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Can we be Keen Observers?

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Keen and minute observation arouses curiosity, inculcates reasoning and develops a scientific attitude. Keen observation plays a crucial role in learning and in the development of science. Fruits fall from trees naturally but the critical observation of an apple falling from the tree led Newton to discover the important Newton's Law of Gravitation. Keen observation of things around us and our environment needs concentration and deep and critical thinking. How can we make good observers? How can we motivate students to develop scientific or logical thinking? Let us start this from lower classes, say Class III or IV. National Curriculum Framework 2005. (NCF, 2005) emphasises the importance of learning by listening, observing, interacting, experimenting and analysing, besides reading. Teachers or teacher educators may take up different environmental activities related to the above for development of learning in children. Pimental (1963) quite interestingly introduces his book *Chemistry: An Experimental Science* with the simple activity of a burning candle.

The activity of observation of a burning candle may be demonstrated by

a teacher or teacher educators for any level of learners. This activity has been demonstrated 61 times by the author

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(VPG, 2001, 2002, 2004) before varied groups of teachers and teacher educators at the national and the international levels and pupil teachers of B.Sc, B.Ed. four year and B.Ed. two year courses. It is generally observed that an individual can write about 5-6 observations but when the observations of different learners are pooled together, the number of observations on many occasions crossed 40, depending upon the level and number of observers. Participants of the workshop on capacity building of functionaries of the Western Region on Environmental Education, including disaster management and mitigation held at RIE Bhopal from 27 February to 3 March 2006 were also asked to write their individual observations about a burning candle. For this purpose, three burning candles of the same colour and size were placed before the participants. Measuring scale, chalk sticks, matchboxes, thread pieces, glass rods were placed near the burning candles. Ten minutes were given for this activity. The participants were asked to feel free to come near the candle and perform any activity that they wanted to. Individual observations made by the participants of the workshop (very senior teachers from Central Schools, teacher educators from SCERTs and DIETs of Maharashtra, Gujarat and Chhatisgarh) are given below for the ready reference P_1, P_2, P_3... denote participants.

Observations about a burning candle:

P_1

- The candle burns to give lighted heat;
- Length of the candle is decreasing;
- There are three layers of flame;
- It blackens a chalk piece.

P_2

- Why was Dr. Gupta lighting the 2nd candle with another match stick? Why not with the help of the first burning candle?
- The candle was melting;
- Fans were switched off before this activity;
- If fingers were momentarily held over the low flame in the beginning, the flame could be extinguished without the fingers getting burnt;
- When the chalk piece was placed on the flame, there was a cracking sound;
- When a plastic scale was placed on the candle, the scale got disfigured.

P_3

- Though there was no smoke it blackened the chalk piece when placed over it;
- There were reflections of the candle.

P_4

- There was a bluish black flame at the bottom, but a yellow one at the top;

- There was radiation around the flame;
- The flame was elliptical in shape;
- Smoke emitted, when the flame was disturbed;
- The material near the flame of the candle is in a molten-state; it is responsible for the continuation of burning.

P_5

- The flame is static;
- The longer the wick of the candle, the larger the size of the flame.

P_6

- The top of the wick is red;
- If any object is moved very fast over the flame, no change takes place, but if an object is kept for sometime over the flame, then there is deposition of soot;
- When a piece of paper was passed through the middle of the flame, the paper did not burn but when it was passed above the flame it started burning.

P_7

- This activity is not a part of sustainable development;
- The flame was very low/small in the beginning but went on increasing with the passage of time;
- A transformation of the substance was taking place.

P_8

- A burning candle can help ignite other substances.

P_9

- The molten wax sticks on one side of the candle and gets solidified.

P_{10}

- The shape of the flame is like a tree-leaf and may be about 1 inch in size;
- The middle portion of the flame looks slightly different;
- The upper portion of the flame is brighter;
- Flame flickers due to air currents;
- When a matchstick was placed 1 inch above the flame, it burnt.

P_{11}

- There are three colours in the flame—blue, black, and yellow;
- Due to flickering of the flame, its diameter increases and length decreases;
- The molten material of the candle takes the shape of a disc.

A few other observations made by the participants in other demonstrations are given below:

- There is a bright flame at the top;
- Thread does not leave behind any ash as a result of burning;
- A burning candle is placed on an inverted beaker, which in turn, is placed on the table;

- The molten wax has taken a concave shape;
- The candle is fixed with the help of molten wax;
- There is a slight bend in the candle;
- About 1 cm of the upper portion of the burning candle is shining;
- There is a luminous zone near the outer portion of the flame;
- There is a reflection of the flame;
- Some changes take place in the candle—they may be physical, chemical or both;
- A candle is cylindrical is shape;
- The flame is silent;
- The candle is white in colour;
- The reddish portion of the wick is inflated;
- On touching, the candle is found to be slippery;
- The candle is placed on a 250 ml beaker, near a piece of wire;
- An open box is also placed near the candle;
- Some reagent bottles are placed near the burning candle on the table;
- The particpants are eagerly watching the flame;
- The process of burning of the candle is continuous due to capillary action of the molten wax;
- The circumference of the candle is 3 cm;
- The diameter of the candle is about 1 cm;
- The original length of the candle was 15 cm;
- After burning for about 10 minutes, the length of the candle is reduced to 11 cm;
- Due to strong air currents, the molten wax gets collected on one side of the flame;
- Proportion of the yellow colours is more in the flame;
- Wax does not start melting immediately but after some time.

Conclusion

It is clear from the above data that no individual teacher or teacher educator could note down more than five observations but the total observations pooled together have come out to be 65. When this can happen with the senior teachers and teacher educators with vast experience of observing, identifying, classifying, and inferring, what would be the case of the budding scientists if they are simply asked to cram answers to the questions given at the end of the chapter without taking them out of the four walls of the classrooms and observe Nature? Classroom transaction strategies will have to be changed. Each class at the primary and the upper primary level must be taken for field excursions at least once a week, maybe for one or two

periods so that the children can enjoy Nature, and observe it—the surrounding plants, crops, variety of vegetation, drains, hillocks, stones around them—and pose questions to their teachers or elderly members of their families. It is not necessary to satisfy their curiosity fully. Answers to one problem/query may lead to another query. This leads to development of mind and brain. The above observations about a burning candle may lead to the following questions:

- What is the composition of the material of the candle?
- What are the products of combustion?
- Why is the candle burning?
- What is the rate of burning of the candle in terms of length and in terms of mass?
- What is the effect of temperature on the rate of burning of candle?
- What is the effect of air current on the rate of burning?
- What will happen if the candle is burnt in a closed room?

To get answer to these problems, one will have to consult teachers, friends or books, elderly persons of the community, make hypotheses, perform experiments, collect, analyse and interpret data, test and modify hypotheses which lead to the development of the scientific thinking. Let us observe keenly, think divergently and produce citizens of logical and righteous thinking.