Effective Engineering "Teaching" in Practice
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Lecture – 11c
Cognitive Development Theories - 2 Main Examples- (part - C)

Welcome back to the C part of the large chapter of accessing literature information. This is on Cognitive Development Theories, the two Main Examples, these are you know widely talked about popular and so on so forth. So, we will talked about these 2 main examples, there are probably others which will not look at in this particular short exposure, remember this is just an exposure, that we are giving you just a small peek that we are giving you.

So, that you can go into it based on your interest and pick up a lot more information, work on it, develop that and so on so forth; let us move forward.

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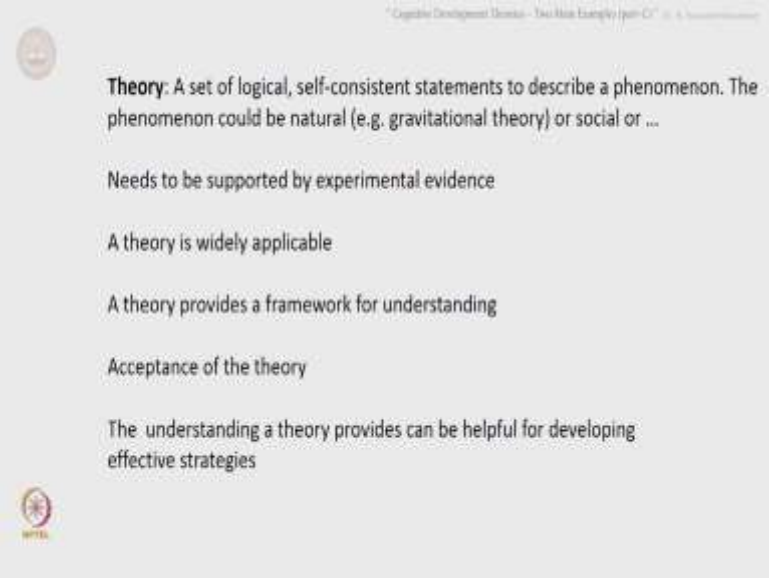

Again to reinforce, theory is a set of logical self-consistent statements to describe a phenomenon. The phenomenon could be natural as we know, the gravitational theory, the acceleration due to gravity being the same and so on and so forth or social and so on so forth.

The theory needs to be supported by experimental evidence, the theory is widely applicable and that is; what our attraction is towards it, we understand it so that we will be able to make sense of a large variety of situations. A theory provides a framework for the understanding, that is what we mentioned, the theory needs to be accepted, that happens over time.

The understanding a theory provides can be helpful for developing effective strategies.

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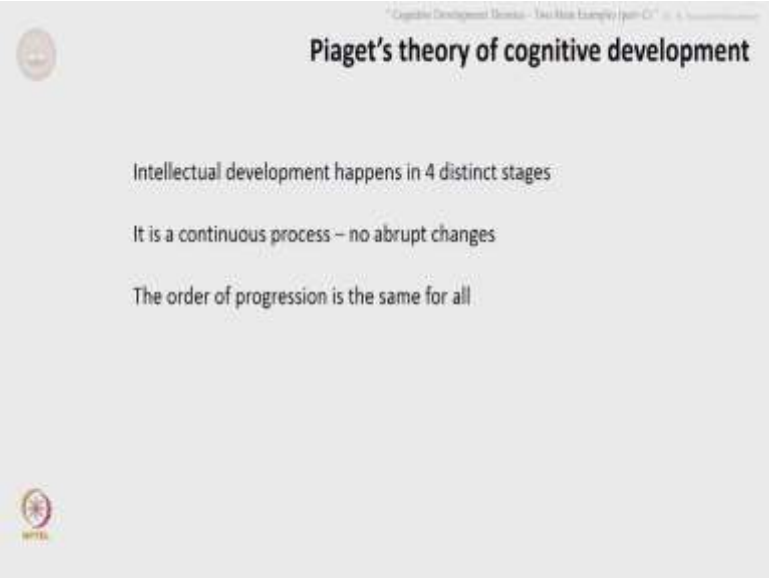

So, here this is a theory of cognitive development. Recall that cognition has something to do with thinking. In a Bloom's taxonomy, the cognitive domain right, the thinking and the mental aspects and this is a theory on how that ability develops from childhood up to an adult phase and the very popular theory is the Piaget's theory of cognitive development.

