to the primary questions are subjected to further query.

To determine whether possible alternatives of place, sequence, persons and or means are practicable at preferable as a means of improvement upon the existing methods. So the answers to the secondary questions for example who else can do the work. Suppose 4 answers come. So this will help us give us alternatives that these are the 4 people who can do

a job better than the person who is doing the job currently.

So these can be practicable maybe preferable alternatives which will further lead us to improve the current way or current method of doing the job.

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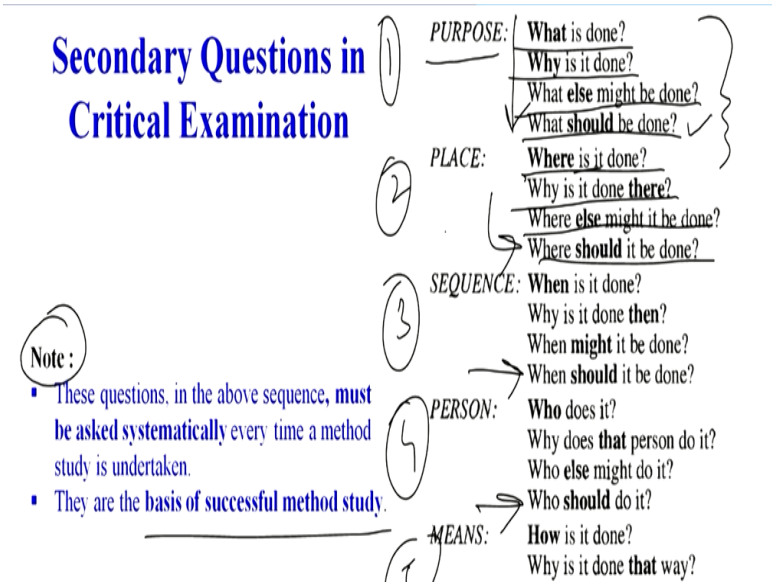

Secondary questions can be note. Let us first see the note here. These questions in the above sequence must be asked systematically every time a method study is undertaken. They are the basis of a successful method study. Now from the purpose point of view we are now having a combination of questions here what is being done, why it is being done, what else might be done, what should be done.

So in sequence we order, we can always find the answer at the last what should be done. Where it is done, where is it done, why is it done there, where else might it be done, where should it be done. What should be done, when should it be done, who should do it, how should it be done. So these are the final questions which are leading us towards the better method of doing the job.

So sequence when is it done, why is it done then when might it be done. So from all 5 purpose, place, sequence, persons and means that is how it is done, why is it done that way, how else might it be done, how should it be done. So all these 5 maybe questions or the logics of asking the questions or we can say salient elements of questioning can help us to find the answers or the better alternatives to the current method of doing the work.

So we will try to understand this with the help of an example because it seems too theoretical. Once we apply it in practice we will be able to understand it in a much better manner and to explain that in a better way we have taken examples which we have already covered. So we have learnt how to draw those charts. Today we will use those charts to solve the problem using a critical examination technique or critical questioning technique.

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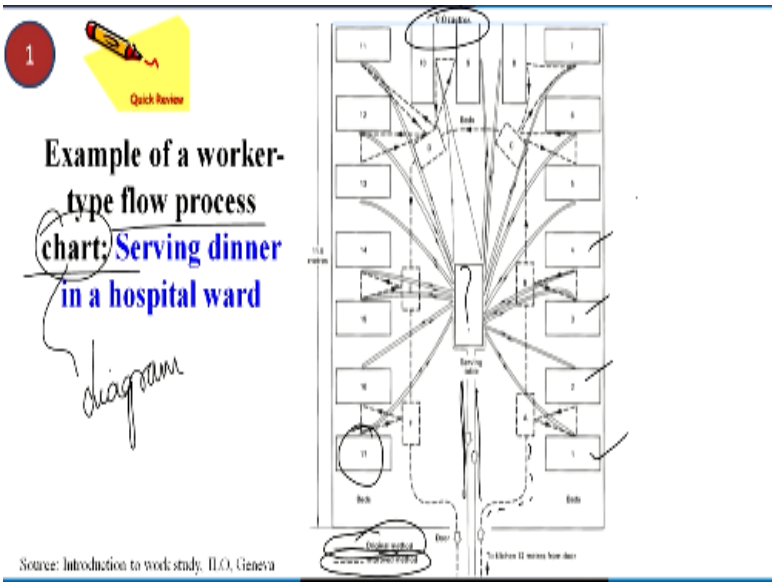

Now this is the example I think third time we are discussing the same example in our course. So here person or a nurse is serving food to 17 different patients. So the sequence I think by now all of you know. The example of a worker type of flow process chart. This is a flow process diagram I think we must write here. Now we know the difference between the chart and the diagram.

