

Effectiveness of E-content in Teaching of Mathematics Education among B.Ed. Student-teachers

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Abstract The study is focused to find out the effectiveness of e-content in teaching of mathematics education among B.Ed. student-teachers. The investigator used the pre-test-post-test control group design. In the present study, stratified random sampling technique was adopted to select a sample of 60 student-teachers to comprise the control group and experimental group of the study. The control group was taken as the reference, which was used to compare the experimental group. The control group was taught through the conventional method and the experimental group was exposed to the E-content. The two research tools such as E-content in Teaching of Mathematics Education, and Achievement Test were used to collect data. In the light of research findings, it has become crystal clear that E-content in the Teaching of Mathematics Education has provided higher achievement among B.Ed. student-teachers.

Keywords: *E-content, teaching of mathematics education, B.Ed. Student-Teachers*

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1. Introduction

Teaching being a noble profession is an art by itself. Presentation of the materials is the style of any art. Hence, producing quality in teaching is the essence of the art of Teaching. Today's classroom teachers must be well prepared to provide technology-supported learning opportunities for their aspiring students. It goes without saying that being prepared to use technology and knowing how that technology can support student-learning, must become an integral part of every teacher's professional repertoire [1].

In India there is a compelling social need for a switch over of education from the conventional method to the modern teaching methods. The modern teaching techniques lead to the Emerging Educational Technology, which is one of the crucial developments in the field of education. The use of Educational Technology is the newly evolved emerging branch of education and it plays a vital role in promoting and strengthening the teaching-learning process.

It has become quite obvious that the traditional educational practices no longer provide the prospective teachers with all the necessary skills for teaching the students, who must be able to survive economically in today's workplace. Teachers must teach the students to apply strategies for solving problems and to use appropriate tools for learning, collaborating, and communicating.

A new role of the teacher for the 21st century means that teachers should be primarily oriented towards guiding the students through the learning process. In this process information and communication technology (ICT) plays a significant role. So it is not surprising that more and more

e-resources are available and can be used in the learning process. But the analysis of the existing resources often reveals that the authors of the resources do not use the opportunities offered by the new technologies. New technologies offer and at the very least give the teachers the chance to adapt the materials to their own and their learners' needs. The teachers are the ones who should personalize the content towards the specific student and the didactical situation in question. Therefore, selection, adaptation and combination of resources are among the major parts of teacher's tasks. Resources should be prepared so that they can be easily adapted according to a particular didactical situation. So there is a conflict between the possibilities technology provides, the teachers' wishes and the e-materials available. E-content resolves this conflict and smoothenes the conveyance of subject materials.

Electronic content (e-content) or digital content is defined by those involved in creating, providing and distributing information as the digitalized content, which is viewed on screen and not on paper. Contents that are produced and stored electronically rather than in print are the result of electronic publishing. The contents can be in any of the following forms:

- Anyone information type (for example fully textual, only graphics content, or only audio content);
- Multimedia or hypermedia (i.e. mixing more than two information types).

E-Contents use in education can be from the usual electronic journals (e-Journals), and electronic books (e-Books) to electronic research reports (e-Research-reports), electronic lecture modules (e-Lecture-modules), electronic lecture notes (e-Lecture-notes) and electronic lecture slides (e-Lecture-slides) [2].

E-content is valuable to the pupil and also helpful to the 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 ultimate aim of the E-content is to abolish the disparity among the learners through effective education.

1.1. Title of the Study

“Effectiveness of E-content in Teaching of Mathematics Education among B.Ed. Student-Teachers”.