I am just going to mention this, I am not going to talk much about it because the objective here is to introduce you to this information, you can go and read more. Please do use the reference book, there is information on all these B, C and D aspects in the reference book Wankat and Oreovicz. Please go and read them first and then move forward from there.

So, the Piaget's theory says that the intellectual development happens in 4 distinct stages. It is a continuous process, there are no abrupt changes is what the theory says. The order

of progression is the same for all; however, the rate of progression could be different for each child, a child may be in 2 different stages,in different aspects at the same time.

These are what the Piaget's theory says and what it actually is something like this.

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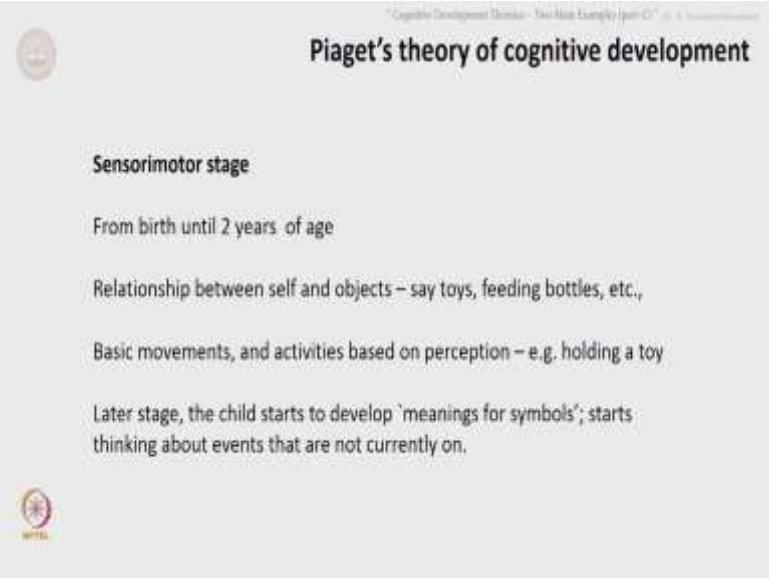

The various stages, the first stage is called a sensorimotor stage, from birth to about 2 years of age, you can relate this to what actually happens with most children. The relationship between self and objects is what comes about say toys, feeding bottles and so on so forth is what is predominant in this phase - the sensorimotor face.

Basic movements and activities based on perceptions such as holding a toy and so on so forth develop. The later stage in the sensorimotor stage itself, the child starts to develop meanings for symbols and starts thinking about events that are not currently on this starts happening.

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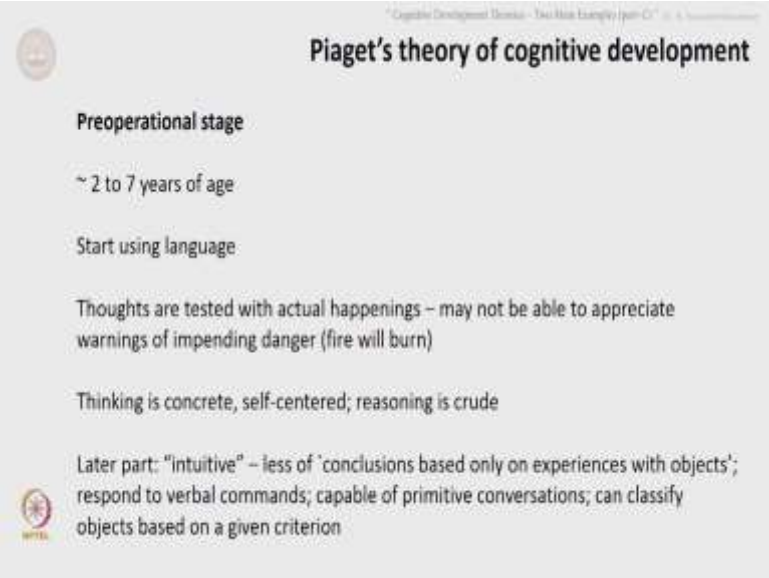

And the next stage is called the preoperational stage, in the preoperational stage or the preoperational stage is from typically 2 to 7 years of age, these are typical values, please keep that in mind. They start using their language, languages. Thoughts are tested with actual happenings. They may not be able to appreciate warnings of impending danger, you know fire will burn, may not make much sense to a child until the child goes and burns it finger or something like that, it should not happen, but that is the part of development.

