Usability Engineering
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Module - 05
Lecture - 15
Requirement Analysis - II

Welcome to module 5 lecture 15. This is the 2nd part of Requirement Analysis that we would be discussing in this module.

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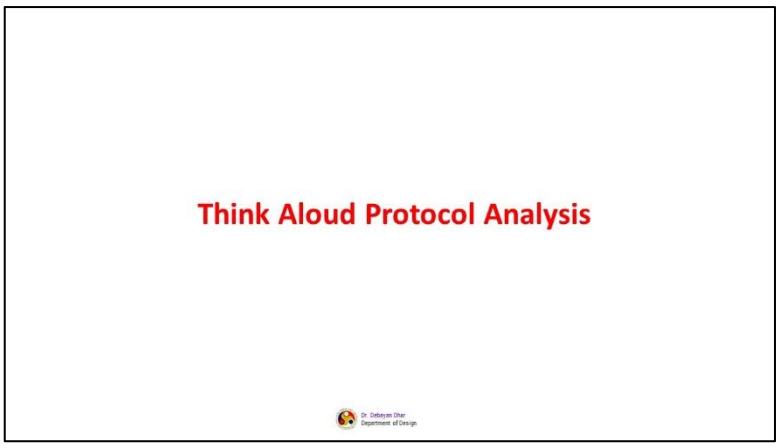

And we will start this module with the technique that is known as think aloud protocol analysis.

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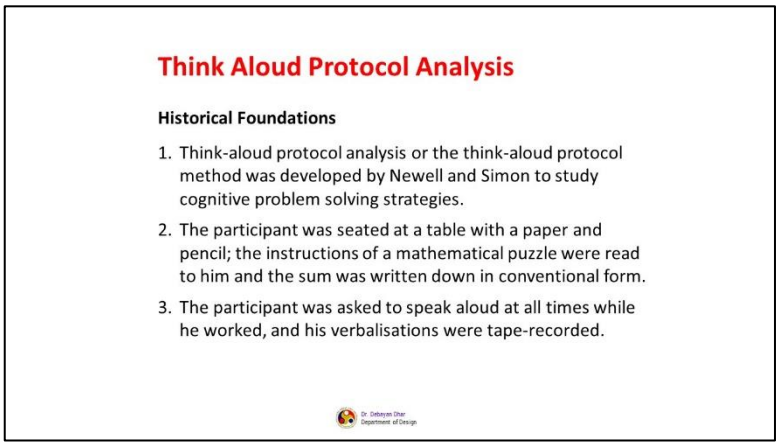

So, let us start discussing about this technique. Now, a think aloud protocol analysis or the think aloud protocol method at it at as it is mainly known as was developed by Newell and Simon to study cognitive problem-solving strategies. How a problem is solved by students and what are the mental processes that are associated with that. It was with that intention that this method or technique was first developed and studied.

Now, the participant was seated at a table with a paper and pencil and the instructions of a mathematical puzzle were read to him and the sum was written down in conventional form. That was the experiment that was conducted by Newell and Simon. The participant was asked to speak out loud at all the times while he worked and his verbalizations were tape recorded. So, that was the procedure.

Think aloud means while the participants were being asked to problem solve a mathematical puzzle whatever was happening inside their mental processes or the mental processes that was driving in their head they were asked to think out loud speak out loud during those problem-solving activities and whatever their verbalizations were heard those were recorded in a tape recorder in the experiment that was conducted by Newell and Simon.

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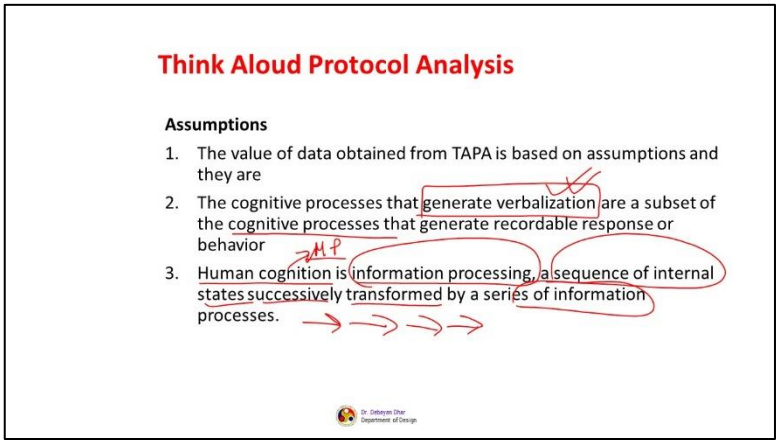

Now, some of the assumptions of this think aloud protocol method or the think aloud protocol analysis is that the value of data obtained from TAPA henceforth will use the acronym of think aloud protocol analysis as TAPA is based on assumptions. And they are the cognitive processes that generate verbalization are a subset of the cognitive processes that generate recordable response or the behavior.

So, what it says is that the cognitive processes that are that generate verbalization. So, that is what we hear. These are subset of the cognitive processes that generate the recordable response or behavior. That means we are trying to understand the cognitive processes from the verbalizations that we hear from the participants.

Human cognition is information processing, it is a sequence of internal states successively transformed by a series of information processes. So, here we are talking about the mental processes and what we understand about mental processes is that it is about processing the data processing the information that we assimilate through our senses and it consists of a sequence of internal states.

So, there are steps of internal states in this processing phase, wherein successively data is transformed by a series of information processes that is the main aspect of human cognition and the mental processes that we would be discussing about.

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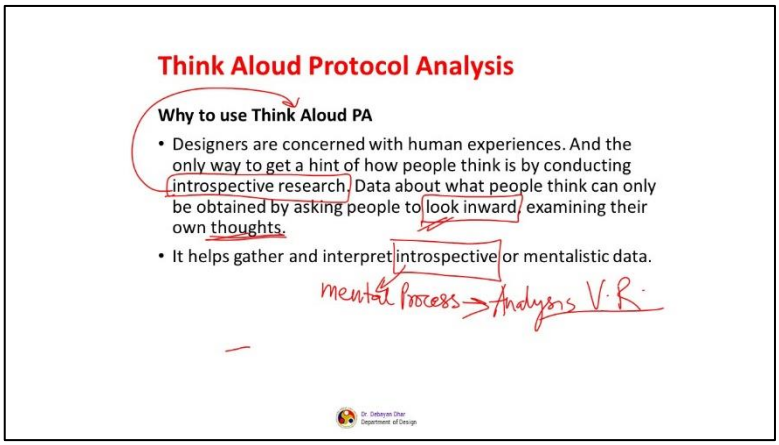

Now, why generally we should use a TAPA or a think aloud protocol analysis or a think aloud protocol method. Now, please understand that designers are concerned with human experience. We want to understand the experiential state of our users and our motto and objective is to understand their requirements accurately, to understand the unmet needs which as designer we want or we intend to address.

