

Effectiveness of Interactive E-Content Module in Enhancing Students' Achievement in Mathematics

B. Prabakaran¹ AR.Saravanakumar²

¹Ph.D Research Scholar, Alagappa University, Karaikudi & Assistant Professor of Education, Government College of Education, Pudukkottai, Tamilnadu, India

²Assistant Professor, Department of Education, DDE, Alagappa University, Karaikudi, Tamilnadu, India

Abstract

The objectives of the study are to find out the effectiveness between the interactive e-Content module of teaching and chalk and talk method of teaching in learning mathematics among high school students. The investigator used the pre-and-post-test of two equivalent groups design in this study. The purposive sampling technique which was adopted by selecting a sample of 20 Ninth standard students of each group was assigned to the conventional and modern method of teaching. An e-content module and a teacher made achievement test was developed by the researcher under the guidance of research supervisor based on the Mathematics subject portion as set theory including drawing skills of Venn diagram. Fmax test, independent t-test, ANCOVA test, η^2 test, R2 test, ω^2 test, r2 test, Effect Size and Gain Ratio test are used for statistical analysis and interpretation for achievement scores (data) and the results are discussed in this paper along with the findings and recommendations.

Keywords: E-Content module in Set Theory, Learning Mathematics, Ninth Standard Students of State Board Schools.

1. Introduction

Chalk and talk method is still being adopted in every Indian school of Government Sector such as the Tamil Nadu state government. We can slowly change the teaching method in government schools but there is a controversy to change quickly the old teaching method in private schools. Chalk and talk method is a modified lecture method simultaneously with visual representation and oral presentation in the classroom. It has not captivated all students. But is it applicable only for the intellectual high students? It is focusing on the main points of content.

Mathematics teaching cannot be done like this to attract the students in the classroom through this method. The New Education Policy (1986) during the period of Prime Minister Rajiv Gandhi recommended and insisted every classroom in India should have at least one blackboard for teaching-learning process.

The Minister of Human Resource Development, Shri Prakash Javadekar has launched Operation Digital Board in 2019 to leverage technology to enhance quality education in the country. The purpose of the operation can be modified to a class environment and learning through technology advancement. Operation Digital Board is a revolutionary step which can make the learning as well as the teaching process interactive and popularize flipped learning as a pedagogical approach. Padmini Devi, KR & Saravanakumar, (2018). Central Government and Government Aided schools from class 9th onwards as well as in higher education institutions of India equipped the digital board with internet and satellite connection. Students get traditional teaching with facilitates e-teaching aids and also it provides educational resources access from the internet and various lessons get from television broadcasting and access e-book reading. If every classroom is established under this operation, it needs to develop the e-content module for boosting the students learning through educational content broadcasting in television channels.

1.1 Title of the Study

Effectiveness of Interactive E-Content Module in Learning Mathematics, Among High School Students- the pre-test and post-test equivalent groups design

1.2 Review of Related Literature

Kutiriko et al (2019), PioAlbina, A. (2018), Devendiran, G., Vakkil, M. (2017), Manikandan (2017), Sudha Kumari, N. (2017), Amutha, S. (2016 and 2011), Sathya, T (2016), Tekin, Ahmet and Polat, Ebru (2016), Jebaraj&Mohanasundaram (2015), Joseph, Manju (2015), Muruganatham (2015),

Sajna Jaleel (2015), Akhavan, Peyman and Arefi, Majid Feyz(2014), DePaepe, Liesbeth (2014), Suresh Prabu, P.(2014), Thakur, Geeta R. (2014), Vasuki, Sudha&Arthy (2014), Eremias and Subash (2013), Panneerselavam, C. (2013), PioAlbina. A. and Edward William Benjamin. A (2013), Robert Joan, D. R. (2013), Nachimuthu, K. (2012), Sivakumar and Arunachalam (2012), Thiyagu and Muthuchamy (2012), Waggener, Shel (2012), Duraisamy and Surendiran (2011), Johnson, N. and Ramganesh, E. (2011), Aravindan, S. and Ramganesh, E. (2010).

A comparatively small number of experimental researches with the development of e-content is being conducted. Specifically, such experiments are conducted for school and college students in India and Abroad. They are mostly conducted in the discipline of Physical Sciences, Biological Sciences, Statistics, Engineering, History, Economics, Medicine, Demography, Education and Languages etc. The small number of researches experiments in India with e-content development in Mathematics for the school and college students.

1.3 Significance of the Study

The teaching of Mathematics in India is being continued through a conventional method such as chalk and talk method but in the modern development world, it is not sufficient for the students to learn mathematical knowledge. Through the fast-growing of technology with continuous innovation, many e-learning methods are being adopted in both developed countries and developing countries. The State Government Sectors are being very slowly modified nowadays... The Government undertaking schools use blackboard teaching at all times for Mathematics teaching. It is not enhancing all type of students' learning especially the below averages, most of the Government school students are below average students except some students. They also have the economic backwardness as their main defect and so the alternative method of teaching is essential for student learning enhancement. Saravanakumar, AR & Padmini Devi, KR (2020). E-content development in mathematics is one of the modern technological innovative methods for conveying the subject content with a good understanding for students. Our study is there is for the implementation of the e-content module of teaching in classroom learning.