Thinking is concrete, self-centered and reasoning a crude. In the later part of the same stages, the preoperational stage, the "intuitive" aspects coming, less of conclusions based only on experience with objects, that starts happening, they respond to verbal commands, they are capable of primitive conversation ,can classify objects based on a given criteria.

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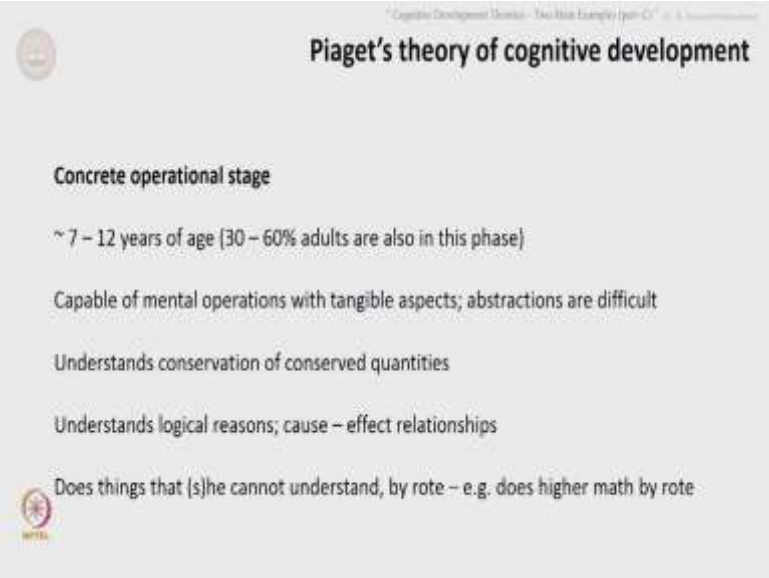

Concrete operational stage this is a little more relevant to us, the first two was for completeness, 7 to 12 years of age and 30 to 60 percent of adults are also in this phase that is, that is what the statistics say.

In this stage they are capable of mental operations and tangible aspects, abstractions are of course difficult, they understand conservation of conserved quantities, they understand logical reason, cause and effect relationships, they do things that they cannot understand by rote, if they are unable to understand something, they switch to a rote method of doing it, the approach to mathematics by some of the students is a very good example of this.

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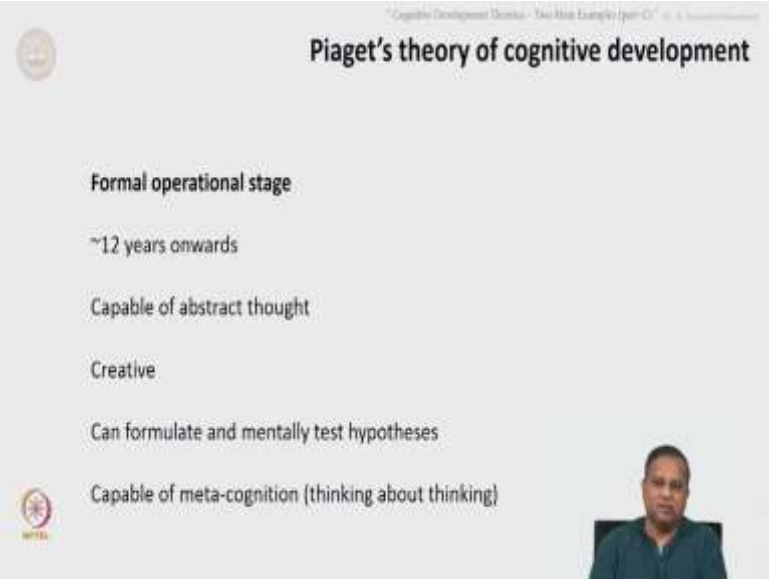

And the fourth stage is the formal operational stage, 12 years and above 12 years minimum and above, capable of abstract thought creative, can formulate and mentally test hypotheses, capable of metacognition which essentially means thinking about one's own thinking process.