1.2. Review of Related Literature

The studies which have been conducted on Computer-Assisted Instruction, Computer-Based Instruction, Computer-Mediated Instruction, Web-Based or CD-Based Multimedia E-learning materials and e-content in abroad and India shows the need and significance of the emerging technology like e-content in the field of teaching of Mathematics Education. It has been supported by Amory, Alan; Naicker, Kevin (2001), Atan, et.al., (2002), Chun-Yen Chang (2002), Kekkonen-Monetamet, al., (2002), Moreno, Roxana; Mayer, Richard (2002), Jha et al. (2002), Doer, Thompson (2004), Bobby (2004), Teabo, Sharon, L. (2004), Norhayati, A.M., & Siew, P.H. (2004), Angeli, Charoula (2005), Glkang.A.Noell, J. & Swartz, L. (2005), Helen Joy; Shaiju (2005), Yuen, S.T.S. Naidu, S. & Kodikara, J.K. (2005), Mohd Hafiz Zakaria, Umawathy Techanamurthy, AnusuriyaD evaraju (2006), Tas, et al (2006), Lau, HYK. Mak, and KL. Ma, H.(2006), Zajaczck, J. Gots et al. (2006), Leuenberger, H., Menshutina, N., and Betz, G.Puchkov, M.N.(2006), Naik, D.C., Teelock, V. (2006), Kanellopoulos, D., Sakkopoulos, E., Lytras, M.T., and Sakalidis, A. (2007), Lanyi, CS., Kosztyn, Z., Kranicz, B., Schanda,J. And Navvab, M.(2007), Jennings, Kathrine, T., Erik, M. Weaver., & Gabriela, C. (2007), Walker, David A. et al. (2008), Abdallah Arman (2009), K Suraez, MDA., Artal, CG., and Hernandez, FMT(2009), enneth, H. Smith (2009), Yusuf, Mudasiru and Afolabi, Adedeji (2010), Shahrina Md Nordin, Wan Fathimah Wan Ahmad, MazzyrahMasri (2010), Elizabeth A. Fisher and Vivian H. Wright (2010), Michele Biasutti, (2011), Campbell, Kristin R., Wilson, Sandra B., Wilson, P., and Christopher He, Zhenli (2011), Koehler, N.A., Thompson, A.D., and Phye, G.D. (2011), KetutBudiastira, A.A. (2011), Anderson, Janice; Barnett, Michael (2011), Hsu, Pi-Sui (2012), Hui-Yi Liang and Chih-Chien Yang (2013), Kamith Osman and Tien Tien Lee (2013), Wolter, Bjorn H.K.; Lundegerg, Mary A.; Bergland, Mark; Klyczek, Karen; Tosado, Rafael; Toro, Arlin; White, C.Dinitra (2013), Rommel L. Verrecio (2014), Jifeng Cao (2014), Fui-Theng and Mai Cao (2014), Li MA, Zhenmei SHI (2014), Najat Smeda, Eva Dakich and Nalin Sharda (2014), Fazzlijan Mohamed Adnan Khan and Mona Masood (2015).

Comparatively very few experimental researches with development of e-content are done. Specifically such experiment works are done for the school and college students and they are mostly in every branch of physical science, statistics, engineering, economics, medicine, demography and languages etc. The research done in India in mathematics with e-content for the students of school and college level is very less in number.

Very few studies are carried out in the field of Mathematics Education in India such as: Jothikani. N and Thiagarajan A.P. (2004), Rosales. J.S. (2005), Lakshmi Narayanan. S (2011), Pramila Ramani, Harsha Patadia (2012), Pramila Ramani, Harsha Patadia (2012), Dhevkrishnan. R. et.al., (2012), Singh. J.D. (2013), Sajna Jaleel (2015).

As far as the investigator knows, the reviews provide to make out the conceptual frame work, sources for hypotheses, method, procedure, sources of data and statistical techniques for the present study. As no study was found related to teaching of mathematics education at B.Ed level with the help of e-content presentation, the researcher having consulted with experts, mathematics teachers and other resources, intended to develop an e-content in Teaching of Mathematics Education for B.Ed. students-teachers.

1.3. Significance of the Study

The advancement in electronic media forces the teachers to change their traditional methods of teaching. The role of the teacher is also changing. Students need E-guru to explain the wealth of information available on-line. In short, with technological advancements the role of the teacher is more than that of facilitator, guide and resource seeker. Kekkonen-Monetam et, al., (2002) evaluated the effectiveness of multimedia e-learning materials and suggested that the use of carefully designed interactive e-learning modules fosters higher-order learning outcomes [3].

The use of E-content is changing teaching in several ways. With E-content, teachers are able to create their own material and thus have more control over the material used in the classroom than they have had in the past.

Anita Rastogi and Babita Parashar (2009) developed an e-content on the concept of micro-teaching and the e-content proved effective in enhancing their level of achievement and their proficiency in teaching skills [4].

Aravindan, S. and Ramaganesh, E. (2010) investigated the effectiveness of e-content in concretizing the concepts of physics among the heterogeneous teacher educators and the results revealed that the e-content was effective in concretizing the concepts [5].

Tharvin sumi, I. & Edward William Benjamin. A. (2011) found the effectiveness of multimedia in teaching and as a result of the study multimedia helped students to withstand their interest and also their retention power than the traditional method of teaching [6].

Robert Joan, D. R. (2013) conducted a Study on Effect on E-Content Learning Package in Mathematics Education for The Prospective Teachers. Thus E-content learning package in Mathematics Education for the prospective teachers is more effective [7].

Therefore E-content is a very powerful tool of education. E-content is valuable to the learners and also helpful to the 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.

