Science and Insight

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Why observational skills are important

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The greatest challenge facing a science teacher (I have been one for more than a decade now) is this whole matter of the student's intuition. On the one hand, the existence of this intuitive understanding of phenomenon is the sign of an active mind that is constructing a coherent picture of the world. On the other hand, as pointed out by David Moody, these intuitive constructions are contrary to a scientific understanding of the world.

Further, it is easily observed that these notions survive science teaching very, very effectively. An anecdote from my own experience illustrates this rather well. One evening at a friend's home, there was an informal gathering of about a dozen people — all of them with substantial university degrees, including two Ph.Ds in the 'hard' physical sciences. My friend, the host, posed the question, 'Where does the moon rise?' There was actually visible panic and all kinds of answers — including, the moon doesn't rise at all — were ventured. There were just two people who could say with certainty that all celestial objects would 'rise' in the east, 'rising' and 'setting' being apparent manifestations of the rotation of the earth.

When science is taught without any intuitive reference to the notions that already exist in the mind of the student, it leads to the fragmentation of the mind and the two seldom meet, and the matter is left unresolved. In time, the intuitive expression resurfaces and dominates responses. This seems quite similar to the relationship between one's conditioning and a philosophical explanation. If one considers the nature of the self and the insight that K offers — the self is put together by thought — this insight is counter-intuitive. The self seems to be all pervasive and the centre which controls the person. The only way out is careful observation. Reason and intellectual argument have at best the value of being pointers and starting points of an inquiry led by the actual observation of what is. It is perhaps in the alertness and openness of observation that insight happens. Understanding K verbally, intellectually, leads at best to a conflict of becoming, which might lead to outward order of a limited kind. It leaves the core of one's being untouched.

At The School, the science curriculum of class V, has over the last couple of years, attempted to provide a series of counter-intuitive 'insights'. The aim has been twofold. First, to bring to the collective consciousness of the group, common aspects of an intuitive picture of the phenomenon; then, through designed experiments and observations, to help them see the phenomenon in a whole new way.

To take some examples of misconceptions connected with flotation:

Heavy objects sink. So, a log weighing one ton would sink. (This reflects a lack of appreciation of the notion of density.)

Iron will always sink. (This reflects a conditioning of always thinking of water as a medium. Further, there is no appreciation of the density of the medium as a factor.)

The first task of the teacher in the approach that is being attempted is to ask the students to visualize the result of a simple experiment, thereby bringing to the surface that which exists in the consciousness of the students.

To illustrate this point, we consider the relation between time-period and the amplitude of oscillation of a simple pendulum. Children have a wide experience of the pendulum from clocks to swings in playgrounds. Children are asked the question, 'Will the time taken by the pendulum to complete one full oscillation vary with the amplitude?' The question, of course, has to be asked without any technical terms, in ordinary language. The almost universal answer is an affirmation. The teacher makes an effort to help students articulate clearly their 'naive' picture by asking the students to share the way they arrived at the answer. Typically, the idea that is in the mind is that the distance that the pendulum traverses is more if the amplitude is more, therefore it takes more time. No attempt is made to correct it at this point. This phase is an attempt to help them articulate clearly the common sense picture. It is a boon that there is often a great deal of commonality in the notions that different children have about phenomena. (This led a colleague to remark that children left to themselves will tend to discover an Aristotelian world view.) This picture is then subject to the test of clear observation. Sometimes, even in the articulation of 'what is', children start to think afresh. I have seen students pointing out: 'the greater the amplitude, the greater the height from which the pendulum is released and therefore the greater the speed; this compensates for the longer distance'. This is even before any experimentation and systematic observation takes place. The intention of the whole exercise is to help the child move to a new perception of the phenomenon, a new location.

A new location — perhaps that's the rub. The new picture of reality is still a picture. It becomes the basis for further conceptualization. The context for another insight. There does not seem to be anything fundamental in the whole process. Nonetheless, an insight curriculum will keep the mind open and become aware of the fact that the world has depth — a depth that is accessible only on keen observation.