This is the more advanced stage.

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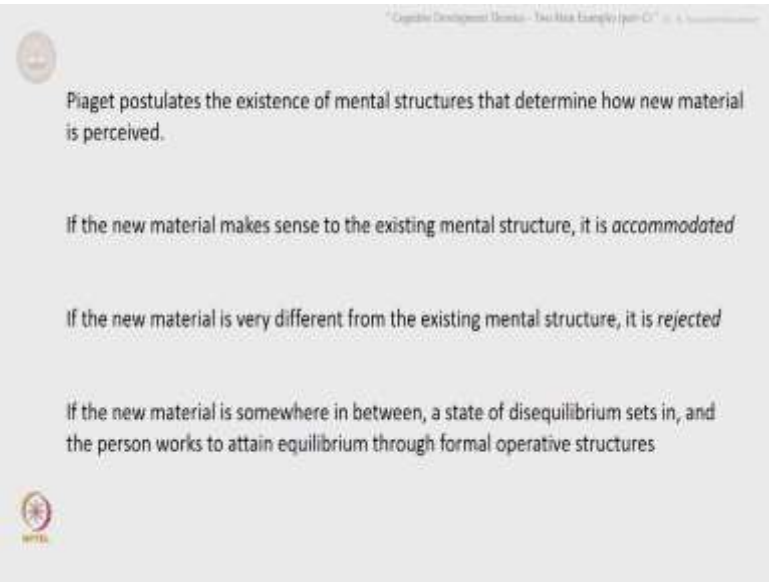

And Piaget postulates that the existence of mental structures, frameworks that determine how the material is perceived exist, the existence of that is what he postulates. If the new

material that the person is exposed to makes sense to the existing mental structure, it is accommodated, it is called, the person kind of accepts it, accommodates into his or her own mental structure.

If the new material is very different from the existing mental structure, then it is straight away rejected and if the new material is somewhere in between, a state of disequilibrium sets in, from acceptable or accommodatable to something that is rejected, this is a wide range of things. If it is in that range, if the new information is in that range, a state of dis-equilibrium sets in and the person works to attain equilibrium through formal operative structures, this is what the postulate of Piaget is or one of the postulates of Piaget.

So, to summarize, the sensorimotor stage until about 2 years, the child or the adult understands the world through senses and actions.

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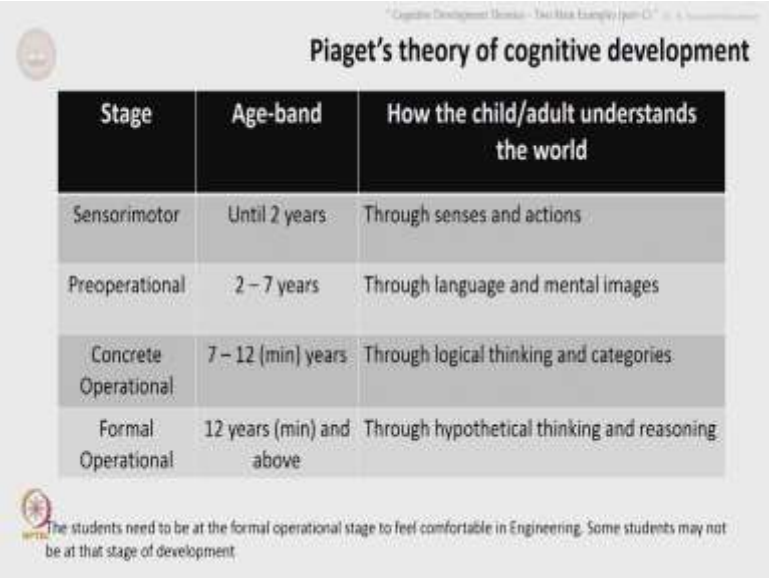

The preoperational stage is 2 to 7 years typical, the understanding of the world is through language and mental images. In the concrete operational stage 7 to 12 years some even adults could be in the stage, the understanding of the world is through logical thinking and categories and the formal operational stage is the final stage where the understanding of the world is through hypothetical thinking and reasoning.