E-content can greatly aid the process of mathematical exploration and clever use of such aids can help the student-teachers to understand various methods available in teaching of mathematics education. Innovations like e-content and use of such material must be encouraged so that their use makes learning mathematics more enjoyable and meaningful.

Hence with the intention of developing E-content and testing its efficiency, the investigator conducted a study on *"EFFECTIVENESS OF E-CONTENT IN TEACHING OF MATHEMATICS EDUCATION AMONG B.ED STUDENT-TEACHERS"*.

1.4. Objectives of the Study

1. To find the significance of difference between the control and the experimental group B.Ed student-teachers in their pre-test mean scores.
2. To find the significance of difference between the pre-test and the post-test mean scores of control group.
3. To find the significance of difference between the pre-test and the post-test mean scores of experimental group.
4. To find the significance of difference between the control and the experimental group B.Ed student-teachers in their post-test mean scores.

1.5. Null Hypotheses

1. There is no significant difference between the control and the experimental group B.Ed student-teachers in their pre-test mean scores.
2. There is no significant difference between the pre-test and the post-test mean scores of control group.

3. There is no significant difference between the pre-test and the post-test mean scores of experimental group.
4. There is no significant difference between the control and the experimental group B.Ed student-teachers in their post-test mean scores.

2. Methodology

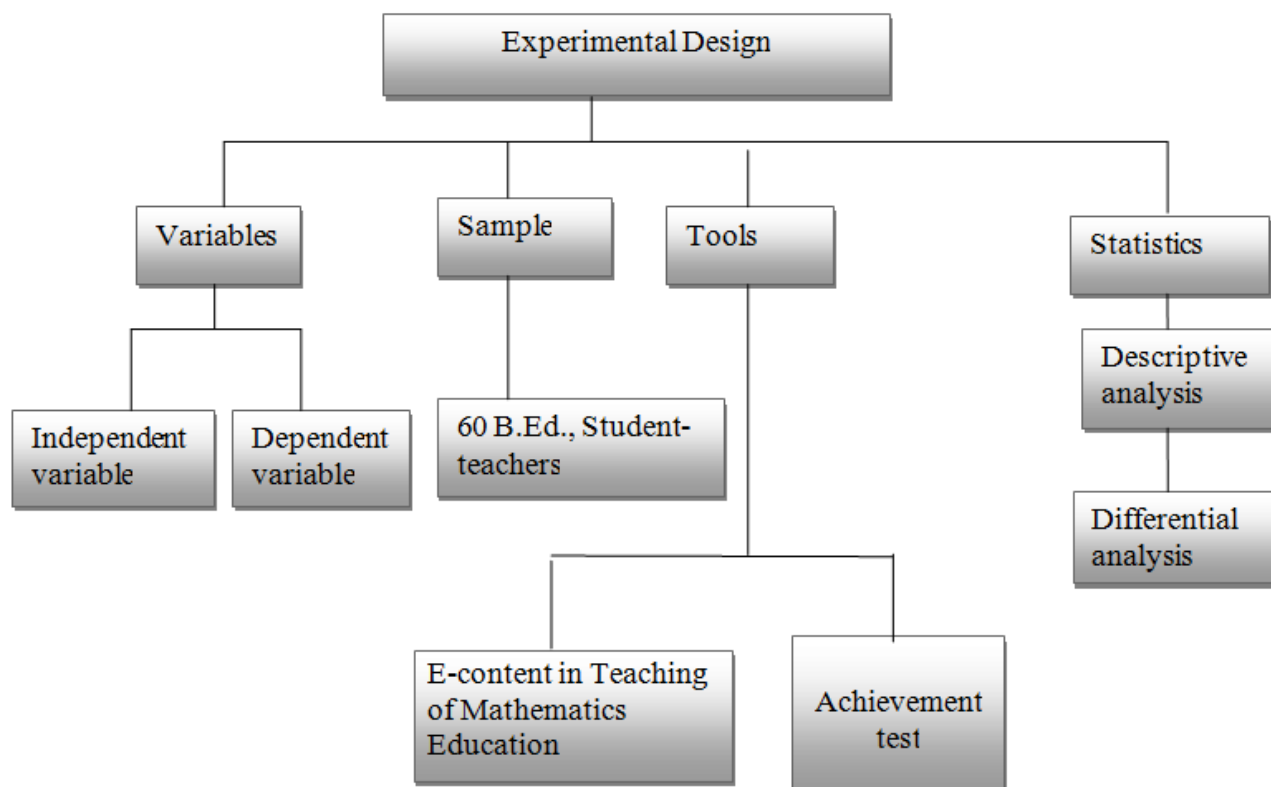
2.1. Research Design of the Study

In order to promote the sensitivity for the experimentation, the investigator used the pre-test-post-test control group design in this study to assess the effectiveness of E-content in the Teaching of Mathematics Education (independent variable) on the enhancement of achievement of B.Ed. student-teachers (dependent variable). The control group and the experimental group were compared in all possible aspects. The control group was taken as the reference, which was used to evaluate the effectiveness of E-content in the Teaching of Mathematics Education for the experimental group. The control group was taught through the conventional method and the experimental group was exposed to the E-content.

