Psychology of Learning

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Lecture – 12

Memory and Cognition (Contd.)

Hello viewers, welcome back to this NPTEL course on the Psychology of Learning. So, in this class, we will be discussing the memory information processing model of the working memory. So, it is similar to models we have done before. We discuss now what is information processing how do we process the information starting from the sensory register to short term memory to long term memory etcetera. So, there are little bit sensory memory, sensory memory to short term memory and short term memory to long term memory and this central processing unit is there. However, what are the different functions different capacities characteristics features of each type of memory that we will discuss right now.

So, this is Atkinson Shiffrin's model of encoding, storage and retrieval. This information processing approach is being considered as the standard model of memory. How the brain functions while in the memory activities while remembering the things and how it operates and functions to retrieve the information all these things. So, as we have already discussed that is the incoming information from the environment is sensory memory that is the information that we collect organs through different sense organs. And thereafter given attention, thereafter with the attention, it enters into the short term memory or working memory from there again with the further elaborations, further practice, further rehearsal, etcetera that is the at this stage encoding and storage takes place and thereafter it goes to long term memory.

However, this activity this process mechanism is two ways that short term memory to long term memory it goes and in return also it back to the working memory. However, later on, some researchers have added that when we try to retain information in the short term memory when the when we try to retain the information restore the information through elaborative rehearsal practice etcetera like for example, that is also called as the working memory. Working memory means suppose for a it is like a working platform. So, with attention it has entered into short term memory, but when we start functioning working on this, suppose the problem is at hand unless and until we solve that problem, it is still with us then we still remember that. So, that is called as the working memory.

Working memory works up to the time we retain it, that is, until we finish the task. So, that is a short-term memory. It is also defined and narrated as the working memory. Working because still we are working on the content. So, that is why working memory. And during this stage the information is there in the working memory. So, maintenance or rehearsal works goes on like you know all kinds of the activities: elaboration or cognitive analysis all kinds of activities takes place unless and until we finish the task. So, once it is completed, is finished then it goes

to   the   long   term   memory.

So, when so, long as the information is there in the working memory. So, all these activities the rehearsal activity analysis thinking all these things two ways processes because whenever we whenever we try to resolve the conflict or the problem. So, we definitely we refer back to the long term memory whether there is there any problem any is there any formula is there any technique is there any strategy is there any clue. So, we refer back to the long term memory try to retrieve it then again try to use it for resolving this issue some challenges or the problems whatever it is there. So, similarly maintenance or rehearsal activities are ongoing CPU is giving   one   or   other   kinds   of   the   strategy   to   implement   it.

So, unless and until is properly encoded. So, it unless and until it is properly finished from completed it is still working we are still working our brains still works on it that is why it is called the working memory. So, once it is lost when it is lost? Lost if not encoded or rehearsed properly. Suppose we have received it from sensory memory to short term memory, but we did not work on it we did not try to retain it then it will be lost then it is simply it stays for few minutes or second something after that. But once we think that now for example, the before the exam suppose we are now that means, the timetable has come up or the content syllabus has   been   given   to   us.

Suppose we have gone through it, but we do not take it seriously and start working upon it then it will be lost it will we will forget it similarly any information unless and until we start working upon it in depth through rehearsal elaboration narration explanation whatever then it is not going to be properly encoded. So, with proper rehearsal elaboration it is once it is get properly encoded then it will be stored into long term memory. So, from this encoding and storage then it moves on to the long term memory. Encoding is that encoding failure means forgetting at this stage if we forget if we forget means encoding has not taken a place properly. And the long term memory forgotten retrieval failure theory is there in then how does the   forgetting   takes   place   again   it   has   many   theories   like   retrieval   failure.

We are not being able to retrieve it we not interference may be there are some other factors some other learning material some other events have interfered may be decay theory because for the long time we have not used it unused for a longer period of time lack of practice and use that also causes the decay even brain damage also brain damage also takes place if biologically brain damage takes place that is also another reason of forgetting. So, we are not going into the forgetting there may be n number of reasons for forgetting. So, this is the basic structure of Atkinson and Shiffrin. Now, let us see again now when we talk about the sensory registers through sense organs we register the information yes sensory register all are 5 sense organs eyes nose skin and tongue and all the 5 sensory organs are there. So, what is that sense when the information comes through our sensory organs suppose we have listen something some auditory signal is coming some visual things are coming or some kinesthetic things   are   coming   some   test   then   we   tackle   things   are   coming.

