UNIT 2 THINKING ABOUT THE LEARNER

Structure **Page Nos.**

2.1 INTRODUCTION

In Unit 1 we discussed various views of what learning is and how we carry forward the process of teaching and learning in our classrooms. One very important component of this process is the learner. Any process of teaching and learning would necessarily depend upon how we look upon our learner. In this unit we will focus on the learner.

In Block 1 of AMT-01, you have already studied about various capabilities of children. Throughout that course you have seen how children develop their mathematical thinking. In this unit we will take you further, on the same lines. We will share several examples with you in which children are the main actors in different contexts. We will try to show you that the abilities of children are vast and that they have a desire to explore and learn about the world. We hope to convince you that a child constructs knowledge for herself — she is not merely an imitator of adults.

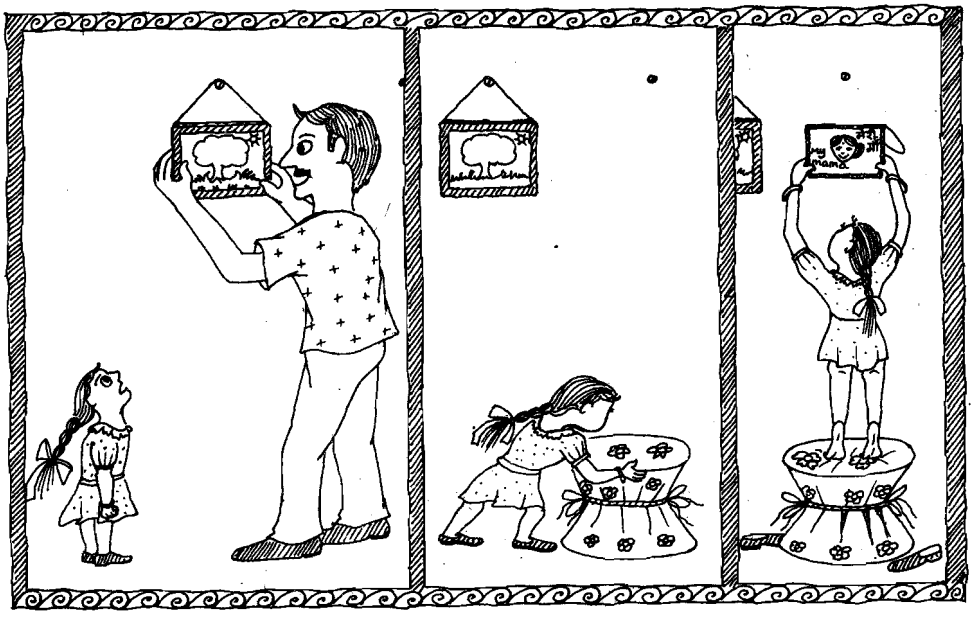

Fig.1: Is this child merely imitating her father?

As we have said before, much of what we do in the classroom and consider as good practice depends on what we think about the way children think. This understanding of children that we have is related to the model of learning in our minds. In this unit we shall try to bring out this linkage more clearly.

Objectives

After studying this unit, you should be able to

- give reasons to show that children do not learn by imitating adults;
- explain why children are not empty slates;
- give reasons for children being disinterested in formal studies;
- suggest some ways of building a child's motivation for studying mathematics;
- explain your understanding of how your learners learn mathematics.

2.2 DO CHILDREN LEARN BY IMITATING ADULTS?

I asked a group of teachers in a workshop their views on how children learn and what mathematics they know before they join school. The teachers were broken up into groups, asked to discuss these questions among themselves and present the summary of their discussions. The summaries from all these groups were basically similar, emphasising that the child learns by observing and copying what the adults show her. The teachers added, in response to further questions, that the child also learns from interactions with peers, but learns only things that are told to her. Their view was that children hear and observe adults. Based on these observations, they try to act in the same way. Parents and other adults praise and positively reinforce "correct" behaviour or "the correct answer", and punish them if it is otherwise. Punishment can also be in the form of the teacher asking them to repeatedly write the fact in their notebooks. The child has to repeat the answer again and again till she is able to answer the question properly.

Fig.2: Has she learnt this by imitating adults?

In the context of learning language also, they said that adults first make a child imitate simple sounds made by them, and practise these sounds. Gradually, they present to the child one-syllable words and have her repeat these words. Once she starts using such words frequently, the adults help her to graduate to speaking simple sentences in the same way.

Such beliefs by the teacher lead to commonly found classroom interactions of the following kind.

Example 1: In Class 1 of a village school, the teacher had an assortment of chalks with him and wanted to 'introduce' counting to children. In a discussion with someone he had realised the importance of concrete objects for this purpose. So he had collected chalk pieces to help children learn to count. He picked up one chalk and said 'One'. The class was instructed to repeat after him 'One'. Then, he put down that chalk piece, picked up another one and said 'Two'. Again the class repeated 'Two'. Putting aside the second chalk piece, he picked up yet another piece and said 'Three'. All the children in the classroom repeated after him, 'Three'. This exercise was still continuing two weeks later. But now, instead of the teacher, the monitor was leading the chorus.

