Sociology of Science

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Lecture - 16
Scientist as an Indexical Reasoner - Part 1

Dear students, today we shall discuss the scientist as an indexical reasoner. Now, this concept of indexical reasoning is essentially drawn from the theory of ethno methodology in sociology. Now, the person who has written this article is in fact, not an article, it is part of a book, I will show you the details of the book and the author as well as the chapter. Here, if you can see in the slide, the chapter is titled scientist as an indexical reasoned, the contextuality and the opportunism of research, the author is Karin D Knorr Cetina. Now, this is part of her book called the manufacture of knowledge and essay on the constructivist and contextual nature of science, which is published by Oxford Pergamon press from Oxford in 1981.

Now, what is this indexical reasoning? How is it related to scientific research? How is it related to problem of knowledge production? How is it related to selection of research problems? How is it connected to the things that happen at the laboratory that decide the course of the research? This discussion talks about the micro level of scientific research. How scientific research takes place at a micro level, at a local level you know. So, when we think about research problems, we think that probably the scientist, who is keen to work on a particular research problem may have been influenced or inspired by a great scientist. Hence, the person has decided to embark on a research problem and consequently continue to do his or her research.

Let us say for example, a person, a graduate student of physics may have been very much inspired by Einstein's general theory of relativity and the person wants to do something in that direction. Hence, enrolls for PhD and decides to join a faculty member in a reputed institute. So, that he or she can pursue his or her interest, an area of general relativity, but once the person joins, it is quite possible that the person may have to settle down for a research problem, depending upon the interest of the supervisor or the thesis guide or the faculty member under which he or she joins.

It may depend upon the research expertise as well as the research interest of the group of scientists, who are working in that department that is, because it is quite possible that the group of scientists along with that particular research students, supervisor must have got a grant to work in a particular research aspect in physics. Hence, they want the research scholars to pursue their PhD in that area.

It can also happen that instruments and apparatus, which are available at that institute, would not be very conducive for the kind of research that, any research scholar initially wants to pursue. Hence, the research scholar may have to change his or her research problem, depending upon the research apparatus instruments machines, available in that particular institute. Hence, we are looking at how this laboratory selection choice of scientific problem is guided by local conditions? This is an article, this is a discussion on the contextual nature of scientific knowledge production, and it is based within the theoretical framework of ethno methodology.

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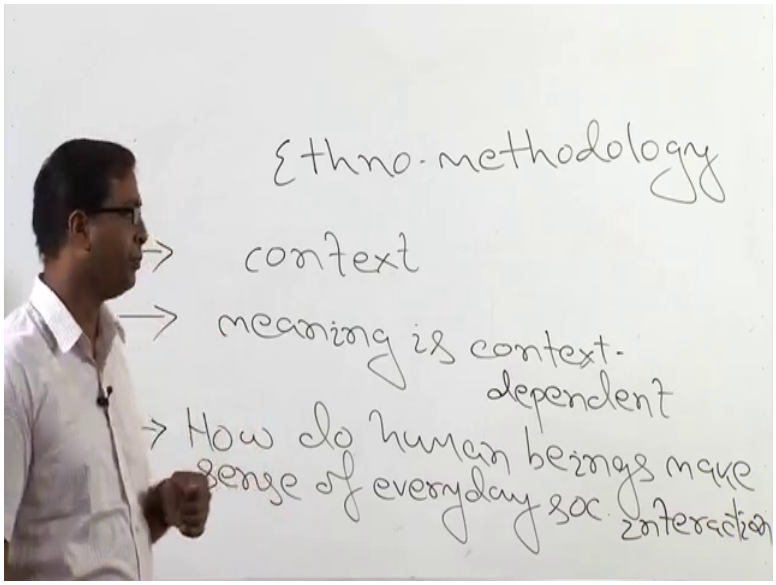

See, ethanol methodology is essentially concerned with how we human beings make sense of the everyday social interaction. There is a method to our everyday conversation; there is a pattern, ethno methodologist try to uncover this pattern for them.

Context plays a very important role in understanding meaning of every human interaction is dependent upon the context.

