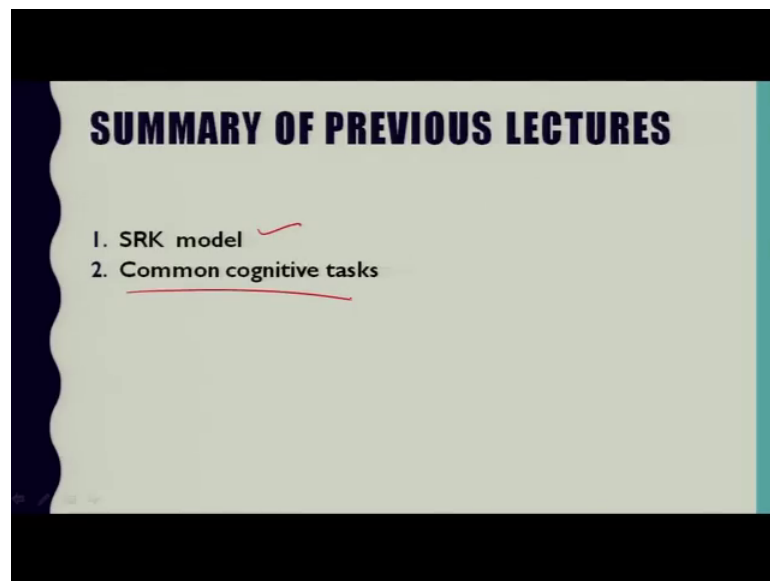**Applied Ergonomics**
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Lecture – 19

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So, welcome to this lecture previously we covered some of the common cognitive task and SRK model, so that we covered in the previous class. And common cognitive task we discussed in the previous class, those common cognitive task were decision-making, planning and problem solving. So, as for as the first part that is decision-making is concerned we covered in the previous class; now in today's class we will discuss about the planning.

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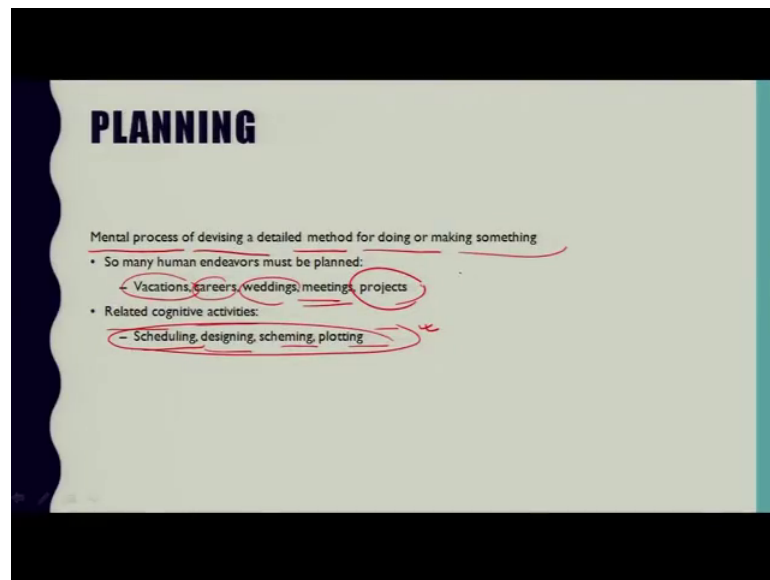
So, planning is a common English word you can easily correlate the meaning of this particular word with your daily life situations. So, it is basically nothing but a mental process of devising a detailed method for doing or making something. So, many human endeavor must be planned like it may be project planning, it may be planning of a meeting, it maybe even planning a wedding, careers and vacations. So, this related cognitive activities include scheduling, designing, scheming and plotting. So, these all cognitive activities required the planner to prepare and in fact to envision the realization of a particular or desired goal or task.