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The teacher in the example above believes that a child learns by watching or listening to an adult, or some person of authority. Is this really so? Think about this while trying the following exercises.

E1) What do you think the teacher in Example 1 believes about the initial knowledge of children? Do you agree with his assessment of what they know, and how they learn?

E2) What is the problem in Example 1 with what the children are being shown and what they are asked to repeat after the teacher?

E3) Observe a 3- or 4-year-old child without her knowing it. Make a list of things she does, and how far she can go. For example, you may find that she is able to count objects upto 3, but not upto 5. Has this child learnt by imitating adults? Give reasons for your answer.

Let us now consider three examples of how children have reacted to certain situations. While going through them, keep asking yourself if the children have learnt merely by copying the adults around them.

Example 2 a): I was told by a friend that once he was walking with his two-year-old daughter, Madhu. They had to go to a shop which had a small drain outside. The father and child walked towards a two-foot wide stone tile right in front of the shop, placed as a bridge. The child stopped a few feet before this stone and pulled the father towards the right saying, "Let us go from there (pointing at another bridge like arrangement). I may fall here." Then she walked over the other bridge, and moved left towards the shop.

Example 2 b): Three-year-old Mansoor has coined the term 'small-big'. He often tells his parents, "I am now small-big, and can do many things. I can drink milk from the glass but I cannot drive the car. When I become big like 'dada' (older brother), then I will go to school. And when I become big like papa, then I will drive the car." He also wets his pants occasionally, without warning, and then says in his own way that he has become small again, and is no longer small-big.

Example 2 c): When Shekhar was about two years old, he used to visit the house of a family friend who had two female dogs. The bigger one of these was black and was called Maya. The smaller one was white, more pesky, and was called Tofu. Shekhar was fascinated by Maya and was very keen to touch her. He began to call both the dogs Maya. One evening, when on a walk, Shekhar spotted a brown dog on the road. Pointing at it, he started shouting, "Maya, Maya ." A few days later he looked at a book with pictures which had a goat. Pointing his finger at the goat, he said 'Maya'. He would now use the word 'Maya' for not only any dog he would see, but also for many other animals. For him elephants and camels were Maya, but, surprisingly, cows were not Maya; they were a separate category.

Shekhar is now three years old, and calls a goat by two names — Maya as well as goat. Dogs remain Maya. But cows also have two names — cow as well as Maya.

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If you examine the three situations carefully, what abilities do you find the children had to be able to behave in the way they did? The child in Example 2a has visually estimated width, related it to safety, made a left turn later, giving evidence of a sense of direction.

In Example 2b, the child has developed a category to describe his situation and differentiate it from that of his brother. He is also trying to describe what grown-ups can do, and recognises the fact that some actions are only accepted from children, not adults.

Coming to the child in Example 2c, think about his abilities while trying the following exercise.

E4) What are the mental processes Shekhar is going through? Which actions can you explain and which can't you explain as being learnt through the process of copying?

Looking at the many many things children can do as independent beings and also at the things they are not able to do, would you accept that they mostly learn by

imitating adults? If this were so, then why can't a two-year-old child count 6 objects even after an adult repeatedly counts up to 6 in front of her? Do we need to look for other explanations of how children learn?

Another belief that some people have is that children learn mostly by observing adults, and then by trial-and-error. For example, the child hears a sound, tries to reproduce it, does not succeed, is corrected, and tries again. In this way, she learns the sound. These people also believe, for instance, that the child listens to others around her calling something big, and she begins to call that thing big. In this way she forms a category of big things and small things.

To see how far we should accept this thesis of how children learn, consider the following example.

Example 3: When Shiela's daughter Kamna was four years old, she had seen a doctor come with her bag to the house to examine Shiela's mother. Kamna had also been into the surgical preparation room of an operation theatre in a private clinic, and had seen a surgical kit being put together there. Soon after this, small things started disappearing from the house. Two scissors were not to be found, one or two needles could not be located, a thread roll was lost, an old mirror piece and even some bottles disappeared over a period of time. They went so slowly that everyone in the house thought that these objects had been misplaced. A month later Shiela woke up with a start from her afternoon nap to find her daughter climbing on to the bed with a small old suitcase. Kamna was saying, "Go to sleep, go to sleep! I will operate on you."

Shiela : What operation?
Kamna : I will take this scissors, cut open your body, put it right, and then stitch it up again.
Shiela : How will you cut it?
Kamna : With this scissor.
Shiela : Show me (*taking it from her gently*). This is small, it won't work.
Kamna : I have this big one also (*pulling out the other pair of scissors*) and this knife also.
Shiela : What else do you have?

