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J. P. Naik Path, Kothrud, Pune-38

Analysing Gain Scores: A Quantitative Assessment of the Impact of E-Content on Trigonometric Achievement in Standard XI Students

Mahesh., L
Research Scholar,
St. Xavier's College of Education (Autonomous), Palayamkottai
Michael J Leo., A.
Research Supervisor,
St. Xavier's College of Education (Autonomous), Palayamkottai

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Abstract:

This research attempts to find out the impact of the utilization of e-content on the achievement of trigonometric functions by IX Standard students through gain scores. Based on the quasi-experimental design, 30 students were selected each in the control and experimental groups from Christian Matriculation School, Kallukootam, Kanyakumari District. The experimental group was taught trigonometric functions utilizing E-content modules; the control group was taught the same topics by the classical method. The investigator developed and utilised the MiMa E-content Learning Module (MMELM) in trigonometric functions for standard XI students and the MiMa Achievement Test in Trigonometry (MATT). The design and development of the MMELM are based on the ADDIE instructional model. The pre- and post-tests were conducted before and after 30 days of treatment, respectively. There is a significant difference between the control and experimental groups of standard XI students in their gain scores in trigonometric functions. While comparing the mean gain scores of standard XI students in the experimental group and control group, the experimental group XI standard students are better in their knowledge, understanding, application, and achievement in total.

Keywords: Achievement, Effectiveness, E-content, Trigonometric function and Module

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Background of the Study:

Information technology and the Internet are important sources of research, innovation, growth, and social change. The development of the Internet has brought about changes in all areas of life, including education. Electronic content includes any content created and distributed through a variety of electronic media, from traditional media such as print and broadcast to electronic devices. More information is combined with audio, video, and text. Electronic content should be creative in terms of both 'data' and 'method' (Nachimuthu, 2012). Keeping this need in mind, the incorporation of instructional design is done in an educational and professional environment. Especially, the technology infusion in the methods of teaching brings a significant difference in the outcome. The abstract concepts in science and mathematics could be

delivered in the classroom, utilising the components of information and communication technology.

The need and significance of the study:

Mathematics is a global language of scientific study. It is essential for human development and sustainability. Mathematics influences all fields of study. Developments in technology affect the teaching and learning of mathematics. Most of the students feel that learning trigonometric functions in mathematics is a difficult task through a conventional method of teaching. So investigations are important to validate students' learning through e-content and e-learning modules. The experiments over the traditional methods of teaching mathematics and employing innovative methods are inevitable and the need of the hour. The students of the present era are electronically engaged, which could be channelled for the purpose of education and professional development. Hence, the impact of an alternative method of teaching mathematics utilising e-content over the traditional method is considered for investigation.

Objectives of the study:

1. To find out the level of achievement in trigonometric functions among the standard XI control group students.
2. To find out the level of achievement in trigonometric functions among the standard XI experimental group students.
3. To find out whether there is any significant difference between the control and experimental groups of standard XI students in their gain scores of achievements in trigonometric functions.

Methodology:

The experimental method was used in which the investigator chose the pre-test-post-test equivalent group quasi-design for experimentation.

Design of Experiment:

Control Group	**Experimental Group**
Pre-Test	Pre-Test
Chalk and Talk Method	e-content presentation method
Post-test	Post-test

Tools used for the study:

1. MiMa's E-content Learning Module (MMELM) in trigonometric functions, developed by the investigator (2022),
2. MiMa's Achievement Test in Mathematics (MATT), developed by the investigator (2022),

Sample for the study:

The sample selected for the present study consists of 60 XI standard students, divided into two groups of 30 students each. Both the control and experimental group students are selected from Christian Matriculation School, Kallukootam, Kanyakumari District.

Conducting the Experiment:

A pre-test was conducted for both groups before starting the experiment. The experimental group students are using MMELM, while the control group students received instruction in the conventional manner. The developed design of MMELM for trigonometric functions is based on the ADDIE instructional model. After completing the experiment, a post-test was conducted.

Analysis of Data:

Objective 1: The level of gain in scores of achievements in trigonometric functions among the standard XI control group students.

Table 1: Level of gain scores of achievements in trigonometric functions among the standard XI control group students

Objectives	Low		Moderate		High	
	N	%	N	%	N	%
Knowledge	20	66.7	9	29.97	1	3.33
Understanding	19	63.3	9	30.03	2	6.67
Application	15	50.0	12	40.0	3	10.0
Achievement in Total	12	40.0	12	40.0	6	20.0

It is inferred from the above table that 66.7% of standard XI control group students showed a low level, 29.97% of them had a moderate level, and 3.33% of them had a high level of knowledge in their gain scores. 63.3% of standard XI control group students showed a low level, 30.03% of them had a moderate level, and 6.67% of them had a high level of understanding in their gain scores. 50% of standard XI control group students showed a low level, 40% of them had a moderate level, and 10% of them had a high level of application in their gain scores. 40% of standard XI control group students showed low scores, 40% of them had moderate scores, and 20% of them had high scores in total.