If you do not understand the context, the meaning of human interaction is very difficult to interpret; I will give you a very short example. Let us say; two persons are conversing with each other, the conversation is like this. So, how was it? The first person says, how was it? The second person says; well it went well, it went fine, then the first person asks, what next? The second person replies; well it depends in a conversation like this. It is very difficult to understand what is happening? What are these two persons talking about? What are the hinting yet, because what is missing here is a context? We do not know the context, without context we cannot read meaning into the conversation of these two persons. The two persons can be talking just after writing an examination college entrance examination. How did it go? It went well, what is next depends upon my result?

My performance, it can also mean the two bank robbers talking just after committing a bank robbery; it can also mean two persons criminals talking after committing a murder. So, unless we know the social context, the meaning to say in human interaction is difficult to interpret and understand. This is the basic idea; we do not go into the details of what is ethno methodology? Ethno methodologist rely upon context and for them meaning is context dependent, another term that they use is indexicality. Now, what is indexicality?

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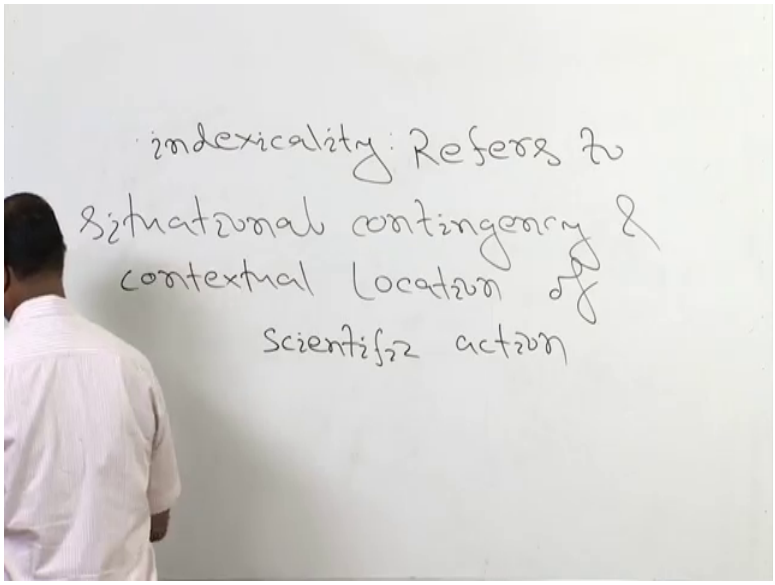

Indexicality refers to situational contingency and contextual location of social action. What does it mean? It means that when we make sense of the social world, we live in.

We try to negotiate, manipulate; understand the social situation. We are in by interpreting each other's symbols language gestures and in ethnomethodology, as I told you context is given primary importance and another term that they use in this regard is indexicality, where they talk about con. The actions are contingent upon situation; the contextual location of the social action determines meaningful human interaction. It imparts the contextual location. It imparts order harmony to everyday social interaction.

So, in this context, in the context of our discussion, just replace the word social with scientific, what we are concerned with is how the scientific action is dependent upon is contingent, upon the micro level situations conditions, operating working at research institutes or laboratories or scientific organizations. How those conditions and situations determine the choice of scientific problem, the choice of methodology, the choice of instrumentation with the decision to make use of certain chemicals in the absence of some important chemicals that is required for the research. These are the issues, we are going to talk about and Karin Knorr Certina, the author of this book has done an ethnographic study of biochemical labs, in California region of us and based on her ethnographic work of nine to ten months.

She arrived at this conceptual, arrived at this findings and she put it within the context of conceptual framework of ethnomethodology, for her scientific research and laboratory selections depend a lot on the local conditions. Low laboratory conditions are local, it depends on the context of research as I told you.

So, the concrete research situation; it determines what scientific problem that we choose, how we go about it? Whom do we join as our thesis supervisor or research guide? How we conduct our experiment? What are the instruments that are used things like that scientific research is locally situated operation.