Table 1. Design of Experiment

S. No	Control group	Experimental group
1	Pre-test	Pre-test
2	conventional method	E-content presentation method
3	Post- test	Post- test

2.2. Experimental Design



2.3. Population of the Study

Population of the study is the student-teachers of mathematics department of the colleges of education in Sivagangai district in Tamilnadu.

2.4. Sample of the Study

The investigator has selected the sample as student-teachers of mathematics department of Alagappa University College of Education, Karaikudi and Sri Raaja Raajan College of Education, Karaikudi. From each of these colleges 30 student-teachers were selected to comprise the control group and experimental group of the study. These 30 student-teachers were selected using stratified random sampling technique. The control group and the experimental group subjects were equated in all possible aspects and thus facilitating parallel groups of the experimental designing.

After the experimental process, the control group as well as experimental group were assessed for the knowledge in the methods of Teaching Mathematics and the attitude towards e-content in Teaching of Mathematics Education.

Finally the post-test was conducted for the control and the experimental group to find the efficiency of the e-content in the Teaching of Mathematics Education.

2.5. Research Tools

The present study used the following tools:

1. E-content in Teaching of Mathematics Education.
2. Achievement Test prepared and standardized by the investigator.

2.6. Features of E-content in Teaching of Mathematics Education

- E-content in Teaching of Mathematics Education is user friendly in nature.
- Every lesson has objectives to be attained, introduction to content; relevant content, the examples are highlighted and a quiz to check the progress.
- Relevant pictures, videos and animation add a colorful meaning to the content.
- Voice is added in every frame to scintillate the senses of the students.
- Navigation buttons are clearly shown so that the user can use it as per their requirements.

2.7. Analysis and Interpretation of Data

Null Hypothesis: 1

There is no significant difference between the control and the experimental group B.Ed student-teachers in their pre-test mean scores.

The mean of the pre-test scores of the control group is found to be 27.73.

The mean of the pre-test scores of the experimental group is found to be 28.33.

Since the calculated 't' value (1.79) is less than the table 't' value, it is inferred from the above table that there is no significant difference between the control and experimental group B.Ed. student-teachers in their pre-test mean scores.

Table 2. Mean, Standard Deviation and 't' value of B.Ed. Student-teachers of the Control Group and the Experimental group in the Pre-test

Group	Number	Mean	SD	't' value	df	Remark
Pre-test scores of Control Group	30	27.73	9.49	1.79	58	Not Significant
Pre-test scores of Experimental group	30	28.33	9.51			

At 0.01 level of significance the table value of 't' is 2.576.