So, it has also the capacity to hold the information for certain time. So, some in some cases it may be like for in comparison to visual auditory may be the capacity may be little bit different may be longer. So, it has a limited capacity when saw. So, sensory registers has a

limited capacity capacity may be that many information can come in, but duration 1 to 3 seconds it retains there may be from different sources many information can come up, but it stays there duration is 1 to 3 seconds. Content is that suppose raw sensory data that is the raw sensory data encoded in the same form as perceived.

Now, whatever we see you have perceived we have seen that is the raw data whatever content that we receive as it is. Then the nature of recognition is that noting the key features of the stimulus and relating them to already stored information. Then suppose may be it is suppose it is the musical tone then we try to recollect assimilate it which is retrieved which is already stored in our memory. So, with the that means, how do we recognize that stimulus whether it is a novel one or it is a known one. If it is a music tone then we try to relate oh may be this is from that this is it is similar to that or if it is completely unknown then it is the we do not we would not be able to recognize it.

So, the nature of recognition that we try to relate it to our existing stored information. Then the impact of attention suppose we have gone through we have received it, but would not attained it. So, attention means it is selectively focusing on that particular photo. Suppose we have gone through some clips visual clips or some pictures some paintings etcetera. So, that is suppose we have just gone through casually then we did not attained to it we did not remember it we would not remember it fits.

So, here impact of attention is that selectively focusing on certain things. So, on the portion of the information and currently stored in the register. So, suppose we have gone through very good. So, we actually we stay for a longer period of time because we like it may be we like it may be we feel that we have somewhere I have seen it earlier. So, some can because of some or other reasons now we could now we are focusing our attention on that picture that visual clip that stimuli.

Then we stored stay back there the focus or attention try to recollect try to recognize it try to find out the where I have seen it earlier all kinds of this activities. So, then only from the sensory register then it will enter into our system. So, what we attained is what we attained to is influenced by the information in the long term memory. So, yes of course, because whenever we are exposed to different kinds of visual stimuli. So, whether to attained this or not whether it is really relevant to me or not whether the meaningful or to me or not whether I can I can I stay learn it or remember it for not whether to remember it attained to it or not it is being command is coming from the long term memory.

That is in the long term it is in our system it is already there what to do what not to do because we have already developed a kind of you know principles or guidelines like yes I am interested in this. So, I will focus my attention in this way. So, that is called actually called the selective attention. The way the selective attention we focus to those things that we would like to do because the we are receiving any signal from the long term memory that yes you attended. So, then only we attained to it.

So, after attention selective attention focused attention then we try to perceive it going to the depth of it. So, in the sensory register then it once it is decided now we are attending it we

are focusing then it will go to the short term memory short term. Again if a information after this passing out from the sensory register. So, when it goes to short term memory it has again limited capacity it has a limited capacity like just now for example, short term memory is remembering that is 7 plus plus minus 2 7 plus minus 2 like chunking information. So, suppose in suppose in the visual there are differences in the visual visual capacity short term capacity and auditory short term capacity.

So, visually that is 7 plus minus 2 that means, at a stage when we look at the look at the some letters or alphabets the phone numbers etcetera. So, we remember maximum 7 7 may be plus 2 or minus 2 may be 5 5 digit can we can only remember or may be 7 plus 2 also in case of higher higher memory span some people can also remember 9 things. So, 7 plus minus 2 otherwise what happens in a in terms of a longer longer longer digit pattern. So, we group it chunking it that is grouping. So, that is a suppose for example, in a mobile numbers all the mobile mobile numbers are 10 digit numbers how do we remember then how do we remember then 10 digit number because we chunk it group it oh this is the code this is the number this is the code this is the number.

So, then it can it can help us in an in remembering the 10 digit number ok. And duration it stays there for 20 to 30 seconds content is that what what we are currently thinking about the information from the register sensory register and information from the long term. So, when the receiving information from the sensory register get connected with the long term memory information then then we decide whether to rehearse it do it remember it or not. So, that is the content that means, just now whatever we have received and when we try to get the meaning what related to the long term long term stories with a long term stories of the queue that are we are getting from the information we are getting from the long term memory. Then rehearsal and maintenance rehearsal is for the maintenance because because rote rehearsal sometimes what happen some number some numbers we just just to remember for a longer period of time either we note it down somewhere or we just utter it again and again.

