Project Report: An Investigation of +2 Level Students' Concepts of Magnetism

S. V. Sharma
Regional Institute of Education, NCERT, Ajmer (Rajasthan)
Email: svsriea@yahoo.co.in

Abstract- *The present study entitled 'An Investigation of +2 Level Students' Concepts of Magnetism' was administered to the students of +2 level learning concepts of magnetism. At the very outset, this study is a pilot study. Research tools were developed in workshop mode which comprises of conceptual multiple choice questions. To ensure the validity and reliability of the test each item was scrutinized in a brainstorming session of experts. The test was administered to +2 students of schools having well equipped facilities and devoted staffs dealing with physics education. Comprehensive analysis of the responses given by the students indicates a significant gap between the learning outcomes as expected from the curriculum given to the students and their real learning. It is suggested that a carefully planned instructions taking into consideration students' alternative frameworks may help to improve the state of affairs.*

Keywords: Concepts of Magnetism, Alternative Frameworks

Present study is undertaken with the following objectives:

- To examine the students' alternative frames about the concepts of physics, particularly magnetism at +2 level.
- To locate the origin of the alternative frames.
- To suggest ways and means for eradicating the alternative frames.

Following assumptions have been made for conducting the present study:

- Learners already have knowledge of Physics, in particular magnetism, before coming to the classroom. In most probability, this knowledge may not be consistent with established principles/theories.
- They are in the possession of different mini-theories and these are very dear to them.
- These mini-theories are inconsistent and random.
- Learners keep on changing and proposing new mini-theories on encountering with new situations.
- Mental structures of learners are highly influenced by the peer group and other members of society.
- This situation of possession of theories by learners is advantageous to the teacher, as he need not start from the vacuum. It facilitates in accepting, rejecting or modifying the knowledge structured in the learner's mind.

Design of the Study, Sample and Process

At the very outset, proposed study is a pilot study undertaken as minor research project financially supported by the NCERT related with the concepts of magnetism. In workshop mode a research tool (questionnaire) was developed which comprises of conceptual multiple choice questions. Multiple-choice questions have four options, one of them is correct answer and other three are suspected alternative frames. To ensure the validity and reliability of the test each item was scrutinized in a brainstorming session of experts. The test was then being administered to plus two students of schools having well equipped facilities and devoted staffs dealing with physics education. Students were directed to give correct option for multiple-choice questions. They were advised to write supportive reasons for selecting the options. Nine schools affiliated to Central Board of Secondary Education (CBSE)/ Board of Secondary Education Rajasthan (BSER) of Ajmer district were selected for the said purpose. Comprehensive analysis of the answers given by the students was done. Details of the sample schools are furnished below:

S.No.	Code of the School	Size of the sample
1	GCS1	20
2	GCS2	33
3	GCS3	30
4	GCS4	37
5	PCS5	30
6	PCS6	23
7	PBS7	32
8	PBS8	53
9	PBS9	09
	Total	267

GCS stands for Government CBSE affiliated schools, PCS stands for Public CBSE affiliated schools & PBS stands for Public BSER affiliated schools

Analysis of Students' Responses

Analysis of percentage of correct and alternative frames indicates that a section of students does carry alternative frames about the basic concepts of magnetism. Responses also indicate that there is a significant difference and a wide gap between the learning outcomes as expected from the curriculum given to the students and their real learning at +2 level. It is also noted that there are not much significant differences amongst students studying in the different schools.

Implications of the study

Investigations into students' frames about the basic concepts of magnetism were limited to 267 students and study was administered over the students studying at +2 level in schools of Ajmer District. Therefore, the results of the study cannot be generalised to other parts of the country. Concepts studied were origin of magnetism, magnetic moment of a magnet, field lines of a magnet, pole strength of a bar magnet, magnetic moment of a current carrying loop, direction of induced current, motion of magnet in magnetic field, magnetic field intensity, work done by magnetic force, motion of change particle in magnetic field, direction of induced current, Motion

of bar magnet in magnetic field, pole identification, direction of Induced current, pole strength, magnetic lines of force, electro motive force, effect of magnetic field on metallic disc, pole Identification, pines of magnetic force, magnetic field lines and effect of heating on a magnetic strength. Responses were obtained using a questionnaire having multiple choice questions to be answered giving reasoning. The responses indicated that there is a significant difference and a wide gap between the learning outcomes as expected from the curriculum given to the students and their real learning at +2 level. There can be a number of reasons, e.g.

- The students do not find content being taught interesting enough.
- Transactional strategies are not effective.
- Students are not able to apply their knowledge to find solution to the unfamiliar situations.
- Concepts are not internalized because of their sticking to naïve theories.

To bridge the gap between what we teach and what is learned, following suggestions are given:

Students are taught theoretical principles, there are very little attempts to integrate them with the experiments which the students' do in the laboratory. This creates a situation where the students are not able to relate their theoretical knowledge with what they obtain while doing the experiments. Moreover, students are given readymade boxes where the students are required to perform experiments and get the result what are given in textbooks or practical books. It does not help the students in concept formation. Rather what they get is only remembered and not internalized. It is, therefore, suggested that theory and practicals should be integrated and routine experiments need to be changed. They may also be engaged in designing the magnetic devices/experiments themselves and asked to make predictions, observe and then explain. Interaction amongst the students may be encouraged so that their ideas are flushed out and mental conflict does take place before any final formation of the concept related to the magnetism.

Students need to be made familiar about the process skills of physics. It has been observed that the students in spite of having knowledge about the basic concepts of magnetism, they are not able to apply them in unknown situation. It is, therefore, necessary that the students are made to perform activities or experiments systematically and they need to be trained in process skills which they can make use of while drawing inferences related with the basic concepts of magnetism and magnetic devices /phenomena/laws accordingly, corrective measures are essential to be taken by the teachers to rectify students' alternative frames related with the basic concepts of magnetism. Change in the style of teaching, methods of teaching in the class, performing experiments and demonstrations, solving the problems for constructing and reconstructing the ideas seem to be paid focussed attention. It seems that the thought structure of the students needs to be studied and modified. To change the thought structure, it is necessary to examine students' preconceptions and then plan the activities based on the concepts of magnetism accordingly. In doing so, the students may be asked to design the magnetic devices

themselves, make predictions, observe and then explain. Interaction amongst the students may be encouraged so that their ideas are flushed out and mental conflict does take place before any final formation of the concept. In case of alternate explanations, it should be discussed as to how the new concept is better than the previous one. Discussion on limitations of the experiment at the same time also can prove to be useful. As teachers/teacher educators, challenge is to match the needs of the students to a world that is changing with rapid pace. To meet this challenge, there is a need to become strategic learners. It is, therefore, suggested that teachers should act as strategic learners (active researchers and developers of innovations and new directions) by deliberately expanding perspectives and updating their approaches related with teaching learning the basic concepts of magnetism. The curriculum for school education should emphasise on 'Higher Order Thinking Skills' in its rationale, stating that thinking skills are essential in 'learning how to learn'. Hence there is a need of well-organized teaching learning strategies for classrooms that invites and supports 'Teaching for Thinking' and 'Quality Learning'. Accordingly, staffs need to be specially trained and methods need to be introduced into the curriculum for teaching the skills of thinking and associated cognitive and metacognitive strategies. Also innovative instructional materials and strategies for teachers to teach different thinking skills are suggested in present time-frame of school to achieve the mission of education in the 'knowledge society' of 21st century.