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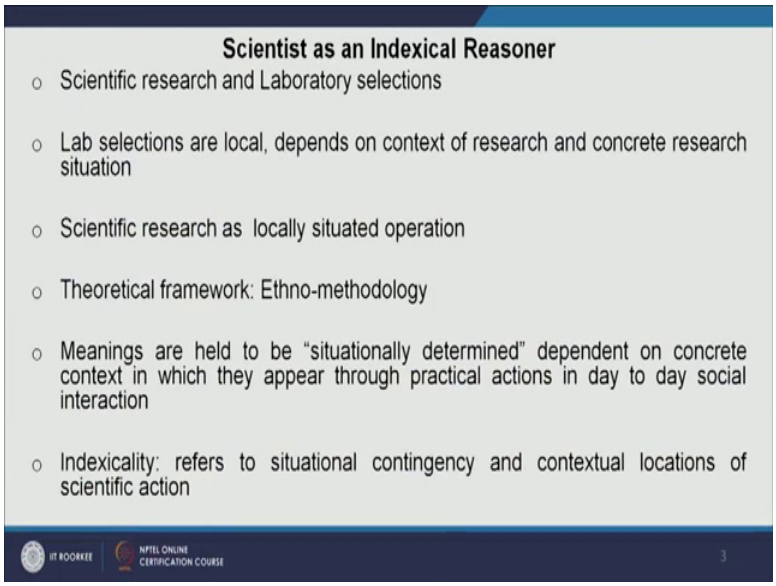

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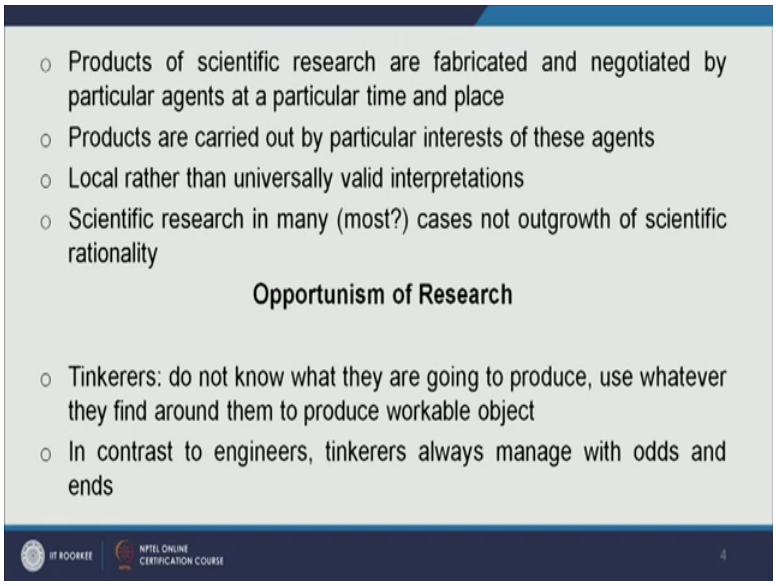

Products of scientific research are fabricated negotiated by particular agents, at a particular time and place. It implies, because we are discussing it within this framework of ethno methodology and indexicality. It essentially means that, we as scientific researchers, have to constantly manipulate, negotiate, bargain many of the situations around us, in order to successfully conduct our research, to publish our paper to get research proposals, to work on a scientific project. It is a constant process of negotiation, bargaining, manipulation, understanding the situation and working according to the constraints or advantages of the situations.

So, it is local rather than universally valid interpretations, which has a strong bearing on actual research that is undertaken. Now, I already give an example that some person may have been very much inspired by Newt, Einstein's theory of gravitation and decides to undertake a research, but the person may settle down for something else, depending upon the interest of the supervisor in that institute or, because the certain instruments or apparatus, which may be required to conduct those experiments, which is not possible, because that is not there. So, you have to reformulate your research problem.

So, it is a local condition, which is a strong bearing on the research process. So, scientific research according to Karina Cetina is not in many cases, not an outgrowth of scientific rationality, is not what is written in the textbook that, this is how we are supposed to do research. Actual research does not take place that way, which we are going to discuss in the due course of this lecture, through under different headings, first sub theme of this is opportunism of research. She says that when we look at scientist, we can always compare them with the aperture, the tinkerers. Who are the tinkerers? Tinkerers are those who through a method of trial and error they arrive at some solutions. They have in most cases, no tools or technology or machine to work with mostly the manners with whatever that is available, they try to use.

Whatever they can find around them to produce workable object, whatever they can lay up, lay their hands on, they will grab it and make and they try to solve a problem that they are involved in the tinkerers, in contrast to the engineers or the scientist tinker is always managed with odds and ends.

