Development and Validation of E-Content on DNA Replication in Botany at Higher Secondary Level

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Abstract- E-learning has influenced every sector of the society and can be used as a tool to improve the quality of education for the society and manpower. A study was undertaken to develop an e-content package related to the topic 'DNA replication' included in Botany for XII standard students of Biology and to compare the effectiveness of this package with conventional teaching methods. The e-content has been developed for learning the concept: *DNA replication using e-content package* from XII standard botany text book prescribed by Tamil Nadu Text Book Society. A pre-test, post-test single group experimental design was adopted. A sample of 20 XII standard students were exposed to different treatments namely e-content package and conventional method of teaching. The control and the experimental groups were assessed through pre and post tests and their achievement scores were compiled and analyzed using appropriate statistical procedure. It was found that the experimental group students who were exposed to e-content materials had better achievement scores than the control group in learning DNA replication.

Index Terms- DNA replication, Botany, 12 standard Biology, e-content package

I. INTRODUCTION

In the present era of modernization and mass education, Educational Technology has been widely used all over the world. It has to be in line with the demand in a competitive environment. Old ideas and methods have been replaced/supplemented by new ones. Conventional chalk and talk classroom instruction is no longer the favoured instructional method. The traditional role of teacher has been as: "Presenters of readymade information and as organizers of learning experiences". Application of Information Communication Technology (ICT) has become an able assistant to teachers and students in classroom learning and other academic engagements. Development, validation and application of e-content are necessary to have specific packages for the required topics.
Though there are packages developed and available for many educational topics, personal development of one for the specific purpose is desirable. This article is an attempt in that direction in developing a package for explaining a specific topic in Botany (DNA replication) and finding its comparative effectiveness in a real classroom situation.

II. DISCUSSION

NEED AND SIGNIFICANCE OF THE STUDY

The usual methods adopted so far in the field of biological science education have yielded limited results. If we use modern informative tools, it should receive maximum attention from the part of the learners, especially at the higher secondary level. An integral component of such attractive medium of classroom communication - e-content - is most suited, economical and effective for imparting knowledge and skills to students and to learn the subject matter thoroughly with full of joy, interest and greater attention shown by students.

Recognizing this importance, the National Policy on Education (NPE) (1986) emphasized that modern technology aids need be used to improve the process of teaching and learning at all levels of education and to improve the learning environment of the institution.
Against this background of importance and necessity, the researchers have chosen the technology of e-content for development and assessment of its effectiveness. Conventional method of teaching does not significantly help the students in easy understanding, retaining and uniform pace of learning. Learning is best facilitated by adopting right type of methods and technology, including ICT using individually developed e-contents for specific purposes.

III. OBJECTIVES OF THE STUDY

The objectives of the study are:
1. To develop an e-content on 'DNA replication' in Botany for teaching Higher Secondary Students
2. To validate the e- content on 'DNA replication' for higher secondary students
3. To find the effectiveness of e-content in learning 'DNA replication'

(Employing pre- and post- achievement tests on the selected topic)

IV. HYPOTHESES OF THE STUDY

The following hypotheses were formulated based on objectives of the study:
1. There is no significant difference between control and experimental group at pre – test level
2. There is no significant difference between control and experimental group at post- test level

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

V. DEVELOPMENT OF E-CONTENT

The development of e-content for the study includes the following different steps:

- ➢ Planning of e-content.
  - • Frame the objectives
  - • Consider the learners
  - • Prepare the specifications
- ➢ Preparation of script writing
- ➢ Making a story board for video/audio
- ➢ Video shooting
- ➢ Editing the pictures/ narrations
- ➢ Merging of text, voice, graphics, sound, video and animations
- ➢ Designing the e-content **:**
  - ❖ Planning a script for e-content in consultation with subject experts/teachers of the concerned subject
  - ❖ Editing the script with the help of technical experts and software programmers.

VI. VALIDATION OF E-CONTENT

- ➢ The e-content material in Botany was screened to a group, consisting of experts in the subject, to ascertain subject matter.
- ➢ Service of senior teachers, who were handling the subject (Botany) at higher secondary level utilized.
- ➢ The faculty in the University Department of Educational Technology ascertained validity of the e-content - both production and subject matter.
- ➢ Technical validity from "Teacher Oriented Televised Education" Studio Staff (TOTE studio).

