P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-1* ISSUE-12* March- 2017
E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Identification of Sources of Misconceptions among Secondary School Students

Abstract

Misconceptions are a problem for two reasons. First, they interfere with learning when students use them to interpret new experiences. Second, students are emotionally and intellectually attached to their misconceptions, because they have actively constructed them. A descriptive method of research was administered to 912 students of ninth class to identify the misconceptions among secondary school students then for the interview the students were categorized by the scores they had achieved in Concept Achievement Test (CAT) in science as better performers and poor performers. The semi structured interviews were conducted with 313 students in order to gain a deeper understanding of the patterns of student's responses to Concept Achievement Test (CAT) in science. On the basis of interview with secondary school students having high or low level of performance on Concept Achievement Test (CAT) in science seven types of sources of misconceptions were identified: Confusion; Language Imprecision; Overgeneralization; Misclassification; Misidentification; Erroneous Reasoning; Incomplete Understanding of the scientific process. The implications of the research are discussed in the paper that will help the teachers to integrate new knowledge into older understandings in such a way that links are maintained and correct concepts are maintained.

Manmeet (Baweja) Oberoi
Professor Cum Principal,
Deptt.of Education,
Shah Satnam ji College of Education,
Sirsa

Keywords: Misconceptions, Semi Structured Interviews, Sources of Misconceptions, Concepts.

Introduction

According to the instructional design research as reported by Tennyson and Park (1980), a concept is assumed to be a set of specific objects, symbols or events which share common characteristics (critical attributes) and can be referenced by a particular name or symbol. Concept is the idea an individual has about a particular class of objects (including animated objects) or events, grouped together on the basis of the things they have in common. If these concepts of a child prove inadequate, he may have to modify them in one way or perhaps try to develop a new concept all together (Fontana,1981). Misconceptions, on the other hand can be described as ideas that provide an incorrect understanding of such ideas, objects or events that are constructed based on a person's experience (Martin et al., 2002). Students do not come to the classroom as "blank slates" (Resnick, 1983). Instead, they come with the theories constructed from their everyday experiences. They have actively constructed these theories and use these to make sense of the world are, however, incomplete half truths (Mestre, 1987). These are misconceptions. Misconceptions are any unfounded belief that does not embody the element of fear, good luck, faith or supernatural intervention. These misconceptions are given several names including "alternative frameworks" (Driver and Easley, 1978), 'children's science' (Osborne, and Cosgrove, 1983), and 'misconceptions' (Griffiths and Preston, 1992). In Piaget's view, misconceptions add on each other like a structure. Misconceptions start as a gap resulting from the lack of knowledge. This gap fills incidentally with the quality education given by the teacher, the present knowledge of the students and the experiences that they face. The knowledge obtained in this way fills the gap successfully to some extent, but after a certain point it may come as misconception.

Sources for the Development of Misconceptions

There are many possible sources for the development of misconceptions. First, not all experiences lead to correct conclusions or result in students seeing all possible outcomes. Second, when parents or

other family members are confronted with questions from their children, rather that admitting to not knowing the answer, it is common for them to give an incorrect one (Alagumalai, pers. comm.). Other sources of misconceptions include resource materials, the media and teachers. The main issue is that all of the above sources are considered to be 'trustworthy', leading to ready acceptance by students of what they are being taught(Thompson & Logue,2006).

Misconceptions are a problem for two reasons. First, they interfere with learning when students use them to interpret new experiences. Second, students are emotionally and intellectually attached to their misconceptions, because they have actively constructed them. Hence, students give up their misconceptions, which can have such a harmful effect on learning, only with great reluctant (Mestre, 1999). Misconceptions can be categorized (Dykstra,1995):

1. Preconceived notions are the popular conceptions rooted in everyday experiences.
2. Conceptual misunderstandings arise when students are taught scientific information in a way that does not provoke them to confront a preconceived notions and non scientific beliefs.
3. Non scientific beliefs include views learned by students from sources other than scientific education such as religious and mythical teachings.
4. Vernacular misconceptions arise from the use of the words that mean one thing in everyday life and another in a scientific context.
5. Factual misconceptions are the falsities often learned at an early age and retained unchallenged into adulthood.

Hershey (2004) has classified misconceptions in five categories i.e. over simplification, over generalization, obsolete concepts and terms, misidentifications and flawed research. It has been observed by the researcher that some misconceptions are easier to identify because they are oversimplification, overgeneralization or misidentifications. Others are more difficult to identify because they are obsolete concepts and terms or flawed difficult to identify because they are obsolete concepts and terms or flawed research. Misconceptions may arise from two sources:

1. from errors in understanding new information or
2. From previous misunderstanding remaining a part of the newly formed knowledge (Debra, 1993).

Objectives of the Study

1. To identify the misconceptions among secondary school students
2. To identify the sources of misconceptions among students.

