**Prepared by: Meher Bano Harri**

**Presented by: Hussain Ali Harri**

**Level: M.Ed. (Science Education)**

**Teaching strategies in science education**

**Describe the nature of Science by providing examples from real life. Also highlight its importance of science knowledge for teacher educator?**

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[**theims.media@gmail.com**](mailto:theims.media@gmail.com)

**What is Science?**

**Science is the study of natural world. Science is defined as “The knowledge gained through observation, experimentations and calculations is called Science. Science is broad based human enterprise that may be defined differently by individual who view it. A layman may define science as a body of scientific information; the scientists might view a method by which hypothesis are tested (e.g., a way investigating); a philosopher may regret it was a way of questioning the truthfulness of knowledge. Science should be viewed as a way of thinking pursuit of understanding nature, a way of investigating, and a body of established know ledge. Science teacher are responsible for developing an adequate understanding of the science in their students. For teachers to accomplish this task, it is imperative that they first possess a clear concept of science and the scientific enterprise.**

**Students must learn factual information, but, more important, they must discover ideas for themselves through laboratory activities, field studies, and library work. Only through these activities will they learn that science is a “ way of knowing “(Gould 1984,P,6)and not merely a body of information found in textbook or obtained from the teacher.**

**Science teacher and educator must not take for granted that, just because students enroll in science course and participate in laboratory experiments, for example, they will develop a scientific value system.**

**The nature of science in science education (historical perspective):**

**Advocacy for students ‘understanding of science and its nature can be traced back to the early years of this century .although at the time the phrase “understanding the nature of science “was not clearly stated ,some elements and characteristics of science were noted as goals worth pursuing in science teaching. For example, Lederman (1992) reported that the central association of science and math teachers in (1907) strongly emphasized the scientific method and process of science in science teaching. Hodson (1991) cities Dewey’s 1916 argument that understanding scientific method is more important than the acquisition of scientific knowledge .Jaffe,(1938)in his high school textbook new world of chemistry listed nature of science objectives such as a willingness to swing judgment while experiments are in progress willingness to abandon in a theory in light of new evidence and knowledge that scientific laws may not be the ultimate truth.**

**In 1946, James Bryan Conant delivered his famous Terry lectures at Yale advocating a historical approach to science instruction.**

**There are two major aims of science-teaching; one is knowledge, and the other is enterprise. From science courses, pupils should acquire a useful command of science concepts and principles. Science is more than a collection of isolated and assorted facts….a student should learn something about the character of scientific knowledge, how has been developed, and how it is used (hurd, 1960, p.34)**

**Where did science education come from? or Beginning of science education :**

**Science education comes from Schwab (1964) who was both a philosopher and science educator he correctly observed that science is taught is an “unmitigated rhetoric of conclusions in which the current and temporal constructions of scientific knowledge are conveyed as empirical, literal, and irrevocable truths “biological science curriculum studies programs were important attempts to illustrate both the products of science in formal curricula.**

**At the turn of decade, several important books were published advocating and defining elements of the nature of science necessary for inclusion in school science curricula. Robinson, (1968) in the nature of science and science teaching provided science educators ready access to the philosophy of science for the first time. In addition, he reviewed many of the important concepts. From the philosophy of science including the value of inquiry learning, the nature of explanation, and the character of observation both in science and in science learning.**

**Recently this disheartening situation is facing more aggressive attack discussions concerning a role for nature of science in school science experiences should include significant attention to how science works including how knowledge is created and established.**

**Incorporating the nature of science in school science:**

**Incorporating the nature of science in school science has been widely embraced by organizations such as the associations for science educations, (1981) in Britain and organizations in the united states such as the national science teachers associations, (1995) the American association for the advancement of science, (1989,1993) and the national research Council, (1996).**

**The nature of science in science education (A rationale):**

**A number of studies exist that document students ‘misconceptions concerning the nature of science (clough, 1995 ;lederman,1992;meyling,1997;rowell and cowthron,1982;rubba Horner and smith;1981).Ryan and aikenhead,1992) collected the responses of more than 2000 upper secondary students, conclude that confused science with technology and were only superficially aware of the private and public side of science an effect that values have on scientific knowledge.**

**While acknowledging that a number of a number of out-of-school factors misrepresent the nature of science, overwhelming evidence exists that school science is at least equally culpable .almost 50 years ago Anderson,(1950) concluded that teachers were more concerned with imparting scientific facts then helping students understand the process of science---an indication that something was awry regarding teachers notions of the nature of science. Four years later they argued (Rowell and caw thorn, (1982) that many science teachers subscribe to an Inducvist –empiricist outlook of science.**

