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November 2007

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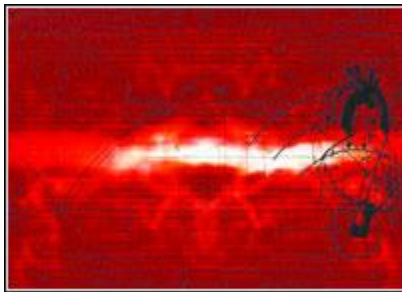
## Recommended Citation

Anwar, N. (2007). New ways of teaching science. *Dawn*.

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## **New ways of teaching science** **By Naheed Anwar**



TEACHERS are often concerned with students' lack of understanding related to certain scientific topic. They repeatedly wonder why, despite putting in a lot of effort, aren't their students able to understand things. By saying this, they put all the blame on students and overlook the importance of evaluating their own teaching practices. Responsible teachers should realise that there is a need to shift one-way transfer of knowledge to two-ways building of knowledge over students pre-existing knowledge. A number of studies have been done to identify students pre-existing ideas. One of the challenging task for me as a science teacher had been trying to identify and shift students' pre-existing ideas to scientific knowledge.

Research studies have revealed that children possess numerous ideas that are inconsistent with scientific knowledge. Concepts are developed with experience and exposure in the cognitive structure of a child as s/he grows. Often these preconceptions are not similar to scientific concepts. As a result, children may form improper or distorted views, if the pre-requisite knowledge necessary for the construction of a new concept is absent from the cognitive structure. Research describes that intended learning does not take place, because learners cannot make sense of the presented material in terms of the existing ideas, and the learner interprets the new material in terms of existing but alternative ideas. In this situation, either the child rejects the formal scientific concept in favour of informal, familiar idea or develops a parallel idea equivalent to the previous one.

Such an exiting idea which does not match with the accepted scientific knowledge is called an alternative framework. Different researchers have used different terms for alternative framework like misconceptions, naïve conceptions, alternative concept, misleading ideas, misunderstanding of facts and pre-conceived notion.

Depending on the nature and source of origin, children's misconceptions can be classified into two types. First, some informal ideas which are developed by everyday experiences which children bring to the classroom. For instance, gases are not matter because they are invisible or air has no mass. Since, they can not see air so they do not consider it matter. Daily used language

also creates some misconceptions like kilogram is a unit of weight or the sun rises from east and sets in the west. Second, students develop incomplete or improper views during classroom teaching propagated by teachers and the textbook.

As science teachers, we should know why and how alternative framework originates in children minds. The use of model is found to be an effective teaching strategy especially for some abstract concepts. However, in an attempt to present a complex idea in a simplified way, teachers use models made of common substances like, ball, nut, foam, beads, styrofoam etc. It may lead students to literally transfer the attributes of the model to what they are supposed to present in terms of scientific knowledge and understanding. For example, in the model of an atom wires are used to show orbit where electron revolves. This model gives an impression that the atom has an electron revolving on fixed lines around a nucleus. In this connection, teachers hold a responsibility not to convey an alternative framework otherwise there is a chance where teacher could be a major source of creating alternative frame.

Research studies specify that teachers who are less competent in subject-matter knowledge may propagate incomplete or erroneous views to their students through inaccurate teaching. Sometimes non-specialist teachers are asked to step in the absence of the specialist teacher. Other times, understanding of certain content area knowledge, differ from teacher to teacher. Apart from the above, students find some abstract biological topics difficult to understand like photosynthesis, cell division, ultrafiltration in nephron, mechanism of circulation (Grreiffard, 2001). Other simple reasons could be that students may not be able to see the blackboard or are unable to listen to the teachers' voice.

Misconceptions that develop during lower grades remain with children till higher grades if not handled properly. That is the reason why certain misconceptions are found among students of major subject areas like physics, chemistry or biology. Nicoll (2001) identified misconceptions related to electronegativity, bonding, geometry and microscopic representation among undergraduate chemistry major students. This has serious consequences since bonding is such a major concept. Misconceptions are not only connected to chemistry but also found in other subjects' students. This connects to the fact that when such students become teachers, they may carry those misconceptions with them and then transfer them onto their students. Yip (1998) found in a research study that novice biology teacher held a number of serious misconceptions, which were then transferred to their secondary school students as well.

Identification of misconceptions is an important step towards better teaching and learning of content. A teacher's aim should be to know the source and type of alternative framework before designing effective instructional strategies to prevent or rectify misconceptions. Gilbert, Watts and Osborne (1982) describe two methods: first, comparative method, which uses multiple-choice questions and open response question; second, non-comparative method, which examines the use of words in the 'real world' settings. Casem (2005) developed concept coaching activities that were designed to make students aware of their misconceptions and provide avenue for them to use their new knowledge. He asked students to develop best drawing of membrane in which he identified misconceptions. Later he created his own drawing based on students' misconceptions and also included correct information. Students evaluate their drawing as part of concept coach activity.

Odom and Kelly (2001) found the combination of concept mapping and learning cycle as effective strategies in promoting conceptual understanding of diffusion and osmosis. Eryilmaz (2002) found conceptual assignment and conceptual change discussion as an effective means for reducing the misconception students held about force and motion. Thus, conceptual change may be considered as a process when one theory or model has more explanatory power than other, and the concept is developed gradually.

In conclusion, we all learn from the interaction of previous experience and new knowledge. Pupils need rich and appropriate experience of using the new ideas in the presence of the existing idea. The teacher should be aware of the learning problems experienced by the students due to alternative framework. It is the teachers' responsibility not to develop alternative framework among students and use effective strategies to rectify the existing misconceptions among students.