And the only way to get a hint of how people think is by conducting introspective research that is what we call as introspective research means we are asking him to think out loud. So, that we introspect in his mental processes by analyzing the data. So, data about what people think can only be obtained by asking people to look inward carefully, you should

look into these words that are mentioned here to look inward examining their own thoughts right.

Now, it helps gather and interpret introspective or mentalistic data. What essentially, we are doing? We are trying to introspect the mental processes of the user or the respondent by analyzing the verbal reports that mean the verbalizations that are recorded during these sessions.

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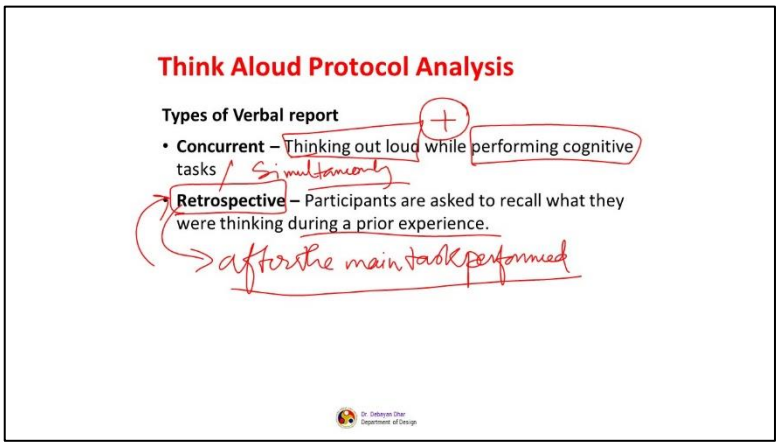

Now, generally there are two types of verbal report and what are they? They are concurrent verbal report and retrospective verbal report. Now, concurrent verbal report means thinking out loud while performing the cognitive task; that means, the task and the verbalizations are done simultaneously right. These are simultaneous activity thinking out loud and performing the cognitive task. These are simultaneous activities, while the retrospective verbal report means participants are asked to recall what they were thinking during a prior experience.

So, what happens is that you record a session with your participant you see him as he complete his task and thereafter once he completes the task you ask him questions regarding the task, regarding the decisions that he has made, regarding what was happening inside him, what were the mental processes that were going on during those situation or during the situation while he was he or she was completing the task. That was called retrospection and that was done in retrospective effect right. After the main task was performed right; that means, it is retrospection.

Now, there are a lot of debate in literatures regarding both the different types of verbal report, some people say that concurrent verbal reports provide richer data, there is another group of people who say scientists and investigators they say that while doing a think out loud session concurrently while the task is being performed hampers the mental processes of task completion and therefore, they do not produce accurate information or verbal reports.

Some people say retrospection or retrospective verbal reports are not does not provide high quality data because it is done in retrospection; that means, the actual experience is not getting verbalized while it is always a reference to what has happened in the past.

While there is another group of investigators and scientist who say that retrospective data provide good quality are of good quality because they do not hamper, they do not affect the task completion the mental processes associated with task completion as the users does not require or the respondents do not require to think out loud during those sessions and therefore, the quality of the data is good.

Now, these are different line of arguments in literature which you would fund find, but based on your requirement if your task is information heavy, if your task is highly highly decision whereas, lot of decision is happening based on processing of information by the respondents. You might take a call whether you would like to go for a retrospection verbal report or you would like to go for concurrent report.

In an information heavy task it is better to go for a retrospection verbal report rather than a concurrent verbal report, but it all depends on the design team and the designer to analyze the situation and take a call on this.

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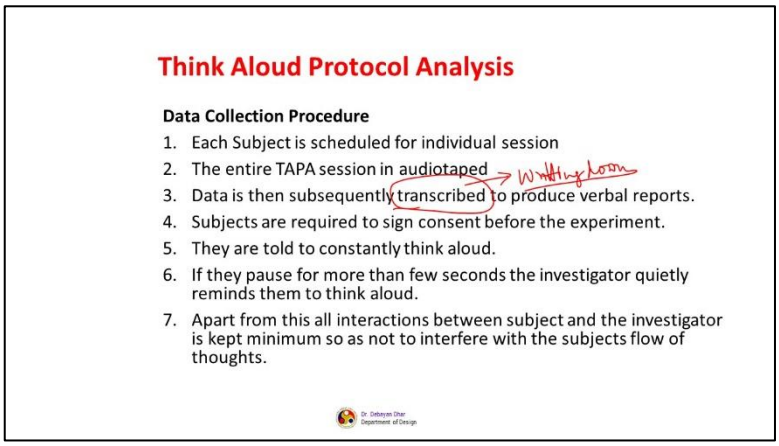

Now, what is the data collection procedure for the TAPA session? Now, each subject; that means, we are referring to the participants each subject is scheduled for individual session. Its not done in group like in focus groups we do it in group, but here the each TAPA session is done individually. The entire TAPA session is audio taped for reference for recording the data. Data is then subsequently transcribed to produce verbal reports.

Transcription means you writing down the detailed verbalizations. You do not even miss words like sounds like um, ok, um I was thinking everything every verbalization by the respondents is transcribed written down in a piece of paper. So, that we can go ahead with the analysis part of the verbal reports; subjects are required to sign consent before the experiment because it would be videotaped and you are going to record the data for further analysis.

They are told to constantly think out loud speak out loud. They do not they should not keep silent; they should speak out loud about what is happening in their mental processes. If they pause for more than few seconds the investigator quietly reminds them to think loud. It should not be in such a way that you are interfering with the respondents or the participants way or line of thinking and his verbalization.

If your participant is silent for few more few minutes you should very gently and patiently you should inform him time and again, that he need to verbalize he need to speak out loud the in the things that are going inside him or the kind of mental processes that are happening inside him and this requires a little bit of training because at the first stage it is very difficult for any respondent to do that activity.