Geeta R Thakur (2014), Suresh Prabu, P. (2014) Rekha, N. and Muthuchamy, I. (2013) explain that in the present days most of the teachers follow traditional methods in teaching Mathematics. Materials supplied are used for teaching through conventional methods. They are taking more time to complete the classroom instructions. Since the classes are crowded, they cannot capture the attention of the students. Interactive e-Content is one of the answers to overcome the difficult point of teaching and learning.

1.4 Objectives

1. To find the significant homogeneity between pre-test scores of experimental and control group of achievement in set theory.
2. To find the significant difference between pre-test scores of experimental and control group of achievement in set theory.
3. To compare the adjusted mean scores of post-test of achievement for an interactive e-content development module group and a Chalk and Talk method group by considering pre-test of achievement scores as covariate.

1.5 Hypotheses

1. There is no significant homogeneity between pre-test scores of experimental and control group of achievement in set theory.
2. There is no significant difference between pre-test scores of the experimental and control group of achievement in set theory.
3. There is no significant difference between the adjusted mean scores of post-test of Achievement for an interactive e-content development module group and a Chalk and Talk method group by considering pre-test of Achievement scores as covariate.

2. Methodology

2.1 Research Design

The researcher adopted pre-test- post-test of two equivalent groups design in this research. One control group with pre-test and post-test are conducted before and after taught through chalk and talk method of teaching in set theory.

One experimental group with pre-test and post-test are conducted before and after the treatment such as subject, content is presented through the interactive e-content module in set theory. The interactive

e-content module of teaching and chalk and talk method of teaching are independent variables, pre-test and post-test of achievement test in set theory of ninth standard are dependent variables.

Two Equivalent Groups Design

R O1 × O2

R O3 C O4

In this design

Subjects are randomly assigned to two groups

1. One Group Receives the Experimental Treatment such as interactive e-content module of teaching (×).
2. One control group receives a conventional method of teaching (C)
3. Two groups receive pre-test (O1, O3)
4. Two groups receive post-test (O2, O4)
5. Both groups are equivalent.

2.2 Population of the Study

Ninth standard students in State Board of Tamil Nadu are the population for the study.

2.3 Accessible Population

Ninth standard students in State Board of Pudukkottai District are the accessible population for the study.

2.4 Sample

40 ninth standard students for 4 groups are selected. It means 20 students in each group is selected from one government school in Pudukkottai District, are the sample for the study. Two groups are randomly assigned the equivalent groups which were considering the half-yearly marks of students.

2.5 Research Teaching-Learning Modules

The interactive e-content module of teaching is presented for the experimental groups and chalks and talk methods teaching is taught by the class teacher.

2.6 Research Tools

The present study has used the following tool:

Achievement Test in set theory is prepared and standardized by the investigator

2.7 Analysis and Interpretation

Null Hypothesis-1

There is no significant homogeneity between pre-test scores of the experimental and control group of achievement in set theory.

Table-1: Homogeneity Test of a Control Group and an Experimental Group for Pre-Test

Variable	Variance of Control Group	Variance of Experimental Group	Hartley's F_{max}	Homogeneity at 0.01 level (3.47)
Achievement	14.0290	12.5684	1.1162	Homogeneity

Scores of Achievement in SET Theory

It is observed from the table-1 that the obtained 'Fmax' value is less than the critical value 3.47 for df (2, 19) at 0.01 levels. Therefore the null hypothesis is rejected and it is evident that the variances of pre-test scores of Control and Experimental Groups are homogeneous. So the variability of scores for the two groups is similar. ANCOVA test can be applied for treatment effect identification.