So this is a flow process diagram. So serving dinner in a hospital ward. So this flow process diagram is shown here, the distance is also marked here 9 meters and the sequence of movement is also marked. So this is the original method the solid line. Solid line this is the original method, transportation is shown and the dotted line is the improved method. Now let us see what is the problem.

The problem is the person or the nurse is taking the food from the kitchen to the central table. This is the central table and from there she is carrying the plates to the different bed these are the beds. Bed number 1, bed number 2, 3, 4 and then coming back taking another plate to the next bed and the movement is depicted in this flow process diagram.

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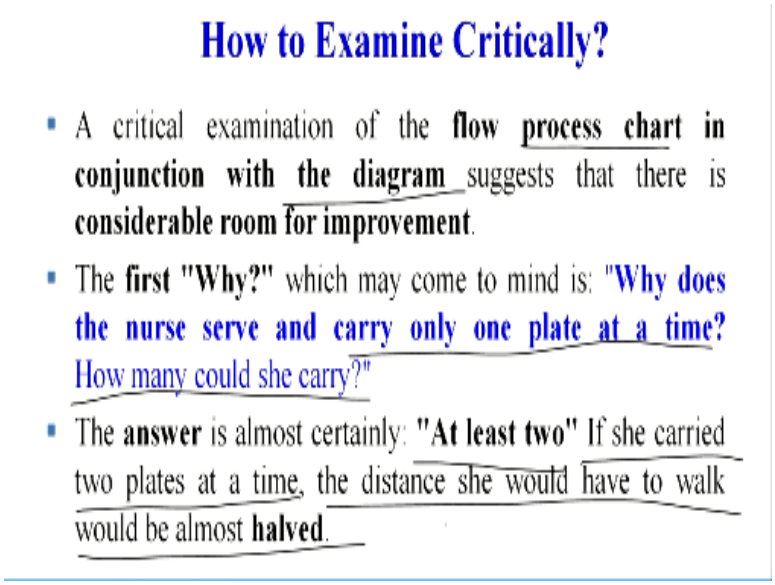

Now how to examine this problem critically. A critical examination of the flow process chart it is in conjunction with the flow diagram. Suggest that there is considerable room for improvement if we see there is lot of movement of the nurse who is serving food to the patients and there are 17 different beds in that ward. Now what we need to challenge here. The first why which may come to mind is why does the nurse serve and carry only one plate at a time.

How many could she carry combination. First is why she is carrying only one plate. Next secondary question is how many should she carry? The answer is almost certainly at least 2. If she carried 2 plates at a time the distance she would have to walk would almost be halved. Questioning techniques has given us answer also.

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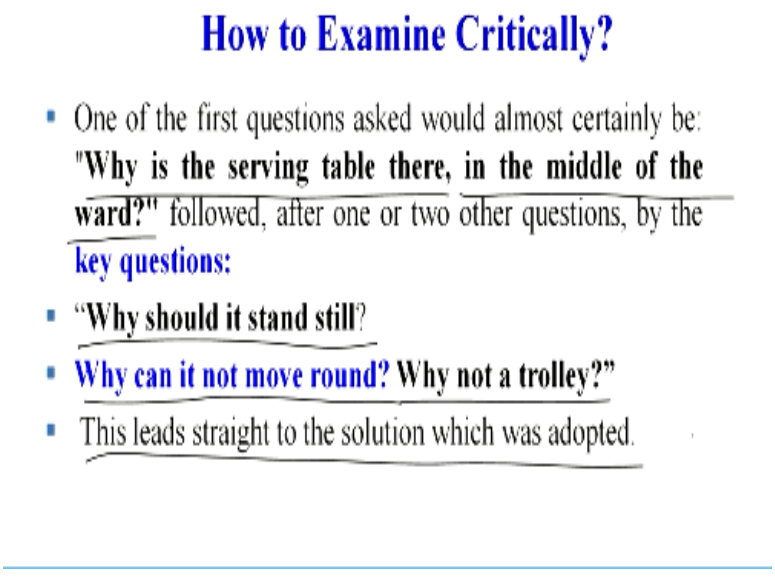

One of the first question asked would almost certainly be why is the serving table there in the middle of the ward followed after one or 2 other questions by the key question why should it stand still, why can it not move around, why not a trolley? This leads straight to the solution which was adopted. So maybe once you question why the nurse is carrying only one plate, why there is a central table, what else can be used in place of the central table, cannot the table be moved to the place and then the food be served.