But, you can have a session previously before you actually start recording the data to expose the respondents to the situations like this. Now, if they pause for more than few seconds the investigator needs to quietly reminds them to think out loud. Apart from this all interactions between subject and the investigator is kept minimum so as not to interfere with the subject's flow of thoughts that is important.

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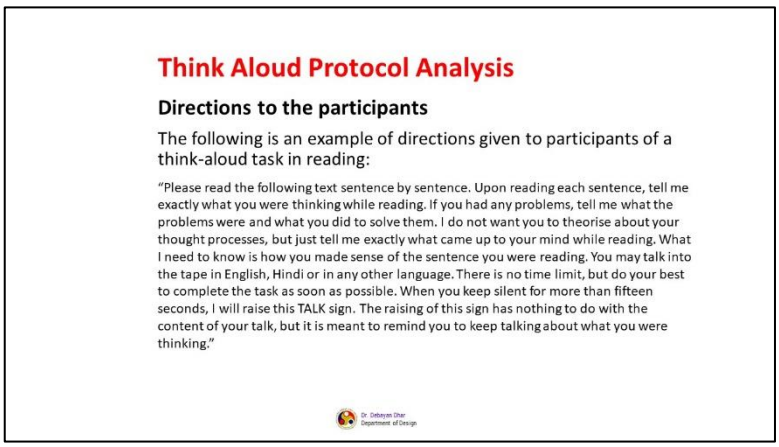

Now, what are the directions to the participants? Now, let us see an example to understand the think aloud protocol analysis. You would see you can see in this slide that a following paragraph was written down as a verbal report from the TAPA session and it was given to the participant this paragraph was given to the participants and then later they were asked to think out loud.

We will see that session entirely, let us read the paragraph you can read the paragraph. The paragraph is this "Please read the following text sentence by sentence. Upon reading each sentence, tell me what exactly what you were thinking while reading. If you had any problems, tell me what the problems were and what you did to solve them.

I do not want you to theorise about your thought processes, but just tell me exactly what came up to your mind while reading. What I need to know is how you made sense of the sentence you were reading. You may talk into the tape in English, Hindi or in any other language. There is no limit time limit, but you do your best to complete the task as soon as possible. When you keep silent for more than fifteen seconds, I will raise this TALK sign.

The raising of this sign has nothing to do with the content of your talk, but it is meant to remind you to keep talking about what you were thinking." So, this kind of texts are used a lot before you actually start the session. This reminds the participants, this informs the participants about your objective, about what you are looking from them and what they need to do. Now, once this is being read out to them or is being explained to them by the investigators.

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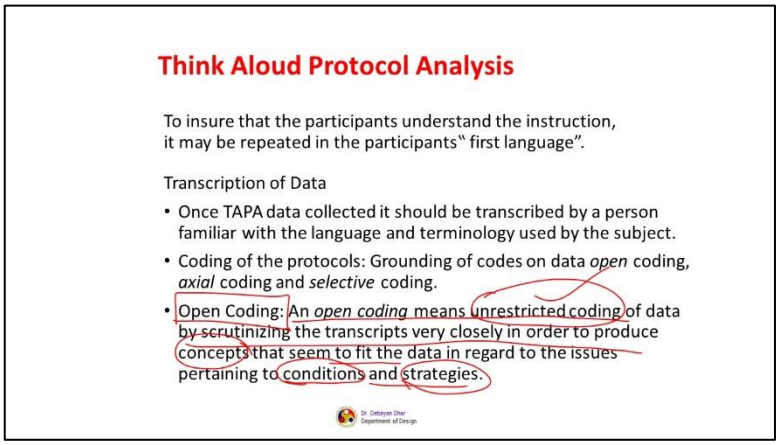

The next is we need to ensure that the participants understand the instruction and it may be repeated in the participants "first language" that is very essential. Now, let us understand the transcription of data. Now, once the TAPA data is collected it should be transcribed by a person familiar with the language and terminology used by the subject that is very important.

If it is collected in a local language, it should be used if an expert of that local language should be used who can transcribe the data analyze the data to interpret the data. Coding of the protocol; that means, once these verbalized reports are there we need to go for coding, because we need to make sense now of the data that we have collected and how do we make sense of the data that we have collected.

We make sense of the data that we have collected by going for a coding session and this code are what? These are codes that are grounded on data. First of all the first level is to go for open coding from the verbal reports, then comes the axial coding and then finally, we go for the selective coding. The selective coding actually tells us about what these

verbalizations are all about and these are the interpretations that we can take forward as inside from these studies for defining our opportunity areas and design brief.

Now, what is open coding? The open coding means unrestricted coding of data by scrutinizing the transcripts very closely in order to produce concepts that seem to fit the data in regard to the issues pertaining to conditions and strategies. So, as you can see here the word open coding means there is no restriction to the kind of codes that you are generating.

For example, if you read this entire sentence you will understand a particular theme or meaning that has been communicated to you and if I ask you to convert this entire sentence into a word into two three words to explain or to express how would you like to relate to these statements that is an example of open codes.

So, open codes mean unrestricted coding that is important right and this is the first level of coding it is done by scrutinizing the data based on its meaning and in order to produce concepts. So, the idea is to come up with concepts that seem to fit the data in regard to the issues pertaining to conditions. So, we are focused in defining concepts based on conditions and strategies that is what is used to define the open codes.

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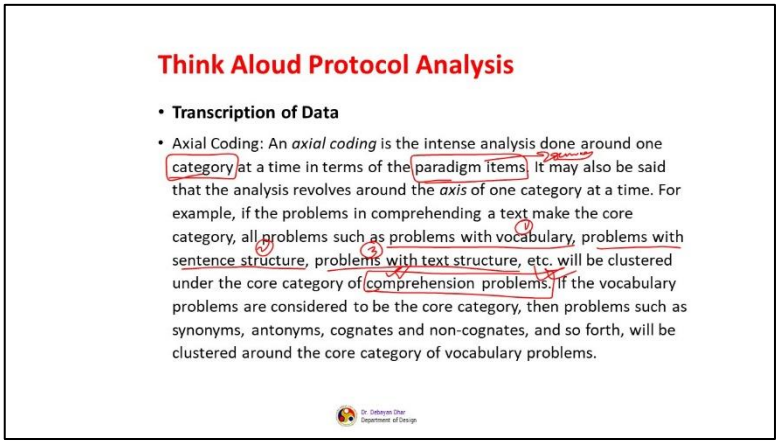

The next level is axial coding. Now, an axial coding is the intense analysis done around one category at a time. I would like you to draw your attention here. So, it is about it is an intense analysis done around one category at a time in terms of the paradigm and items paradigms.