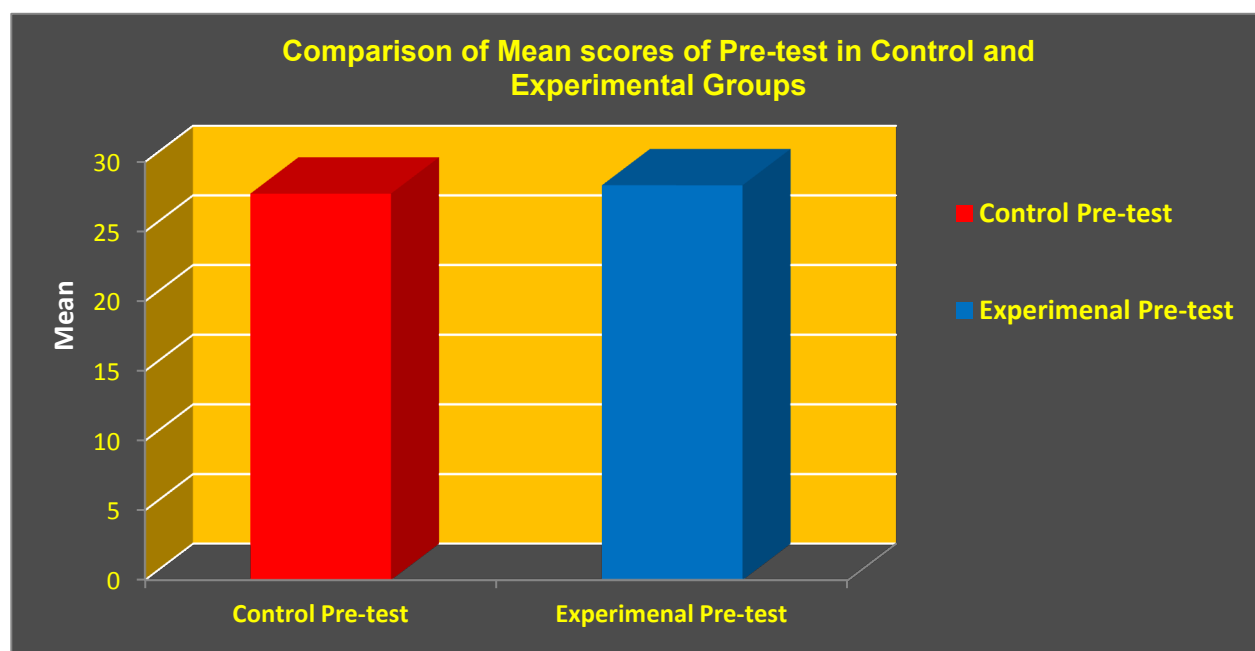


Figure 1. Comparison of Mean scores of Pre-test in Control and Experimental Groups

Null Hypothesis: 2

There is no significant difference between the pre-test and the post-test mean scores of control group.

The mean of the pre-test scores of the control group is found to be 27.73.

The mean of the post-test scores of the control group is found to be 69.00.

Since the calculated 't' value (39.12) is greater than the table 't' value, it is inferred from the above table that there is significant difference between the pre-test and post-test mean scores of control group.

Null Hypothesis: 3

There is no significant difference between the pre-test and the post-test mean scores of experimental group.

The mean of the pre-test scores of the experimental group is found to be 28.33.

The mean of the post-test scores of the experimental group is found to be 82.47.

Since the calculated 't' value (62.37) is greater than the table 't' value, it is inferred from the above table that there is significant difference between the pre-test and post-test mean scores of the experimental group.

Table 3. Mean and Standard Deviation and 't' value of B.Ed Student-teachers of the Control Group in the Pre and Post tests

Group	Number	Mean	SD	't' value	df	Remark
Pre test scores of Control Group	30	27.73	9.49	39.12	58	Significant
Post test scores of Control Group	30	69.00	11.60			

At 0.01 level of significance the table value of 't' is 2.576.

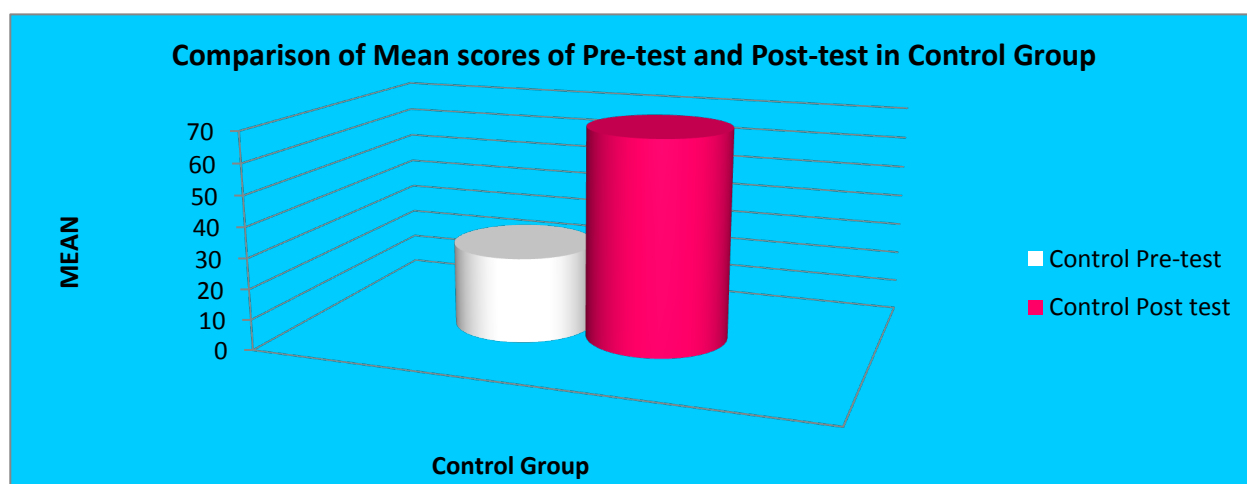


Figure 2. Comparison of Mean scores of Pre-test and Post-test in Control Group

Table 4. Mean and Standard Deviation and 't' value of B.Ed. Student-teachers of the Experimental Group in the pre and Post tests

Experimental Group	Number	Mean	SD	't' value	df	Remark
Pre test scores of the Experimental Group	30	28.33	9.51	62.37	58	Significant
Post test scores of the Experimental Group	30	82.47	6.78			

At 0.01 level of significance the table value of 't' is 2.576.