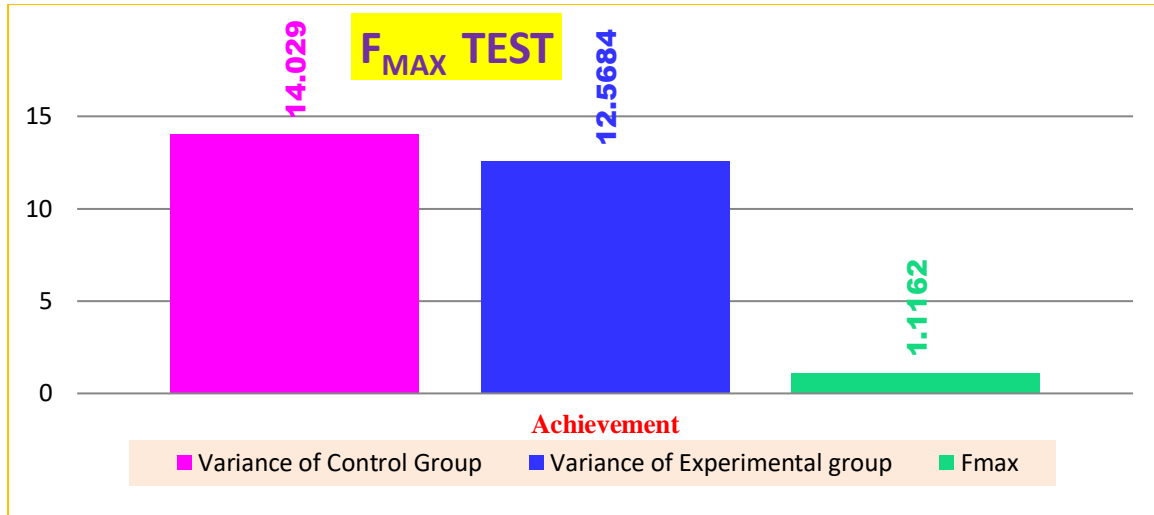


Figure-1: Hartley's FMAX Test for Pretest between Two Groups

Null Hypothesis -2

There is no significant difference between pre-test scores of the experimental and control group of achievement in set theory.

Table-2: t-Test for Pre-test Scores of Experimental and Control Group of Achievement

Variable	Group	Mean	SD	t-test	Significant at 0.01 level
Achievement	Control	11.15	3.7455	0.477	NS
	Experimental	10.6	3.5452		

It is observed from the table-2 that the obtained **t**-value **0.477** is less than critical value **2.7116** for **df = 38** at **0.01** levels. Therefore the null hypothesis is not rejected and it is evident that there is no significant difference between pre-test scores of an experimental and control group of achievement in set theory. It means a control group and an experimental group are equivalent groups at 0.01 levels of achievement scores in set theory. Therefore further proceeding to find the effectiveness between Chalk and Talk method of teaching and e-content development module of teaching.

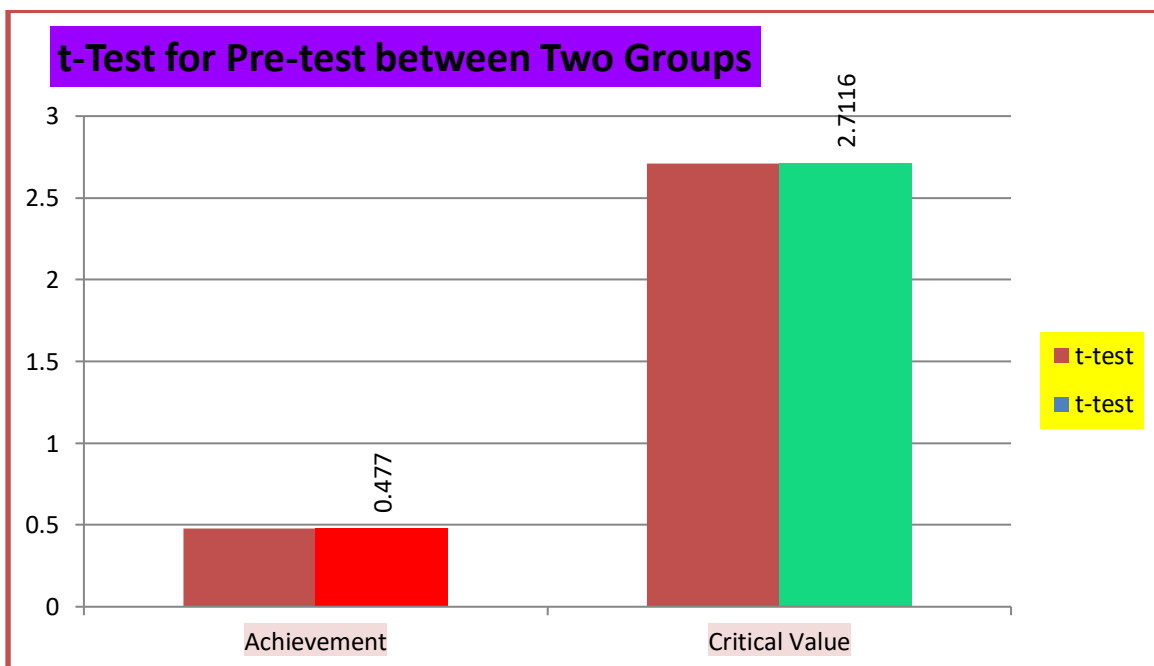


Figure-2: t -Test for Pretest between Two Groups

Hypothesis-3

There is no significant difference between the adjusted mean scores of post-test of achievement for an interactive e-content development module group and a Chalk and Talk method group by considering pre-test of Achievement as a covariate.

Table- 3: Ancova Test for Achievement Scores of Experimental Group and Control Group

Source	Type III Sum of Squares	df	Mean Square	F	Significant at 0.01 level
Pre A	283.791	1	283.791	28.486	**
Treatment	2180.946	1	2180.946	218.917	**
Error	368.609	37	9.962		
Total	1988	40			

From the table-3, the obtained treatment ‘F’ value **218.917** is greater than the critical value **7.3734** for **df (1, 37)** at **0.01** levels. Therefore the null hypothesis is rejected and it is evident that there is a significant difference between the adjusted mean scores of post-test of Achievement for an interactive e-content development module group and a Chalk and Talk method group by considering pre-test of Achievement as a covariate.

