EFFECT OF E-CONTENT FOR LEARNING INTEGRAL CALCULUS AT HIGHER SECONDARY LEVEL

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Abstract: The main objective of the study was to assess the effectiveness of e-Content for learning Integral Calculus at higher secondary level. Experimental method of research was used for this study. The sample of the study was 64 students. e-Content package for learning Integral Calculus was developed and standardized for higher secondary students studying XII standard in Government Higher Secondary Schools. Criterion Referenced Test (CRT) on Integral Calculus was constructed and validated for pre, post and retention test. In this study, t- test was employed to analyse the data. Findings of this study revealed that the developed e-Content is an effective tool for learning Integral Calculus. Further, it is proved that there is retention capability in learning Integral Calculus using e-Content method. So, the e-Content on learning Integral Calculus is a highly effective tool for higher secondary level students.

Key words: e-Content, integral calculus

INTRODUCTION

Calculus is the mathematical study of change. It is a part of modern mathematical education. A course in calculus is a gateway to other courses in mathematics devoted to the study of functions of limits, broadly called mathematical analysis. The content calculus is made up of two inter connected topics such as differential calculus and integral calculus. Differential calculus is the mathematics of motion and change. Integral calculus covers the accumulation of quantities, such as areas under a curve. The two idea work inversely together as defined by the fundamental theorem of calculus. Calculus is a very versatile and valuable tool. It is used in every branch of physical science, statistics, engineering, economics, medicine, demography and in other field wherever a problem can be mathematically modeled and an optional solution is desired. Calculus can be used in conjunction with other mathematical discipline. In this aspect, calculus is an important unit in mathematics. At the same time, in school education the students are facing problems in understanding the concept and derive the problems. The teachers are also finding difficult to teach the concept effectively because of heterogeneous group of learners. So, there is a need an alternative strategy to learning the concepts.

e-Content is a very powerful tool of education. e-Content is valuable to the learners and also helpful to teachers of all individual instruction systems; e-Content is the latest method of instruction that has attracted more attention to gather with the concept of models. The individualized instruction through e-Content helps the heterogeneous group of students to learn themselves at their own pace depending upon their ability and also reduce the teachers work load of instruction in the classroom. Hence the present study reads as ***"Effect of e-Content for Learning Integral Calculus at Higher Secondary Level".***

OBJECTIVES

1. To find out the effectiveness of e-Content for learning Integral Calculus at higher secondary level.
2. To find out the retention of learning Integral Calculus through e-Content at higher secondary level.

HYPOTHESES

1. There will be a significant mean score difference in learning integral calculus between pre test and post test among higher secondary students.
2. There will be a significant mean score difference in learning integral calculus between pre test and retention test among higher secondary students.
3. There will be a significant mean score difference in learning mathematics between post test and retention test among higher secondary students.

VARIABLES SELECTED FOR THE STUDY

Independent Variable

- Learning Integral Calculus through e-Content method.

Dependent Variable

- Learning outcome in Integral Calculus through e-Content method.

RESEARCH DESIGN

Considering the objectives of the present study, the researcher adopted quasi experimental method.

SAMPLE

64 students studying 12th standard from Government Higher Secondary Schools located in Tiruchengode Taluk in Namakkal Educational District of Tamilnadu state were selected as sample for the study using simple random sampling technique.

DEVELOPMENT OF E-CONTENT

The developed and validated e-Content package for learning integral calculus based on the 12th standard state board syllabus. Integral calculus is a unit of 12th standard mathematics syllabus. In order to prepare the e-Content, the investigator used ADDIE model.

CRITERION REFERENCED TEST (CRT)

A test is said to be Criterion Referenced Test (CRT), if it aims at assessment of individual performance in terms of well defined behavioural objectives such as competencies, skills, attitudes, values etc. In the present study, the tool which assesses the cognitive skills such as knowledge, understanding and the application of the selected content unit is called as CRT. The CRT has 3 parts such as Part A: 20 Objective type questions, Part B: 5 Short answer questions and Part C: 5 Big answer questions. Total marks–100. Knowledge, Understanding, and Application level questions were included in that question paper. 1 hour and 30 minutes provided for answering the questions. The Criterion Referenced Test was used for pre, post and retention tests.

PHASES OF TEST

Before the manipulation of the independent variable, the CRT in Integral Calculus is administered to assess the achievement level at the entry level of the study is called pre test phase. At the end of the manipulation, the CRT in Integral Calculus is administered to study the achievement level of the student. This is called as post test. Fifteen days after the post test, the CRT is administered again to study the knowledge and skills in Integral Calculus retained by the students which is called retention test.

DATA COLLECTION AND ANALYSIS

The investigator has employed three phases such as pre test, post test and retention test for collection of data and manipulation of independent variable of the present study. These phases have taken five continuous days for collection of data and one day for the retention test. i.e 15 days after the post test phase.