So, the focus is on genres right different genres or paradigms. It may also be said that the analysis revolves around the axis of one category at a time. For example, if the problems in comprehending a text make the core category, all problems such as problems with vocabulary, problems with sentence structure, problems with text structure, etcetera will be clustered under the core category of comprehension problems.

So, you can see all these open codes like problems with vocabulary then problems with sentence structure, problems with text structure, all these categories can be clubbed together in terms of saying that these all relates to comprehension problems. So, did you see how these open codes which were conveying the meanings of the large sentences of the paragraphs that they have been coded for now getting clustered towards a particular theme or a meaning which they are getting associated to.

Now, if the vocabulary problems are considered to be the core category then problems such as synonyms antonyms cognates and non-cognates and so forth will be clustered around the core category of vocabulary problems.

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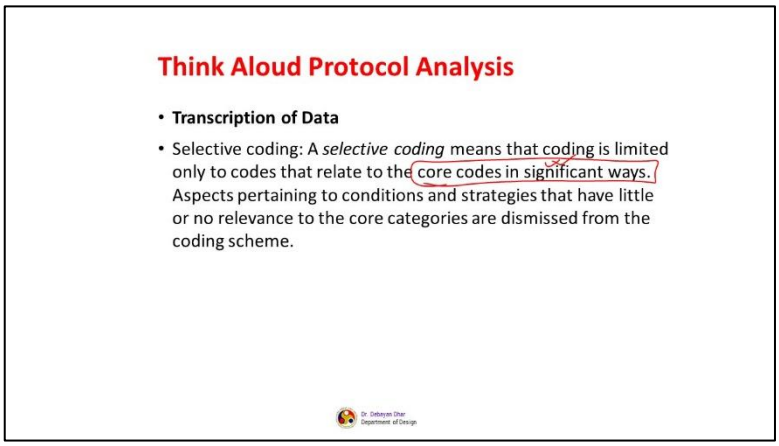

The third and the final stage is selective coding. Now, what we do in selective coding? So a selective coding means that the coding is limited only to codes that relate to the core codes in significant ways, focus here the idea is to relate core codes in significant ways. Aspects pertaining to conditions and strategies that have little or no relevance to the core categories are dismissed from the coding scheme, it is about significance.

So, from for a designer or for the design team the significance would be whether they see an opportunity area, where they can focus their energy and come up with a design solution that would be an area or a topic of significance for the design team.

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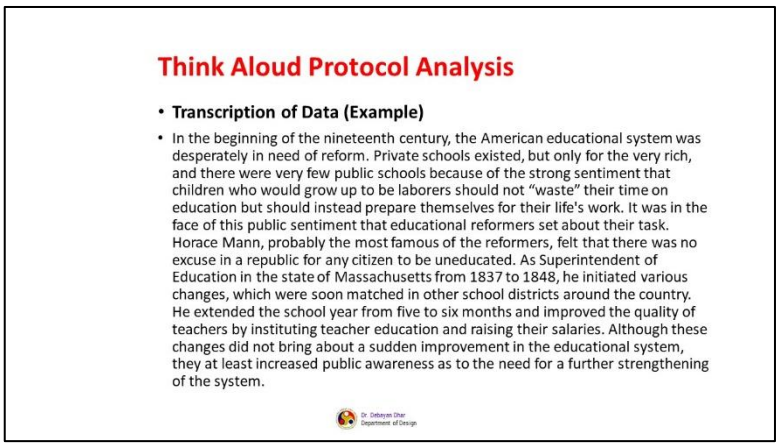

Now, let us take an example here. Let us see this transcription data what you see in this slide is a transcription that has been carried out from a verbal verbalizations of a TAPA session and it says like this.

So, in the beginning of nineteenth century; so, let me again tell you this paragraph was given to the participant he read it out and then what he did some questions were asked and based on those questions he was asked to come up with a summary and some questions he made some sentences his verbalizations were recorded and then classified and all these three steps like the open coding the actual coding and the selective coding were then carried out.

Let us see in detail and the paragraph is this. In the beginning of the nineteenth century, the American educational system was desperately in need of reform. Private schools existed, but only for the very rich and there were very few public schools because of the strong sentiment that children who would grow up to be the laborers should not "waste" their time on education, but should instead prepare themselves for the life's work. It was in the face of this public sentiment that educational reformers set about the task.

Horace Mann, probably the most famous of the reformers, felt that there was no excuse in a republic for any citizen to be uneducated. As superintendent of education in the state of Massachusetts from 1837 to 1848, he initiated various changes, which were soon matched

in other school districts around the country. He extended the school year from five to six months and improved the quality of teachers by instituting teacher education and raising their salaries.

Although, these changes did not bring about a sudden improvement in the educational system, but they at least increased public awareness as to the need for a further strengthening of the system. Now this was the paragraph that was given to a person to read.

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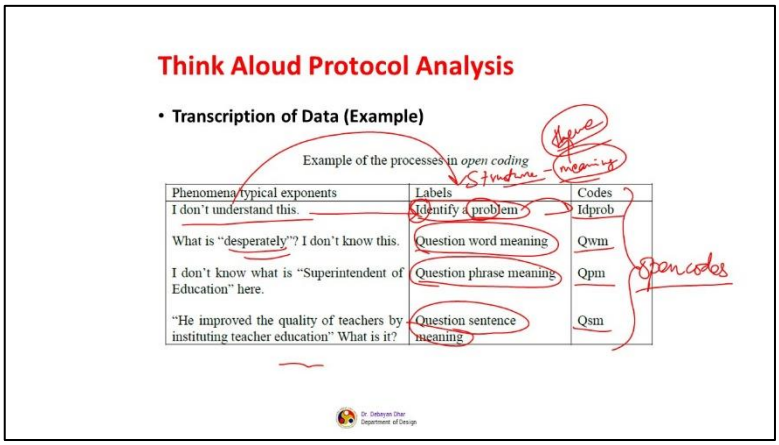

And then he was asked to explain or to communicate what he understood from this paragraph. What you see in the left-hand side of the table are the verbalizations that this participant made and his verbalizations are I do not understand this. What is desperately? I do not know this. I do not know what is superintendent of education here. He improved the quality of teachers by instituting teacher education, what is it?