$\eta^2 = 0.855$, % of $\eta^2 = 85.5\%$ of the variables in the Pre-test is accounted for two variables such as Chalk and Talk method of teaching and e-content development module of teaching in the Post-test for Achievement scores in the achievement of set theory among ninth standard students in Mathematics learning as well as it is indicated that the treatment has significantly a large effect size ($0.855 > 0.14$) as **Cohen’s Interpretation (1988)**. Therefore e-content development module of teaching in Mathematics unit “Set Theory” is more effect on students’ Mathematical learning.

R2 = 0.865 and adjusted **R2 = 0.857 > 0.49**, so, it is significantly a very large effect size. Based on the statistical tests conducted by the researcher it was evident that the developed-content module in set theory to teach ninth standard students positively and very largely influenced in Achievement scores.

Table -4: Comparison of Adjusted Mean, Effect Size, % of ω^2 , % of R2, Gain Ratio between Chalk and Talk Method and E-Content Development Module

Treatment of Teaching	Adjusted Mean	Effect size (d)	% of ω^2	% of r^2	Gain Ratio
Chalk and Talk method	20.094	2.1549	69.67	28.08	0.2355
e-Content development module	34.906	13.8175	98.96	76.33	0.6117

It is observed from the table-that the obtained **adjusted mean** of an instructional objective such as Achievement scores for e-content development module **34.906** is greater than the adjusted mean of Achievement scores for Chalk and Talk **20.094**. Therefore the e-content development module of teaching is more effective than the Chalk and Talk method of teaching concerning Achievement.

From the obtained **effect size values**, $2.1549 > 1.30$ which indicates that effect size is very large for Chalk and Talk method of teaching. $13.8175 > 1.30$ which indicates that effect size is very large for e-content development module of teaching. Comparatively, $13.8175 > 2.1549$ which interprets the e-content development module of teaching is more effective than Chalk and Talk method of teaching concerning Achievement.

From the obtained **% of ω^2** , **69.67%** of the variables in the Pre-test are accounted for variables in the Post-test of Achievement scores in set theory among ninth standard students for Chalk and Talk method of teaching in set theory of Mathematics learning. $69.67\% > 15\%$ which indicates that Chalk and Talk method is a large effect size by using the interpretation table of **Murphy and Myers (2004)**. **98.96 %** of the variables in the Pre-test are accounted for variables in the Post-test of Achievement in set theory among ninth standard students for interactive e-Content development module in the set theory of Mathematics learning. $98.96\% > 15\%$ which indicates that the e-Content development module is a large effect size. Comparatively $98.96\% > 69.67\%$ which interprets the e-content development module of teaching is more effective than Chalk and Talk method of teaching concerning Achievement.

From the obtained % of r^2 , $0.49 > 28.08\% > 0.25\%$ that indicates it is a large. **28.08** % of Achievement for influencing the Chalk and Talk method of teaching in set theory among ninth standard students is large effect size. Based on the statistical tests conducted by the researcher it was evident that the Chalk and Talk method of teaching on set theory to teach ninth standard students positively large influenced in Achievement scores. **76.33%** $> 49\%$ which indicates it is very large. **76.33%** of Achievement scores influence through an e-content development module of teaching in set theory among ninth standard students. It is large effect size. Based on the statistical tests conducted by the researcher it was evident that the e-content development module of teaching on set theory to teach ninth standard students positively and very largely influenced in Achievement scores. Comparatively **76.63%** $> 28.08\%$ which interprets the e-content development module of teaching is more effective than chalk and talk method of teaching concerning Achievement.

From the obtained Gain Ratio, $0.6500 > 0.3800$, so, the e-content development module of teaching is more effective than the Chalk and Talk method of teaching concerning Achievement. Finally, it is concluded that the adjusted mean value, all effect sizes and gain ratio is a favour to e-content development module of teaching rather than Chalk and Talk method of teaching concerning Achievement. Therefore e-content development module of teaching is more effective for enhancing the ninth standard students' Achievement as compare as Chalk and Talk method of teaching in "Set Theory" for Mathematical learning.

