

Title:

Empirical Estimation of Computer Animation as a self- study material
for science learning

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Abstract:

The advent of technology is almost in the field of education for teaching – learning and cannot be ignored. Students are exposed to superior quality product of advance technologies in other fields around them. In such a scenario whether chalk and black board education is relevant in today’s multicoloured and multidimensional digital age?

The purpose of this study was to find out effectiveness and agreeability of computer animation as self-learning material among the school students in India for learning science. Twenty four students from Class XI, science randomly selected and tested by pre-post test. The data collected and analyzed. Paired t test was used to find out its effectiveness. The questionnaire reflected their perceptions about the computer animation for science learning.

Key words-

Interactive computer animation package, Self study material, Self-learning, Science learning, Distance learning

Introduction: The growing concern to improve the science learning in schools and the better accessibility to the Information Technologies were impetus to explore Interactive Computer Animation as a self learning material for learning science.

Change is inevitable in life. World around us is changing at breath taking pace. Technology is advancing amazingly, today's technology getting out dated tomorrow. Fantasies of science fiction or movies are a reality today. Mobiles and internet has become part and parcel of day to day life which could not have been thought of ten years back. In such a scenario, chalk and black board education is not relevant in today's multicoloured, digital, technology driven society.

The multimedia integrated learning seems to be more effective and acceptable way of learning. (Fletcher, 1989; Kulik, Bangert, & Williams, 1983; Kulik, Kulik, & Cohen, 1980; Kulik, Kulik, & Shwalb, 1986).

However a few negative evidences warn about the use of technology in education. Yasemin Gülbahar, 2007 concluded from her research in Turkey, the advent of technologies available for teaching and learning, schools have been advocating considerable amount of their funds for the procurement of hi-tech

technologies. Despite this huge investment, there is a little success achieved so far. Technology integration is a complex and demanding issues and this puts more burdens on schools. Utilization of Computer animation technology in science learning is complicated since it can be implemented in a variety of ways and lack of guidelines that would lead to successful integration.

The science teachers unequipped by technology have no choice but to go for “lecture and listen” instructional scenarios. The stand-and-deliver method is often referred to as the expository approach to instruction, in which the teacher spends most of the time giving verbal explanations while the students listen and write notes. Inadequate and limited teaching methods tend to negatively affect the learners’ knowledge and dispositions of scientific concepts and associated methods (Wekesa, Kibose, and Ndirango, 2006).

In earlier days, science instruction was designed to meet the demands of citizens whose work lives changed relatively little over their lifetimes. In the 21st century, the situation has changed dramatically. Our society has become technologically and information-driven and our students need to know more than the basics in science to cope with accelerating changes.

History of education is the introduction of new technologies into the classroom for better teaching and learning. Technologies like radio, television, videos come and go, innovations tried and tossed out. However, no other instructional tool has been at the center of an educational revolution like the computer, nor has any other innovation been as invested in, supported, criticized, and

researched as the computer (Groff, J., & Mouza, C., 2008 as reported by Tyack & Cuban, 2000). It is clear that computer technology will not be tossed out so quickly.

It is universally accepted that the quality of education depends on the quality of instructions imparted in the class room. Hence there is a need not only to enrich the curriculum but also devise innovative ways of teaching and learning science.

Considering all these point, Interactive Computer Animation Package was tested for its effectiveness and agreeability in Indian school as a self study material.

There is lot of research done in this region. In a study, the literature review indicated that although computer simulations cannot replace science classroom and laboratory activities completely, they offer various advantages both for classroom and distance education. The study suggested that the success of computer simulations use in science education depends on how they are incorporated into curriculum and how teachers use them.

The most appropriate use of computer simulations seems that they are used as supplementary tools for classroom instruction and lab activities.

