Constructivism and Conceptual Change - The Learning Process

Constructivism *refers to the way by which knowledge or information is stored in the brain.*

Nothing is ever recorded in the brain exactly the way it was experienced (or felt). This is true for the experience we receive from any of our five senses.

When two people have seen or heard the exact same thing, their memories of what they saw or heard will almost certainly differ.

Differences in our perceptions and memories arise because we interpret everything we experience. And interpretation is always in light of whatever knowledge we already possess. Thus, our interpretation of experiences becomes new knowledge, which keeps growing and helping us interpret new experiences.

This is what is meant by knowledge being ***constructed*** *by the learners.*

Another important aspect of knowledge in the brain is that it is organised in meaningful ways.
E.g. Information or knowledge is organised differently depending on whether you find it in a textbook, an encyclopaedia or a dictionary.

In the human brain, knowledge appears to be organised flexibly in all these and many other ways. These organised structures of knowledge in the brain are called ***"schemas"*** by a child development psychologist Jean Piaget.

He said experiences are continuously being 'fitted into' our schemas and the schemas also need to be changed in order to allow new information to get in or accepted.

If this is how the mind works, according to principles of constructivism and organisation, are we using these faculties in the ways we teach?

Unfortunately, the answer is No.

Our traditional education frequently fails the children on both counts:

1). We give our students knowledge in disconnected chunks and
2). We expect our students to reproduce knowledge in more or less the same way it was received.

Presenting disconnected chunks of knowledge makes it difficult for the student to do what he or she does best - interpret new information in the light of existing knowledge. ***This makes true conceptual understanding impossible.***

To remedy this situation, we need to change the way we approach teaching quite dramatically.

- We would first have to acknowledge that all children start off with preconceptions of reality.
- The 'pre' refers to the fact that these conceptions are developed before they join a formal school. Each student is far from a blank slate on which we can simply write pages and pages of information.

It is found that there are many examples of the 'naive' or intuitive theories that children construct about subjects as varied as force, matter, earth, numbers, seasons etc.

Sometimes it can happen that a naive theory coincides with the correct adult theory. E.g. children usually figure out that natural numbers are discreet, and that numbers go on forever.

But often students' intuitive knowledge conflicts with the textbook or scientifically accepted knowledge. These instances are common: E.g. Senior school students see force as a characteristic of a single object rather than of a system, or understand floating or sinking with reference to weight alone.

Our tendency is to say that such statements are wrong. Well from our point of view they are wrong, but the students' explanations are generally based on their internally consistent theories and there is a strong drive towards internal consistency in children's explanations of almost any phenomenon.

Nevertheless, we must replace these theories with the correct ones. *And here is where we may make mistakes, by assuming that we can simply 'replace' them. That's not how the brain works. It cannot reject a schema outright in favour of a new one - instead, it must interpret the new innterms of the old, adjusting the old to allow the new, and so on.*

Remember, knowledge has to be constructed, it can not be imported wholesale.

This process, according to the research, is usually slow and gradual, not sudden and instantaneous. Along the way, the students' changed schema will contain misconceptions, errors and sometimes inconsistencies, until a complete and thorough understanding is achieved.

This kind of learning is called conceptual change.

Students learn best through a process of conceptual change that is very important; if such conceptual change does not happen, the old schemas remain powerful as ever.

Even highschool and college students show surprising misconceptions in their answers to science or mathematics questions.

The students from "Top Indian Schools" can show such gaps in their understanding of the concepts and still they are able to 'perform' satisfactorily in school tests and examinations.

It might be because sometimes academics can be very different from everyday experiences. The result is that students build schemas of what is taught in class that are independent from, and disconnected from, their schemas of everyday experience.

How are we teachers going to find out our own students' schemas?

Conversations, classroom discussions, open-ended questions and journal writing can help.

We must frequently ask questions such as, 'What do you mean?', and 'How is that different from what he said?', and 'Can you give an example?'

We may feel that we just don't have the time for this, or that there are too many children in class for it to work. But if we engage in discussions and conversations with our students at least occasionally, the process might get internalised in their minds.

After all, we want them to learn to be good learners.

The best way to encourage conceptual change is to ***confront*** students with clear examples, which their schemas cannot explain. Then they will have to modify their schemas accordingly, and this is a step-by-step process.

Some teaching practices for conceptual constructivism:

1). Ask your students the right questions.

Most questions are of the kind, 'What is the right answer to so-and-so?'. Questions of the how and why kind are less common, but they aid conceptual understanding, and the students if teachers who ask such questions are better at mathematics. This occurs even when the student does not actually know or answer the question - merely thinking about it encourages higher level conceptualization.

2). Ask your students for different ways of solving a problem.
Seeing that alternate methods yield the same result and understanding why, will, promote conceptual learning. Almost every problem has multiple means of solution, so this is an idea to practise.

3). Encourage them to classify different problems according to how they must be solved.
Problems that appear superficially different may have common underlying structures, and recognizing this will strengthen conceptual understanding. You might have to collect problems or write your own for this. Most textbooks cluster the problems according to method, so that this challenge is never given to the students till they face an examination.

4). Have your students teach a concept to someone else.
Actually, psychological research shows that even reading something with the intention of teaching it to others improves conceptual understanding.

5). Ensure that word problems in mathematics are set in context familiar or relevant to the students.

6). In language teaching, you can encourage conceptual understanding by showing students earlier drafts and finished pieces of writing by others. They can thus learn for themselves what has been changed or corrected. Students' can edit each other's work, as well as their own.

7). In history teaching, the students can be shown different versions of the same event, and be encouraged to think about how history is represented,

interpreted, and therefore constructed. They can examine evidence and come up with historical theories themselves, which can then be compared with the theories and explanations in their textbooks.

Whichever subject you teach, let your students learn to ask the 'right questions' - a more valuable skill than giving the 'right answers'.

Use analogies, models or graphics to explain concepts.

Encourage them to talk about - describe - explain - elaborate, what they are learning.

They can keep journals to record, in their own words, what they used to know before a class and how their understanding has changed.