So, see these are the verbalizations that was captured by the recorder by the recording session and then what we did is that we use this verbalization to identify the labels. Now, when he says that I do not understand this: it means he is trying to identify a problem he is not very clear, he is still in confusion.

So, we use the label that this means he is trying to identify a problem. What is desperately? I do not know this. He is trying to question the word meaning. This means questioning word meaning, then I do not know what is superintendent of education here. Again, he is questioning the phrase meaning. He improved the quality of teachers by instituting teacher education, what is it? He is again questioning sentence meaning right.

Now, all these labels we now used acronyms like idprob; that means, id for identify and problem prob for problem. So, these are the codes that we have came up with and that is what we call as open codes right. So, what we did is that we transformed these sentences into a structure into a structure based on its meaning, it can be a theme also right and then these are converted into these codes. So, the codes are acronym of the labels that is called open coding.

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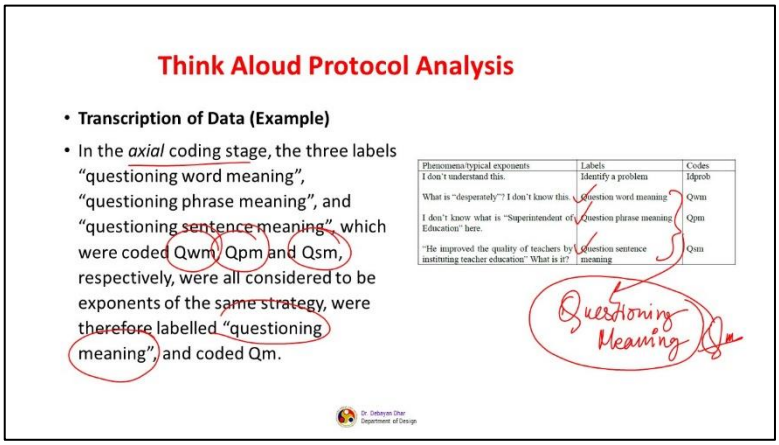

The next level is axial coding. Now, in the actual coding stage the three levels questioning word meaning; that means, this these three levels know. We have these three levels. Questioning word meaning, questioning phrase meaning, questioning sentence meaning, these three labels were coded which were coded as; were coded as Qwm Qpm and Qsm. They were all considered to be exponents of the same strategy because they are questioning certain things, though they are questioning different things.

So, questioning word meaning is different than questioning phrase meaning and questioning sentence meaning, but the essential theme is about questioning only. So, they were labeled as questioning meaning. So, the axials coding now what we did, we clubbed them together and said that these three actually is converted into questioning meaning right. So, Q m probably; so, that was the axial coding.

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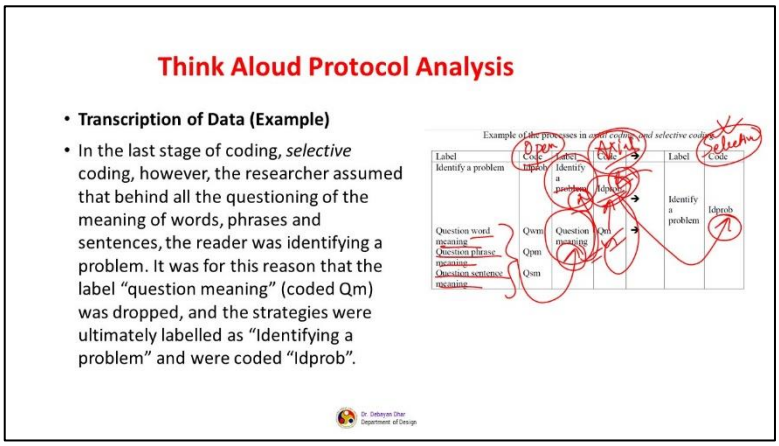

Now, what we will do is that see. So, this was the open coding, this from here we went to axial coding and now what we are going to do is that we are going to come up with the selective codes and how we do that let us understand this process. Now, in the last stage of coding the, it is known as the selective coding.

The researcher assumed that behind all questioning of meaning of words, phrases and sentences the reader was identifying the problem. So, essentially what we are saying that he is questioning all this thing, he is questioning the meaning he is of the word meaning he is questioning the phrase meaning, he is questioning the sentence meaning. All these are related to questioning meaning only and he is doing this because he wants to identify the problem.

So, if we focus on identification of problem as a theme or as a strategy all these about questioning meaning becomes a, sequential process that are being performed in order to identify the overall objective of identifying a problem. So, this becomes the selective code. So, now we had this.

So, from the axial coding stages we had these two codes which is identifying a problem and identifying and the question meaning that is i d p r ob and the Qm now we understand that this Qm is also part of idprob and we feel that idprob is the essential focus on which if we address this or we if we consider this naturally all these aspects are being addressed.

So, therefore, this is taken as the final selective codes. Now, since you are selecting this out of the various other codes that are available to you in the actual stage therefore, it is

called as the stage for selective coding right. That is the process of how you do a qualitative analysis using the coding strategies.

So, think aloud protocol analysis has two aspects. The aspects are how do you conduct an experiment ask your respondent to think out loud concurrently or in retrospection and then you record those verbalizations you transcribe this data and use this data to analyze it in terms of open codes axial codes and selective codes.

The selective code that you get provide you with the focus of the design team or the design brief or the opportunity areas that you are looking for. That is how you analyze the qualitative data or this kind of data for further interpretation.

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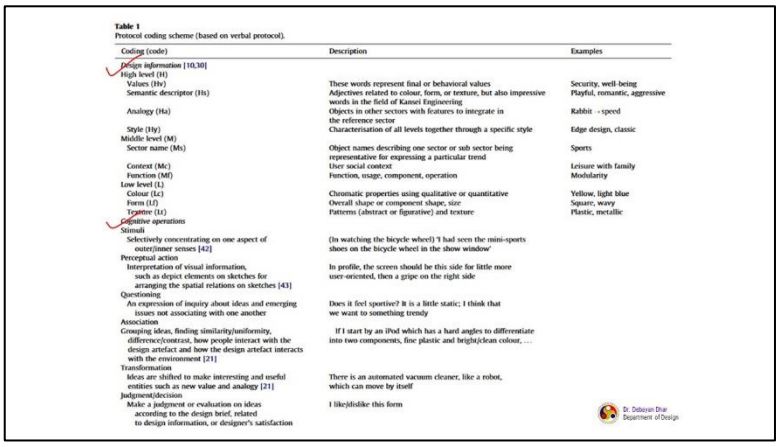

Table 1
Protocol coding scheme (based on verbal protocol).