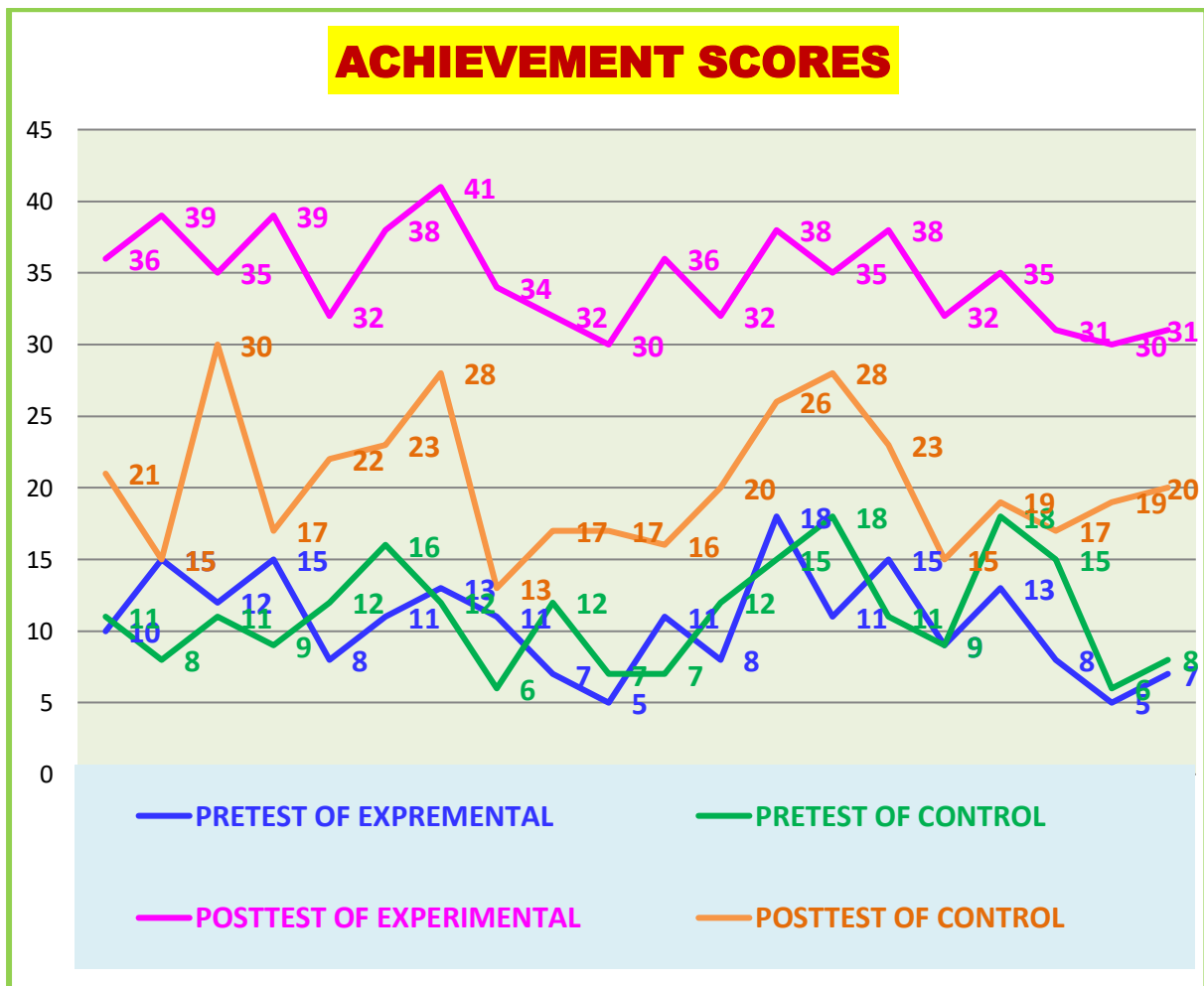


Figure-3: Before and After-Treatment of Achievement in SET Theory

3. Findings of the Study

- The variances of pre-test scores of Control and Experimental Groups are homogeneous at Achievement. So the variability of scores for the two groups is similar. Achievement score of

two groups are normally distributed and that each group has an equal number of members. Its consequences the ANCOVA test can be applied for effective identification of treatment.

- A control group and an experimental group are equivalent groups at 0.01 levels the achievement in set theory. Therefore we are further proceeding to find the effectiveness between Chalk and Talk method of teaching and e-content development module of teaching.
- e-Content development module of teaching is more effective for enhancing the ninth standard students' achievement when compared with Chalk and Talk method of teaching in "Set Theory" for Mathematical learning.

3.1 Discussion of the Findings

Finding-1

The variances of pre-test scores of Control and Experimental Groups are homogeneous at Knowledge, Understanding, Application, Skills level and they're total such as Achievement. So the variability of scores for the two groups is similar. Achievement score of two groups are normally distributed and that each group has an equal number of members. In consequence, the ANCOVA test can be applied for effective identification of treatment.

It has been supported the following studies to the same finding of Hartley's Fmax test.

Pain Responses in Athletes: The Role of Contact Sports by Claire Thornton (2018). Hartley's $F_{max} = 1.28$, the data can be treated as homogenous.

Professional learning community impact on student's Achievement by Courtney S. Bennett (2017) expresses Hartley's F-max testing indicated that the data was homogenous ($F_{Max}=2.05$).

Mobile way or the highway! The Role of Deployment and Design in Problem Solving Using Information Dashboards by Ganapathiraman Raghu Raman (2016) use Hartley's test on the ratio of the largest variance (413) to the smallest variance (136) indicated that the assumption of the equality of variance could not be rejected (Test statistic = 3.03, critical value = 3.12).