So, 94347, 94347, 9537, 9537 similarly. So, we maintain a rote rehearsal also takes place repetition takes place sometimes we note it down somewhere. So, in this way we try to maintain do some kind of rehearsal to retain it for a longer period of time. So, information is repeated over and over again with no effect on the long term memory. So, that is what in this repetition it is not that that will be stayed there in the short term memory for a period for a for a for a certain time not just instantly within it will not you know it will not be vanished after 30 seconds just to more retain it for more than 2 minute 1, 2 minute, 3 minute, 5 minute or maybe 1 day 60 minutes or 1 day.

We just for that matter for that reason we just do it rehearsal maybe 10 times, 14 times, 15 times, 25 times or after going back to home we then write it down somewhere. So, but it has nothing to do with the long term memory at that moments. So, then elaborative rehearsal takes place. The rote rehearsal it is it stays for a for a period for a specific timing, but for the elaborate rehearsal if you work on this elaborative coding that is new information is related to the knowledge already stored in the long term memory. We try to you know add on something we that means, we try to restructure it reorganize it as per our you know as per our suitability as per our understanding like for example, suppose a new content that we have been

how to remember it is something suppose it is a very difficult thing.

Suppose it is a very yeah either it is a very difficult subject content like math or science or physics content or maybe it is something foreign language content suppose foreign language. So, how to remember how to remember the difficult content because we are not familiar with and we do not have any backup in the long term memory how can we remember it. Then we start coding it in our own preferential way that means, suppose maybe for in Chinese word something something some for something we just give another clue. So, another clue. So, in this by giving the cues and the clues we so, that is the you can say we formulate a set of coding a kind of coding things set of code language code narratives as an extension of that   content.

So, that by looking at this thing this means tree this means see this means fish this means house in this way try to remember the novel words. These are again the this is again these are again the mnemonic strategies that we use for remembering the unfamiliar things or known things foreign language so many things. So, that is called the elaborative rehearsal either we write it know before the examination suppose the topic is very difficult sometimes we also draw a map concept mapping mind mapping concept mapping from this is the concept this is the these are the function these are the dimension these are the branches in this we try to draw it in a pictorial or you summarize it in a pictorial form concept mapping. So, in this that is called the elaborative rehearsal we make the rehearsal elaborate extensive meaningful for us so, that we can retain it in the long term memory. So, organization so, that you putting the interrelated pieces of information into chunks either in the suppose if it is a numerical number things data type things then how to chunk it group it into different things.

So, the meaningfulness how to add the meaning to the new information by giving some clues by giving some pictures pictorial signs pictorial in symbolic way in a coding way in giving by giving the some cues. So, visual imaginary coding the generating the images in our mind objects ideas and actions suppose. So, for example, when by giving a pictorial picture in an imagination. So, we try to remember certain things by giving some cue means for example, suppose when we are visiting a new place the new city unknown place. So, how to remember that location by giving those you know these are the landmarks these are the this house   this   tree   this   building   this   tower   this   tower   in   this   way.

So, that is the visual imaginary coding generating the create kind in generating the kind of mind map in our within our self by creating the different images that we that we give to give the we select and give for our benefit. So, that comfortable easily conveniently we can remember it. So, visual imaginary coding imaginary coding dual coding theory dual coding theory in the both way that is both in the auditory way auditory way you are also memorizing it in the visual way also that is the visual and auditory primarily you know two active mode. So, dual coding is that we are also phonologically auditory mode we are also remembering it and at the same time visually measuring. So, visual we also we are also remembering.

So, implications of this implication for this is that for this how does it affect influence or it has implication for the education for the instruction the short term memory and its control

processes implications are the how to that means, how to you know retain the information or how to do certain kind of rehearsal how to make the students work hard practice certain things. So, that they can remember the things learning material for a for a longer period time one such technique is a rehearsal. Rehearsal is a rehearsal prevents the quick disappearance of the information from short term level. So, rehearsal most children actually they do not begin to rehearse on their own. So, that is a you might have observed that in the primary school in the nursery school primary level it is more of mugging off it is more of rehearsal more of mugging off because first thing is that they do not that brain development has not taken place in a such a to a higher with a high maturity level because they are at the tender age of childhood.

