Scieence Student–Teacher's Reflection Upon Intelleectual and Procedural Honesty on Conducted Practicals

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SCIENCE for all up to secondary stage was envisaged making future citizens literate and endowed with scientific temper. Teaching of the prescribed scientific content and remembering it by the students neither develops nor nurtures scientific outlook and attitude in them. Proper understanding and appreciation of scientific concepts can only come by engaging learners in processes and procedures that unearth unknown characteristics possessed by the physical, chemical or biological realities that they can investigate at their level of cognitive functioning.

Brown and Brown (1972) conducted a study on the American Professors of Science regarding what constitute scientific values according to them. On the basis of semantic differential technique of Osgood et al, they delineated ten scientific values. Intellectual and procedural honesty was ranked III by them. Other values ranked I to X were Curiosity; Integrity; Creativity; Open-mindedness; Experimental verification; Commitment and persistence; Cause-and-effect; and Skepticism. Sampled Indian Science-teachers had marked intellectual and procedural honesty from ranks III to VIII; (Pachaury, 1973; 2003a, b, 2004). Students develop this and other scientific values when they conduct, biology, chemistry and physics practicals during their higher secondary; B.Sc. and M.Sc. courses. The main concern of present study has been to ascertain how intellectual and procedural honesty had been practised by the science student-teachers when they had engaged themselves in performing science practicals during their schooling and undergraduate/post-graduate studies.

Sample: 30 graduate and post graduate science student-teachers who were studying in a B.Ed. College of new Bhopal township participated in this study (18 men and 12 women). Their modal age was 22 years.

Data collection: An opinionnaire constructed by the investigator formed the tool for data collection. The participants were requested to mark their responses on the following five point percentages. A 0-10%; B 11-25%; C 26-50%; D 51-75% and E 76-100%.

When you did biology, chemistry and physics practicals/ experiments during higher secondary, B.Sc. or M.Sc. courses, how often did you

(i) wrote objectives of the experiment/ practical in your own language?

(ii) collected your data step-by-step?

(iii) analysed and did calculations on the collected data?

(iv) interpreted/ reported on your own data?

(v) took help from external sources in writing objectives, data collection, analysis/ calculations, interpretation and reporting?

Results: The accompanying table provides how often the sampled science student teachers had responded on the five administered queries. They are all expressed in percentage.

Question	A	B	C	D	E
I	30	33	30	03	03
II	27	17	23	20	13
III	20	17	23	40	–
IV	13	17	33	33	03
V	30	33	17	17	03

(Percentages have been rounded off)

In all 93% (A, B and C) of the sampled science student-teachers accepted that for about half of all the experiments done by them, they did not write objectives in their own language. Similarly 67% did not collect their data step-by-step. This percentage was 20 and 13 for up to 761100 times, respectively. 60% of these student-teachers also did not analyze, did calculations on their collected data. However, 40% did so for 50-75 times of experiments done by them. A little more than 60% of them did not interpret or report on their own collected data. Only 33% and 3% did so for 76/100 times, respectively. As many as 97% of them admitted that they resorted to the use of external sources in writing objectives, collection of data, analysis and calculations, interpretation and reporting up to 75% of time. By any criterion, this is very low index of intellectual and procedural honesty displayed by the sampled science student-teachers on the practicals conducted by them.

Discussion: From the point of view of development of scientific temper among the science student-teachers, this is not encouraging at all. It appears the verificatory character of the conducted practicals failed to tempt their awe for knowing something new. This, therefore, dampened their enthusiasm and epistome in investigating already known facts. Apart from this, it was thought useful to ascertain the reason that caused this situation. Five subjects from each gender category of the respondents' interview revealed interesting facts. Non-monitoring of the practicals by the concerned staff being one of them. The other is related with the staff biases in both the internal and external assessments. The respondents asserted that this thwarted their self-esteem as well.

Educational implications: In the opinion of the investigator, all these observations to a very large extent can be easily tackled. In order to shake students' monotony in engaging verificatory exercises/practicals, it is suggested to modify the nature of the practicals. Experimental/investigatory activities can be conceived by the teaching staff on the basis of the scientific concepts learnt in the theory classes. It shall be useful only when

some orientation of the students is first done with regard to

- the nature of scientific investigation
- generation of a hypothesis
- its experimental testing by isolation and control of variables
- conducting the experiment
- analysis and drawing of data based inference and
- collection and reporting of data honestly

Besides these, issues like what is objectivity, how law of parsimony works, and why replicability are essential ingredients of an experiment need to be thoroughly discussed before students embark on exploration of new relationships constructed in the form of a hypothesis. A slender percentage of the students in all possibility would be prone for violating rules of doing an experiment properly. Such incidences can be reduced by individual monitoring and through interactive dialogue on the reasons for resorting to dishonest practices.

Lastly, but not the least, staff displaying intellectual and procedural honesty in their day-to-day behavior shall provide a positive and reinforcing role model for the development and nurture of these scientific values in their students.

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