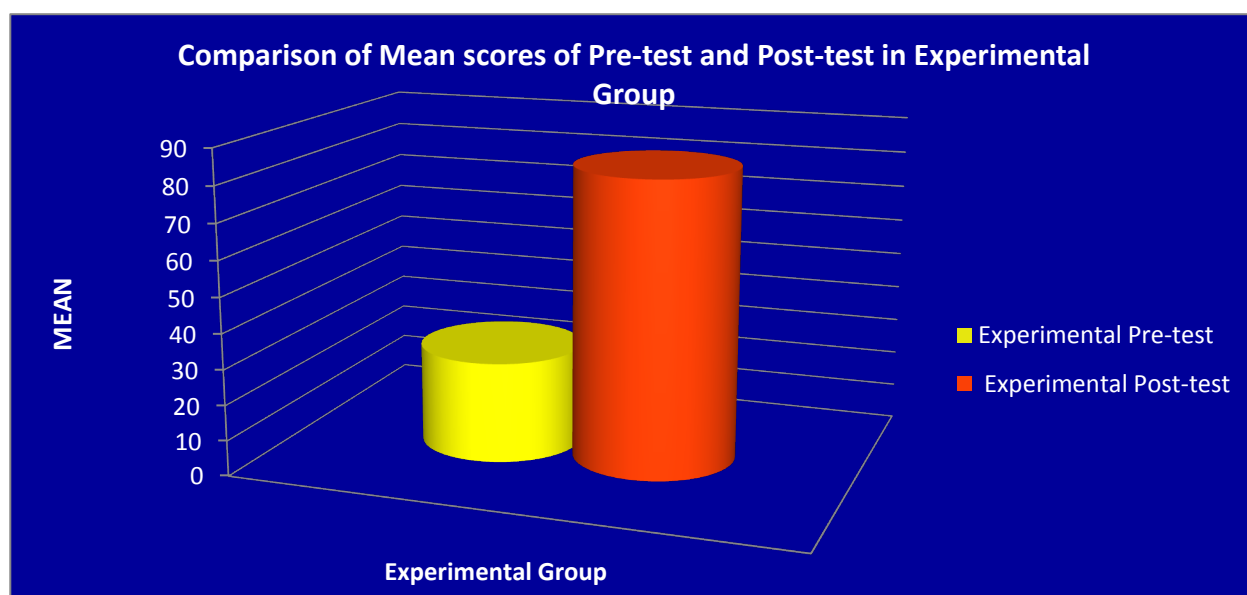


Figure 3. Comparison of Mean scores of Pre-test and Post-test in Experimental Group

Null Hypothesis - 4

There is no significant difference between the control and the experimental group B.Ed student-teachers in their post-test mean scores.

The mean of the post-test scores of the control group is found to be 69.00.

The mean of the post-test scores of the experimental group is found to be 82.46.

Since the calculated 't' value (11.43) is greater than the table 't' value, it is inferred from the above table that there is significant difference between the control and the experimental group B.Ed. student-teachers in their post-test mean scores.

Table 5. Mean and Standard Deviation and 't' value of B.Ed Student-teachers of the Control Group and the Experimental group in the Post Test

Group	Number	Mean	SD	't' value	df	Remark
Post-test scores of the Control Group	30	69.00	11.59	11.43	58	Significant
Post-test scores of the Experimental group	30	82.46	6.78			

At 0.01 level of significance the table value of 't' is 2.576.