Coding (code)	Description	Examples
Design information [10,30]		
High level (H)		
Values (Hv)	These words represent final or behavioral values	Security, well-being
Semantic descriptor (Hs)	Adjectives related to colour, form, or texture, but also impressive words in the field of Kansei Engineering	Playful, romantic, aggressive
Analogy (Ha)	Objects in other sectors with features to integrate in the reference sector	Rabbit - speed
Style (Hy)	Characterisation of all levels together through a specific style	Edge design, classic
Middle level (M)		
Sector name (Ms)	Object names describing one sector or sub sector being representative for expressing a particular trend	Sports
Context (Mc)	User social context	Leisure with family
Function (Mf)	Function, usage, component, operation	Modularity
Low level (L)		
Colour (Lc)	Chromatic properties using qualitative or quantitative	Yellow, light blue
Form (Lf)	Overall shape or component shape, size	Square, wavy
Texture (Lt)	Patterns (abstract or figurative) and texture	Plastic, metallic
Cognitive operations		
Stimuli		
Selectively concentrating on one aspect of outer/inner senses [42]	(In watching the bicycle wheel) 'I had seen the mini-sports shoes on the bicycle wheel in the show window'	
Perceptual action		
Interpretation of visual information, such as depict elements on sketches for arranging the spatial relations on sketches [43]	In profile, the screen should be this side for little more user-oriented, then a gripe on the right side	
Questioning		
An expression of inquiry about ideas and emerging issues not associating with one another	Does it feel sportive? It is a little static; I think that we want to something trendy	
Association		
Grouping ideas, finding similarity/uniformity, difference/contrast, how people interact with the design artefact and how the design artefact interacts with the environment [21]	If I start by an iPod which has a hard angles to differentiate into two components, fine plastic and bright/clean colour, …	
Transformation		
Ideas are shifted to make interesting and useful entities such as new value and analogy [21]	There is an automated vacuum cleaner, like a robot, which can move by itself	
Judgment/decision		
Make a judgment or evaluation on ideas according to the design brief, related to design information, or designer's satisfaction	I like/dislike this form	

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Now, in this slide what you see is that I have identified some of this code now. There is an interesting way of code this coding strategy either you can come up your own codes completely or what you can do, you can refer to this codes that you can see here. You will see that I have you from a paper I have taken this code and this code relates to something called design information cognitive operations right and you can use these codes if you can find out the themes from the data that you have and then if you can relate them to this code.

So, instead of getting generating your own codes you can use this code as reference and see if this exists in the transcriptions and then you can identify them and that will ensure that you have a very specific directed selective codes that can be related to the design brief.

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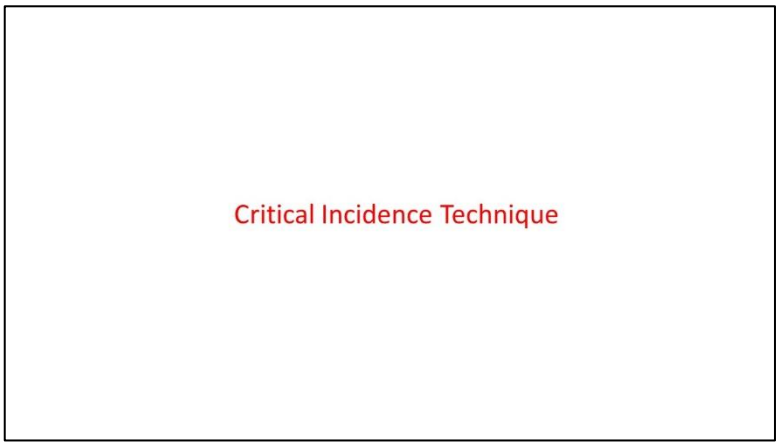

So, now after discussing this think aloud protocol analysis, we the next technique that we are going to discuss is the critical incidence technique. This is a very interesting and very carefully thought out technique that are used by interviewers or putting or asking questions to their participants.

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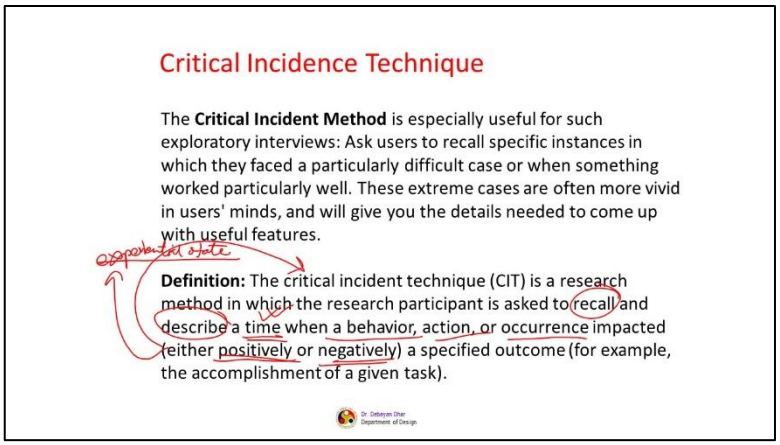

Now, the critical incident method is especially useful for exploratory interviews ok. You need to ask users to recall specific instances in which they faced a particularly difficult case or when something worked particularly well. Now, these extreme cases are often more vivid in users minds and will give you the details needed to come up with useful features right. So, what is the definition of critical incidence technique? So, the critical incidence technique is a research method in which the participant is asked to recall and describe a time when a behavior action or occurrence.

So, this is important, we are asking the participant to recall and describe a time ok. When he executed a behavior action or occurrence that impacted; now this is what we are defining as the critical aspect that impacted either positively or negatively, the experiential state. So, we are focusing here about the experiential state right, a specified outcome right.

So, for example, accomplishment of given task. So, what essentially, we are trying to say that your memory if you relate to the theory of self Professor Daniel Kahnemans work that we have referred to in our earlier lectures. You would realize that the objective of your remembering self is to record critical incidences whether it is a extremely negative experience or whether it is a extremely good experience.

Now, so, your memory essentially is anecdotes of these experiences combined together. So, when you use this technique when you ask questions regarding a time-based situation where you asked the participant about a time when a critical incidence has occurred; that means, an extremely positive and extremely negative experiences has happened. You were essentially trying to understand the reasons behind those experiential states in terms of what was the behavior that triggered that experience, what was the action that was performed by the user and what was the occurrence.

