exploring CONSTRUCTIVISM

"What did you do at school?" is a routine question that most mothers ask their children when they return home. My daughter Priya was in Class One and when I asked her about her school day, she led me to the tamarind tree in our courtyard, picked a little leaf and said "I learned this." Elaborating further as she pointed to every pair of leaflets, she said "Look, this is two ones are two, two twos are four, …" "Is this what teacher used in class today?" I enquired. "No, no. Teacher wrote this on the blackboard and made us say 'two ones are two'. But mamma, I had seen this 'two ones are two' leaf while playing." I loved the new name that the tamarind leaf had got. A 'two ones are two' leaf! Mathematics abounds all around. My daughter taught me this is through many more examples. Here is another interesting one.

Priya was about three when she was helping me arrange eggs in the refrigerator. As we placed the eggs (in twos) in the egg-rack, she commented "5 is not a partner number, 6 is a partner number, 3 is not a partner number, and 4 is a partner number." Amused that my daughter was hinting at odd and even numbers, I asked her to explain. "With 3 eggs, we can place 2 eggs next to each other, but 1 is left behind. When there are 4 eggs, all get partners, none are left behind." I told her that 'not a partner number' is the same as odd and 'partner number' is the same as even, but she seemed happier with her terminology; it made more sense than 'odd' and 'even'. Later, when she learned about the same in school, I reminded her of this incident. I had read about constructivism and designed constructivist activities, but it was this experience that gave me a chance to explore constructivism. Based on this and my experiences as a teacher, I share a few thoughts about constructivism.

➲ Constructivism values individual thinking strategies: In Mathematics, there can be no one fixed method to solve a given question. Sadly, teachers insist on a particular method, answer keys supplied to examiners allot marks for a set pattern of steps, and we end up with stereotyped answers. "Why can't I solve it using my method?" is an often heard query. Following a set of steps may be beneficial as it brings in some kind of standardization and facilitates the teacher's task, but in insisting on 'following a fixed method' we fail to nurture individual thinking strategies, we fail to allow creativity and this is the first stumbling block to constructivist thinking.

➲ Constructivism involves sensory input: Mathematics teaching is often considered challenging as much of the content is abstract. We may not have a plausible hands-on activity for every concept in Mathematics, but wherever possible a multimodal approach (using both cognitive and psycho-motor domains) should be used. To learn more about multimodal learning in Mathematics, I recommend Rashmi Kathuria's work which can be accessed on http://mykhmsmathclass.blogspot.in/, http://mathematicslearning.blogspot.in/, http://mathematicsprojects. blogspot. in/.

➲ Constructivism uses dovetailing, scaffolding and extrapolation: Mathematics involves connections. An analytical teacher takes into account the previous content that needs to be dovetailed into the present content being explored. One needs to provide the minimum support that is adequate to the learner and thus provide leverage to further learning. One has to help the learner extrapolate what is presently being learned to what will be learned in the future. When my daughter learned formally about odd and even numbers,

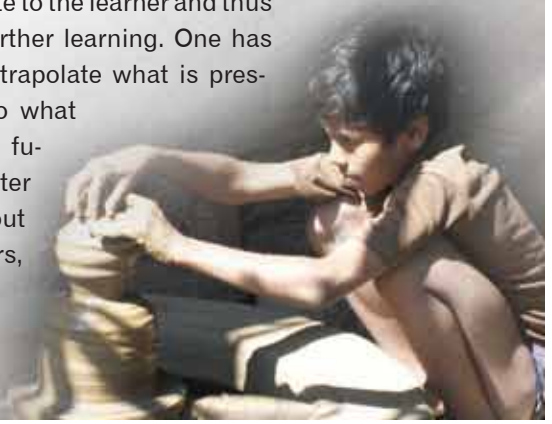

Image Courtesy: Mukesh Malviya,
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I reminded her of the 'eggs and partner numbers' incident. Next I took a number of small circles and we arranged them in pairs. So if we took seven pairs, we had 14 circles. If we had 20 circles, we had ten pairs. The next step was to try and arrange circles in different combinations, not just pairs. For example, 16 could be arranged as a pair pattern (2 x 8) but going beyond pairs, we could arrange 16 as (4 x 4); 15 could be arranged as a 3 x 5 pattern; 18 could be arranged as either 3 x 6 or 2 x 9 pattern. This was dovetailing what Priya knew about even numbers into factors of a number, which was something she did not yet know. I had to provide help for one example. The remaining examples were like a game. This step of providing minimal support is scaffolding. Constructivism also takes into account extrapolation. This activity of arranging circles was now made challenging by giving 31 circles or 19 circles to arrange in a pattern. This helped introduce the concept of prime numbers. Meaningful connection between what is known and what needs to be known is the crux of constructivism.

➲ Constructivism encourages queries: A healthy learning environment welcomes questions. I once had a question from my daughter: "When we add, subtract and multiply, we begin with the unit's place. Why do we follow a reverse order when we divide?" Such questions indicate that the learner is looking for meaning, and this is the corner stone of constructivist learning.

➲ Constructivism is contagious: Learners who indulge in constructivist learning apply it to all forms of learning. They tend to use it for all subjects. They tend to experiment, to interact with content. They look out for alternative ways to arrive at knowledge gaining. Most important, they see application of what they learn to real life. When Priya learned that metals expand on heating, she had this experience to share with me. She said "When we leave for school each morning, the two panels of the iron gate of our housing complex slide open easily. But when we come home in the afternoon, they are hot and have expanded. So the iron panels are touching each other and we have to apply force or sometimes kick the gate to open it." I had experienced the same phenomenon but my adult mind had not made the connection. Allowing learners to see the application of what they learn and encouraging them to quote examples beyond the textbook should be a prime focus in constructivist learning.

➲ Learn from and with your learners: All teachers need to learn from and with their learners. Learners could be forming connections based on misconceptions, and this will mean learning something erroneous. My daughter is now thirteen and learning about tests of congruence of triangles. Recently she told me that when she was small and had seen figures of triangles, she thought that segments with one stroke across them were smaller than those with two strokes! Thankfully this misconception was corrected. Thus constructivism has a lot to do with the ideas that the learner forms about content and here vigilance on part of the mentor is required. Else such misconceptions affect further learning. Teachers need to be vigilant about how learners learn, how they think and what they think.

My experience with my daughter has taught me how learners think. Once a teacher is in sync with how the learner thinks, the strategies used to stimulate learning can be aligned to the learner's thinking strategies. Constructivism fosters a 'learning to learn' attitude, an asset in today's era. As educators let us learn how students learn, so that learning is enriching and enjoyable. And before I end, thank you, Priya, for being my teacher!

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