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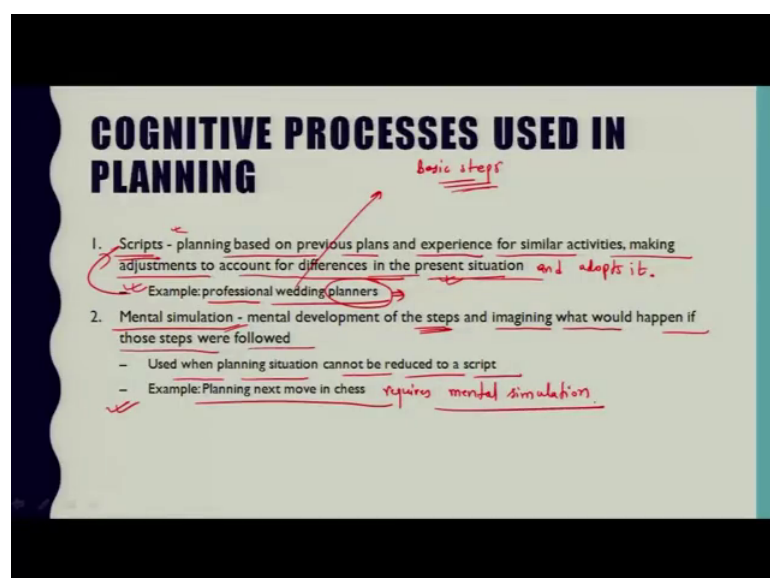
So, basically this particular planning is accomplished using two cognitive process and in fact, sometimes in combination of both. So, the first involves the use of script. So, this particular script a kind of planning is based on the previous plans and experience for similar activities making adjustments to account for differences in the present situation. So, basically planner does what planner recalls the previous plan perhaps making adjustment to account for differences in the present situation and adopts it.

Like for example if it take a work of professional wedding planner, so in that particular activity this particular planner use this kind of routing planning approach. So, the cast of characters in wedding ceremonies and venues may change, but not the basic steps which is leading up to an concluding the marital union. So, this kind of example you can take it in understanding this kind of script.

The second kind of cognitive process used in planning is mental simulation. So, in this mental simulation, the planner must develop the steps in the method and imagine what would happen if those steps were followed. Basically this mental simulation is required when the planning situation cannot be reduced to a script. For example, planning the next moves in chess game requires mental simulation. So, in this particular game, you have to mentally simulate the response of your opponent; and in this way your course of action will be defined on the basis of what your opponent is going to move in a particular in next step. So, the any chess player must imagine what the opponent will do in response to various board moves that might be made. So, the planning can make significant demands on a person's working memory, especially when mental stimulation is used. Consequently, people tend to be easily distracted when the planning activity is purely maintained; also people seem to plan over the short term rather than long-term.

So, now, we will move towards in fact, this planning technique also in in industrial engineering let us say they use various kinds of tools and techniques like a giant chart, critical path network, PERT, CPM, so these are the techniques for planning edges which is useful for documentation and visualizing the steps in the plan. And in fact, this particular planning can also be performed with the help of graphical technique or visualization techniques. So, now, we come to another common cognitive task which is the problem solving.

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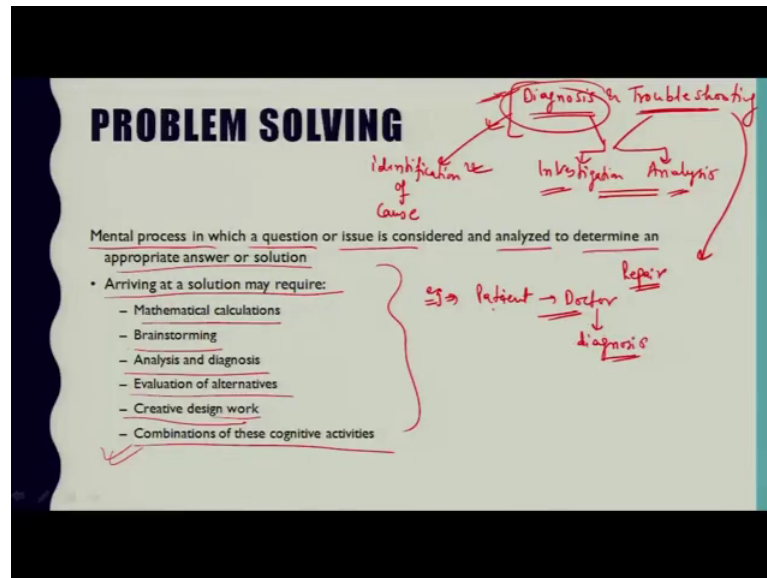
So, like a problem is what, so the problem is a question that can be raised with respect to a person's doubt or in order to raise for solution and this solution may require any kind of brainstorming and as well as mathematical calculation also, some kind of analysis and that solution or may also include the diagnosis evaluation of alternative, creative, design, work or combination of these common activities. So, as a definition we can say that the mental process in which a question or issue is considered and analyzed to determine an appropriate answer or solution.