Multimedia supported, highly interactive, collaborative computer simulations appeal growing interest because of their potential to supplement constructivist learning. Computer simulations are good tools to improve

students' hypothesis construction, graphic interpretation, and prediction skills. This study also implied that computer simulations have potential for distance education laboratories. (Sahin, Sami, 2006)

In comparative study, web based material found to be more efficient and satisfactory than print materials. (Douglas S. Bell, Gregg C. Fonarow,; Ron D. Hays,; and Carol M. Mangione, 2000). Multimedia appeared to be an effective way to learn when the multimedia presents information in a way that is compatible with learner's preferred internal representation of that information (Kozma, 1991). Laurillard (1993) describes a teaching and learning model containing the four aspects of discussion, interaction, adaptation and reflection. She argues that the use of multimedia can enhance the teaching-learning process effectively by facilitating 'conversations' between students and instructional material. Lawrence J. Najjar elaborates the effects of multimedia information presentation on learning. In this study he examined to determine whether general multimedia learning is effective and also reviewed studies comparing learning in traditional classroom lectures to learning with computer-based multimedia. Lloyd P. Rieber explored how adult users interact and learn during an interactive computer-based simulation supplemented with brief multimedia explanations of the content. Results showed significant differences for both the use of the explanations and simulations containing graphical feedback in helping participants gain both implicit and explicit understanding of the science principles.

Objective

1. To find out effectiveness of interactive animation package in terms of understanding concepts in science when used as self study material.
2. To test its feasibility.
3. To find out agreeability of animation among the class XI students.

Methodology

Twenty four students from class XI, science from New English School, Thane, Maharashtra, India randomly selected. Interactive Computer Animation Package (ICAP) developed for the topics related to syllabus of class XI and class XII such as current electricity – atomic structure, static electricity, potential, potential difference and voltage, current in conductors- electrolytes and concept of resistance current, Ohm's law, potential difference and EMF and effects of electric current. Surprised pre-test conducted for all participants.

Pre-test paper included multiple choice questions since comparatively it takes less time to judge, answers of questions are not affected by linguistic knowledge or speed and answers are specific. The questions were based on topics from previous year's science text book. They were designed to test the understanding of the topics. Total ten questions for ten marks and 15 minutes time duration arranged. Then all students have given the treatment i.e. Interactive Computer Animation Package provided on the computer individually in computer lab for one hour. Finally, all students post tested after completion of learning in a fair and unbiased manner. Post test was prepared for ten marks containing multiple choice questions based on same topics as pre test for 15 minutes. (Ref.

Appendix for pre test and post test) Study conducted in January because at that time students who are from vernacular medium are used to English language.

Questionnaires were paper-and-pencil test filled out by research participants.

The questionnaire gained their perceptions about the ICAP used for science learning. While developing questionnaires Principles of Questionnaire

Construction were followed. (Burke Johnson, Larry Christensen 'Educational Research Quantitative, Qualitative and Mixed Approaches')

Natural and familiar language was used. Questions were clear, precise, and relatively short since short items are more easily understood and less stressful than long items. "Leading" or "loaded" questions were avoided. Question should not be double-barreled (i.e. questions that combines two or more issues in a single question).

Comparing achievement of the students in pre and post-test, effectiveness of ICAP as self study material was tested. To decide feasibility of method, feedback from computer lab attendants, science teachers, headmasters were taken into consideration. In addition to that practical difficulties for regular use of computer animations in schools were also considered.

Data collected

No.	Pre-test marks /10	Post-test marks /10
1	2	5
2	3	7
3	3	7
4	4	6
5	4	7
6	4	7
7	4	8
8	4	7
9	5	6
10	5	7
11	5	7
12	5	6
13	5	6
14	5	5
15	5	8
16	5	9
17	5	6
18	5	3
19	5	5
20	5	6
21	6	9
22	6	8
23	7	8
24	7	7

Feedback from the participants collected in the form of questionnaire.

Data

24 students participated in the study.

No.	Questions	Class XI	
		Yes	No
1.	I can operate computer independently	24	0
2.	I find animation-supported learning entertaining	23	1
3.	I find that computer can help me for better understanding	22	2
4.	Using animations for science learning is enjoyable	23	1
5.	I can concentrate better in animation-supported learning than classroom learning	23	1
6.	I would like to use animation package again	24	0
7.	I will prefer animation supported science learning	24	0

Statistical analysis

Paired t test was used to calculate the effectiveness of ICAP as a self study material for learning science.