So, how can they remember with the by by surely practicing the rehearsal rote learning kind of thing they can remember the thing. So, so that that approach the rehearsal approach is being used at the primary level at the when the children they are exposed to the learning materials or the formal education. Then next is that organization then we try to organize the group organize the whole things learning materials either in terms of like the children when they first they go through the picture books and learn the alphabets and the you know try to color about the color shape size. So, they are being asked to categorize it like the in terms of color in terms of shape in terms of fruits in terms of animals in this way. So, that is organization they start organizing   the   thing.

So, that they can remember and organize the material then can chunk it group it and then can remember it. So, meaningful learning also takes place when the learner relates the new information to the prior ideas maybe this just example. So, they like for example, when they are exposed to a new or tourist tourist tourist tourist spot. So, where they are where they are witnessing a kind new kind of you know waterfall or any you know on forest kind of things. So, they try to you know that they try to try to connect it to their previous experience like previous experience maybe that in earlier they might have visited some other places.

So, for example, you know so, for example, the best example I could see that suppose the child when they grow up when initially they have just seen some kind of you know vegetables green vegetables at home and very often being used that we green it is greens that we use you know food items. But when suddenly when they are exposed to for the first time when they are exposed to a dense forest or dense forest or you know very big garden etcetera. So, they just in at the very tender tender is they say that oh how many greens are there that means, in the vegetable in the thing in terms of vegetable items that is greens because in our house there are lot many greens are there and these are also similar. So, that this is a kind of assimilation that takes place in the in the childhood. So, later on when as they grow up and they they are get they get they used to get exposed to different kinds of situation then they are a simulation after a simulation then accommodation takes up then they differentiate know this is the kind of other things even though they are similar in terms of color, but this is the another group of stimuli this is the another event this is the another stimulus in this way they slowly and slowly they isolate they distinguish the discriminate about among the among the different stimulus.

So, visual imagery also is easier to recall the abstract suppose whatever it is given to them if

it is a learning material content etcetera if you narrate it in terms of picture pictorial story like story. So, visual so, that is and frame a mental picture then it becomes it becomes you know becomes very easier to remember. So, even for example, taking some abstraction some abstract ideas can be better organized in a in terms of the visual imagery for the long term retention. So, long term memory capacity is unlimited duration is permanent or you can say relatively permanent long term contents are it is that means, when the information get into the long term memory these are being stored as an schema. Schemata that is the plural of schema not just one schema multiple n number of schemas like we can say in the computer it is the data sets in the data sets similarly schemata means it ultimately it gets stored in the long term memory in terms of concept in terms of ideas in terms of schemata in terms of data set.

So, that is the content is not that raw content, but organized content is getting scored there ok. So, how the information is organized in long term memory that is schemata that is all the interrelated networks of associated ideas into which the new knowledge is assimilated. So, the schemata the new schemata may be that you are naming it as a new concept a new concept or you are consolidating it and naming it as a new concept because it the utterance of that concept or the idea of that concept itself in the when you recapitulate that concept means all the elaborated things automatically comes into your mind. So, then how then how well do we remember what we learn then again the thing is the whole processes more than 7 out of 10 studies report that 20 percent loss of what was learned what was learned. So, whenever again there are different you know levels of learning and ways of learning sometimes we learn very superficially sometimes we learn in depth sometimes we learn with different purpose like purpose you know suppose where our only purpose is to get over the examination section.

So, we accordingly you prepare hurriedly prepare etcetera do it deliver it and thereafter we forget it. So, different mechanism here depends on how much we remember it depends on how in which way we have learned it. So, subject matters that had higher range higher than average level of the unfamiliar facts which the students would have little relevant prior knowledge was associated with the increasing level of forgetting. So, suppose for example, when we are suppose you are learning a new language foreign language which is very on very uncommon it is not relevant to any our any of our known language neither it is like for example, European language if you know English then you can yes you can understand the German, Spanish etcetera etcetera. But suppose in our context suppose we are the Indian we are familiar with English, but suppose we are suddenly were exposed to Taiwan language, Mandarin language, Chinese language the it is completely it is no it is it is completely different that the they are in the pictorial forms ours in a in a different order.