Automatically after number of questions we arrive at a solution that we can have a trolley which can carry all the plates. The hint may come from how the food is served in the aircraft once we are travelling. There is a trolley which carries all the plates a plate is taken out and serve to the passenger in the aircraft. So the hint can come from there. So why the stationary table is required. So when you question the things automatically the solutions start to emerge.

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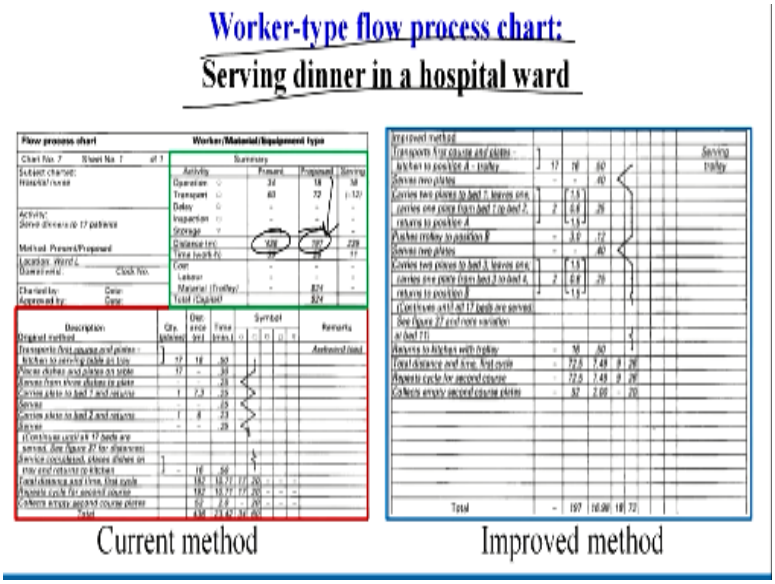

The next problem can be related to this is the flow process chart worker type flow process chart of serving dinner in the hospital ward. Already you have seen this number of times and the savings have also been reported. So in the current method you can see this is the current method the distance in the current method is 436 meters. But in the proposed method if you see the distance travelled is 197 meters with the help of a trolley.

So we can see that it reduces the movement of the nurse who is serving food to the patients inside the ward. So basically we can see the time spend 39 in the present method and in the proposed is 28 only. So it is always better to look for improvements by using the questioning technique.

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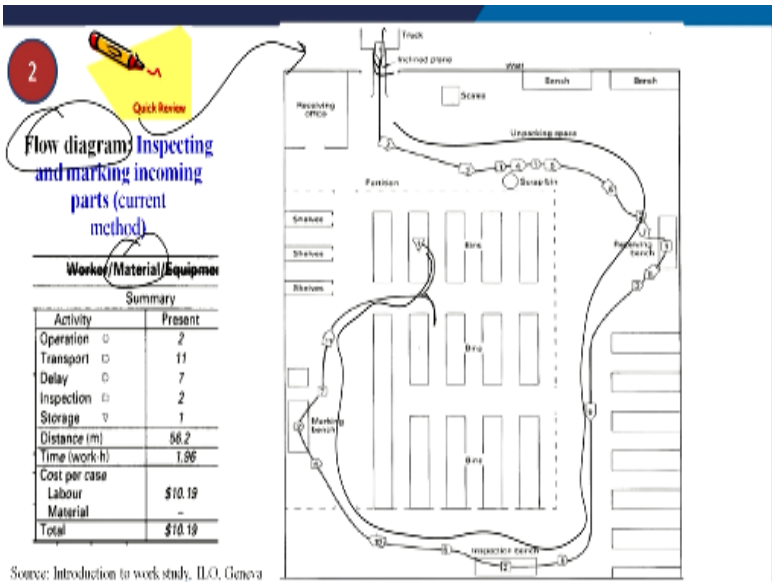

Now this is the second diagram which we have already seen. So this is the flow diagram it is written correctly here this is the flow diagram here. And here we can see this is the material type. A material is coming here and then it is moving all the way around and then it is being stacked here. Now the question can be why such a long movement or such a maybe larger distance the material has to cover.