Tests for Homogeneity of Variance by Natasa Erjavec (2014) tell Homogeneity of variance (*homoscedasticity*) is an important assumption shared by many parametric statistical methods.

Finding-2

A control group and an experimental group are equivalent groups at 0.01 levels under instructional objectives wise such as Knowledge, Understanding, Application, Skills and their total such as Achievement.

Therefore we are further proceeding to find the effectiveness between Chalk and Talk method of teaching and e-content development module of teaching.

It has been supported for the following studies to the same finding of the equivalent group.

Development of Multimedia Courseware for Teaching Chemistry at Higher Secondary Level by Anandakrishnan, K. (2017) showed that there is no significant difference between pre-test achievement scores of the control and experimental groups.

Impact of e-Content Integration in Science on the Learning of Students at Tertiary Level by Amutha, S. (2016) revealed that Students in both control and experimental group do not differ in their pre-test performance which shows the equivalence of both the groups in their entry behaviour as far as their performance in science learning was concerned.

Effectiveness of Multimedia Learning Package in Learning English: A Study among the Unaccompanied Learners by Joshy Thomas P (2015). Experimental group students taught through innovative method using Multimedia Learning Package does not differ significantly from the Control group students taught through Conventional method in Language Creativity Test scores in the pre-test.

Impact of Multimedia-Aided Teaching on Students' Academic Achievement and Attitude at Elementary Level by Iqbal Shah and Muhammad Khan (2015). The calculated t-value is less than the table value (calculated value = 0.92 vs. table value = 2.01), so there are no significant differences (at $\alpha = 0.05$) between the achievement scores of the experimental group and the control group before treatment. The hypothesis is accepted. It means that both groups are the same before treatment.

The impact of using multimedia on students' academic achievement in the College of Education at King Saud University by Sara Aloraini (2012). There are no statistically significant differences between the experimental and control groups at the significance level of 0.05 in the pre-test which indicates the equivalence of the two groups.

Finding-3

E-Content development module of teaching is more effective for enhancing the ninth standard students' Achievement when compared with Chalk and Talk method of teaching in "Set Theory" for Mathematical learning.

It has been supported and contradicted the following studies to the same findings.

Effectiveness of E-Learning in Teaching Tamil on XI-Std Student in Tamil, Respect to School Locality, Parental Occupation and Learner Generation by Azhagapuri, C. and Ponraj, P (2019). The XI Standard Students in experimental groups have excelled in e-learning on Tamil than control groups which had gone through Tamil in the traditional method.

Effectiveness of E-Content in Botany by Nachimuthu, K. (2018). Teaching through e-Contents was an effective manner and the application of e-Content in the teaching-learning process had a significant impact on Botany.

Effectiveness of E-Content Package on Teaching IUPAC Nomenclature of Organic Chemistry at Undergraduate Level by Devendiren, G. and Vakkil, M. (2017). The finding showed the control group and experimental group in teaching IUPAC nomenclature of organic chemistry significantly varies when compared their mean scores.

"Preparation and Try Out of E-Content for Electronic Mode for Mensuration at Secondary School Mathematics" by Palli William Banerji and Nehru, R.S.S.(2017) observed that the student's academic achievement and participation in learning had enhanced significantly when compared to traditional instruction.

"E-content: an Effective Tool for Teaching and Learning in a Contemporary Education System" by Urvashi Mishra et al. (2017) showed that the students learning can be enhanced through using the e-content method in classroom teaching.

"Impact of e-Content Integration in Science on the Learning of Students at Tertiary Level" by "Development, Validation and Effectiveness of E-Contents in Teaching Physics to Engineering Students" by Gershom Jebaraj, P. and Mohanasundaram, K. (2016) showed that The experimental group Engineering Students who were taught through e-content method achieved better in Physics than the controlled group students who were taught through conventional lecture method.

"Designing an Effective e-Content Development Framework for the Enhancement of Learning Programming" by Meysun Hamdi and ThairHamtini (2016) resulted that there is a significant difference in the average score of the students who studied Quick Basic Programming Language through the e-content.

4. Recommendations of the Study

1. E-Content enhances students learning. So, it is frequently used for classroom teaching handled by the teacher.
2. State Government of Tamil Nadu allocated the sufficient fund to e-Content developers.
3. Management tries to promote the Attitude that the e-Content of Teacher is a positive one.
4. Teachers distribute e-Content to the students for enhancing self-learning apart from classroom teaching-learning
5. Blended learning or hybrid learning is motivated to the students to raise the further clarification of the subject matter.

5. Implications of the Study

Researcher suggests some implications in the field of education as listed below based on the research findings.

1. Meaningful content is enhancing students' learning. So, e-Content contains meaningful content.
2. Concrete thinking to abstract thinking is gradually introduced in e-Content in Mathematics because mathematical learning is more abstract than concrete.
3. The logical way of preparation is important than ideal way of preparation in e-Content because a learner improves his/her logical way of learning in Mathematics.