So, with these we understand the extreme situations and we try to focus on addressing these extreme situations, because remember that it is the remembering self that influences the mood of a person. How he is going to remember a person or a product for the rest of his life. It depends on the experience when the last interaction the end was there the interaction ended the exponential state and the peaks and the troughs, the extreme peaks and the extream troughs according to self theory of Professor Kahneman.

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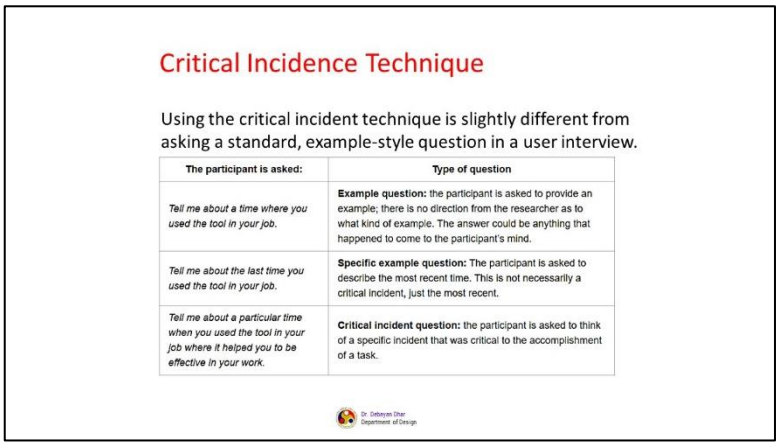

So, using the critical incident technique is slightly different from asking a standard or an example style question in an interview. What you can see in this slide is a table where the participant is asked like tell me about a time where you used the tool in your job. Now what is the type of question is this? The participant is to is asked to provide an example.

Now, there is no direction from the researcher as to what kind of example he is trying to understand. The answer could be anything that happened to come to the participants mind. So, there is no direction specific direction that is given to the participant in order to respond. The participant is asked tell me about the last time you use the tool in your job right.

Now, the participant here is asked to describe the most recent time. Now, this is not necessarily a critical incident; it is just the most recent one. Then the participant is asked tell me about a particular time when you use the tool in your job where it helped to be effective in your work. Here also the participant is asked to think of a specific incident that was critical to the accomplishment of a task. So, here you can see we are asking about incidences either had a peak or a trough we are focusing on the remembering self.

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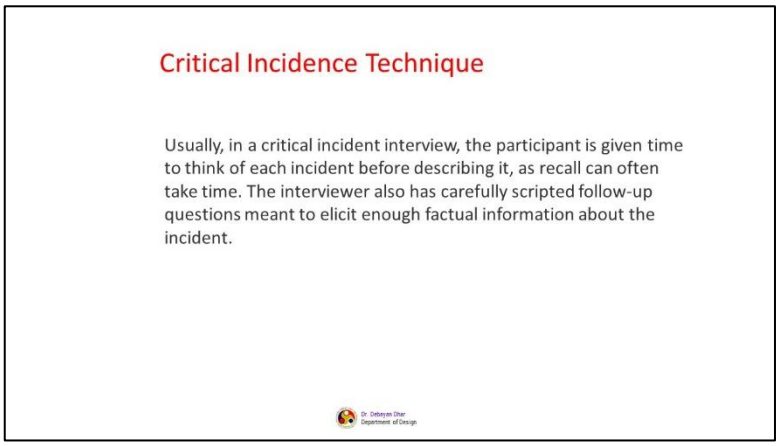

Now, usually in a critical incident interview the participant is given time to think of each incident before describing it, as recall can often take time. The interviewer has also carefully scripted follow up questions meant to elicit enough factual information about the incident.

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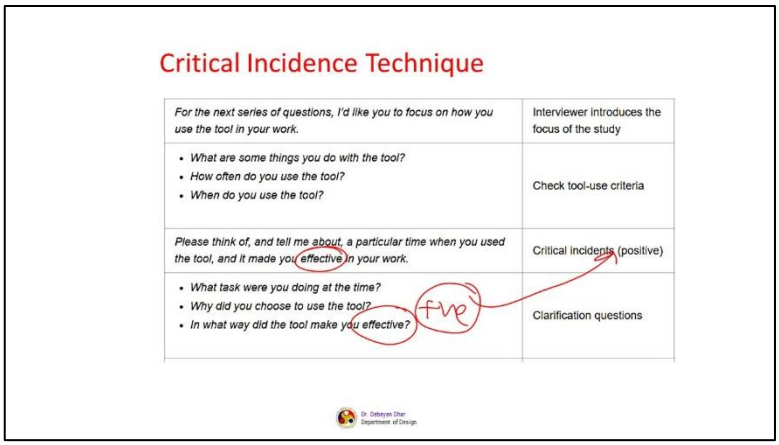

What you see here is a successful critical incident technique that has been employed using specific questions, let us see this. So, for the next series of these questions that you see in the table I would like you to focus on how you use the tool in your work. Now, this is the statement of an investigator who is asking these questions to the respondents.

So, the interviewer introduces the focus of the study. What are some things you do with the tool? How often do you use the tool? When do you use the tool? These are about

identifying or checking the tool use criteria. Please think of and tell me about a particular time when you use the tool and it made you effective in your work.

See gradually once the check tool use is done, the tool use criteria are identified the focus is now in trying to understand the critical incidents that are positive effective, we are essentially trying to understand the positive critical incidence. What task were you doing at that time? Why did you choose to use this tool? In what way did the tool make you effective right? So, the focus is on effectiveness which is a positive criterion and therefore, these incidences are the critical incidences that get recorded. So, we are trying to understand those critical incidences.