Kamna brought out a tube and put it to her ear. She also showed her the needle that was to be used to stitch Shiela up. All the things that had gone missing, were coming out one by one from Kamna's bag.

Shiela : All this is very good, but all these things need to be boiled before they are used. I shall boil them, and after they are boiled and sterilised, I shall give them to you, and then you can operate on me.

Fortunately, Kamna happily agreed to this, and Shiela was relieved. She took all the materials, put them in the kitchen, apparently for boiling, and with a lot of effort ensured that Kamna went to sleep. Then she hid all the equipment, stopped sleeping in the afternoon and tried to keep all such things safely out of Kamna's reach!

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Let us consider another such example.

Example 4: Five-year-old Neelu walked haughtily, dragging her slipper in to her mother's room, asking "Renu, O Renu! Where are you, Bahu?" When her mother, Renu, looked askance at her, Neelu said "Shh! Shh, I am Badi Tai (older aunt)." Renu immediately covered her head as a mark of respect and said, "Come in, come in."

Neelu: Where is your son? Asleep is he?
Renu: He has slept now. Both children trouble me a lot.

Neelu: Well, my children do not trouble me. You should give children whatever they want, like I do. Then they do not give any trouble.

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What is happening in this incident? Is Neelu copying her Taiji? Would her Tai say, "Give children whatever they want, like I do?" What is Neelu doing by pretending to be Taiji? Is she learning about Taiji, or is she displaying what she has learnt about Taiji and about her status and relationship with her mother?

When given the examples above, some teachers reacted by saying that the children concerned have clearly observed adults, are trying to imitate them and reproduce their actions. Others disagreed. They believed that Kamna and Neelu were certainly observing what was going on around them. But they were **trying to understand** what was happening **and interpret** it for themselves. For instance, Kamna had constructed **her own version** of how a doctor behaves, based on what she had heard and seen.

Let us now consider an example of an older child, who may be said to be learning by imitating adults. But, if you analyse the situation, you will see how much understanding the child has built on her own.

Example 5: Saroj's 7-year-old daughter brought out an old calculator from her pile of toys and asked her to repair it. Saroj took a screwdriver, twisted one or two screws and the calculator started functioning. Her daughter was watching this process very carefully. A couple of days later, she brought the calculator back to Saroj and asked her to repair it again. This time round no amount of fiddling with the screws would help, and Saroj gave up. Two days later her daughter came back excitedly saying, "See I have repaired the calculator." Saroj said, "That is not possible, it is totally broken". "See!", said her daughter, and brought the calculator out, showing her that it was working. It turned out that the child had also used the screwdriver to fix the calculator.

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Think about all these examples of children's actions and examine them in the context of the models of learning. Don't they show that we are often unkind to children? In situations describing learning we say that the child functions as a mere information store, looks at adults to imitate them and only learns some of what the adults repeatedly tell her. We often hear adults say, "I told her to do it like this and showed her how to do it. She was able to copy what I was doing, and that is how she learnt", or "I told this child the rule and she was given some sums. She did them but made some mistakes. I pointed out her mistakes to her, repeated the explanation and gave her some more sums to do. This time too her performance was not good, but somewhat better. She tried again and again, and slowly became capable of solving the problem."
Do you still feel that these statements are correct or meaningful? Think about this while trying the following exercises.

E5) Would you say that the child in Example 5 had merely copied her mother? Why?

E6) Why is the statement "Children learn whatever they learn by imitating others." **not enough to explain learning** or the behaviour of children?

E7) What is the implication of what we have said in this section for teaching children mathematics?

In this section we have given you several examples to show you that children certainly **do not learn by blindly imitating others**. They are keen to explore and experiment with materials around, and relate those objects to their experience.

Even if they do as the adults do, it is not in the sense of imitation but in the sense of trying to do all that the grown-ups can do, **and much more.**

Now, let us consider another common belief about the nature of children.

2.3 ARE CHILDREN CLEAN SLATES?

Swami, a highly respected teacher, was involved in a discussion with some of us about whether children learn only because adults tell them something. He was of the firm opinion that this is true. He also believes that children can be taught whatever we want to teach them, provided it is done slowly, bit by bit. I discovered that this view is held by many adults, who very clearly believe that children know nothing (their minds are a clean slate) unless the older people tell them.

There are others who believe that children know a lot just from their own observations and by using their very active minds. Try and clarify what you believe about this matter while studying the following situation.

Example 6: Eight-month-old Rehana was sitting in her mother's lap stretching out, striving to pick up the things on the table nearby. She was smiling, cooing and trying to reach out towards all the visitors sitting around her. Her particular interest was in a 2-year-old neighbour who was a good friend. All the while the neighbour was there, she kept pulling towards him, stretching out her hand and trying to talk to him. Of course, to the adults around she seemed to be making meaningless sounds. Then the neighbour left.