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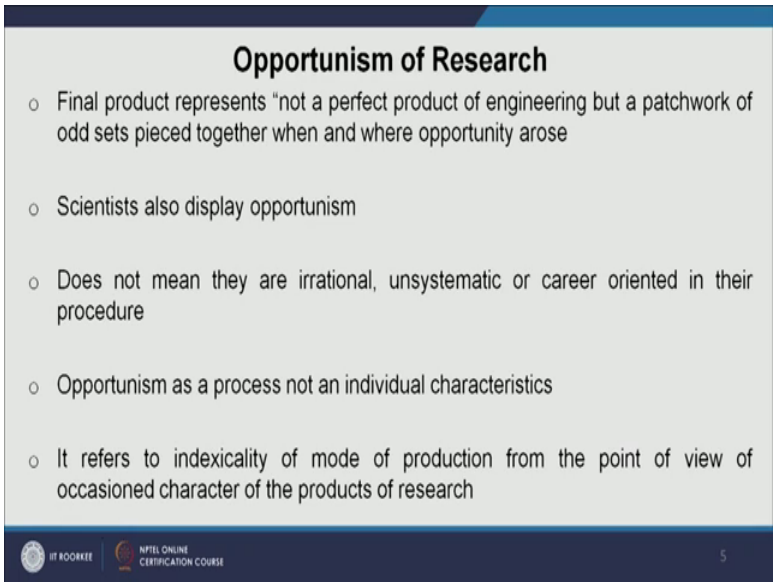

So, the final product of tinkerers, it does not represent a perfect product of engineering, but a patchwork of odd sets pieced together when and where opportunity arose that is, they are very much aware of the opportunities and they always try to make use of such opportunities or advantages. If they find a small tool, small object, which they can use to do something on the project that they are working on, they will do that, because ultimate aim is to find a workable solution to the project. They are doing it, can all the tinkerer can be tinkering with tampering, with or are given the task of repairing a radio, a transistor, or a television.

So, in the process there is just you through and they may not have the basic knowledge of how to how the radio works how television works, but with trial and error with whatever object that is available around them they will try to make the radio work they will try to make the television work that is how tinkerers go about the task why we talk about tinkerers, because now Cetina says that, scientists can be compared to the tinkerers, this does not mean that the scientists are irrational unsystematic or carrier oriented.

They display opportunism here, opportunism implies indexicality of mode, of production from the point of view of occasion, character of the product of research that is while working on your research program, research project as occasion demands, you may have to reformulate, you are the research strategy. You may have to add or subtract a research

step, a methodological procedure, you may have to make use of certain material in place of the material that you originally intended to use.

So, occasioned character of product of research decides the mode of production within scientific world. Opportunism for him is not a individual characteristic, when we say scientists display opportunism, it does not mean that it is a individual characteristics of the scientist for him, for her that is for Karina Cetina. It is the process of scientific research and this is true of opportunism as a characteristic is true of the scientific community, in general is not a specific feature of any particular scientist. Now, how does this occasion character of research manifest itself?

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How the occasion or situation presents itself in such a way the scientist reformulate their research design, let us take the example of a role played by local resources and facilities.

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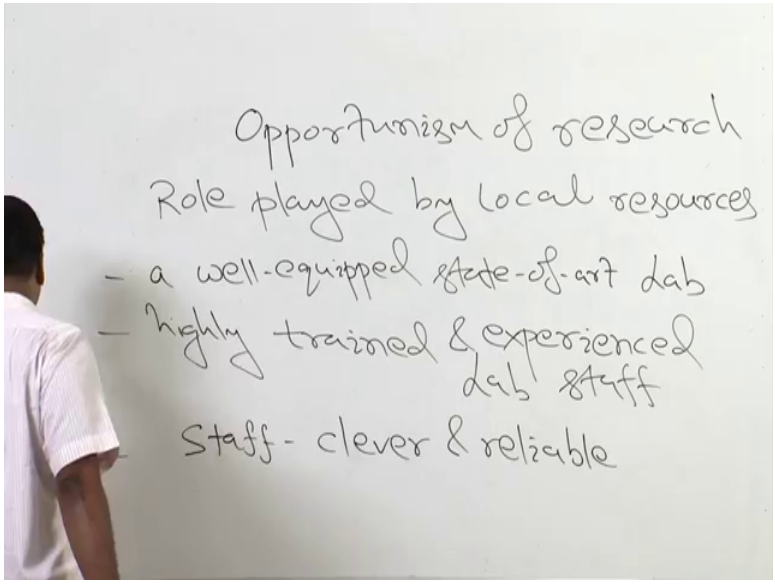