Method

A descriptive method of research was used to identify the misconceptions then interviews were conducted to identify the sources of misconceptions.

Tools

1. Concept Achievement Test constructed and standardized by researcher herself.
2. Interview schedule for identification of sources of misconceptions.

The test was administered to 912 students of Punjab to find out the errors and misconceptions among students. The interviews were conducted with students in order to gain a deeper understanding of the patterns of student's responses to Concept Achievement Test (CAT) in science. A semi structured approach was used to obtain the sources of misconceptions about the concept of environment as done by Odom et al. (1995). The interviews in each school were conducted individually and lasted for 30-40 minutes. The researcher allowed the interviewees to go through the responses given to them in Concept Achievement Test (CAT) in science. The questions asked by the interviewer towards the end of the interview most commonly took one of the three forms:

1. The reason for change of answer.
2. The reason for selection or rejection of a particular response.
3. Defining of concepts namely ecology, environment, food chain and food web, habitat, ecosystem, biological magnification, biodiversity, and biomass.

Sample selection for Interview

To use interview for a deeper diagnostic probe, it is needed to establish protocol to follow for a consistent structure. Individual interviews are very time consuming to conduct and analyze. It is important that the sample of the students should be the representative of the class. So, the students were categorized by the scores they had achieved in Concept Achievement Test (CAT) in science as better performers and poor performers. The students who scored 16 (Mean + 1 S.D.) or above were selected as better performers and the students who scored 7 (Mean -1 S.D.)Or below were selected as poor performers. In this way, out of the total sample of 912 students, total of 313 students were interviewed.

The Gender-wise and achievement-wise distribution of Sample for Interview

	High Achievers	Low Achievers	Total
Boys	108	63	171
Girls	71	71	142
Total	179	134	313

Data Collection

After finalization of research tools and selection of schools, the researcher personally visited the school and collected the data from 9th class students on Concept Achievement Test (CAT) in science then the data was collected for interviews.

Scoring of Interviews

Scoring of the interviews was a qualitative scoring to find out the sources of misconceptions. The views of students (interviewers) were noted and evaluated by the interviews and various sources of misconceptions were categories as done by Comins (1993).

Findings

On the basis of interview with secondary school students having high or low level of performance on Concept Achievement Test (CAT) in science seven types of sources of misconceptions were identified:

Confusion; Language Imprecision; Overgeneralization;Misclassification; Misidentification; Erroneous Reasoning; Incomplete Understanding of the scientific process . Mester (1982), Tyson, Treagust and Bucat (1999), Debra (2000) and Ross (2004) found language imprecision to be the souce of misconceptions; Pearson and Hughes (1988), Hardt and Paula (1997) found confusion as the source of misconceptions Kesidou and Duit (1993), Lord and Marino (1993), and Graham and Berry (1997) found incomplete understanding of scientific process to be the source of misconceptions.

Implications

1. In the study, it is found that the students having higher scores on the Concept Achievement Test (CAT) in science have misconceptions in some aspects as compared to the students with low scores. Therefore, the teachers should consider that even if the students have high scores in the examination, they may have as many misconceptions as the students with low scores. In the interviews, it was seen that even if the students were academically high achievers, they had little or no understanding of the concepts of environment. For example, when the students were asked to count the number of food chains in a food web, they explained that their teachers do not ask such questions. They only memorize but do not understand the concepts scientifically. Tytler (2002) also argued that deep rooted conceptions can offer a serious barrier to effective teaching. Therefore teachers should emphasize on the conceptual understanding of the students. The constructivist approach is important in terms of encouraging students to think about the scientific concepts and their conceptions.
2. Class room instructions may be organized in a manner that takes into account students' conceptions similar to the ones that have been identified in this study. When directly confronted with conceptions that students realize are not scientifically acceptable and through discussion with the teacher and with peers in small groups, students may lead to arrive at more fruitful understanding of concepts of environment. For example, discussions about adaptations in plants and animals will help to remove various misconceptions generated due to confusion and language imprecision. Earlier, Engel Clough and Wood Robinson (1985) have also suggested providing more structured opportunities for students to talk through ideas at length, both in small groups and whole class discussions.
3. It was found that the students often had roughly correct conceptions that appeared to be intuitive or experiential, but that these could be easily confused by what they had been subsequently taught. We saw a number of examples where an initially sound (and often simple) concept became confused after additional information was added through teaching (such as when learning specifically about insects led to acquisition of the misconception that they now had to be classified separately to other animals). It is commonly suggested that parents, teachers and the media all influence the development of misconceptions in science . In the same way that learning in science can be considered to be a sequential process, so can the development of misconceptions, so that once a misconception has been acquired it may be carried on and built upon further. As such it is imperative that teachers need to be very careful to introduce new topics in such a way as to prevent students from developing misconceptions that did not exist before as new but related concepts are introduced, namely, to integrate new knowledge into older understandings in such a way that links are maintained and correct concepts are maintained(Thompson & Logue,2006).

