Effectiveness of Multi Media Teaching on Process Skill in Biology

Sunitha Behera¹, Dr. C.V. Satyaprakasha²
¹Assistant Teacher, Biology Department
Baldwin High School, Bangalore - 560025, Karnataka
²Associate Professor
Department of Post Graduate Studies in Education
Vijaya Teachers College, Bangalore-560011,

Abstract
Multi Media Teaching is an instructional strategy which refers to the presentation of the content using text, audio, still images, animation, video, or interactivity content forms. In the present study, an attempt has been made to find out the effectiveness of multimedia teaching on achievement in biology. Objectives of the study were to find out the effectiveness of multimedia teaching on process skill in biology as well as find out the effectiveness of multimedia teaching on process skill in biology of students belonging to different intellectual levels. In this study, pretest-posttest equivalent group design was used to evaluate the relative effectiveness of multimedia teaching with respect to conventional method of teaching in biology. The sample of the study consisted of 80 students of class VIII with a mean age of 13 years studying in an unaided school at Bangalore, Karnataka. Cluster and random sampling techniques were adopted for the collection of data. Two groups of students of class VIII were selected for the study and were considered as experimental and control group respectively. Experimental group was exposed to multimedia teaching and the control group was taught by conventional method of teaching. Tools used were 1) Process skill Test in Biology developed by Satyaprakasha and 2) Raven’s Progressive Matrices Test. Statistical techniques used were t-test, ANOVA. Major Findings of the study were 1) there was a significant difference between experimental and control group in process skill in biology with respect to observation, generalization, interpretation, inference and prediction and total process skill in biology as compared to conventional method, 2) there was no significant difference in achievement among the students belonging to different intellectual levels of experimental group in biology. This implies that multimedia teaching equally promoted process skill in biology among the students of different intellectual levels of experimental group in biology.

Key Words: Multimedia Teaching, Intellectual Levels, Experimental Group, Process Skill, Biology, Technological Consequences, Science Advancement, Class VIII Students, Bangalore
1 Introduction

Modern science, which began about 300 years ago, has been enlarging our knowledge of the environment at an ever increasing pace, and society has become more and more dependent on the technological consequences and advancements of science. Science has become one of the human activities that man has created to gratify certain needs and desires. Science has improved the conditions and quality of living and has saved mankind from excessive toil and boredom. From cradle to grave, thus, scientific discoveries and inventions have inextricably woven themselves into the fabric of human existence. The advancements that are taking place in medicine, astronomy, agriculture, engineering, oceanography, aeronautics, space travel, microbiology, nuclear biology and innumerable other branches and sub-branches of scientific study are marvelous. In such an age of rapid scientific advancement, everybody must have some knowledge of science for making some effective and useful contribution to life. The growing need for scientists, engineers and technologists in our country has made it all the more imperative to provide a science-based education. Every secondary school pupil should necessarily study general science as a compulsory subject, so that he gains a basic quantum of scientific knowledge as a part of his general education, and it has to be taught both as process and product. Process of science refers to what scientists do i.e., the way they locate information, learn through observation, experimentation, develop hypotheses, test hypotheses and communicate their ideas to others. Product is the another side which is basically knowledge, including facts and figures, formulae and equations, principles and scientific laws. Better process leads to better product. There is an urgent need to develop process skills among the students. Champagne and Klopfier (1981) used the term 'process skills' to refer to the processing strategies that a person brings to bear in solving a problem. The emphasis on science process skills in elementary science curricula since 1960s has made the acquisition of science process skills as one of the major goal of teacher preparation programme.

1.1 Process Skill in Science

Successful science school programs in the life sciences are those programs that students who are able to “think like a scientist” that is, students who are able to solve problems in multiple contexts and effectively integrate information into meaningful scientific concepts. Scientists and science educators agree that a hallmark of successful science learning is the acquisition of skills such as data interpretation, problem solving, experimental design, scientific writing, oral communication, critical analysis of primary literature, collaborative work, and monitoring and regulating one's own learning process. Although scientists use these skills daily, these skills are rarely taught to undergraduates in an explicit and scaffold manner. A more effective way to help students master science disciplines and better prepare them for careers in science would be through explicit instruction of science process skills, helping students acquire a repertoire of these skills early in the college curriculum and thereby augmenting their content acquisition and interdisciplinary ways of knowing. Science process skills are the indispensable tools of scientists, helping them form their conceptual framework, thereby facilitating learning of new content associated with novel science problems. Through explicit instruction and assessment of students' science process skills teachers can help students gain the same skills that faculty use every day and help them to approach science as scientists do. Indeed, these are the same skills strongly promoted by the American Association for the Advancement of Science (AAAS) for K–12 science education and highlighted in reports that outline recommendations.
Acquisition of science process skills can have a profound impact on student success in school science classes. Although content is clearly important, science process skills provide the tools and ways of thinking that enable students to build the robust conceptual frameworks needed to gain expertise in the life sciences. Scientists use these process skills to approach inquiry in a particular way, leading to a scientifically valid method for obtaining results from which they base new investigations. American Association for the Advancement of Science (AAAS) identified thirteen science processes. These are best thought of as a set of intellectual skills that are associated with acquiring reliable information about nature. Each process is defined. In addition, comment about the inherent nature of each of the skills is provided. The first eight processes are called "basic processes" and are appropriate for children in the primary grades. The last five are called integrated processes and are more appropriate for children at grades four and above. In the present study observation, inference, generalization, generalization and prediction were the process skills selected for testing its development due to the implementation of multimedia teaching.