At this point, the mother decided to show the visitors how capable Rehana was. So she asked her, "What does an elephant do?" Rehana was engrossed in her own work and did not respond. The mother put her hand in front of the child's nose and repeated the question. This time Rehana put her hand to her nose and waved her other arm quite elaborately. The mother then asked how an elephant bathes. With her arm touching her nose, Rehana turned her hand towards her head. The mother then asked what an elephant eats. Rehana took an imaginary banana and peeled it.

The next question was, "What sound does a cat make?" And then, "Show aunty how to say mother (ma)." Rehana made sounds quite like the miaowing sounds of a cat and 'maa' for mother. She then asked Rehana how a lion roared, and the child responded by saying 'waa'. Since the child did not know the sound a lion made, she had improvised and uttered any sound that came to her mind. Her grandparent commented, "She does not know this."

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In this interaction the mother kept asking the child to do what she was saying, sometimes even cajoling her to do it. The mother thought that the child had learnt enough to be able to copy an elephant's trunk and how the elephant uses it in a pond to bathe because she had 'trained' her to do this.

But, was the child only doing what her mother had asked her to repeat after her? Was there no understanding being used in her activity? Remember how she had used her mind to imitate a lion? Also, remember that as long as the friend was in the room, the child was trying to talk to him and move towards him. Once he had left, she didn't seem to be particularly interested in the others. She knew her mother was asking her to do something, understood what was being asked, but did not do it. This lack of interest could be because she may have felt that the tasks that were being set for her of reproducing actions or sounds were trivial.

We call children clean slates because we want to only explore whether they know the **specific** things **we** have in mind. We want to test them on things that are only in the books. We do not take into account their vast abilities, including their

ability to understand us. What is very interesting is how we adults actually try to restrain children to learn only what we tell them. The following example clearly brings this out.

Example 7: The teacher had given the Class 3 children 'the algorithm' for subtracting one two-digit number from another. Then she gave the children several questions of this kind to do at home.

Aftaab did some problems, where 'borrow' was not needed. He got stuck when it came to 56 – 28. He came to his mother and asked her, "What should I do? I cannot subtract 8 from 6." She said, "But you are subtracting 56 from 28." Aftaab thought and thought about this. Finally he said, "I can subtract 8 from 16." With his mother's help he worked out a way of handling this step.

Having solved the problem by 'his method', he happily did the rest of his homework also and submitted it the next day. He was completely unprepared for the red cross from the teacher over all that he had done. He was upset and spoke to the teacher. She explained to him that his method (given in Fig.3a) was wrong, and he should do it by her method (given in Fig.3b).

$\overset{1}{5}\ 6$	$\overset{1}{\overset{4}{\not 5}}\ 6$
$-\not 2\ 8$	$-2\ 8$
$2\ 8$	$2\ 8$
(a)	(b)

Fig. 3

When he told her that the answer was correct, she agreed, but said that it may be just a coincidence.

When Aftaab went home, he was upset and told his mother about what had happened. She sat down with him to pacify him and help him understand why both the algorithms worked. When she suggested that he go and explain this to the teacher next day, he started shouting, "I will not tell her. Do you want the class to laugh at me? I will only do it her way in the exam and in my copy from now on."

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The role of the teacher in the example above has been, in one sense, very helpful. She has taken care to give children tasks to do, has looked at what children have done and has tried to be careful that the children learn the correct algorithm. But there are some serious flaws in the way the teacher has dealt with the situation. Can you find them?

Would you say that the teacher is helping the child learn mathematics? Or, is she making sure that the child does not develop his mathematical thinking? Is she curbing his creativity? Is she decreasing his self-confidence? Is she trying to ensure that the child's mind is a slate that only she can write on, and not the child?

Think about the many important points just made while doing these exercises.

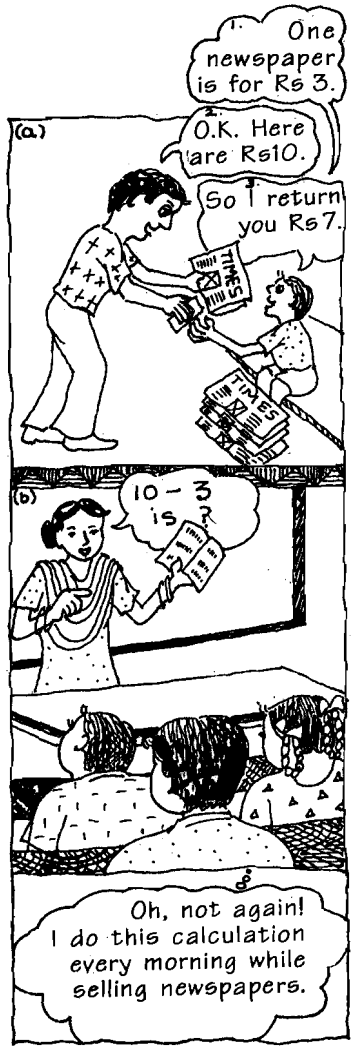

Fig.4: Is this child a 'clean slate'?