Now, what is the role of local resources in determining, modifying the research problem, research methodology. She gives a very fine example of a well equipped state of art laboratory; mostly the laboratories that she was referring to in her research, in a field work are biochemical laboratories. Now, this is a well-equipped, because all the apparatus has all the state of art, latest technology and instruments. It has highly experienced staff, the laboratory staff is highly experienced, has been working for a long time.

So, the person knew each and every aspect of the resource that was undergoing there and the person is also very clever, can manipulate the situation to the advantage of the scientist, who are undertaking the research. There the person is very reliable can be relied upon for any important research process that is to be handled by him. Hence, such a lab with experienced lab hands as well as a state of art instruments available was eagerly sought after by the scientist who are working in that institute, they all wanted to work do their research in that laboratory.

They all modified, reframed the research problem in such a way that they will get an opportunity to work in that lab, and this is a lab where protein could be generated, modified and tested in large volumes. So, that was a big advantage for though for the biochemical scientists, because they could make use of this lab to do their protein research and we have a very well, you cube lab with experienced lab hand. So, they

would reformulate their research problem, they will add a strategy add a methodological step, so that they can undertake the research in that laboratory, research problems were invented.

So, that can be undertaken in that particular lab. For instance, she says another example of such kind of negotiation and manipulation that happens at the local level, within scientific community. Let us say example of newly purchased electron microscope utilizing laser beams, it also held similar attraction. What is attractive about this electron microscope? It is newly purchased, one is a fresh electron microscope; that means, it will give correct reading; that means, unlike the previous electron microscope, which is some defect and you may not get the correct reading, but you are assured that this particular microscope, which has been purchased recently, the latest one would definitely be better than the previous one technologically and also it will also give you bit correct reading. Hence, the scientist wanted to use that particular microscope in that particular lab. That particular microscope was eagerly sought after.

Now, having said that you will have a state of art lab laboratory with highly experienced staff, more clever and reliable holds, lot of attraction for the scientist working in that particular institute or a newly purchased electron, micro cope eagerly sought after by the scientist. It also implies that the certain people, who are owning these resources, the certain people who are in charge of those laboratory, certain people who are in charge of this electron microscope go to great lengths, to protect it, to establish their ownership on it.

So, that only few people can use it. So, if you have ownership of this particular lab, if you are in charge of the particular lab, you are the scientific officer, who controls the laboratory facility, which is a well-equipped one. You make sure that only you and your friends, your colleagues with whom we have good terms, they get an access to it. You deny the access to just about every scientist, who wants to make use of it. So, it brings in the power dimension in the scientific research, which is social one of the social dimensions, working at the micro level, of this micro level at any research site opportunism and particular interest also sustain each other.

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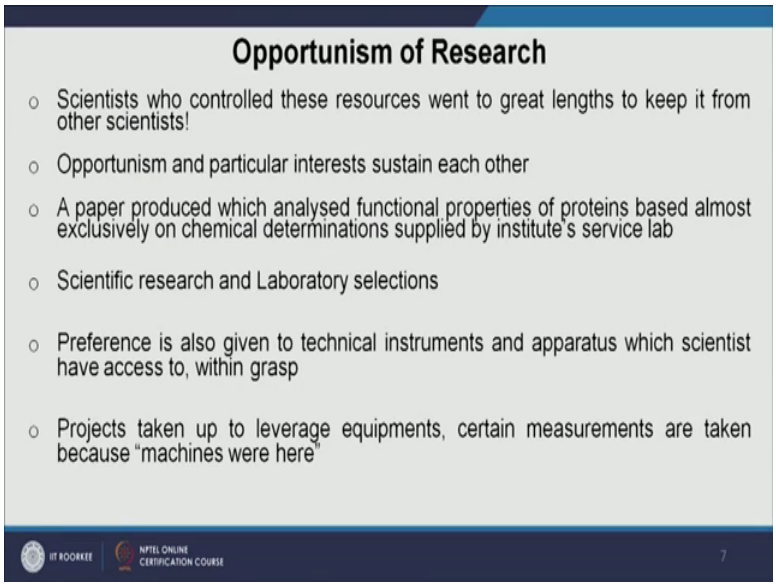