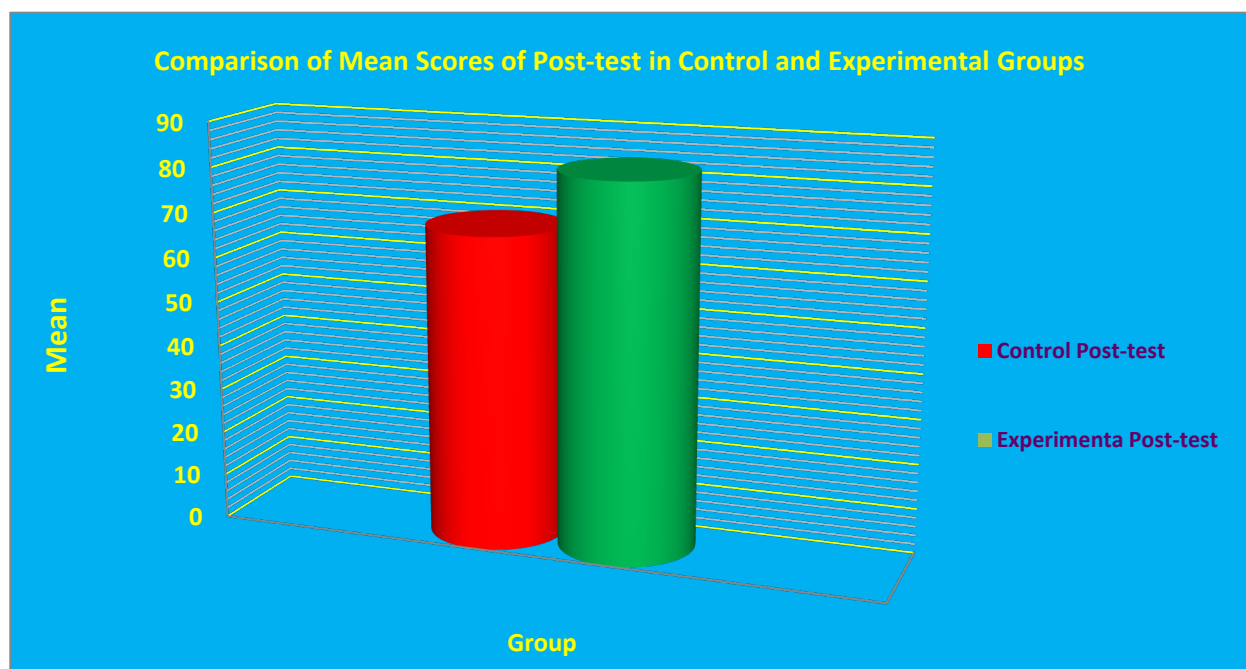


Figure 4. Comparison of Mean scores of Post-test in control and Experimental Groups

3. Discussion

Finding No.1 shows that there is no significant difference in the pre-test scores attained by the control and experimental groups. This justifies that the subjects in both the groups have been equated under the rationale of their previous knowledge.

Finding No.4 points out the significant difference between the control and experimental groups in their post-test scores. This finding justifies the significant effectiveness of E-content in Teaching of Mathematics Education. This finding ascertains that e-content has the potentials to improve learning opportunities for the students, and it is a very powerful tool of education and is valuable to the learners.

Moreover it has been observed from the following studies:

2.8. Findings

1. There is no significant difference between the control and the experimental group B.Ed student-teachers in their pre-test mean scores.
2. There is no significant difference between the pre-test and the post-test mean scores of control group.
3. There is no significant difference between the pre-test and the post-test mean scores of experimental group.
4. There is no significant difference between the control and the experimental group B.Ed student-teachers in their post-test mean scores.

- a. "Effects of Computer Assisted Instruction (CAI) on the secondary school students' performance in Biology" by Yusuf, Mudasiru and Afolabi, Adedeji (2010) indicate that the performance of the students who were exposed to CAI either individually or cooperatively were better than their counterparts who were exposed to the conventional classroom instructions [8].
- b. "Effectiveness of teaching chemistry through Computer Assisted Instruction over the Traditional Teaching Method" by Vasanthi and Hema (2003) indicate that the teaching chemistry through CAI was found to be more effective than teaching through the traditional method [9].
- c. "Effectiveness of Computer Multimedia Package [SLM] on Achievement of Eleventh Standard

Students in Social Sciences” by **Girija. N. Srinivasalu, and Vijayalakshmi S. (2010)** indicate that the superior performance of the experimental group over the traditional group suggested that SLM was found to be effective [10].

- d. *“Effectiveness of Interactive Multimedia-Based Learning with the Conventional Teaching Method with the Science Group Students”* by **Arulsamy, S. (2005)** observed that the experimental group’s performance was far superior to that of their counterparts. This study clearly revealed the positive impact of multimedia [11].
- e. *“Development of Multimedia Instructional System on Educational Technology for B.Ed., student-teachers”* by **Vishnu Panddurang Shikhare (2007)** indicate that the Multimedia Instructional System was found more effective than the Conventional Instructional System [12].
- f. *“Influence of Interactive Multimedia Courseware: A Case Study among The Students of Physical Science of Class VIII”* by **Sujit Pal, Sibananda sana and Asis Kumar Ghosh (2012)** indicate that the computer assisted multimedia courseware facilitates students’ learning in Physical science better than the traditional chalk and talk method [13].
- g. *“Development and Effectiveness of Computer Based Learning Programme in Teaching Mathematics for the students of standard IX Gujarati medium secondary school”* by **Falguni S. Vansia (2012)** indicate that the Mathematics teaching through CBL programme was comparatively better than the traditional method in terms of the achievement of the students [14].
- h. *“Effect on E-Content Learning Package in Mathematics Education for The Prospective Teachers”* by **Robert Joan, D. R. (2013)** indicate that the experimental group is more effective than the control group. Thus E-content learning package in Mathematics Education for the prospective teachers is more effective [7].
- i. *“Effectiveness of E-content in Mathematics on Mathematical Thinking among Secondary School Students”* by **Sajna Jaleel (2015)** indicate that the e-content in Mathematics is more effective than Activity Oriented Method for developing Mathematical Thinking among the Secondary School Students [15].