VII. METHODOLOGY IN BRIEF

The higher secondary students from two different schools situated in rural area of Pudukkottai District were randomly selected (Kothari, 2008) as sample for the study. In each school 20 students have been selected for experimental group and another 20 students for control group on the basis of pre achievement scores. Here both the groups were equally matched in terms of their knowledge at Pre-test level. The study followed pre test, post test equivalent groups design. The samples of two groups were subjected to different treatments. After one week the experimental group was taught through the e-content and the control group with the traditional teaching. At the end of the treatment, the post-achievement test was administered to them. The difference between the mean scores of control and experimental group was analyzed by using appropriate statistical techniques -mean, standard deviation and t-test (Aggrawal, 2000). The results are tabulated in Tables 1-4.

VIII. DATA ANALYSIS

Hypothesis 1 (No difference in the pre achievement test 'mean score' in the two groups)

Table 1: Comparison of pre test-test scores of experimental and control groups

Groups compared	No. of students	Mean	S. D.	't' value	Level of significance
Control group	20	11.4	3.24	0.28	Not significant
Experimental group	20	11.2	3.10		

The calculated t-value 0.28 is less than the critical value 2.10 corresponding to the 0.01 level of significance. This implies that the control group and experimental group do not differ significantly in the level of achievement at pre test, agreeing with the hypothesis1.

Hypothesis 2 (No difference in the post achievement test scores in the two groups)

Table 2: Comparison of post-test scores of experimental group and control group

Groups Compared	No. of students	Mean	S. D.	't' value	Level of significance
Control group	20	13.5	3.35	3.43	Significant
Experimental group	20	17.8	3.56		

The calculated t-value 3.43 is greater than the critical value 2.10 corresponding to 0.01 level of significance. This implies that the control group and experimental group differ significantly in their achievement at post test; this is contrary to hypothesis 2. Further, it is concluded that the experimental group has better level of achievement than the control group. This indicates that e-content material is more effective than traditional instruction.

Hypothesis 3 (no significant difference between pre- and post- test scores of control group)

Table 3: Comparison of pre –test and post- test scores of control group.

Control Group	No. of students	Mean	S. D.	't' value	Level of significance
Pre-test	20	11.42	3.051	0.77	Not significant
Post-test	20	12.25	3.42		

The calculated t- value 0 .77 is less than the critical value 2.07 corresponding to 0.01 level of significance. This implies that the pre-test and post- test scores of control group do not

differ significantly in their achievement, in agreement with hypothesis3.

Hypothesis 4 (No significant difference between the pre- and post-test scores of experimental group)

Table 4: Comparison of pre-test and post-test scores of experimental group

Experimental group	No. of students	Mean	S. D.	't' value	Level of significance
Pre-test	20	12.33	3.08	10.92	significant
Post-test	20	19.02	3.59		

The calculated t-value 10.92 is higher than the critical value 2.81 corresponding to 0.01 level of significance. This implies that the pre- and post-test scores of experimental group differ significantly in their achievement; this is contrary to hypothesis 4. Further, based on this difference, it is concluded that the instruction assisted by e-content material is superior to conventional method.

IX. MAJOR FINDINGS

1. The mean difference between pre- test scores of control and experimental groups is not significant. The control and experimental group students got similar level of achievement at the initial level in the selected topic

2. Significant difference was found between control and experimental groups in the post-test. The higher secondary students exposed to e-content in experimental group got higher achievement scores than the control group, exposed to traditional method

3. The mean difference between pre-test and post-test mean scores of control group is found not significant. This group students do not improve their achievement, while adopting usual method.

4. The difference between pre-test and post-test mean scores of experimental group is found to be statistically significant. The higher post-test mean scores of experimental group indicate that e-content material is more effective in the process of teaching and learning.

X. RESULTS AND ANALYSIS

It is observed that the pre-test mean of the control group and experimental group is almost same, with no significant difference between them before treatment.

When considered the post-test average marks, both the groups had increased value. The average marks for controlled groups were less than that of the experimental group and this difference is slightly statistically significant.

The striking and statistically significant difference is noticed between the average of pre-test and post-test marks of both the groups. Therefore the teaching through e-content has significantly improved the performance of experimental group students. Though the average marks of the controlled group has increased (pre-test to post-test), it is less than the increase (pre-test to post-test) of the experimental group. This difference could be attributed to the use of e-content material in teaching.

XI. CONCLUSION

This study clearly indicated that the development of e-content in teaching DNA replication in Botany for higher secondary students was effective. The effectiveness was found in terms of post-test of the students of experimental group taught through e-content. One can presume similar effects in other topics and other science subjects by the application of e-learning techniques. It's hoped that there would be wider application of e-learning packages developed for specific topics and subjects for more effective knowledge transaction at school level.

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