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Constructivist Teaching in Primary Classes

Santosh Sharma*

The Context

Most of us are products of traditional instruction. As learners, we were exposed to teacher centered instructions, fact based subject matter, and a steady diet of drill and practice. Teacher centered education, teaching by transmission and learning by rote memorisation are part of teachers' personal histories and these practices persist in today's classrooms. In traditional, teacher centered classrooms, individual desks face the front of the room, where the teacher occupies a privileged space of knowing authority. Students work individually on identical, skill based assignments to ensure uniformity of learning.

In this environment, it is assumed that more quiet and orderly the classrooms are, more likely the learning tends to take place. In order to move away from this traditional classroom culture, teachers require critical reflection. Teachers must ask themselves, 'Is my role to transmit authoritative knowledge which I learnt during my school days or to nurture independent thinkers? How can I nurture students as independent thinkers?' Teachers will have to struggle to develop well articulated rationale for instructional decisions. Shifting the centers of authority and activity from teacher to students required both effort and persistence. In the beginning, the teachers can be uncomfortable with their apparent lack of control as students engage in activities with peers. But with persistence, teachers will discover themselves as investigators/guides, trying to find out new instructional strategies and decisions. However, if discrete practices that have been associated with constructivism such as cooperative learning and performance assessment are simply inserted as special activities in their traditional classrooms, then learning will remain as usual for the students. The shift to constructivist teaching requires

*Professor, Curriculum Group, NCERT, New Delhi

teachers to relook into their roles in the classroom. Constructivist teaching can not be grafted on traditional teaching. This requires a change in classroom culture. Teachers need to understand the basic principles involved in constructivist teaching and reflect upon their existing practices.

Principles in Constructivist Teaching

1. ***New learning depends on learners' previous knowledge.*** Therefore, first step is to make students' existing concepts explicit. For this, teachers should ask a number of questions, relate these to students' experiences, ask students to speak about their experiences and observations. Do you try to know what students know or start telling/reading the 'definitions'?
2. ***Learner actively create, interpret and organise knowledge in individual ways by reconciliation of formal instructional experiences with their existing knowledge in the cultural and social contexts in which these ideas occur.*** Teachers must provide students opportunities and experiences to construct their own knowledge. Students should be provided such learning experiences and situations which require students to solve problems, design activities, experiment, collect and interpret the data. Students should be encouraged to draw their own conclusions and inferences. They should be encouraged to express their understanding of new concepts. They should also be given opportunity to apply and validate their understanding in new ways. Students should also be encouraged to work in groups and to discuss their ideas with peers and teachers. What methodology do you practice? Does it involve active engagement of learners?
3. ***Learning is facilitated by social interaction.*** Students should be encouraged to speak, discuss their ideas among peers and with teachers. They should be taught to respect others' ideas, validate their own ideas, question their own and others' ideas. Students should be encouraged to provide alternate explanations, compare their results and interpretation with those of other students. Do you allow students to articulate their understanding or compare their understanding with others?
4. ***Meaningful learning occurs within authentic learning tasks.*** Therefore, teachers should design and construct learning tasks. Teachers should act as guides when students work on

these 'authentic learning tasks'. Do you read activities given in book or provide 'real' situations for interaction?

5. ***Learning is a meaning making process required to solve meaningful problems.*** Passive teaching should be discouraged in the classroom. Pupils' participation in teaching-learning process is very important. Teachers should encourage pupils' participation. They should also work on 'how pupils participation can be enhanced'. For that teachers must respect students' ideas. Students should not be told 'wrong' and sit down. Let students explain their perception, how and why they reached a specific 'answer'. Students should be allowed to justify and argue their own explanations. Are students passive listeners in your class? Do you provide them problem situations? Do students bring problem questions to class?

The following observations from the constructivist classroom may help teachers in evolving the characteristics of constructivist teaching.

Constructivist Teaching – Observations from the classroom

Teacher taught topic of 'Light and Shadows' to students of class V of MCD school, New Delhi. The leading question was 'how shadows are formed'? The teacher started the lesson by asking questions to make students existing concepts explicit.

The questions asked were of the following type :

1. Have you seen your own shadow?
2. Have you ever tried to catch your shadow?
3. If yes, could you catch it and hold it?
4. Is light required to form a shadow?
5. At what time of day, your shadow is smaller than you?
6. Does size of your shadow increase or decrease as you move towards the source of light?
7. Does your shadow form in front of you or behind you when source of light is behind you?

