"LEARNING GAPS IN APPLIED MECHANICS"

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INTRODUCTION :

Present study is an outcome of a comprehensive research undertaken to analyse the results of first year polytechnic diploma course of Gujarat State. When the assessment of performance of these students was evaluated, it was observed that students do commit mistakes. Such mistakes in some cases were of specific nature and in some cases of general nature.

Researches conducted in this area on alternative frameworks in Science reveal that "conceptions the student's already hold considerably influence the learning process"(1). Therefore, emperical studies have been started to investigate student's conceptions before providing instructions. Some studies reflected that student's conceptions are content specific.

In a study on misconceptions i.e. incorrect conception in Science, it was viewed that they have been formed by Science instructions itself (2). The reason being,. the text book's conceptions, or the teacher's conceptions of Science topics (3). are not always correct. Some studies have also been conducted under the heading of students errors (4).

Most of the researches were done in the area of Physics. In mechanics also, hundred and odd studies were conducted on topics like force and motion, work power energy, speed acceleration, gravity etc. In investigations of conceptions in mechanics, there is a search for "general mode of thinking" such as schemes like "give schema" (5).

In the first year polytechnic diploma course "Applied Mechanics" is taught. This discipline needs a good background in Science. Misconceptions in Science do influence learning in "Applied Mechanics".

Therefore, it was felt that investigations in "Applied Mechanics" is necessary, in order to provide teachers with a sufficient knowledge about students' conceptions to help them in planning strategy for effective teaching-learning.

Present study is planned on identifying "Learning gaps in Applied Mechanics".

OBJECTIVES :

The specific objectives of the study are :-

i) to identify the common mistakes committed by the students in different areas of Applied Mechanics.

ii) To classify them in differrent categories.

iii) to diagnose the causes for such mistakes.

iv) to suggest possible means to avoid these mistakes.

The article deals with objectives at serial No. (1) & (iv) only.

THE SAMPLE :

To collect students mistakes, a stratified random sample of one hundred answer scripts of Applied Mechanics was

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drawn from total population of 3846 answer scripts of February 1988 examination of first year polytechnic diploma course. The distribution of marks of entire poplution was positively skewed with (Mean = 34.2 and standard deviation 17.2). The sample represents all the 18 polytechnics and includes students of high, medium & low abilities.

THE TOOL :

- A questionaire, indicating the type of mistakes most likely to be committed by the students was developed by a group of five experts.
- An interview schedule was also prepared to collect information from teachers and students, to diagnose the causes of these mistakes and to suggest the feedback.

PROCEDURE :

Study was conducted sequentially in following steps :-

i) a random sample of one hundred answer scripts was drawn from the total population.

ii) an exercise was conducted to collect the mistakes committed by the students in these answer scripts. The frequency of each type of mistake was also recorded. Two experts selected for this purpose were persons with sincerity, dedication and rich in experience of teaching "Applied Mechanics". One expert each was drawn from a polytechnic and an engineering college.

iii) a team of five experts undertook the task of classifying these mistakes in different categories.
They analysed the question paper and valued it as that of the right difficulty level. The content coverage from different topics, the time allocated and the options were also found to be appropriate. The paper has 50% theory and 50% problem (application of theory) questions. It contained thirty three items.
A list of identified mistakes is given in Appendix-A

iv) members of the study group conducted interview of eighteen subject teachers selected from the polytechnics of Gujarat State. They recorded the responses of these teachers in an interview schedule to analyse the teacher's perceptions on students' learning. The view of teachers were also sought on curriculum, teaching - learning process and evaluation techniques etc.
Teacher's suggestions to rectify the mistakes are listed in Appendix - B.

v) to get the opinion of students on some aspects of curriculum implementation, an attempt was made to interview mostly those students who appeared in February 1988 in first year polytechnic diploma examinations. The number of students contacted was eighty one. The students expressed general views on curriculum, learning process, text books and problems related to management of teaching in polytechnics. The students were of opinion that the language of Science, the applications of principles of Science and the action of forces in different directions create difficulty in understanding "Applied Mechanics".

CONSTRAINTS :

Study was conducted under the restraints of time and constraints of practical consideration to obtain information at a short notice. It was a herculean task to collect sampled answer scripts from a large number of sealed bundles of answer scripts. This study is a post-facto, therefore, some aspects of learning could not be integrated in it.

ACKNOWLEDGEMENTS :

The constant encouragement by Prof. L.N.Verma and Prof. S.Z.Haider, to complete this study is duly acknowledged. The investigator also extends thanks to all those who have contributed for this study.

APPENDIX - A

A list of identified mistakes is as under :-

i) Incoplete definition/law.
ii) Wrong explaination/concept.
iii) Figures/diagrams drawn wrongly.
iv) Conditions not speculated.
v) Directions represented wrongly.
vi) Formula used is wrong.
vii) Mistakes in writing units.
viii) Substitution of terms wrong.
ix) Calculations done wrongly.
x) Wrong derivation of formula.
xi) Mistakes in finding out the angle.
xii) Mistakes in using Sign conventions.
xiii) Interpretation of information done wrongly.
xiv) Principles stated wrongly.
xv) Mistakes in resolution of forces.
xvi) Wrong selection of axes.
xvii) Notations lack clarity.
xviii) Mistakes in conversion of Units.
xix) Mistakes in establishing mathematical relationships.
xx) Diagrams not properly labelled.

APPENDIX - B

A list of some suggestions to rectify the mistakes given by teachers is as under :

i) Experiments should be subject-based.
ii) Graphic statics should be included in engineering mechanics.
iii) Concepts of physics should be reinforced before teaching applied mechanics.
iv) Work-book be developed in tune with syllabus.
v) Tutorials be conducted to clarify the concepts.
vi) More home assignments be given to students.
vii) Use of A.V. aids be encouraged to teach basic concepts.
viii) Opportunity be given to students, to use computers in learning applied mechanics.
ix) Demonstration experiments be conducted in laboratory, not in class rooms.

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