Conclusion

This research provides a picture reflecting that students' learning is dependent upon conceptual understanding and the misconceptions must be identified and taken care of during the teaching-learning process. Misconceptions are the output of a divergent set of current daily language, direct observation of natural objects and acts, formal instructional interference and the teachers' content knowledge and mass media which are shaped by personal experiences. Misconceptions may come from certain experiences that are commonly shared by many students. Children hold misconceptions that are advanced before and during their formal educational settings. Social interaction and daily life conversation causes spreading of misconceptions. So, the identification of sources of misconceptions may help to overcome the misconceptions and enhance the performance of students in exams.

References

1. *Comins, N.F. (1993). Sources of misconceptions in astronomy, In Third International Seminar On Misconceptions and Educational Strategies in Science and Mathematics, New York: Cornell University.*
2. *Debra, M. (1993). Recognizing and changing students' misconceptions: an instructional perspective, Questia:: Journal Article, (On line)*
3. *http://www.questia.com/PM.qst?a=0$se=gglsc$d=76945961*
4. *Debra, Myhill (2000). Misconceptions and difficulties in the acquisition of metalinguistic knowledge, Language and Education, 14 (3), 151- 163.*
5. *Driver, R. and Easley, J. (1978). Pupils and paradigm : A review of literature related to concept development in adolescent science students, Studies in Science Education, 5,61-84.*
6. *Dykstra, D.I. (1995). Misconceptions as barriers to understanding science,(on line).*
7. *http://bob.nap.edu/reading_room/book/str/4.html.*
8. *Fontana, David (1981). Psychology for teachers, London: The British Psychological Society and Macmillan Publishers limited.*
9. *Griffiths, A.K. and Preston, K.R. (1992). Grade-12 Student's misconceptions relating to fundamental*

characteristics of atoms and molecules, Journal of Research in Science Teaching, 29, 611-618.

10. *Hardt, E. and Paula V. (1997). Examining student's understanding of electrical circuits through multiple choice testing and interview, Dissertation Abstracts International, 58(6), 2141-A.*
11. *Hershey, David R. (2004). Avoid misconceptions when teaching about plants, American Institute of Biological Sciences (on line). http://www. actionbiosciences.org/education/ Hershey html*
12. *Kesidou, S. and Duit, R. (1993). Students' conceptions of the second law of thermo dynamics- an interpretive study, Journal of Research in Science Teaching, 30, 85-106.*
13. *Lord, Thomas., Marino, Suzanna. (1993). How university students view the theory of evolution, Journal of College Science Teaching, 22(6), 353-357.*
14. *Martin, R., Sexton, C. and Gerlovich, J. (2002) Teaching Science for all Children: Methods for Constructing Understanding. Boston: Allyn and Bacon.*
15. *Mestre, J. (1982). The interdependence of language and translational math skills among bilingual Hispanic engineering students, Journal of Research in Science Teaching, 19, 399-410.*
16. *Mestre, J. (1987). Why should mathematics and science teachers be interested in cognitive research findings?, Academic Connections, 3-5, 8-11, New York: The College Board.*
17. *Mestre, J. (1999). Misconceptions in mathematics- research,(on line)*
18. *http://www.penpages.psu.edu/penpages_reference/28504/285073220.html.*
19. *Odom, Arthur Louis Barrow, LIoy H. (1995). Development and application of a two - tier diagnostic test measuring college biology student's understanding of diffusion and osmosis after a course of instruction, Journal of Research in Science Teaching, 32(1), 45-61.*
20. *Osborne, R.J., Bell, B.F. and Gilbert, J.K. (1980). Science teaching and children's views of the world, European Journal of Science Education, 5(1), 1-14.*
21. *Pearson, J.T. and Hughes, W.J. (1988).Problems with the use of terminology in genetics education, Journal of Biological Education, 22 (3), 178-182.*
22. *Resnick, L. (1983). Mathematics and science learning: A new conception, Science,220, 477-78.*
23. *Ross, Judy (2004). Misconception research paper (1-4), On line*
24. *http://www. esu. edu/sps/Deanf)udy_ross.htm.*
25. *Tennyson, R.D. and Park, OK Choon (1980). The teaching of concepts : A review of instructional design research literature, Review of Educational Research, 50(1), 55-70.*
26. *Thompson,F., Logue,S.(2006)."An Exploration of Common Student Misconceptions in Science", International Education Journal, 7(4), 553-559.*
27. *Tyson, L., Treagust, D.F. and Bucat, R.B. (1999). The complexity of teaching and learning chemical equilibrium, Journal of Chemical Education, 76, 554-558.*