So, the students need to be, this is how we could use it, the students need to be in the formal operational stage to feel comfortable in engineering, this is well known. Some

students may not be at this stage of development. If you find it so, then we could help them to make that transition.

The second example we talked about 2 common examples of the 2 common theories, the second theory or the model is the Perry's model, which talks about the development in college students. This was published in 1970 based on a study of one of the IVY League school graduates, or ivy league school students.

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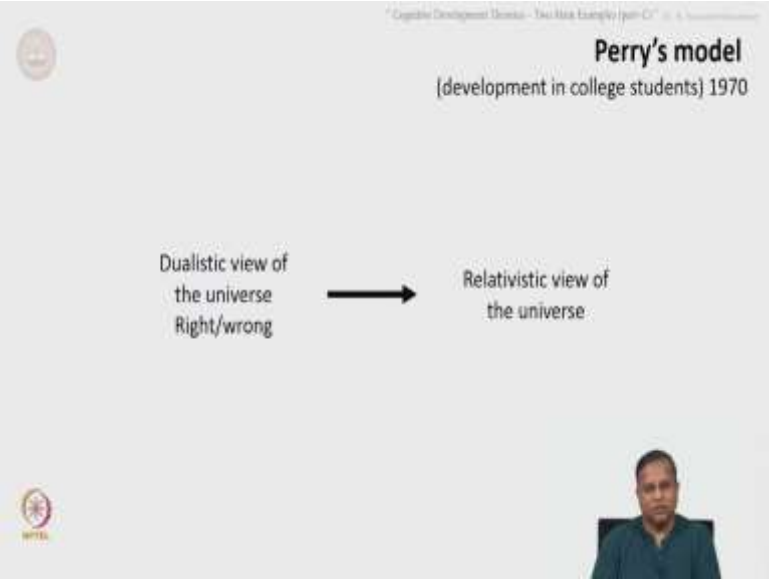

This looks at a dualistic view of the universe on one side either right or wrong, that is all. From there the person develops to a relativistic view of the universe, this is essential.

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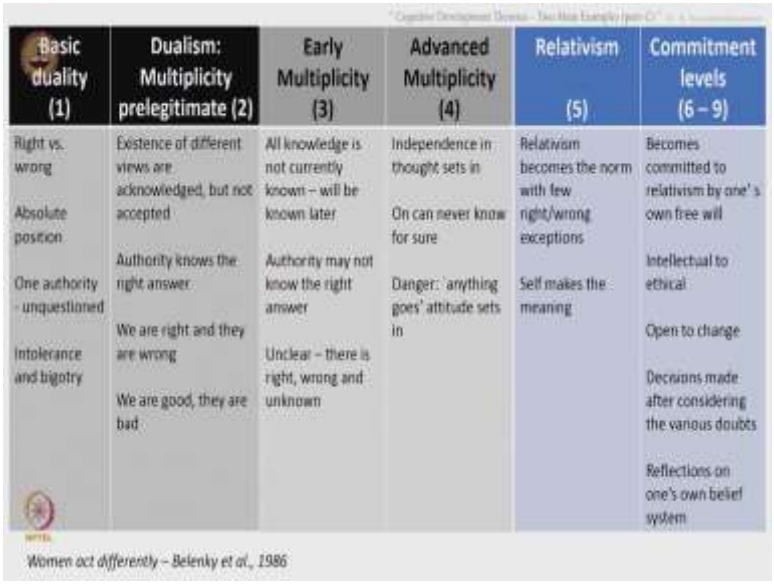

So, in the dualistic view, if we look at the various stages, it is right versus wrong, the positions are absolute. One authority unquestioned is what the person looks for, intolerance and bigotry sets in there, the essential aspects of that stage, the duality stage.