So, arriving at solution may require mathematical calculation, brainstorming, analysis and diagnosis, evaluation of alternatives, creative design or combination of any of these possibilities. So, cognitive task related to problem solving include diagnosis and troubleshooting. In fact, this diagnosis and troubleshooting are often required steps in problem solving. So, these both diagnosis and troubleshooting involved an investigation and analysis of the cause as you can take an example of medical diagnosis of a disease based on patients symptoms.

So, this particular example you can take in order to make an understanding for this diagnosis and troubleshooting which are included in cognitive task related to problem solving. So, this investigation and analysis is required and now this diagnosis results in the identification of the cause. And this troubleshooting implies that not only the identification of the cause is there, but also its repair or solution. So, in the case of

diagnosis, repair or other corrective actions is not necessarily included. So, for example, if you can take example of let a patient going to doctor and doctor may provide diagnosis, but refer the patients to another doctor for a second opinion that includes recommending a cure. So, in this way you can understand this diagnosis and troubleshooting situations with the this practical example.

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And now the something more about problem solving. So, the problems have a technical context which refers to the field of expertise needed to solve the problem. For example, a chemical engineer is solving a problem based on his own curriculum, so it will require a different approach; and the use of different solution techniques obviously, then a problem in accounting. So, problems also causes a degree of difficulty. So, easy problem requires less mental effort to solve than the difficult one. So, the degree of difficulty relates to the attribute such as uniqueness of the problem, number of steps required to solve the problem, and technical complexities that is a product with let say 1,000 parts is more complex than a product with 100 parts.

So, like take an example another example that a chemical process consisting of five reactions. So, it is likely to be more complex than one involving a single reaction that is bit obvious example, so that you can correlate with your daily life problems. So, planning and problem solving is a very simple because every human being faces these things on daily basis. So, first step in problem solving is to realize that a certain pieces of

information are relevant to the solution of problem and in fact other parts of the information are irrelevant. So, a good problem solver is able to distinguish between the two categories.

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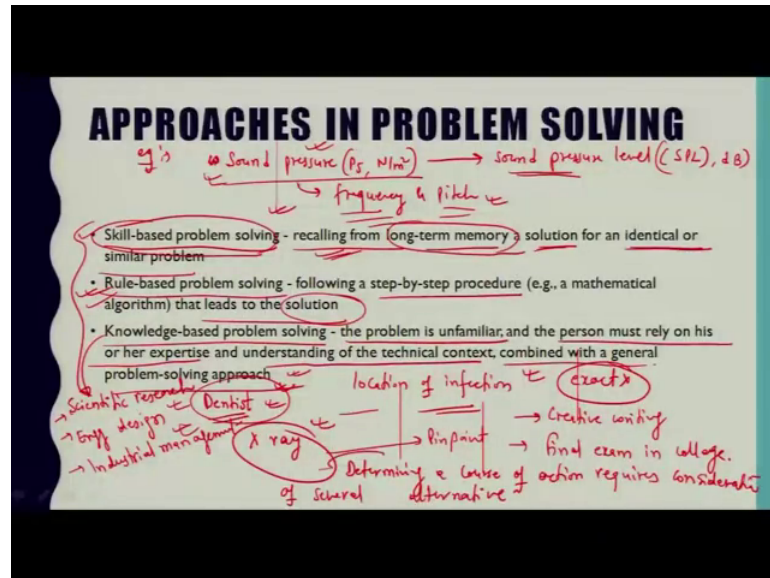
So, like for example, when if you take example of sound pressure. So, this particular sound pressure that is expressed in PS Newton per meter square. So, it is converted to sound pressure level that is expressed in SPL in decibel. So, here the frequency of sound is irrelevant. So, it does not enter the computational part. So, as we have learned that this sound is characterized by frequency and pitch, but when we calculate the sound pressure this frequency and pitch does not come into picture. So, in that way it is here in this case to calculate the pressure of the sound this particular information in the form of frequency and pitch is irrelevant. So, in this way, we have to realize that the certain piece of information in a particular context is important and the information which is not relevant we have to skip.