On the first day, the investigator conducted CRT on Integral Calculus in mathematics as a pre test phase to study the entry level knowledge of the students. 1 hour and 30 minutes were given for answering the question. In the 2nd, 3rd and 4th day, the students learned the topic integral calculus through e-Content package at their own pace and choice. The post test was conducted on the fifth day and evaluated the achievement score. After 15 days from the post test, the retention test was administered. Thus, the collected data was scrutinized and analysed using appropriate statistical techniques. After conducting the pre test, post test and retention test, the achievement score were evaluated with the help of the scoring key. In this study, test of significance like t- test was employed to analyse the data.

HYPOTHESES TESTING

Hypothesis No.1*: *There will be a significant mean score difference in learning integral calculus between pre test and post test among higher secondary students

TABLE – 1

MEAN SCORE DIFFERENCE IN LEARNING INTEGRAL CALCULUS BETWEEN PRE TEST AND POST TEST AMONG HIGHER SECONDARY STUDENTS

Test Phases	N	Mean	Difference in Mean	S.D	t –value	p-value
Pre test	64	30.94	30.65	8.49	43.285*	.000
Post test		61.59		11.27		

*** Significant at 0.01 level**

Table-1 shows the mean score difference in learning integral calculus between pre test and post test among higher secondary students. The calculated t-value is statistically significant at 0.01 level. So, the hypothesis No.1 is accepted. It is also found that the mean score of the post test is higher than that of the pre test phase which is due to manipulation of the content unit on integral calculus with help of e-Content package as an individualized instruction. Therefore we conclude that the e-Content method has definitely helped the learners to learn the content unit under study.

Hypothesis No.2: There will be a significant mean score difference in learning integral calculus between pre test and retention test among higher secondary students

TABLE– 2

MEAN SCORE DIFFERENCE IN LEARNING INTEGRAL CALCULUS BETWEEN PRE TEST AND RETENTION TEST AMONG HIGHER SECONDARY STUDENTS

Test Phases	N	Mean	Difference in Mean	S.D	t –value	p-value
Pre test	64	30.94	33.26	8.49	40.64*	.000
Retention test		64.20		10.70		

*** Significant at 0.01 level**

The Table–2, presents that there is a mean score difference in learning integral calculus between pre test and retention test among higher secondary students. According to the table, the calculated t-value is statistically significant at 0.01 level. Hence the stated hypothesis No.2 is accepted. It also reveals that the mean score of the retention test is higher than that of the pre test phase. Further, it is verified from the results that the manipulation of content unit through individual instruction i.e e-Content package helped the student to retain their learning.

Hypothesis No.3: There will be a significant mean score difference in learning integral calculus between post test and retention test among higher secondary students

TABLE – 3

MEAN SCORE DIFFERENCE IN LEARNING INTEGRAL CALCULUS BETWEEN POST TEST AND RETENTION TEST AMONG HIGHER SECONDARY STUDENTS

Test Phases	N	Mean	Difference in Mean	S.D	t –value	p-value
Post test	64	61.59	2.61	11.27	4.167*	.000
Retention test		64.20		10.70		

*** Significant at 0.01 level**

It is evident from the Table –3, that there is a mean score difference in learning integral calculus between post test and retention test among higher secondary students. This difference is statistically significant at 0.01. Hence the hypothesis No.3 is accepted. Besides the retention test score is higher than the post test phase. It is due to the manipulation of content unit through e-Content method and reinforcement in regular classroom teaching after post test phase.

FINDINGS

- There is a significant mean score difference in learning integral calculus between pre test and post test among higher secondary students. It is also found that the mean score of the post test is higher than that of the pre-test phase which is due to manipulation of the content unit on integral calculus with the help of e-Content package as an individualized instruction. Therefore we conclude that the e-Content method has definitely helped the learners to learn the content unit under study.
- There is a significant mean score difference in learning integral calculus between pre test and retention test among higher secondary students. The mean score of the retention test is higher than that of the pre test phase. Further, it is verified from the results that the manipulation of content unit through individual instruction i.e. e-Content package helped the student to retain their learning.

- There is a significant mean score difference in learning integral calculus between post test and retention test among higher secondary students. Besides the retention test score is higher than the post test phase. It is due to the manipulation of content unit through e-Content method and reinforcement in regular classroom teaching after post test phase.

CONCLUSIONS

Based on the results and findings of the present study, it is concluded that the developed e-Content for higher secondary level students is a highly effective tool for learning Integral Calculus.

EDUCATIONAL IMPLICATIONS OF THE STUDY

The present investigation studied the effectiveness of e-Content in learning Integral Calculus. The e-Content package on Integral Calculus is well-designed, scientific and scholarly work. No doubt that this will contribute to the learning of Integral Calculus in Mathematics among higher secondary level students. The computer based e-Content packages developed for the present study, made the learning experience much more interesting. There are numerous learning packages available for the subjects such as Arts and Science. The present study suggests that computer based e-Content packages can be developed for the subject of Mathematics. It is a subject of study that needs to be focused on a conceptual understanding rather than a lining up of facts to be memorized for examinations.

Development of e-Content products may take considerable time, but it is worth spending. Once developed, these packages can be used any number of times and individualized learning can be catered. On the whole, the present study clearly demonstrates that the e-learning technology as individualized instructional strategies could be employed for teaching and learning integral calculus in addition to conventional classroom situation.

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