Paired *t* test

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pre test minus Post test equals -1.92

95% confidence interval of this difference: From -2.57 to -1.26

Intermediate values used in calculations:

$t = 6.0266$

$df = 23$

standard error of difference = 0.318

Group	Pre Test	Post Test
Mean	4.75	6.67
SD	1.15	1.37
SEM	0.24	0.28
N	24	24

Conclusion

The statistical analysis revealed that the computer animation integrated science learning was more likely to help students to understand science. t-value is positive and statistically significant ($p < .05$).

The responses to questionnaire reflected the positive attitudes of the students

regarding the use of computer animation in science teaching and this is the agreeable method for science learning students believed .

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Appendix A

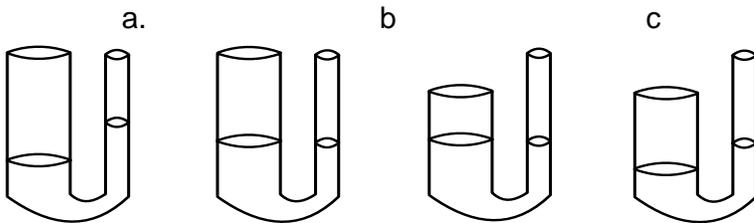
Understanding test for class XI science

Pre test

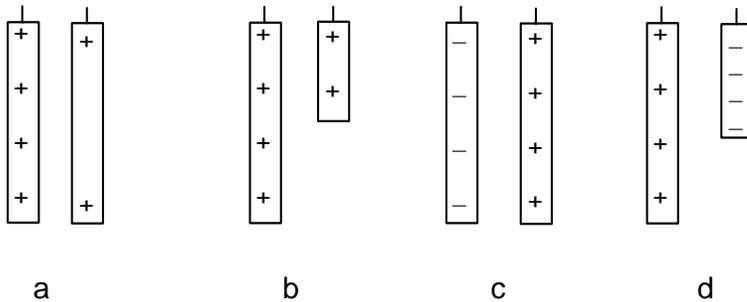
Name of the student.....

Name of the college.....

1. A liquid is filled in U tube. Tick the correct answer /s from the following figures.



2. In which case/s of the following potential difference between two plates is zero, if the plates are connected with each other by copper wire.



3. When a conductor are connected between the terminals of the cell, electrons move from negative to positive terminal but protons does not move because....

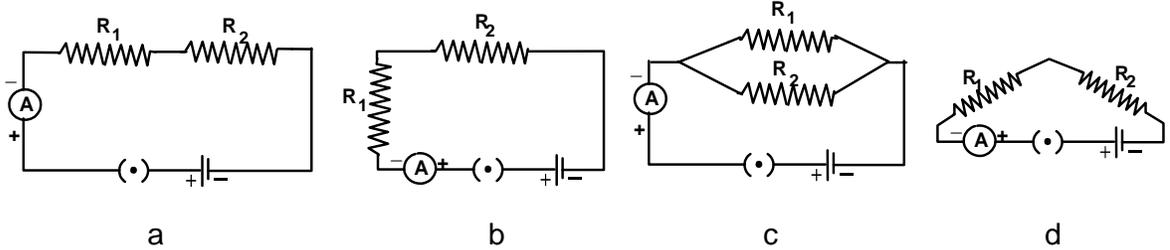
- a. electrons are lighter than protons b. protons are inside the nucleus c. protons are positively charged. d. electrons are negatively charged.

4. Within electric cell flow of current is due to motion of....

- a. positive & negative ions b. free electrons c. holes d. free electrons & holes

5. Which of the following copper wire has maximum resistance?
 a. 0.01 mm diameter & 10 cm length b. 0.01 mm diameter & 1 cm length c. 0.1 mm diameter & 10 cm length d. 0.1 mm diameter & 1 cm length

6. Which of the following circuit has minimum resistance.

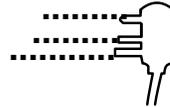


7. EMF of a cell is equal to its potential difference when...

- a. current is not flowing through cell b. the cell has no internal resistance c. the cell has maximum resistance d. current is flowing through cell.