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How to Examine Critically?

- A study of the flow diagram **shows immediately that the cases take a very long and roundabout path** on their journey to the bins.
- This could not have been seen from the flow process chart alone and the chart, however, **enables the various activities to be recorded and summarized in a manner not conveniently possible on the diagram**.

A study of the flow diagram shows immediately that the cases take a very long and roundabout path on their journey to the bins. This could not have been seen from the flow process chart. So again it is explained that the flow process chart is different from the flow diagram. So this we are able to see with the help of a flow diagram. So in flow process chart we will not be able to see that much.

But we will be able to see the distance can be written there, but the flow diagram is clearly showing that it is roundabout way. The material is taking in the shop floor. This could not have been seen from the flow process chart alone and the chart however enables the various activities to be recorded and summarized in a manner not conveniently possible on the diagram.

So we need to learn the flow process chart also and we must also know the flow process diagram also or the flow diagram also. So the previous image that we have seen this is a flow diagram. Now it has shown that there is a lot of a movement of the material, how now we can challenge this problem.

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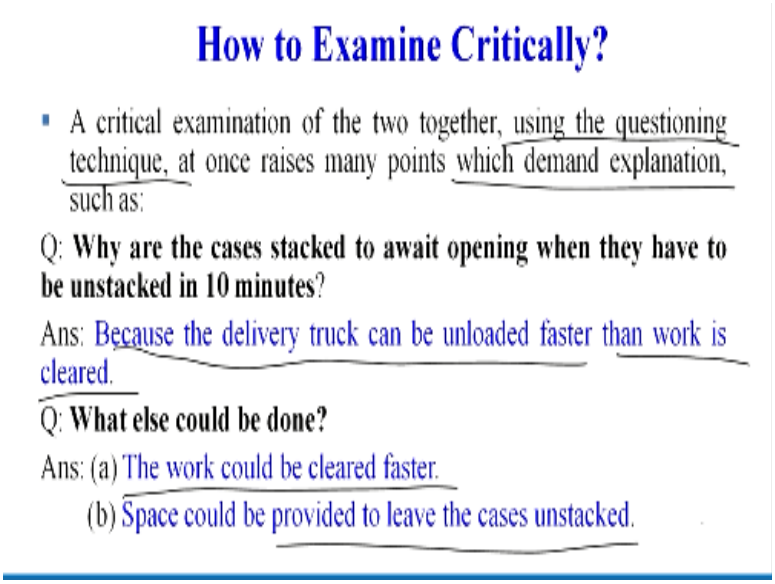

A critical examination of the 2 together, using the questioning technique. Our target today is the questioning technique, learn about the questioning techniques. At once raises many points which demand explanation, which requires answers. What are the questions? Why are the cases stacked to await opening when they have to be unstacked in 10 minutes? So from the truck the cases if we go back we can see.

This is the truck here the cases are coming this is unpacking space here. They are stacked here for further movement inside. The question that is asked is that why are the cases stacked to await opening when they have to be unstacked in 10 min. The answer is because the delivery truck can be unload faster than the work is cleared. So the rate of clearing the work from that unloading section is slower and the unloading work from the truck of the rate of

unloading the cases form the truck is much faster than they are getting cleared.

So therefore they are getting stacked there So what else could be done, what is the solution secondary question The work could be cleared faster you start clearing the work at a faster rate at least matching the rate of unloading or the space could be provided to leave the cases or you provide additional space where you need not stack the cases again. So 2 alternatives have been generated with the help of secondary question.

And then we can look for finding the better alternative which one is more suitable out of the 2.