E8) Do you believe that children's minds only develop along the lines of what we tell them? Give a list of arguments to support your view.

E9) Give one example of your interaction with children which shows that they are **not** clean slates.

Looking at what has been said so far, why do you think some children find mathematics easy, and some don't? Could it be due to their motivation to learn? Let's consider this angle now.

2.4 ARE CHILDREN KEEN LEARNERS?

"Chhotu will be the death of me. He doesn't listen to me or to his teachers. He just won't take anything seriously. All he wants to do is to play gulli-danda," said his angry father. Like this father, so many other parents and teachers believe that children are basically disinterested in studies. So many teachers complain that the children have to be forced to sit in the class and concentrate. The teachers say that this attitude forces them to repeat the idea being taught many many times.

But, are the children at fault? How many of us do things that we don't have an interest in? All of us, adults and children, need to find a task attractive before getting down to doing it. So, the critical question for the teacher is "what motivates a child?" In this section we will try and answer this question.

Have you ever observed children playing together, or a child on her own at home? I have. If you observe a small child playing with different things, you would get some idea of what interests her. The child picks up an object, say, a toy car, and explores it from various sides, attempting to turn and pull at the projections in it. If there are any parts that are bright or different from other parts, they are specially examined. She tries to use the toy as a car or as something else for some time before she decides to pick it up and hit it on the ground a couple of times. She may then decide to drop it from a height and watch what happens to it. In between she may try to shake it like a rattle or even suck at it. She may then leave it or decide to explore it further by throwing it as far as possible, and then chasing it. If she gets the opportunity, she may even drop the object down a flight of stairs. If we try to take away the object and tell her it would break, she would say that it won't break. If you tell her that she is being too rough on the toy, she will barely listen and go on with whatever she is doing.

Fig.5

If we carefully examine the child's behaviour, some things become clear. For the child, playing with a toy means a lot more than simply using it the way an adult intends it to be used. The child, while playing with the object, is fully involved in what she's doing (see Fig.5), and is not easily distracted. Occasionally this kind of play with a toy can go on for a fairly long time.

Let me give you a few more descriptions of children doing things on their own and leave you to interpret them. If you observe a two or three-year-old child playing with more than one toy, you would be surprised by the elaborate procedures she may adopt. For example, if she has decided to play with some cars, she may create a parking place, and move them from the parking place along different routes to various stops. She would drag a car back and then let it go to see what happens, or slide cars from a pillow used as an inclined plane, or make two or more cars collide with each other. She may place one car on top of the other and try to move them, or lead the car with something else and try to push it. With or without playmates, she would be quite content and would be carrying out her play intently.

If an adult enters this situation and is willing to play with the child on her terms, there would be innumerable ideas that the child would try out with her. For example, the child may suggest that they have a race in which they see which colour the car with the maximum speed has, or she may pretend that these are cars belonging to a taxi stand, and try to recreate the scene at the taxi stand.

In fact, games in which children re-create many such different situations are very common and popular among children. If two or three children get together, they start playing 'House house'. They try to act like their parents, their teachers, their adult relatives, and recreate their interactions. In fact, their presentation of adult interaction often goes beyond how they see adults behaving. If you watch this game or the game of 'school - school' carefully, you would realise that not only do these games represent an extremely critical observation and analysis of what adults do, they also indicate an extension of what they have observed. They contain a display of how children conjecture adults would behave in different and new situations. Actually, you would also find a reflection of how children would like adults to behave, instead of the way they really do.

Why don't you try an activity now?

E10) Closely observe children playing at home, without intervening in what they are doing. Do your observations agree with what we have talked about in this section? What more have you observed?

After what we have just said, would you still say that children are not keen learners? Do you believe that they are not motivated and are lazy? Don't we need to think of a different reason for their lack of interest in formal studies? Could it be that we need to make the objects of study, and the mode of teaching, more attractive to them? If so, how?

In the descriptions above the child is interacting with an object and is observing the effect of her action on the object. So, we could say that if we provide children with concrete materials they would be able to play and interact with the materials and this would get them interested in learning. Or, we could say that if we allow children to go at their own pace and in their own way at school, they would want to learn. While these two points are clearly positive steps, they would not be enough. What more can we think of?

