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Construction and Measurement of Effectiveness of Educative Tool in Electromagnetism

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ABSTRACT

There are various concepts involved in electromagnetism which are otherwise difficult to explain to students. Thus an educative tool was constructed for explanation of some concepts like mutual induction, effect of change in core medium, number of turns of coil, etc. All these concepts were explained on one experiment specially designed. This apparatus was used in explaining electromagnetism for one group of undergraduate students between pre and post test. While another group attempt only pre and post test. Using z test the effectiveness of educative tool was tested and it was found to be effective.

KEYWORDS: Concepts, Cognitive beliefs

Introduction:
After analyzing the response of undergraduate students in core areas of physics like electromagnetism it was observed that it was poor but if students are instructed with specially designed apparatus then it is possible to improve their conceptual understanding. The apparatus was tested on group of undergraduate students with respect to control group and using z test it was observed that the apparatus was effective.

Additionally MPEX test that is Maryland physics expectancy test was also taken on the students from experimental group, which measures there cognitive beliefs and it was found that the cognitive beliefs of independence and mathematics link showed improvement that is it showed above 60% favorable response otherwise it was always below 50% of favorable response.

Construction of educative tool:
Two coils were wounded on plastic base and then packed by plastic, but outputs were taken for different number of turns. Thus basically these coils were similar transformers. Through these coils provision was made to pass rods of different materials like iron, wood, aluminum. Direct AC supply was given to one coil and output was taken across another coil in the form LED. As a result one can measure effect on number of turns, effect of change in the medium between the coils, effect of change in the distance between the coils etc.

Methodology:
Two groups were selected for testing the effectiveness of apparatus specially designed for the explanation of concepts of electromagnetism. The control group was given pre and post test while the apparatus was shown and explained to experimental group. The responses of these students were analyzed by z test. Also MPEX test was given to experimental group students and it was observed that their independence and mathematical cognitive belief was improved as compared to the similar surveys taken on undergraduate students.

Observation:
Pre test and post test was comprises of each 20 objective type questions with four choices such that only one option was set to be correct. MPEX test was also taken just to observe effect on cognitive beliefs of students.

A) For Control group: The average marks obtained in pre test= 5.6
The average marks obtained in post test= 5.4
Z value= 0.348

B) For experimental group: The average marks obtained in pre test= 7.7
The average marks obtained in post test= 10.5
Z value= 2.03

MPEX test:
Independents (Cognitive belief D1): 60% Favorable response, 25% Unfavorable response.

Mathematics link (Cognitive belief D5): 63% Favorable response, 17% Unfavorable response.

Other domains were found to be similarly developed and were Novice like.

Analysis:
The control group showed no difference in pre and post tests given as the z value was just 0.348 which not sufficient to reject null result. Hence there was no difference between the average marks obtained in pre and post test by these students.

However due to specially designed apparatus the z value for experimental group students was found to be 2.03 which imply that there is significant difference in average marks obtained in pre and post tests. This implies the specially designed apparatus was found to be useful in explaining concepts of electromagnetism.

Also when MPEX test was given to Experimental group there was significant improvement in Independence and Mathematics link domain. These are cognitive beliefs which plays vital role in conceptual understanding of basic Physics. In all there are six such domains or beliefs defined. Comparatively there were improvements in favorable response. The comparison was made with respect to previous surveys done on undergraduate students.

Conclusion:
The apparatus was found to be effective in explain basic concepts in electromagnetism as proved by Z test. Also there was improvement in Independence and, mathematics link beliefs. The apparatus was very innovative and useful and is recommended to be used for regular use.

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