6. Conclusion

The research found that an interactive e-Content enhances the students' achievement in Mathematics than the conventional method of teaching such as chalk and talk method of teaching for mathematical subject learning. An e-Content can be used for self-learning module in the home for students in their conveniences with speed and interest. E-content acts as an enforcement tool and

keeping the students' enthusiasm with a concentrate on learning along with continuously stimulate from various representations incorporated with subject matter such as video, animation, text, still figures, graphs, 2D or 3D pictures, simulated games etc. It is shifted to the students from passive listening to active listening. Students are learning through more than one sense such as seeing, hearing and touching (navigating).

Acknowledgement

This research article is Supported by RUSA 2.0 MHRD, INDIA in ALAGAPPA UNIVERSITY (A State University Accredited with A+ Grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category- I University by MHRD-UGC, 2019: QS ASIA Rank -216, QS BRICS Rank -104, QS India Rank -20), Karaikudi-630 003.

References

- [1] Adedamola, A. Kareem (2018). The Use of Multimedia in Teaching Biology and Its Impact on Students' Learning Outcomes. The Eurasia Proceedings of Educational & Social Sciences, Vol.9, pp.157-165.
- [2] Anice James (2016). Methods of Teaching Mathematics. Neelkamal Publication, Hyderabad.
- [3] Ashley Brown (2018). Advantages of Using Chalk Boards in Teaching.
- [4] Bhandarkar, K.M. (2016). Statistics in Education. Neelkamal Publication, Hyderabad.
- [5] Bruck, Peter A. (2009). Multimedia and E-Content Trends. Springer Publishing Company, New York.
- [6] Charles, R. (2011). An experimental study on the effect of using Multimedia in teaching trigonometric concepts. PhD thesis, madras university, Chennai.
- [7] Devendiran, G., and Vakkil, M. (2017). Effectiveness of E-Content Package on Teaching IUPAC Nomenclature of Organic Chemistry at the Undergraduate Level. i-manager's Journal of Educational Technology, 14(3), pp. 49-54. <https://doi.org/10.26634/jet.14.3.13859>.
- [8] Henry E. Garrett (2016). Statistics in Psychology and Education (Reprint Edition), Indian Books and Periodicals, New Delhi.
- [9] Iqbal Shah & Muhammad Khan (2015). Impact of Multimedia-Aided Teaching on Students' Academic Achievement and Attitude at Elementary Level. US-China Education Review, Vol. 5, No. 5, pp.349-360.
- [10] JayakumaryMuttappallymyalil (2016). Evolution of Technology in Teaching: Blackboard and beyond in Medical Education. CEA, Nepal Journal of Epidemiology, 6(3), pp. 588–592.
- [11] Jazeel, A.M. & Saravanakumar AR (2016), "Significance of the Internet for Teaching Poetry in English: An Innovative Approach for Sri Lankan Literary Teachers", Roots: International Journal of Multidisciplinary Researches, India, 2(7), March 2016.
- [12] Jazeel, A.M. & Saravanakumar, AR. (2014). Infusion of ICT Tools for Enhancing the Quality of Teacher Education in Sri Lanka, Proceedings of International Conference on Recent Advances in Educational Technology: Implications and Future Directions, Department of Educational Technology, Bharathidasan University, Tiruchirappalli, 23rd and 24th August, 2014, pp. 112.
- [13] Jazeel, A.M. & Saravanakumar, AR. (2014). Computing and ICT as a Change Agent for Education, Proceedings of International Conference on Recent Advances in Educational Technology: Implications and Future Directions, Department of Educational Technology, Bharathidasan University, Tiruchirappalli, 23rd and 24th August, 2014, pp.6.
- [14] Jamin, E. (2017). A study of the effect of an e-content in teaching Tamil language learning to 9th Standard English medium. International Education Journal, Vol. 3, Issue. 11, pp.39-40.
- [15] Kalaiselvi, R., Palanisamy A & Saravanakumar AR (2012), "Implementing Life Skill Education Strategies in Teaching – Learning Process", Indian Journal of Applied Research, India, Vol.1, Issue 5. <https://www.worldwidejournals.com/indian-journal-of-applied-research/article/implementing-life-skill-education-strategies-in-teaching-learning-process/MjI1/?is=1&b1=85&k=22>