Regarding this matter, the comments that a father gave, based on his interactions with his child, are very striking. He said, "Whenever I want to teach her something, I find she is bored, uninterested, not motivated. But, when I see her on her own and with the kind of things she wants to do, she is able to learn to do so much that I am amazed. Perhaps children want to learn in their own way and on their own terms with freedom and do not like to be told what to do all the time. I feel that children do want to learn things, want to think, also want to create new knowledge. They do not want to simply repeat what the adults have done. They want to explore new directions."

Sometimes, children are keen to learn in their early years of school, but the motivation decreases considerably by the time they get to the higher classes. What could the reasons be? Does the following example give you a partial answer?

Example 8: The children of the village primary school would attend classes on one day, and not the next day. There was rampant absenteeism, particularly in the higher classes. Then, the new teacher, Sharda Devi, joined. And, within a month, all the children in her class became regular. What's more? The children of other classes kept trying to crawl into her class.

What was so special about Sharda's method of teaching? She wouldn't just repeat what was in the book, and make the children repeat it. She would actually take the children out of the school building, get them to note down where they could see rectangles around them (for instance), ask them about what problems dealing

with ratios they came across at home, let them create toys and games with any material they could lay their hands on. And Sharda turned each of these activities into meaningful learning experiences for each child under her care.

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Does the example above give you any ideas about how to interest a child in any area that you want her to learn?

Based on what you have just read, try the following exercises now.

E11) In what ways can an adult dampen a child's keenness to learn? And, in what ways can she help the child explore the world around her?

So far we have seen several examples of children's behaviour only. We have tried to find out from these (and other) examples if children learn by copying adults. We discovered that this is not so. We also tried to see if children don't know anything unless specifically told (or taught) by someone. Again, we concluded that this does not explain a lot of things that children know.

We have also tried to find out what measures would ensure that a child learns in the formal set-up. We don't have any final answers. You must be still wondering about how children acquire new notions. We will try to answer this now.

2.5 HOW CHILDREN LEARN

In the earlier sections of this unit, we have given several examples of how children think. We have seen that neither do children only copy grown-ups nor do they simply follow instructions blindly. They also learn a lot on their own, based on their interaction with their environment. Unfortunately, teachers usually ignore this fact. Because of this, for instance, they don't use the fact that most of the children coming to school would be counting a few objects at home.

Another unfortunate error that teachers often make is related to their understanding of how children learn by exploring concrete objects. Teachers are sometimes supplied with materials that children can play with for building their understanding. But, many of these teachers do not let the children play with the materials, lest they get damaged! The teacher assumes that her telling and showing the objects to children is enough to make them understand. If she would only allow children to communicate with each other or articulate what they have understood from what she has taught them, she may realise the kind of inferences they draw from her display of objects.

E12) Give an example of a classroom interaction in which the teacher does not appear to move in accordance with the ideas we have expressed in AMT-01 or in this unit so far. Explain why you feel so, and suggest how the teacher could have dealt with the class differently.

We have spoken about the child not being an empty slate, and in fact, knowing far more than what we would normally believe. We have also mentioned instances of a child playing with an object and attempting to explore what she could do with it as well as explore her own physical capabilities. The examples we have given show that children are extremely keen to learn new things and do not want to stick to instructions imposed on them by adults. They are not keen to repeat and copy adults. In fact, they like to challenge adults in their own way, as the two examples given below show.

Example 9 a): A friend tells a story about his 3-year-old daughter Farida, who wanted to go out in the afternoon. He told her it was too hot to go out. Farida kept on badgering her father, but he did not budge. Finally, she asked her father to give her some water. Once they went to the kitchen, she insisted on taking water in a very pretty glass which was a part of the set. She drank half the water, looked at her father and said, "I am going to drop the glass." The father put up a brave front and said, "Do it if you want to." She again said she would drop it, all the while looking for the extent of fear or disapproval in his expression. Finally, after 3 or 4 minutes of this, she dropped the glass, which broke of course!

Example 9 b): A hassled parent of a two-year-old girl complained one day, "My daughter is always upto new things. Today we were playing on the floor in the room, and you know the high window sill in our house, I just went to the kitchen for a moment, and, in a flash, she had used the stool to get on to the table, the table to get on to the high window sill and had the latch open, all this in half a minute. I was just in time to see her leaning out of the window into space and to drag her back. I don't know how she did all this."

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The child in Example 9(a) was certainly not blindly following her parent or imitating any adult. She was challenging her father, using her judgement about how far she can go. Similarly, when a child climbs on the window sill, she is not copying anyone because nobody climbs on the window sill to look outside. What she has done is to find a way to increase her capability to look outside. So she does want to be like adults, do all the things they do, and in fact, do more than them, **not copy them.**

Similarly, older children reflect a lot of knowledge and understanding. They, too, can share it if they get the opportunity, as in the following example.