For instance, a paper produced, which analyzed the functional properties of protein based almost exclusively on chemical determinations, supplied by institutes service lab that is one person conducted an experiment. Making use of the chemical determination, chemical available in the service lab of the institute and this paper looked at the functional properties of protein, when interviewed that scientist said, if I had my way, if I would have done the research myself in my own lab, I would have preferred another method, I would have made use of other chemicals.

This is an example of again scientist having to reformulate their research methodology, in order to suit the local condition. In the local conditions only this particular chemicals are available and you are working in that research institute, you have only access to that particular service lab, where you can do the experiment. So, you have to make use of, whatever chemical instrument that is available, this is how the local conditions, local situation determines the process of scientific research production, the process of knowledge production, within scientific community. Preference is also given to technical instruments and apparatus, which scientist have access to or within grasp.

I have, I work in an IIT and I have spoken to many faculty members, who are from engineering and sciences. They also say that many a times, this students are told to work on a project, because there are certain instruments, which are already available in the department, in that particular lab there certain machines, which are lying there, which

had come, because of some previous research project, because through funding, from previous research project, what is that is lying? So, let us make use of this machine, this gadget, this instrument.

So, they invent a research problem that can make, that can be done making use of those instruments. So, technical instruments and apparatus available at the service lab or at any laboratory, anywhere in the world can also be a source of choice and selection of scientific research problems, projects are also taken up to leverage equipments and certain measurements are taken, because machines were here, I shall give a very brief example of how resources and facilities available are also negotiated and manipulated.

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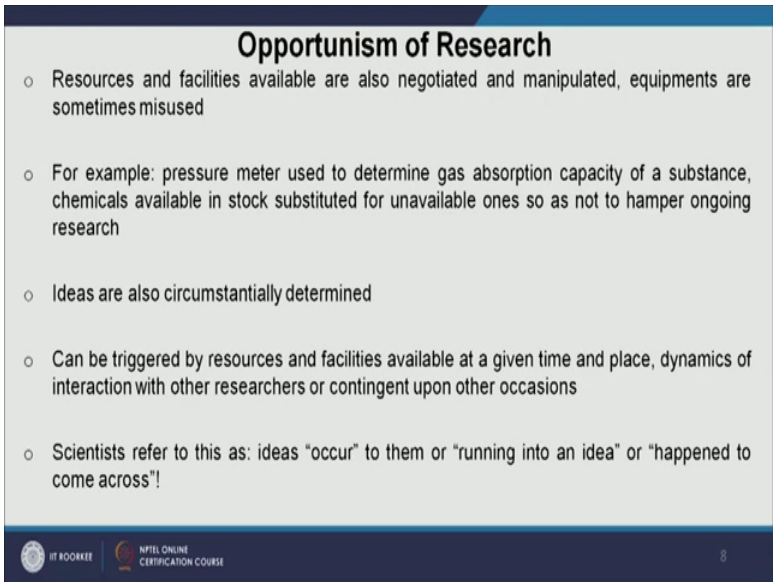

Equipment's are sometimes misused, the equipment's are misused, because particular equipment is necessary needed, but it is not there. So, make use of another equipment, make slight changes in that equipment, so that, you can go ahead with your research. For instance, pressure meter is meant for something else, but in the research that was conducted by Karina Cetina.

She found that pressure meter was used to determine the gas absorption capacity of a substance sometimes, another example, sometimes chemicals available in the stock are substituted for unavailable ones. So, that the ongoing research and do not get hampered, people make use of certain chemicals, which are easily available in the laboratory whereas, they needed something else and the research is already undergoing, the

experiment is already ongoing. Hence, they do not want to hamper it, they do not want to interrupt the process. So, they make use of another chemical, which can substitute it technically. So, I shall give you few more examples as well as I will talk about some different aspects of scientist as an indexical reasoned in my next lecture.

Thank you.