In the beginning students were nonresponsive and silent because they are not used to speak freely and interact with teachers. Students looked at the teacher as if they were asking her permission to speak. Their regular teacher nodded in positive. Then students started responding to the questions. These questions motivated students to think and interact. Some students started looking at their shadows in the classroom itself. One of the students replied that "Shadow runs as I run. Shadow leaps, jumps, does what I do." Responses of students to questions were as follows :

No. of students = 23

Q. No.	RESPONSE	RESPONSE
1.	20 – Yes	3 – No
2.	19 – Yes	4 – No
3.	01 – Yes	18 – No
4.	13 – Yes	10 – No
5.	11 – Noon	12 – Evening
6.	15 – Increases	8 – Decreases
7.	12 – Behind	13 – Front

The responses of students to questions 4 to 7 suggested that they did not have enough opportunity to play with shadows. Their responses were not based on their observations. These were trivial responses. When probed further, some of them understood light as 'natural Sun light.' Light from bulbs, candles etc; at night was not included when they replied to Question No. 4. The teacher suggested students that they should first observe these phenomenons and then answer questions on the basis of their observations. 'What kind of activities can you do to verify your answers ?'

One of the students suggested that they should be allowed to observe shadows in the Sunlight outside class. 'Yes, students can go to the playground and experiment with shadows.' But before that, can you suggest some activities inside the classroom, asked teacher. Students suggested following activities :

Activity 1

(i) The windows of their classroom had wooden panes. By closing the window panes, the classroom became dark. Students observed that their shadows were not formed in dark room.

(ii) One of the students lighted a candle in the dark room and placed a pen next to candle. Now, they could see the shadow of pen.

(iii) Students moved pen away from candle and again towards the candle and observed the size of shadow.

(iv) Students placed pen at different positions around the candle and observed the position of shadow. They tried to relate the position of shadow to the position of source of

light, that is, the candle. They observed that shadow of pen moves around the candle as the pen moves.

Activity 2

Students threw light from a torch from above the object (ball) and below the object. Students could observe the changing shape of shadow.

Activity 3 (suggested by the teacher)

Keep torch light at a distance of 5 felt from the wall. Now, hold your hand with spread fingers near the torch and observe shadow of your fingers on the wall. Move hand nearer to wall and observe the size of shadow of your fingers. Students observed that shadow of fingers and hand is very big like branches of a tree when hand is near torch and this shadow shrinks to finger size when hand is close to the wall.

Students performed a number of such activities with the help of a torch and candle. They observed the shadow of one student by throwing torch light from his right, left, behind and front.

Similarly, they observed the shadow of a ball when torch, the source of light, is placed below it, above it, to its left and to its right.

Activities outside the classroom :

Students played and made fun with their own shadows.

After performing all these activities and making their observations, students verified their earlier answers and changed their responses as follows :

1. We all have shadows.
2. When we run in Sun, our shadows run with us. Shadow does what we do, that is, when we raise hand, shadow also raises hand, when we jump, shadow also jumps.
3. We can not catch and hold the shadow.
4. Light is required to form shadow.
5. Our shadow is smaller than us at noon but we will observe our shadow in morning and evening.
6. As we move nearer to the source of light, the size of shadow increases. Size of shadow shrinks as we move away from the source of light.
7. When light falls from behind us, shadow is formed in our front and when source of light is in our front. Shadow forms behind us.

Students were suggested some activities which they can do outside classroom. For example, observe the shadow of a tree at different times of the day – 7 a.m., 10 a.m., 12 noon, 3 p.m., 6 p.m.

On 2nd and 3rd day, teacher asked many questions and allowed students to make their responses without any fear or hesitation. Students asked a large number of questions such as :

1. Do Earth, Moon, Sun and Stars have shadows ?

2. Can we make any use of shadows in everyday life ?
3. Can we take photographs of the shadows?

Teacher took all these questions as cues for designing activities. She also asked students to formulate hypothesis and design activities to answer the questions raised by them.

Can you guess time by looking at the shadow of a tree in front of your house or in your school's playground, asked the teacher.

Teacher suggested them to make a Sun dial. Teacher also narrated a good story about Sun dial. She also gave interesting information to students such as "One of the biggest Sun dials in the world was built in India about 300 years ago. The shadow was made by a pointer that slanted up from the Earth to a height nearly eighteen times as tall as man". In earlier times, people used Sun dials to see time. They also used shadows to learn things about the size of the Sun and the Moon.

On 4th day, students formed a Sun clock as follows :

They drew a big circle on the ground. They took a stick about half the size of circle. Placed one end of the stick firmly at the center of the circle so that the stick points to north. At 9:00 a.m. they marked 9:00 at the shadow of stick, then after each hour they marked time at the shadow of stick. Like this they observed up to 1 p.m. They asked their friends of second shift to do the same. Students prepared a Sun dial from 9:00 a.m. to 5:00 p.m.