1.2 Observation, Generalization & Interpretation

- Observation is the most fundamental of all of the processes. Observation may be defined as the gathering of information through the use of any one, or combination of the five basic senses; sight, hearing, touch, taste, and smell. The term observation may also be used to express the result of observing. In other words one might observe and, as a result, gather observations. These observations can also be called data or facts. It is using one’s own senses to gather information about an object or event. It is a description of what was actually perceived. This information is considered qualitative data.

- A generalization is taking one or a few facts and making a broader, more universal statement. It is the process of formulating general concepts by abstracting common properties of instances. A generalization of a concept is an extension of the concept to less-specific criteria. It is a foundational element of logic and human reasoning. Generalizations posit the existence of a domain or set of elements, as well as one or more common characteristics shared by those elements. As such, they are the essential basis of all valid deductive inferences. The process of verification is necessary to determine whether a generalization holds true for any given situation. The concept of generalization has broad application in many related disciplines, sometimes having a specialized context or meaning.

- An interpretation is an assignment of meaning to the symbols of a formal language. Many formal languages used in mathematics, logic, and theoretical computer science are defined in solely syntactic terms, and as such do not have any meaning until they are given some interpretation. The general study of interpretations of formal languages is called formal semantics. It is an act or process of interpreting or explaining; elucidation, the result of interpreting; an explanation, a particular view of an artistic work, as expressed by stylistic individuality in its performance, explanation, as of the environment, a historical site, etc, provided by the use of original objects, personal experience, visual display material, etc. Interpretation is the act of explaining, reframing, or otherwise showing your own understanding of something. A person who translates one language into another is called an interpreter because they are explaining what a person is saying to someone who doesn't understand. Interpretation requires you to first understand the piece of music, text, language, or idea, and then give your explanation of it.
1.3 Inference & Prediction

Inferring is an inventive process in which an assumption of cause is generated to explain an observed event. This is a very common function and is influenced by culture and personal theories of nature. Formulating assumptions or possible explanations based upon observations. Guessing the most likely outcome of a future event based upon a pattern of evidence. This process deals with projecting events based upon a body of information. One might project in a future tense, a sort of trend analysis, or one might look for an historical precedent to a current circumstance. In either case, the prediction emerges for a data base rather than being just a guess. A guess is not a prediction. By definition, predictions must also be testable. This means that predictions are accepted or rejected based upon observed criteria. If they are not testable they are not predictions. It is not unusual to find that a data base is not available for a particular system. In such cases predictions about that system are not possible. The first step in understanding such a mystery system would be to observe it as objectively as possible with the goal being to acquire the data base necessary to develop predictions. The nature of the skill of predicting is to be able to identify a trend in a body of data and then to project that trend in a way that can be tested.

2 Methods of Teaching Development of Process Skill

The most common methods of teaching science in schools even to this day are lecture and lecture-cum-demonstration methods accompanied by visual aids, such as demand and supply charts. This conventional approach may not always engage the attention or interest of students. Both these methods stresses upon naming, memorizing and recalling information. These methods may make the learner to be passive in the learning process. Learning is to effect desirable changes in behavior, in our habits, style of living and adjustment of knowledge, skills etc. Traditional methods do not provide much scope for the development of process skills among students, it limits ones interest to investigate and decline the spirit of inquiry. In such classrooms students are unhappy, disinterested and unsatisfied. They lack in providing any scope and provision to enhance the impulsive and innate powers of the learner into systematic patterns of controlled inquiry in scientific methods i.e. learning to search for information, learning to identify a problem, formulate hypothesis, gather data, analyze and evaluate evidence and draw vital conclusion to gain knowledge. There are many reform efforts now taking place to improve the teaching of science. New curricula, new methods and approaches, alternative assignments are all part of these efforts. High school science instructors should explore other methods of instructional delivery, more active tools that get students involved in learning the basics of the discipline. Multimedia teaching is one such instructional strategy.