- [16] Kavitha, M. and Saravanakumar, AR. (2015). Enhancing Performance in Basic Mathematical Operations through Selected Strategies among Rural Upper Primary Children. PhD thesis, Alagappa University, Karaikudi.
- [17] Kshirsagar, O.M. (2018). Research in Educational Statistics. ABD Publishers, India.
- [18] Mangal, S.K. (2016). Pedagogy of Mathematics, Bookman India Publisher, Muzaffarnagar, India.
- [19] Marimuthu S, & Saravanakumar (2017), “Enhancing Performance of Higher Secondary Students Through CAI and SIM,” International Journal of Scientific Research. India. Vol.06. [https://www.worldwidejournals.com/international-journal-of-scientific-research-\(IJSR\)/article/enhancing-performance-of-higher-secondary-students-through-cai-and-sim/MTA2MzA=/?is=1&b1=181&k=46](https://www.worldwidejournals.com/international-journal-of-scientific-research-(IJSR)/article/enhancing-performance-of-higher-secondary-students-through-cai-and-sim/MTA2MzA=/?is=1&b1=181&k=46)
- [20] Marimuthu S & Saravanakumar (2017), “Effectiveness of CAI and SIM for Enhancing Performance of Higher Secondary Students,” Indian Journal Applied Research, Vol.07, Issue, 04. [https://www.worldwidejournals.com/indian-journal-of-applied-research-\(IJAR\)/article/effectiveness-of-cai-sim-for-enhancing-performance-of-higher-secondary-students/MTE3NjA=/?is=1&b1=89&k=23](https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/article/effectiveness-of-cai-sim-for-enhancing-performance-of-higher-secondary-students/MTE3NjA=/?is=1&b1=89&k=23)
- [21] Martin Lee Abbott (2011). Understanding Educational Statistics Using Microsoft Excel and SPSS 1st Edition. Wiley publisher, New Jersey, USA.
- [22] Nachimuthu, K. (2018). Effectiveness of E-Content in Botany. International Journal of Research in Humanities, Arts and Literature. Vol.6, No.9.
- [23] Nathan D. Lang-Raad & Robert J. Marzano (2019). The New Art and Science of Teaching Mathematics (Kindle Edition), ASCD and solution tree press, Bloomington, USA.
- [24] Rajesh V. Parmar (2018). Development and Effectiveness of Computer-Assisted Instruction in English Grammar for Standard IX Students. PhD thesis, Centre of Advanced Study in Education (CASE), Faculty of Education and Psychology, the Maharaja Sayajirao University of Baroda.
- [25] Ravichandran T & Saravanakumar AR (2014), “Effect of Video Programmes in Developing Experimental Skills among Prospective Biology Teachers”, Indian journal of applied research, India, vol.4, issue. 12. [https://www.worldwidejournals.com/indian-journal-of-applied-research-\(IJAR\)/article/effect-of-video-programmes-in-developing-experimental-skills-among-prospective-biology-teachers/NTI5MQ==/](https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/article/effect-of-video-programmes-in-developing-experimental-skills-among-prospective-biology-teachers/NTI5MQ==/).
- [26] Sara Aloraini (2012). The impact of using multimedia on students’ academic achievement in the College of Education at King Saud University Journal of King Saud University – Languages and Translation, 24, 75–82.
- [27] Yi, J. -. (2019). Research for developing english learning contents based on user’s native language. International Journal of Advanced Science and Technology, 28(3), 167-173. Retrieved from www.scopus.com
- [28] Saravanakumar AR (2016). “Role of ICT in transforming Sri Lankan Higher Education”, International Journal of Advanced Research Trends in Engineering and Technology, India, Vol. 3, Issue. 20.
- [29] Saravanakumar AR (2018). ‘Role of ICT on Enhancing Quality of Education’, International Journal of Innovative Science and Research Technology, Vol. 3, Issue 12, pp. 717-719.
- [30] Saravanakumar AR, Paavizhi K, & Palanisamy P (2019). ‘Effectiveness of Video Assisted Learning Module’ International Journal of Control and Automation. Vol.12, pp.268-275.
- [31] Saravanakumar AR, Paavizhi K, & Balamurugesu KR (2019). ‘A Survey on Effectiveness of Video Assisted Learning in Enhancing Knowledge Competencies for Teachers’ Test engineering and management. Vol.82, pp.5866 – 5872.
- [32] Saravanakumar AR, & Padmini Devi KR. (2020) Indian Higher Education: Issues and Opportunities, Journal of Critical Reviews. Vol. 7, Issue 2, pp.542-545.
- [33] Satyaprakasha, C.V., & Yaspal Sudhanshu (2014). Effect of Multi-Media Teaching on Achievement in Biology. International Journal of Education and Psychological Research. Vol 3, Issue 1.
- [34] Sakar Das & Rama Chandra Dhir (2017). Pedagogy of Mathematics, Kalyani Publishers, New Delhi.

- [35] Sunita Arya & Manisha (2018). Comparative Study of Effectiveness of Multimedia and Traditional method for Teaching Biology. *International Education & Research Journal*. Vol.4, Issue: 5, pp.38-39.
- [36] Tam R. Lawson, Anna C.Faul & Verbist, A.N (2019). *Research and Statistics for Social Workers*, Routledge, 52 Vanderbilt Avenue, New York.
- [37] Vijayakumar S, & AR.Saravanakumar AR, (2017), ‘Developing A Conceptual Model for Teaching Students with Maths Anxiety Among Upper Primary Level’, *Paripex-indian Journal of Research*. Vol. 06, Issue: 12, DOI : <https://www.doi.org/10.36106/paripex>.