Example 10: Ganga was going to teach the Class 3 children of a remote village about eskimoes. Feeling hesitant about using the word 'ice', she asked the children if they had ever seen ice. The children began answering hesitantly. Some said they had seen it when they went to the fair (mela). Some said they had eaten a 'Gola' (a syrup-sweetened puff of ice). Others said ice is white and melts into water. Since the teacher wanted to explore what they knew, she allowed them to keep talking. More and more properties of ice were emerging from the children — its hardness, its coldness, about how it splinters, how it is cut into pieces, how it is stored, etc.

On another occasion Ganga was beginning a unit about crops with her Class 4 children. On an impulse she asked the children what crops grew around them. All the children seemed to be just waiting for an opportunity to talk! They told her the names of the crops, how they were sowed, the period they were sowed in, the number of times they needed to be watered, the varieties used when rains were delayed, about fertilizers and pests, etc. Ganga was overwhelmed. Neither the book nor what she knew matched the kind of information she had got in the class.

Ganga's experience does not match the experience of other teachers in the school. The usual classroom interaction of the other teachers has them asking questions, and the students warily watching. These teachers say that the children speak hesitantly, incorrectly, and do not appear to know anything.

When Ganga was asked for the reasons for such wide differences in perceptions about the children, she said, "When we want children to tell us (repeat) what we already know and we correct them (harshly or nicely) whenever they make mistakes, they are not eager to share their views with us. When they feel that we genuinely want to listen to them and no one is looking out for mistakes and errors, they feel confident and contribute to the discussion."

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Do you agree with Ganga's view? Think about it and do the following exercise.

E13) How would you explain the two contrasting pictures the teachers have of the same set of children?

If we examine what has been said so far, you would agree that the banking model and the programming model of learning cannot describe how the child relates to the world. In her development, the child tries to form a relationship with the world around and interpret everything in her own framework. She likes to explore everything around her. From this interaction with reality, she forms her own concepts.

Fig.6: Children learn by interacting with the real world

We need to keep these facts in mind while teaching children, more so when teaching mathematics. This is because children consider learning mathematics particularly difficult. We have often discussed mathematics learning with teachers. In all such interactions with teachers and teacher trainers, we find that they believe that one reason for children not learning is their perceived lack of motivation. The other major reason, according to them, is that the teacher has probably not explained the concept properly. If the teacher explains properly and repeats the explanation a sufficient number of times, they believe that the children would learn. Regarding this belief, consider the following example.

Example 11: A Class 4 mathematics teacher had very sincerely done addition of fractions with his students. He had taken over three weeks on it and was very happy that all the children could solve the problems, including problems that required the calculation of LCM. I asked permission of him to give the students an easy set of questions on fractions to solve. He looked at the questions that I had set and said they were trivial. He was certain that all the students would be able to do the questions. In fact, he asked me to set some more difficult questions. I said that I was not looking for very complicated things but simply wanted to understand whether fractions make any sense to the students.

We gave the test to the 44 children in the class. When the teacher looked at the answer sheets of his students, he was shocked and said, "How could this be true! Just a couple of days back, I had given a much stiffer test and they had done the test so well. In any case, I had explained all these points to them again and again. I tried to make it as easy as possible for them, showed them how they could solve problems using many examples. I showed them shortcuts they could use to solve problems quickly. In fact, I allowed them to ask questions whenever they wanted to and explained as many times as anybody required." He said that he had been so happy that most of his students had learnt fractions, but this test had made him realise that they had not learnt anything.

The teacher in the example above clearly believed in the programming model. And so did the teacher-trainer who was explaining difficulties children have in learning mathematics to the teachers. He said, "Children have to be motivated to learn. Because they find maths difficult and boring, we must simplify it and teach it to them in small steps. It is only after we tell them clearly and explain to them all the steps, that the children can do it. And if we teach well and explain properly, children would learn." He suggested, therefore, that the teacher should break up the concept into sub-concepts, explain each piece separately and ask children to follow and practise the procedure given.

Think about this suggestion while doing the following exercises.

E14) Do you agree with the teacher's final reaction in Example 11? Give reasons for your answer.

E15) What would you say about the approach suggested by the teacher-trainer to teaching and learning of mathematics in the light of what you have read in this unit? What would you suggest teachers do so as to make children more involved in learning mathematics?

E16) According to you, how do children learn mathematics?

We have looked at various aspects of how children acquire knowledge. Let us put them down in brief.

2.6 SUMMARY

In this unit we have considered the following points.

1. Children do not learn by imitating adults.

2. Children do observe adults, and often try to do what the adults do. But this is not imitation. They try and understand the action or the concept and present their own version of it. They are keen to overshadow their parents or other adults around.

3. Children learn by interacting with the world around them on their own terms. Therefore, they know a lot by the time they enter school.

4. Children are keen to learn and naturally curious. They learn whatever they find meaningful and interesting.

5. In situations where they are involved with the task at hand and are following their own questions, children give evidence of abilities far beyond what we teachers may consider normal.