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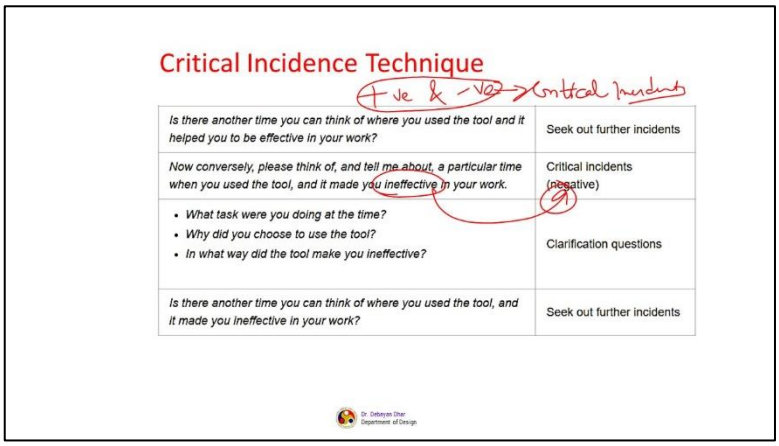

Is there another time you can think of where you use the tool and it helped you to be effective in your work? You are trying to understand any other critical incidences that are positive that has happened or not. Now, conversely please think of and tell me about, a particular time when you use the tool, and it made you ineffective in your work. See now the focus is on negative.

So, you are inquiring both the positive and the negative critical incidences right. What task were you doing at that time? Why did you choose to use the tool? In what way did the tool make you ineffective?

So, these are the clarification questions that are asked in order to understand the critical incident that happened. Is there any another time you can think of where you use the tool and it made you ineffective in your work? So, again after he or she explains to you a particular negative critical incident after seeking the clarification question the next

question that you ask is to further look for any other critical incidence be it positive or negative it happened and to seek for further clarification questions.

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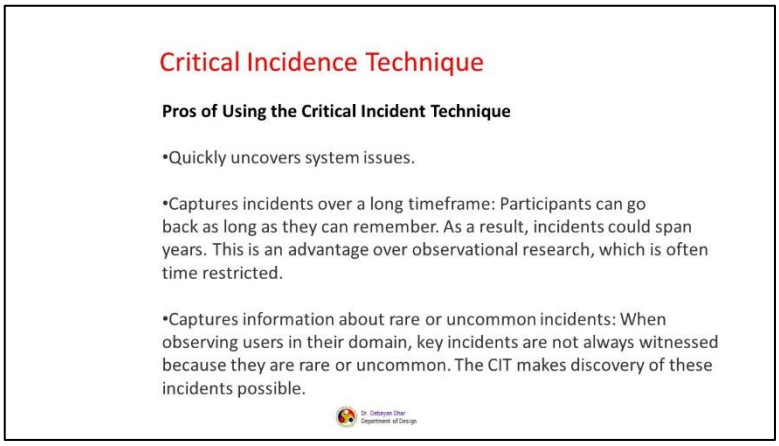

Now, what are the pros of using this critical incident training? You know it first of all quickly uncovers system issues you know it captures incidents over a long time frame. So, participants can go back as long as they can remember as a result incidents could span years this is an advantage over observational research which is often time restricted.

So, observational research like contextual inquiry is time restricted you might not be able to identify issues or breakdowns if you remember the way we discussed when we talked about contextual inquiry, but then here you have a technique which will allow you to extract those critical incidences that you are looking for, the critical incidence technique.

It captures information about rare or uncommon incidents. When observing users in the domain key incidents are not always witnessed because they are rare or uncommon. So, therefore, in these situations the critical incidence technique makes discovery of these incidents possible.

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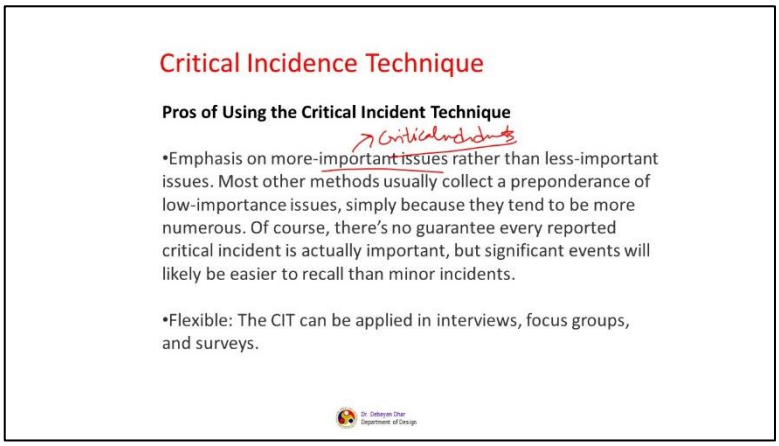

The emphasis is on more important issues rather than on less important issues and the more important issues are what? Are on the critical incidents right. Most other methods usually collect a preponderance of low importance issues, simply because they tend to be more numerous. Of course, there is no guarantee over reported critical incident is actually important or not, but significant events will likely be easier to recall than minor events that is what we are we have discussed about when we talked about the self theory of Professor Daniel Kahneman.

Its flexible the critical incidence technique can be applied in interviews, it can be applied in focus groups; it can be applied in service. It can also be applied in any other even in think aloud protocol sessions also when you are trying to understand the practice. You can focus whether any critical incidence has just happened when you are asking retrospective questions.

You can see that the experience that he had recently did not had any critical incident there, but if you are doing it concurrently probably you cannot ask those questions because whatever things he will experience he is going to tell you that.

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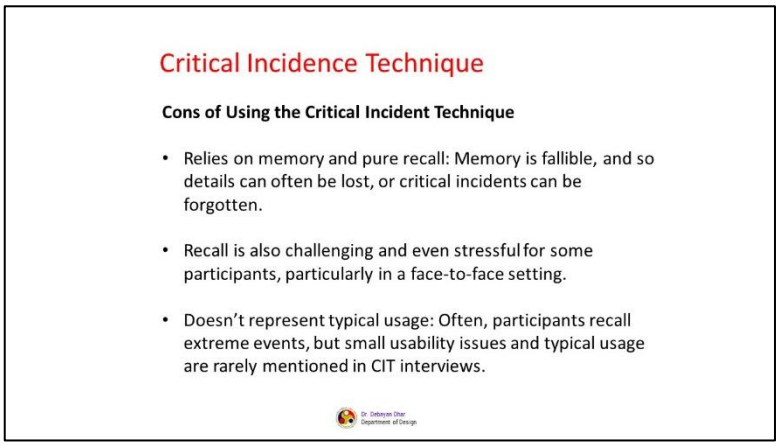

Now, what are the cons of using the critical incident technique? Now it relies on memory and pure recall. So, memory is fallible and so details can often be lost or critical incidents can be forgotten. Recall is also challenging and even stressful for some participant, particularly in face to face setting. Does not represent typical usage. So, often participants recall extreme events, but small usability issues and typical usage are rarely mentioned in CIT interviews.