Finding No. 2 & 3 reveals that E-content has significant effect on teaching of Mathematics Education. This effectiveness is significantly greater than that played by conventional method. This may be due to the following features of e-content:

- E-content presents the content in multiple formats.
- The contents are explained in a simple text with unambiguous suitable graphics, animations and with relevant supportive headings.

These ideas can be strengthened by the results from the study *“Effectiveness of Computer Assisted Teaching Lesson on the topic UNO in History at the Higher Secondary Level”* by **Helen Joy, Shaiju (2005)** indicate that the mean post-test scores of the Computer Assisted Teaching

(CAT) group were found to be significantly higher than that of the Lecture Method group [16].

4. Recommendations of the Study

The recommendations of the present study are as follows:

1. Lecture method in the class should be minimized and new technologies, such as; use of e-content and interactive multimedia courseware can be introduced.
2. Both theoretical and practical knowledge should be enhanced through e-content.
3. The student-teachers may also be involved in the preparation of e-content.
4. In-service course training in the preparation of e-content should be given to the teacher-educators and teachers at all level.
5. An orientation should be given to the student-teachers for preparing script and story board to develop e-content.
6. The NCERT, SCERT, NCTE should introduce e-content in the form of curriculum development, to meet the challenges in education.
7. Practical demonstration should be carried with the help of e-content.
8. Subject periods may be increased for the effective use of the e-content in the classrooms.
9. Ensure an environment conducive for the students to be engaged in learning through e-content by minimizing possible distractions.
10. There is a possibility of cognitive overload and the teacher must be cautious about it.
11. Awareness about e-resources where the texts, images, animation and video pertinent to the topics selected for the development of e-content should be given to the teacher-educators.
12. The teacher-educators and the student-teachers should be aware of the University Grant Commission’s Consortium for Educational Communication.
13. Adequate infrastructure may be established in the educational institutions at all levels for the development and usage of e-content.
14. The e-content can be prepared to other topics like micro-teaching, aims and objectives of teaching mathematics, various techniques of teaching mathematics and lesson plan, etc.
15. Since e-content is found effective among the student-teachers it may be effective to the students of school and college level.
16. More involvement and greater variety in dissemination of the content are possible when e-content is used for instruction.

5. Educational Implications of the Study

The following are some of the suggested implications of the present study on the basis the major findings.

- a. Student-teachers get benefited by the individualized instruction, self pacing and interactive nature of the e-content.

- b. As e-contents are found to be effective, e-content can be used to help students to concretize the abstract ideas in mathematics.
- c. As teaching through e-content effects more meaning in learning, the student-teachers could make use of the learnt methods of teaching mathematics in their classroom teaching in a more effective manner and it would help them to be good mathematics teacher.
- d. The e-content in other topics could be prepared on other subjects as well.
- e. Use of e-content proves that the instruction is more effective than that of the traditional method of instruction.
- f. Learner's active participation in the instructional process results in better teaching effectiveness among the student-teachers.
- g. Teacher educators should use this kind of e-content for the slow learners or low achievers as per the requirement.
- h. E-content will be helpful to the teacher educators as well as the student-teachers for the effective teaching-learning process.
- i. Teaching through such e-content increases the curiosity and capabilities of the student-teachers.
- j. E-contents are also useful for distance learning, adult education and other types of awareness programs.
- k. Increasing the strength of the classroom, burden of the syllabus, heavy competitiveness will be reduced if e-content is applied.
- l. To prepare e-content, training should be arranged for the teacher educators.

6. Conclusion

In the light of research findings, it has become crystal clear that E-content in the Teaching of Mathematics Education has provided higher achievement among B.Ed. Student-teachers.

E-content changes Teaching, not Teachers. E-content has great power to influence their teaching, but it does not fundamentally change them as teachers. So the teachers have to use E-content not just for technology's sake but to support the students' learning most efficiently and most effectively.

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