Dualism, multiplicity, pre-legitimate is the second stage where existence of different views are acknowledged, but not accepted, authority knows the right answer is the predominant thinking there, we are right, they are wrong. We are good, they are bad, this is the way in which people come across. You could relate this to what is happening in the world and you will understand where we are towards that side.

Then come the early multiplicity stage, stage 3, where a person realizes all knowledge is not currently known, will be known later, authority may not know the right answer. It is unclear there is right, wrong and the unknown is what the person is able to do give consideration for in stage 3. Then the stage of advanced multiplicity stage 4 where independence in thought sets in, one can never be sure, one can never know for sure also starts dawning on the person.

However there is a danger that anything goes attitude can set in, this is something to watch out for and help the student get out of that. You know a person has kind of resigned, whatever I do is not going to make much sense and therefore, I do whatever I want, that is a very dangerous side effect or a side branch that the person can take.

Instructors need to be a little careful about this, if you see a student getting in, just help the student out of that phase.

And then the more advanced stages, the fifth stage relativism, relativism becomes the norm where very few things you can categorizes as right or wrong, they are essentially exceptions, that becomes clear, self makes the meaning, this also becomes slowly clear to the person. And then commitment levels as they are called 6 to 9; there are 9 levels, various levels of commitment; the details are given in your reference book.

Here the person becomes committed to relativism by one's own freewill, intellectual to ethical, that is a transition that happens. The person becomes open to change, decisions made after considering various doubts, reflections on one's own belief system also happens.

So, you could see the development that is required and this nicely gives you the various stages in which it happens. Of course, this is one theory and it was found later by a Belenky; through a publication in 1986, the world came to know that women act differently from what is given here, that has been incorporated now.

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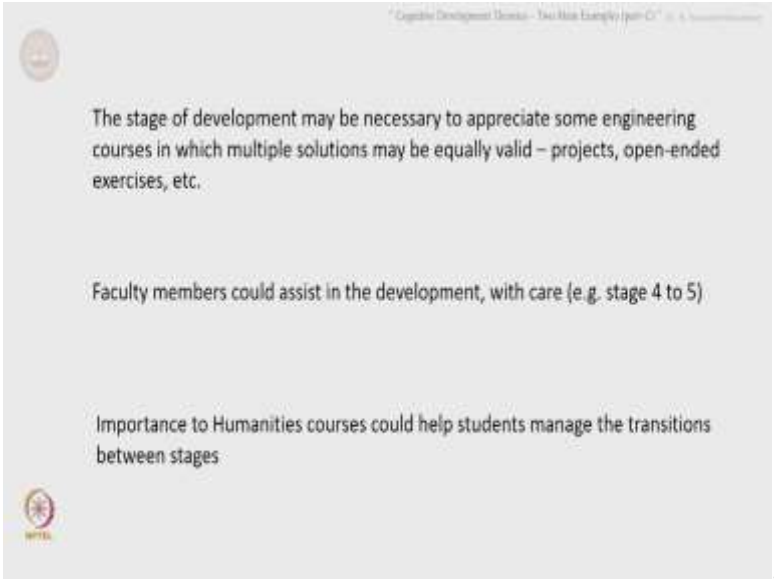

So, the stage of development may be necessary to appreciate some engineering courses in which multiple solutions may be equally valid for example, projects, open ended

exercises and so on so forth. So, this is how it becomes relevant to engineering education.

Faculty members could assist in the development with care as I mentioned from stage 4 to 5, where there is a danger of people bearing off, one can help. The importance to humanities courses could help students manage the transition between stages, very many people feel that humanities courses do not play a role in engineering, they are vociferously against it, but there is enough proof, enough enlightenment to know that they play a vital role, especially in this particular aspect one example has been given.

So, this is what I have now. In this short exposure, we looked at the theories of cognitive development, two of those. The first one, a very well-known theory by Piaget, which covers a wide span and then that by Perry, which looked at college students. When we meet next, we will look at the last part in this particular chapter of looking at or bridging the gap between theory and practice, we would start looking at the D part then, see you.