Objective 2: The level of gain scores of achievements in trigonometric functions among the standard XI experimental group students.

Table 2: Level of gain scores of achievements in trigonometric functions among the standard XI experimental group students

Objectives	Low		Moderate		High	
	N	%	N	%	N	%
Knowledge	6	20.0	20	66.7	4	13.3
Understanding	6	20.0	18	60.0	6	20.0
Application	5	16.7	23	76.7	2	6.7
Achievement in Total	5	16.7	12	40.0	13	43.3

It is inferred from the above table that 20.0% of standard XI experimental

group students showed low level, 66.7% of them have moderate, and 13.3% of them have high level of knowledge in their gain scores. 20.0% of standard XI experimental group students showed low level, 60.0% of them have moderate, and 20.0% of them have high level of understanding in their gain scores. 16.7% of standard XI experimental group students showed low level, 76.7% of them have moderate, and 6.7% of them have high level of application in their gain scores. 16.7% of standard XI experimental group students showed low level, 40.0% of them have moderate and 43.3% of them have high level of gain scores in total.

Objective 3: To find out whether there is any significant difference between the control and experimental group of standard XI students in their gain scores of achievements in trigonometric functions.

Hypothesis 1: There is no significant difference between the control and experimental group of standard XI students in their gain scores of achievements in trigonometric functions.

Table 3: Difference between the control and experimental group of standard XI students in their gain scores of achievements in trigonometric functions

Objectives	**Experimental Group(N=30)**		**Control Group(N=30)**		**Calculated P-value**	**Remarks at 5% level**
	Mean	**S.D**	**Mean**	**S.D**		
Knowledge	9.00	2.30	6.00	2.27	0 .01	S
Understanding	10.17	1.60	6.93	2.48	0.01	S
Application	8.93	1.62	2.97	2.14	0.01	S
Achievement in Total	28.10	1.81	15.90	3.92	0.01	S

S- Significant

It is inferred from the above table that the calculated P value of gain scores and their attainment in knowledge, understanding, and application are less than the P value (0.05). Hence, the null hypothesis is rejected. Therefore, there is a significant difference between the control and experimental groups of standard XI students in their gain scores in trigonometric functions. While comparing the mean gain scores of standard XI students in the experimental group and control group, the experimental group XI standard students are better in their knowledge, understanding, application, and achievement in total.

Table 4: Effect size analysis of control and experimental group students in their gain scores in trigonometric functions

Objectives	**Mean difference**	**Effect Size**	**Percentage of control group below the mean of Experimental group**
Knowledge	3.00	1.31	79
Understanding	3.23	1.55	92
Application	5.97	3.14	92
Achievement in Total	12.20	4.00	92

It is inferred from the above table that 79% of the gain scores of the control group are below the gains scores of the experiment group in their knowledge, 92% of the gain scores of the control group are below the gains scores of the experiment group in their understanding, 92% of the gain scores of the control group are below the gains scores of the experiment group in their application, and 92% of the gain scores of the control group are below the gains scores of the experiment group in their achievement in trigonometric functions in total.

Findings and Interpretations:

There is a significant difference between the control and experimental groups of standard XI students in their gain scores in trigonometric functions. While comparing the mean gain scores of standard XI students in the experimental group and control group, the experimental group XI standard students are better in their knowledge, understanding, application, and achievement in total. E-content has proven to be instrumental in enhancing the acquisition of mathematical knowledge, fostering cognitive understanding, facilitating practical application, and boosting achievement in the field of trigonometric functions within mathematics. The effectiveness of e-content lies in its ability to deliver information with exceptional clarity, incorporate pictorial representations, and utilize multi-sensory approaches, all of which collectively contribute to improved learning outcomes.

Further, the effect size analysis also showed that 92% of the gain scores of the control group are below the gain scores of the experiment group in their achievement in trigonometric functions in total. This is additional evidence to convey the effectiveness of e-content in the teaching of trigonometric functions in mathematics over the traditional method.

Educational Implications:

Electronic content is a powerful learning tool. Electronic content is useful for learners and teachers; the use of electronic content is changing teaching and learning

in a number of ways. With electronic content, the students have the ability to build their own knowledge, with more control than ever before over the information used in the classroom. In the e-content system, they can share their knowledge with each other so that, at the end of the learning process, the learners will have complete information about assignments or units. The e-content module encourages cooperation, active learning, and a personal pace of learning.

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