2.1 Concept of Multi Media

Multimedia, the term defines using more than one medium of expression or communication. In other words, it is the combination of various digital media types such as text, images, sound and video, into an integrated multi-sensory interactive application or presentation to convey a message or information to an audience. In general, multimedia refers to an electronically delivered combination of media including video, still images, audio, text in such a way that can be accessed interactively. It has its application in various areas including, creative industries, commercial uses, entertainment and fine arts, education, journalism, engineering, industry, mathematical and scientific research, medicine, document imaging, disabilities and other areas.
2.2 Use of Multi Media in Classroom

Using multimedia in classroom helps engage students and provide them with valuable learning opportunities. It’s easy to remember a picture than a paragraph, an animated video of a concept worth more of a lecture and a video demonstration of a process (or an instrument) by a scientist gives more real time knowledge than a theoretical explanation. There is no doubt teachers consider multimedia as a great tool to improve student learning. There are many benefits of using multimedia in classroom. Multimedia empowers students to create and design rather than absorb representations created by others. Multimedia can stimulate more than one sense at a time, and in doing so, may be more attention-getting and attention-holding. It improves reflective thinking, provides students with suitable learning resources according to their learning styles and abilities.

2.3 Personalized Learning using Multimedia Resources

Multimedia resources help different learners meet their learning needs. Different students have different learning styles, educators can easily provide them with suitable learning resources using multimedia. Multimedia resources make everything easy for students to learn in their comfortable learning style. Unlike traditional approaches, in which only the teachers used to lead the entire classroom delivering long lectures at the same pace, the use of multimedia results in personalization of learning.

2.4 Group Learning

Multimedia tools such as blogs, social networks and wikis enable students to work together in processing of information and learning a particular concept. Students use these to share their works with others, give feedbacks on others works and discuss among others a particular topic. It can be done through either blogging or micro blogging (Tweets). Using these multimedia tools, teachers can engage students in several works and watch them collaborating with each other, peer assessing each other’s works and learning as a group.

2.5 Improve Presentation Skills

Using storyboarding, videos and slideshows is a great way to improve student learning, because it allows them to engage with text in a very visual way aided by multimedia. Multimedia tools enable students to express their ideas and works in concise ways that capture the attention of the audience and they develop an ability to communicate thoughts and concepts through a variety of resources, including text and recorded narrations. Giving students a wider choice of software and tools to process and present their work is an effective approach as it allows learners to decide on the style of presentation that best suits their personality. This is also a way to allow the learners to engage in their education in a more personalized way and also improve their creativity, critical thinking and reflective thoughts.

2.6 Multi Media Teaching and Science Learning

One of the techniques to improving the students’ meets the academic needs and helps them developing science related skills is providing multimedia during the process of teaching and learning in the classroom. Multimedia classroom provide the students chances for interacting with diverse texts
that give them a solid background in the tasks and content of mainstream secondary school science courses. The research uses a qualitative method giving a deeply description using multimedia in the classroom. Through the media the teacher could give more opportunity to students to express their opinions and enjoy learning of science during the course. The highly presence and motivation also bring positive aspects to students so that they can develop the ability of processing the information collected through several media and science related skills which are very much basic to learn science called process skills.

Due to a vast expansion of scientific knowledge and technology and its contribution to increase the level of learning, a teacher by being equipped himself/herself with various technology based efficient methods of teaching can bring effective learning on the part of learners and can make their classroom interesting and teaching effective. Review of related literature indicted that studies have been rarely reported except a study conducted by Shirley Pasion Caday (2004) which showed that effective use of multimedia increased process skill in science. Keeping in mind the importance of using multimedia teaching as classroom instructional strategy to improve process skill and the dearth of research calls up the researcher to take up the present investigation. Hence the problem of investigation is stated as follows.

**Problem: Effectiveness of Multimedia Teaching on Process Skill in Biology**

**3 Objectives of the Study**

1. To find out the effectiveness of multimedia teaching on process skill in biology
2. To find out the effectiveness of multimedia teaching on process skill in biology of students belonging to different intellectual levels.

**4 Research Methodology**

**4.1 Hypotheses of the Study**

1. There is no significant difference between process skill of experimental and control group in biology
2. There is no significant difference between process skill among the students belonging to different intellectual levels of experimental group in biology

**4.2 Variables of the Study**

**Independent**- Multi Media Teaching was the independent variable.

**Dependent**- Process skill in biology was the dependent variable.

**4.3 Design of the study**

In this study, pretest-posttest equivalent group design was used to evaluate the relative effectiveness of multimedia teaching with respect to conventional method of teaching in biology. Two groups of students of class VIII were selected for the study and were considered as experimental and control group respectively. Experimental group was exposed to multimedia teaching and the control group was taught by conventional method of teaching. The effect of multimedia teaching and conventional method of teaching on the respective group was assessed with the help of pretesting and
post testing on process skill in biology. Both the groups were compared by calculating the gain scores in process skill test in biology.