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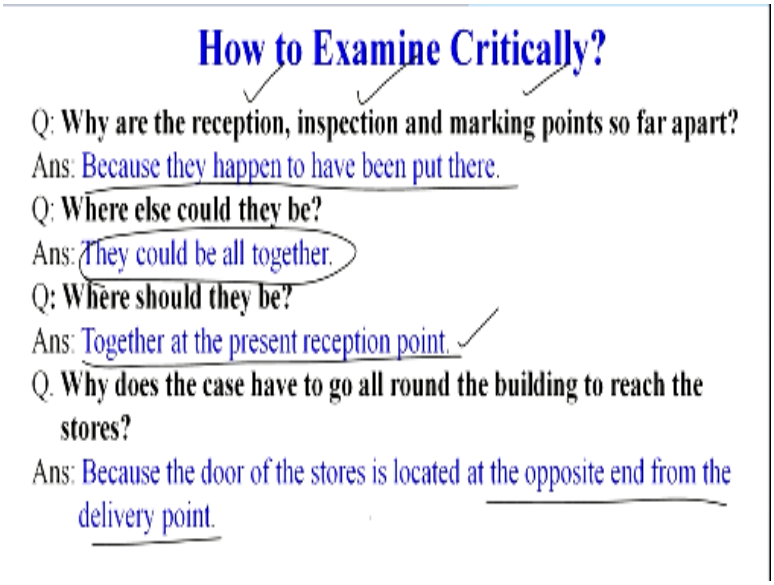

The next question can be why are reception inspection and marking points are so far apart. There is lot of movement of the material on the shop floor. Why there are so far apart, why they cannot be together because they happen to have been put there. So since there are there for so many years so we are using them in their place. Where else could they be? They could all be together.

So we can bring all these reception, inspection and marking points nearby each other so that the material need not travels a long path on the shop floor. Where should they be together at the present reception point the solution is coming there Why does the case have to go all around the building to reach the stores. So we are seeing that the material is moving all around the building and then it is entering gate for storage.

Because the door of the store is located at the opposite end of the delivery point. So why cannot we have the door towards the delivery point only, why do we have the door on the opposite end from the delivery point. So we can think of finding a solution to this problem.

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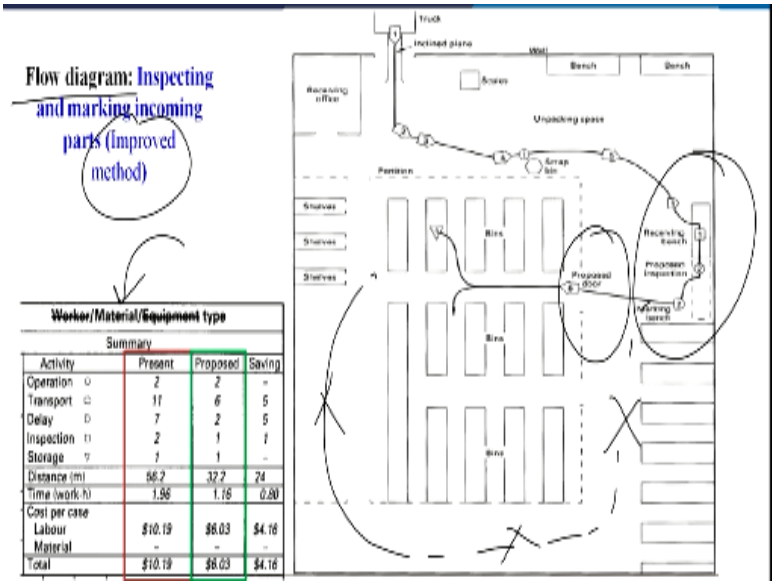

So this is the flow diagram of the improved method. You can see here a new propose door is there near to the delivery point and all the movement which was earlier going all the way there has been eliminated and the receiving bench is there, inspection point is brought closer, the marking bench point is brought closer. So all the 3 are brought together as we have seen from the questioning technique.

And it has considerably reduced the movement of material in the shop. So here we can see this is the material type of flow diagram which has helped us to solve our problem of unnecessary movement of the material in the shop floor and the proposed you can see the distance in meters travelled present is 56.2, but using this proposed technique 32.2 meters only and the time is also saved.

And the cost per case that is the labor cost per case because the labor has to carry the cases from all around the building to the storage bins. Now the labor cost has also reduced significantly from 10 dollars per case to dollar 6.03 per case. So we can see just by rearranging the facilities on the shop floor by redesigning our layout, we have been able to have substantial savings.

And how these saving were possible only because of the questioning technique that why the

work is being done in that manner. So with this we conclude the today's session. In next session, we will discuss may be the next steps that are followed in our systematic method study approach. Thank you.