**Tragically, too often science teachers simply do not include nature of science issues in the design of science learning plans (belle al .1997; king 1991; lakin and Wellington, 1994), likely because they lack knowledge of them.**

**The role and chapter of the nature of science:**

**The significant misconceptions that both students and teachers hold regarding the nature of science, by themselves, represent an important justification for including the social studies of science in science courses and preserve science teacher education programs.**

**Mattews, (1997)argues that questions regarding the nature of science are inherent in many education issues such as multicultural science the evolution’s /creation public education controversy ,feminist critiques of modern science and their suggestions for science program reform, the place of religion in science education environmentalism and new-age science, and the notion that learning science will results in an understanding of its nature while at the same time causing students to become more scientific in solving life’s problems.**

**Moreover, students in a recent study by Myeling (1997) showed significant interest in the nature of science.**

**Importance of science knowledge for teacher education:**

**Matthews (1994) has argued for the inclusion of NOS courses in science teacher education programs. The examples he provided demonstrates that a firm grounding in the nature of science is likely to enhance teachers’ ability to implement conceptual development in science may shed some light on individual cognition development (wander see, 1986) e.g. many student ideas parallel that of early scientific ideas ,suggested that “alternatively conceptions” may sometimes to a better descriptions than “misconceptions”. In other words teacher’s interest in NOS could assists in understanding the psychology of students teaching (Matthews, 1994).**

**Scientific knowledge is not exclusively determined empirically:**

**The history of science confirms that scientific knowledge is not exclusively determined empirically. The construction scientific knowledge (latour, 1987);latour and woolger,1986;knorr-cetina,1981;Kuhn,1970;mendelson,1977;mulkay and gilbert,1982;shaping,1982)has much in common with conceptual change. This makes the nature of science useful as a dis equilibrating agent in changing and teaching. e.g. Some of the resistance to conceptual change theory among classroom teachers arises from the mistaken notion that knowledge of the natural world is completely objective existing independently of the searching individual.**

**Children misconceptions difficulties in learning contemporary science:**

**History of science may also reveal a fierce battle to construct meaning concerning the natural world .this concerning, sometimes requiring enormous effort and time, is not a straightforward process. When science is seen in the this light children misconceptions difficulties in learning contemporary science ideas are understandable to assists in this process inquiry based or constructivist teaching , Daschle , 1987 states that teachers themselves need to have and adequate understanding of the nature of science.**

**The effect of teacher’s knowledge of the nature understanding:**

**Teachers represent the most variable in the class room learning equation. Even well-design NOS instructional packages that are at odds with the philosophical orientation of teachers may not be affected. Daschle, 1987 writes that in spite of attempts to “teacher proof” schooling through the enforcement of stricted curriculum guidelines and teaching models, teachers will continue to make the most critical decision in the education of students.**

**Processes and construction of knowledge:**

**Other curricula designs also impacts students, about the nature of science. As the form of laboratory activities coveys much about processes and construction of knowledge. Unfortunately these experiences are a cookbook or verification type laboratory activity which again parries science as rhetoric of conclusions totally divorced from human influence. Clough and Clark 1994 have suggested a different approach to laboratory exercises that more actively engaged students in science content and accusatory portray many significant issues in the nature of science.**

**Despite the pervasive and critical role of curricula:**

**Despite the pervasive and critical role of curricula , evidence is clear and substantial that teacher are the most influential factor in educational change .(Duffee and Akienhead 1992;eyolon and linn 1989;fullan).for instance after observing how science teachers assimilate new writing activities into their odd ways of thinking , longer and Applebee(1987).**

**Student experience illustrates the learning process:**

**Teachers translate the written curriculum into a form ready for classroom application and decide what how and why to learn. As Eisner (1985) writes “in the final analysis what teacher do in the classroom and what students experience define the educational process. “In fact curricula has been claimed to constitute only five percent of the variance in the students’ learning(Welch1979) while science teachers believe knowledge and practices represent the bulk of what the science instructional experiences for students(smith1980).**

**The creativity and subjectivity of the language of humanity:**

**One of the dominant activities in the classes=room is teacher talk and therefore important implications for students understandings could be derived from an analysis of teachers, verbal behavior. Munbees analysis of language applies equally well to teachers verbal patterns. The six variables represent teacher’s conceptions of the nature of the science. By way of the language teachers use to convey the subject matter in an earlier paper Zeilders and ladder man (1987) conclude from his analysis that “The results reveal that the variables testable developmental arbitrary constructs anthropomorphic language creativity and subjective where highly significant and distinguishing between instrumental and realistic conceptions of the nature of the science with respect to the teachers language and subsequent changes in students orientations ,It is concluded that the ordinarily language teachers used to communicate science contents thus provide the context in which students formulate their own conception s of the nature of science.”**