2.7 COMMENTS ON EXERCISES

E1) The teacher is trying to familiarise children with one, two, etc. He is showing them something and wants them to speak after him. This implies that in his opinion children coming to Class 1 do not know these numbers. What else does it imply?

From your experience of children, what they know and how they learn, do you think the understanding of the teacher is correct? What do you disagree with and what do you agree with? Do you think Class 1 children need to be introduced to one, two and three? Is repeating in a chorus a good way of learning?

E2) Imagine what the children are seeing and what they are being asked to repeat. Could they be getting a very different message about what 'one', 'two', etc., mean? They may think, for instance, that these numbers are the names of those chalk pieces. What other wrong ideas could the children be getting?

E3) You may watch a child in a situation where she has materials and is on her own. You could give her more objects and enter into a dialogue with her. Ask her to count which is more which is less, or how many objects of one kind there are, or what can be made with them, etc. Allow the child free play with these materials. While recording what the child is doing or saying do not look for expected answers or push her towards any specific response. Just record what she is saying and try to understand the implications of her actions and statements.

E4) In all these incidents children create new ideas and use them to describe new situations. They are trying to comprehend what is going on around them. In the process, they are formulating ideas that they may not have heard before by mixing categories, or they are forming their own generalisations. All the three children have shown their own choice and their own understanding of things around them. Do you think the children are copying adult's actions in any of these examples? Are they displaying capabilities that can be acquired through the process of copying? Which adult is calling a goat Maya?

E5) The child observed her mother, analysed what she was doing and probably used the same technique (according to her). She was able to repair the calculator, something her mother was not able to do. In fact, her mother was surprised when she saw the repaired calculator. This happened because the child **did not** merely copy her mother.

E6) Analyse the examples given so far as well as other examples that you know, of children learning. Think about whether all the evidence of learning in them can be explained by imitation. For instance, when a child insists on wanting more of something, and the parent keeps refusing it, who is the child imitating? In the process, the child shows other behaviours which she's learning, but not by imitating.

E7) The implications relate to the changes in some commonly held assumptions about how children learn. They certainly are not keen to imitate, and most of what they learn is not by imitation. Most mathematics teachers, unfortunately, force children to copy and learn by rote. Would solving one sum on the board and asking children to solve similar sums be useful learning? How do we facilitate children's learning, rather than forcing something down their throats?

E8) Consider the examples above. All of them tell you that children's minds develop in many different ways, not only along the lines adults want them to develop.

E9) For example, take an infant. You have not taught her to grasp your finger, but she does it.

Take children in nursery school. They have lived their lives for 3 or 4 years, learning by exploring every single of these days. So, how are they empty slates?

E10) In this section, we have talked about the fact that an adult-child interaction in which the child has freedom and space allows the child (and the adult) to learn a lot. It also says that children adopt quite elaborate procedures while playing with toys, and use them in many different ways. A child playing on her own can play quite intently, trying out various ideas. Together with other children, she can fantasise and create many new situations. So much learning, exploration and development of ideas takes place.

Now, you have to look at children who are playing together or singly. Observe them without disturbing their direction of play. Point out the differences and similarities in the nature of your observations with what has been said in this section.

E11) Write down how some attitudes of an adult towards a child can make the child resent doing what she is told to do. In fact, when parents over-protect a child, they are also hampering her from learning. Children can do a lot on their own, and in ways that they are not able to do when with adults. If the adults allow them to try out new things, and participate in their games, they would be helping them learn.

There are several other points you can think about.

E12) Recollect the ideas that we have expressed in AMT-01. These include for example, the fact that children need to have space to make mistakes, articulate ideas and formulate problems. AMT-01 also said that children do not learn by being told something. All of them do not learn in the same way. Give an example of a classroom, in detail, where these ideas are not being used, and how you could have made the class different, according to the ideas of AMT-01.

E13) The basic difference between the two teachers is in their understanding of learning and the learning process. Bring out the possible points of importance in each teacher's attitudes that make her say such different things about children. (For instance, the classroom methodology adopted, the understanding of what learning means, expectations from children, etc.)

E14) Had the children not learnt anything at all? Each child would have understood **something**, in her own way – an intermediary stage towards learning the concept.

E15) The approach of the teacher-trainer has certain assumptions about the learner as well as the learning process. He believes, for example, that children are not keen to learn themselves but have to be motivated. He also feels that children should learn a concept bit by bit in a well understood sequence. Think about this view, and all that we have discussed and learnt in the course. Based on your view, suggest ways that would make children more involved in learning mathematics. Some ways have already been suggested in this unit, and the previous one.

E16) Based on what you have learnt in these two units, and AMT-01, what do you understand of how children learn maths? Do they learn by being taught algorithms by solving several problems using an algorithm? Or, by rote learning tables of facts? Or, is it something else that needs to be done to help them learn?