8. Which device of the following based on heating effect of electric current?

- a. Telephone b. Fuse c. electric generator d. electric motor.



9. Label the three pin plug from following names.

- a. live wire b. neutral c. earthing wire d. conducting wire e. non conducting wire

10. Electric bell is a application of...

- a. magnetic effect of electric current b. heating effect of electric current c. chemical effect of electric current d. both a & b

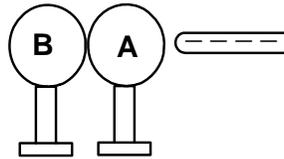
Post Test

1. If the length of the wire is doubled and its cross section is also doubled, then the resistance will be

- a. be halved b. become double c. remain the same

2. Two metal spheres A and B each on an insulated stand are brought together so that their surfaces touch each other as shown. A negatively charged body is now

- a. A will be positively charged & B will be negatively charged.
- b. A will be negatively charged & B will be positively charged.
- c. both A & B will not have any charge.



1.

brought near A and then the spheres are separated. Now...

3. If the leaves of a charged gold leaf electroscope still spread further apart when we bring a test body near it, the test body has

- a. A charge which is of the same sign as that of the electroscope.
- b. A charge which is of opposite sign as that of the electroscope.
- c. no charge

4. An electric bulb glows when connected to a chemical cell. Name the energy changes taking place in the bulb.

- a. chemical energy converted into electric energy
- b. electric energy converted into heat & light energy
- c. electric energy converted into chemical energy

5. Static electricity is produced by

- a. friction only
- b. induction
- c. friction & induction both

6. A glass rod rubbed with a piece of silk is brought near a rubber rod rubbed with a piece of wool. Then between them there will be a force of ...

- a. attraction
- b. repulsion
- c. neither repulsion nor attraction

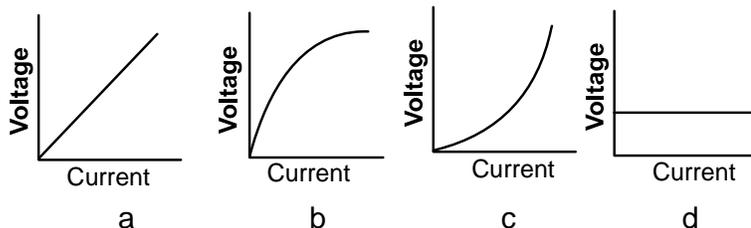
7. A positively charged glass rod attracts an object, this object must be ...

- a. positively charged
- b. negatively charged
- c. either negatively charged or without any charge

8. If a metal sphere is held in the hand & rubbed with a piece of fur & then tested it will be found to have..

- a. positively charged
- b. negatively charged
- c. no charge

9. Which of the following graphs represent ohmic resistance.



10. Ten identical wires (same material, same length & same cross section) each having resistance of 1 ohm are joined in parallel. The combination has a resistance of
- a. 10 ohm b. 1 ohm c. 0.1 ohm d. 0.01 ohm
11. The electric bulb have Tungsten filament of same length. If one of them gives 60 watts & other 100 watts then
- a. 100 watts bulb has thicker filament b. 60 watts bulb has thicker filament c. Both filaments are of same thickness. d. It is possible to get different wattage unless the lengths are different.
12. Resistance of a conductor does not depend upon
- a. length of conductor b. temperature of conductor c. potential difference across conductor d. specific resistance of material of conductor.
13. The equivalent resistance of resistor to parallel is always
- a. higher than highest of component resistor. b. lower than lowest of component resistor. c. In between lowest & highest of component resistor. d. equal to sum of components.
14. Current in a conductor is due to
- a. motion of free electrons b. protons c. motion of positive ions d. free electrons & holes.