On 5th day, teacher taught shadows and eclipse. Teacher started by asking questions such as :

Have you seen Moon (lunar) eclipse ? How does the Moon look on 'Moon eclipse day'? Only one or two students had idea that Moon darkens when Moon eclipse occurs. They had heard from their family members that we should not look at the Sun on the day of the eclipse and astronomers can predict the day of eclipse. Teacher further probed that 'Sun is the source of light for Earth, you all know, then will Earth form shadow'?

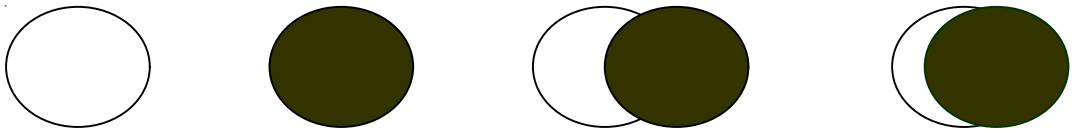
'Yes, Earth has its shadow. Students themselves told that Moon also has shadow. The Earth and the Moon form shadows into space because the sunray cannot pass through them. Teacher asked the students to verify their answers by doing the following activity :

Take small cardboard circle 'A' as Moon. Hang it against the wall. Take another ball 'B' as Earth bigger than 'A'. Now throw light from torch so that shadow of Earth is formed on the wall. Now move 'Earth' ball and torch in such a way that Earth's shadow covers Moon. What do you observe?

(i) Does Moon darken as the Earth's shadow covers it ?

(ii) How is the position of Sun (torch), Earth (Ball B) and Moon (Ball A) related ?

(iii) Are Sun, Earth and Moon in one straight line ?



Can you describe the formation of eclipse? Student response, "Both the Earth and the Moon throw shadows into space because the Sun cannot shine through them. When Moon moves into the Earth's shadow, the Moon darkens. Moon eclipse occurs

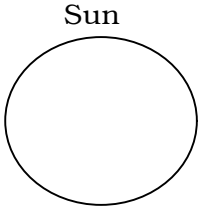
when the Sun, the Earth and the Moon are in one straight line. During an eclipse, the curve of the shadow shown on the Moon.

Similarly, you can make a model of solar eclipse. "How dose the Sun look when solar eclipse occurs ?" asked the teacher. "Sun is dim, not bright", said students. "Do you know why" asked teacher. "the Moon passes between the Earth and the Sun", said the students.

To understand the phenomenon of solar eclipse, do the following activity.

Activity : (Suggested by teacher)

Teacher had one green pea and a balloon. Blow up the balloon and make it big in size. Tie it with a string. Imagine that the balloon is the Sun and the pea is the Moon. Teacher put the balloon on her table. Then she asked one student to stand 2 feet away



from the table. She gave one green pea to the student and asked him to hold the pea at an arm's length in front of one eye. She asked the student to look at the pea and the balloon at the same time. And then move the pea towards the eye slowly. She asked the student to tell us when she did not see the balloon or when the pea covered the balloon completely. When pea was very

close to the eye, student said with joy, "Now the pea has covered balloon." Other students also tried this experiment.

Now, can you explain how this small Moon could cover the big Sun. Students could not provide adequate explanation for this. Teacher further asked some more questions. Can pea cover balloon if pea is at an arm's distance from the eye? 'No', said the students. Only when pea is close to the eye, the balloon becomes invisible. What does that suggest ? 'Distance of the Earth to the Moon should be less than the distance of the Moon to the Sun,' said one student. Teacher then helped the students by giving the explanations.

The Moon is about 390,000 km from the Earth. The Sun is nearly four hundred times as far away (15,00,00,000 miles). This great difference in distance makes it possible for the Moon to hide the Sun.

Teacher also suggested students to make a model of total solar eclipse in the project mode. Groups of students can prepare the model. Based on her experience, teacher evolved the following characteristics of the constructivist teaching.

Characteristics of Constructivist Teaching

1. Teacher must ask a number of questions and probe further to make explicit the existing concepts of students. Students' prior experiences must be taken into consideration while teaching a new concept.
2. Problem should be clearly stated involving pupils in making the problem statement. Questions can also be in terms of research questions or hypothesis.
3. Students must be encouraged to provide alternate solutions to the problem. They should be allowed to discuss their ideas among themselves.
4. Students should be encouraged to design activities, do experimentation, record observations, draw conclusions and provide alternate explanations.
5. Teacher should work as the team leader, as a guide and support.
6. Textbook reading method is not appropriate for science teaching. Difficult words should not be given directly. First explain the process/ phenomenon and then give the terms. In constructivism, students should be given opportunity to provide alternate explanations.
7. Students should be encouraged to work in groups. Students should respect each other's ideas. All the students should be engaged in activities. This also helps to maintain class discipline.

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