So, it is very difficult. So, if the similarly if any content which is unfamiliar and we cannot relate it to our past learning experience or prior knowledge then the there is more likelihood of forgetting to take place or maybe that we need to put more effort to remember those things. So, most of the forgetting actually takes place within 4 weeks of the learning in the beginning in the beginning stage once we have learned something within 4 weeks within a month we will forget it unless and until we do extra rehearsal, extra activity or organization etcetera to remember it. So, less forgetting occurs in among the students who learn the material at a high level higher level that is at the initial stages suppose we have you

have just not just remember it through rote memorization you have also understand understood the whole thing by and writing the concept basic concept summarizing it with analyzing semantically pictorially all this if you have done all these exercises in the before at the beginning then you can retain it for the long time. So, that is why it is the educational implication is that we have to teach the students or the like the slow learners or maybe the average or the below average students how to put extra effort make more effort or rehearsal or practice   etcetera.

So, that it can be remembered for a longer time. So, less forgetting occur in the classes where the students were more actively involved. Similarly that is why we are introducing all these activities that is classroom discussion you know dialogue projects and group learning collaboratively because you have here we have to ensure that whatever they are learning they are also practicing it sharing the information exercising the queries exercising the information sharing the information analyzing the things and further engage in the discussion through question answer. Queries clarifying the queries further discussion further narration even dialogue and discussion or even having the having a debate also. So, this is that is the otherwise in this process that is why to engage. So, automatically it comes here not just how can we ensure that the things learning materials are being remembered to engage the students to engage the students in different activities and with engagement in different activities definitely   the   learning   material   will   be   retained   for   a   longer   time.

So, this is again the same thing the functional memory approach how the memory in the functional process. So, the executive processes like the problem solving and meta cognitions these   are   the things control processes like attention recognition chunking processes meaningfulness organizations. So, when control processes control processor does all these things chunking the materials in meaningful creating the meaningful organizations attention etcetera. Executive process further higher level of exercise is that problem solving meta cognition and reflective thinking all kinds of here comes all kinds of higher order thinking activities. And at the lower levels memory structure the sensory register decoding, short term memory encoding long term memory decoding decoding decoding and encoding short term memory then output and input is from the environment is a simple that how the memory function   system   functions   this   is   the   just   a   sketch   of   that.

So, another here another thing is that. So, if from input to sensory memory sensory memory to attention to working memory which is also known as the short term memory short term memory because it is a span is short, but unless and until we complete the task at hand. So, it still there it retains the memory still holds it for some time that is why it is called as the working memory and with the rehearsal elaboration, rehearsal practice etcetera then only it goes to the long term memory. And when the information there is there in the working memory platform then very on and off very often it relates to the long term memory for getting the queue and again practicing it applying it then again getting back the long term memory. So, this process is ongoing in this way after that once it is done with once it is done it is solved it is finished then it will it will go to the long term memory further. So, here so, from there only from short term   memory   to   working   memory.

So, the working memory model component comes in. So, here we can see how there is a

completely separate working memory model and how the researchers have elaborated: how this working memory model functions and how and what are its different systems and how it functions how what are its systems what are the strategies etcetera. So, here nowadays, for the researchers, the working memory has become very important. So, if we equate it to the intelligence models you have the PASS model like PASS model all the activities like planning attention simultaneous successive are there. So, after attention then when we encode the processes simultaneous processing successive processing again. So, you can say, this encoding process is very much similar. All these are activities are very much relevant for working memory   model.

So, we will discuss in the next class the detailed discussion about the working model for all our day to day activities like all our office work all our educational work all our assignments all our projects etcetera. Primarily our working memory is very vital because we on to retain maximum information and unless and until we complete the task we are engaged simultaneously with various projects various assessment assignment etcetera here. And we do not easily forget it unless and until we complete the task. So, that is why the working memory model has become very important. Working memory model system is very important. And in the next class we will discuss elaborately how this working memory model functions how effectively it can function what are the factors what are the channels what are the mechanisms and what are the action executive actions all these things we can discuss in the next class. Thank you very much.