So, in a technical way, this problem solving is defined on the basis of three categories we can say or three different approaches. So, these approaches are skill-based problem solving; the second approach is rule-based problem solving, and third approach is knowledge-based problem solving. So, in this skill-based problem solving, just recalling from long-term memory as solution for individual for an identical or similar problem. So in some cases, the problem solver is able to relate problem to previous experiences with

similar problem, so that this particular solving a new problem is will be a just a matter of recalling from long-term memory the solutions that work with those previous problem.

So, as an example, if we take example of a dentist, so he has seen a type of tooth infection many a times, before and has prescribed a particular antibiotic that has worked nearly every time to relieve the symptoms. For the current patient, experiencing those same symptoms, the dentist immediately jumps to the solution of prescribing the same antibiotic. So, in effect dentist has exhibit this skill-based behavior to solve the problem. So, this particular skill-based problem solving is completely based on your previous experiences and knowledge that you have gained in previous times.

In a slightly more difficult situations when a particular knowledge that you have gained previously or your experiences will not give you any kind of solution. So, in some situations you need some procedures and that is being said by previous workers. So, in that case you solve a problem with the help of some rules or step-by-step procedure. So, it may be a mathematical algorithm that leads to the solution. So, in this way, this particular in rule-based problem solving a procedure must be followed and in fact that will lead to the answer or solution.

So, the dentist in previous example that we have taken to understand this skill-based problem solving. Like if dentist wants to know the location of infection. So, how he will manage to find out the location of the infection? So, the patient is able to identify the general location of discomfort, but not the exact tooth. The standard procedure for dentist to follow will be to take a proper x-ray to pinpoint the infected tooth, so that another remedial procedure can be followed or it may be a root canal the something can be performed. So, in this way this particular test need to be performed and that is step-by-step procedure that will lead to some sort of solution in that case.

So, in another context, when the problem is somewhat more complex and it contains high degree of difficulty that are less likely to lend themselves to a skill-based approach and a purely rule-based approach. So, this may not be applicable either in that case this particular knowledge-based problem solving will help us to provide the solution of a particular problem. So, the particular problem solver is confronted with the situation that is unfamiliar and must rely on his or her expertise and understanding of the problems technical context stored in long-term memory combined with general problem solving

approach. These kinds of problems situations are common in scientific research. You can find out many examples based on scientific research where this knowledge-based problem solving is best fit in. It may be engineering design, it may be industrial management, it may be creative writing or it may be your final exams which you face in college.

So, returning to our this dentist example, what we can have as an another example like the dentist is faced with a problem that is and characteristics of those he has treated before. So, it may not be a dental problem at all. So, in fact, determining a course of action requires consideration of several alternatives including referral of the patient to some other medical doctor. So, determining a course of action requires also consideration of several alternatives. So, we have to because it is completely uncertain and you do not know what could be the final result. So, you have to seek out all the alternatives present around you, and you have to find out the best possible alternative at that particular situation, so that is also knowledge-based problem solving example.

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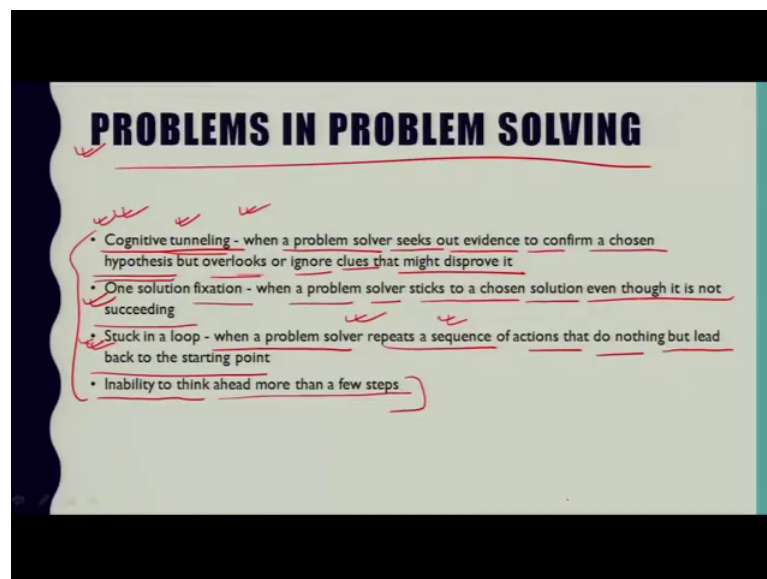
So, now, in extension to this problem solving topic, so this problem requires requiring a knowledge-based approach are specially demanding of cognitive resources, so in particular working memory. And the problem though occur with problem solving process, so the principal difficulties and biases encountered during problem solving or troubleshooting or diagnosis, so that can be summarized in the following list. So, there

are various problems and problem solving. So, those we are listed here the first kind of thing is cognitive tunneling. So, what is that? So, this is a particular bias associated with troubleshooting and diagnosis. So, it is when the expert identifies one hypothesis to answer the question and he stays focused on it to the exclusion of other possible explanation. So, in that a person or a problem solver seeks out the evidence to confirm the chosen hypothesis, but overlooks or ignore clues that might just prove it.

Another kind of problem in this problem solving is one solution fixation. So, basically analogous to cognitive tunneling in troubleshooting and diagnosis this particular problem occurs when a person or a problem solver chooses one solution for a problem and sticks with the solution even though it may not be succeeding. Another situation is stuck in a loop. So, the problem occurs when the problem solver or a person continuous to repeat a sequence of actions that do nothing in fact, that have no result except to lead back to starting point of the problem. So, you may sometimes your friend just like that which is given in this statement.

So, now, another troublesome situation is like inability to think ahead. So, here in this case, the problem occurs in the situation that requires multiple solution steps or to the consideration of multiple alternatives which causes the working memory of the problem solver to become overloaded. So, the person is unable to think ahead more than a few steps, so that helplessness situation where inability to sink ahead comes. So these are the possible or four floors which we face while solving a particular problem.

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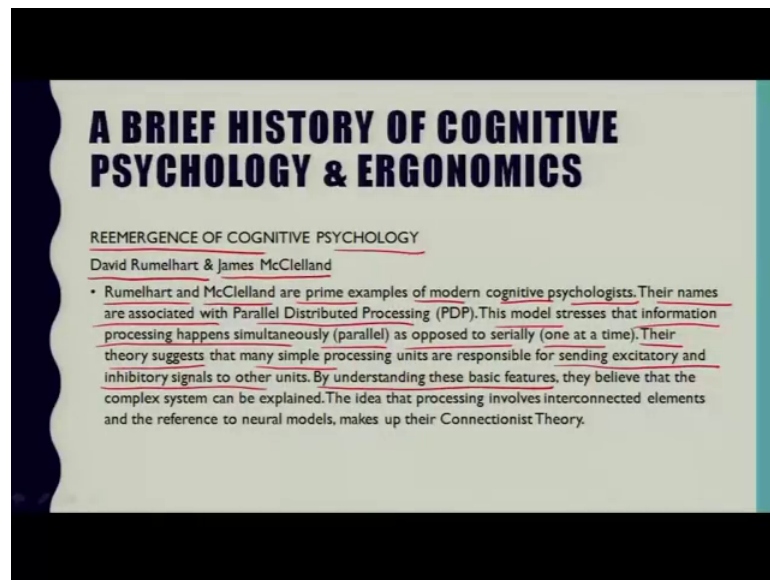
So, let us close this lecture here. So, as per our cognitive psychology part that we are covering in near about each lecture; and at last we are trying to cover the history of the persons who has contributed in cognitive psychology topic. So, the reemergence of cognitive psychology, so one researcher David Rumelhart and James McClelland. So, Rumelhart and McClelland are prime examples of modern cognitive psychologist. Their names are associated with parallel distributed processing. This model stresses that information processing happens simultaneously that is parallel as opposed to seriously that is one at a time. Their theory suggests that many simple processing units are responsible for sending excitatory and inhibitory signals to other units. By understanding these basic features, they believe that the complex system can be explained. The idea that processing involves interconnected elements and the reference to neural models makes up their connectionist theory. So, in this way, this particular cognitive psychologist has contributed in parallel distributed processing.

So, that is all for now. In the next lecture, we will try to cover the design guidelines for various cognitive activities and we will also discuss with the help of human information processing model in the next lecture.

Thank you.