4.4 Sample of the Study

The sample of the study consisted of 80 students of class VIII with a mean age of 13 years studying in an unaided school at Bangalore, Karnataka. Cluster and random sampling techniques were adopted for the collection of data. Process skill test in biology and Raven's progressive matrices test were administered to all the students of class VIII. The students were matched by pairing their scores obtained in the test of process skill in biology and Raven's progressive matrices. Finally, 40 pairs of students were selected for the experiment. Out of these 40 pairs, 40 students were treated as experimental group and remaining 40 students were considered as control group. Both the groups had no previous experiences of multimedia teaching in their classes/schools.

4.5 Tools

1) Process skill Test in Biology developed and standardized by Satyaprakasha (2001)
2) Raven’s Progressive Matrices Test (1938).

Before and after the transaction of the lessons, test was administered as pre-test and post-test respectively on process skill in biology. The test was scored following their respective scoring procedure and the results of the experimental and control group were compared.

4.6 Statistical analysis

1) t-test was be used to determine the significance of difference in the means of process skill in biology.

2) To find out the effectiveness of multimedia teaching on process skill of the students belonging to different intelligence levels, ANOVA was used.

5 Analysis and Interpretation of Data

In order to test the objectives, two hypotheses have been framed. One of them has been tested for its significance by using appropriate statistical techniques i.e. mean, standard deviation and t-values which were computed for gain scores of experimental and control group for process skill in biology and one way ANOVA was calculated for the attainment of process skill in biology of students belonging to different intellectual levels of experimental group.

5.1 Analysis of Gain in Process Skill in Biology

Comparison of Gain scores of Experimental and control Group in Process Skill in Biology

**Hypothesis- 1** There is no significant difference between process skill of experimental and control group in biology. To test the above, gain scores of process skill in biology of experiment and control group were obtained by subtracting pre-test scores from post test scores. Mean, SD, and t-values were computed and are presented in Table 1.
Table-I: Mean, Standard Deviation and t-values of Gain Scores of Experimental and Control Group in Process Skill in Biology

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Experimental (40)</th>
<th>Control (40)</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>Mean</td>
</tr>
<tr>
<td>Observation</td>
<td>0.9250</td>
<td>1.54235</td>
<td>0.2500</td>
</tr>
<tr>
<td>Generalization</td>
<td>1.0500</td>
<td>1.35779</td>
<td>0.1250</td>
</tr>
<tr>
<td>Interpretation</td>
<td>1.2000</td>
<td>1.55580</td>
<td>0.0750</td>
</tr>
<tr>
<td>Inference</td>
<td>1.9000</td>
<td>1.93218</td>
<td>0.1000</td>
</tr>
<tr>
<td>Prediction</td>
<td>2.1500</td>
<td>2.08228</td>
<td>0.1750</td>
</tr>
<tr>
<td>Total</td>
<td>6.2250</td>
<td>6.98162</td>
<td>0.3750</td>
</tr>
</tbody>
</table>

**Significant at 0.01 level**

Table 1 indicates that there is a difference between the mean gain scores in process skill of experimental and control group. The obtained t-values for observation, generalization, interpretation, inference, prediction and total scores are 2.871, 3.889, 4.776, 3.130, 5.531 and 5.235 respectively. All these values are greater than the table t-value (2.64) for 78 degree of freedom at 0.01 level of significance. The result reveals that the multimedia teaching has improved the process skill in biology. Hence the null hypothesis that there is no significant difference between process skill of experimental and control group in biology is rejected and alternative hypothesis has been formulated.

From the table it also becomes clear that the means for Observation (M = 0.9250), Generalization (M = 1.0500), Interpretation (M = 1.2000), Inference (M = 1.9000), Prediction (M = 2.1500), and Total (M = 6.2250) in experimental group were found higher than that of means for Observation (M = 0.2500), Generalization (M = 0.1250), Interpretation (M = 0.0750), Inference (M = 0.1000), Prediction (M = 0.1750), and Total (M = 0.3750) in control group. This clearly indicates that multimedia teaching was found effective in the development of process skill in biology.

This result might be attributed to the exposure of the experimental group to multimedia teaching. The significance of the result may be due to constant exposure of the student to the Multimedia technology such as use of teaching materials like Charts, Models, Pictures etc and also power point presentation which provided ample opportunities for the students to observe, generalize, interpret, infer and make presentations as well. power point presentations inculcate the process skill of observation. Pupils are exposed to computer simulations and movies which enables them to interpret the taught concept. Interaction between students-student, student-teacher, and group activities with the help of internet, computer assisted assessment allows pupil to predict as well as derive inference. Thus all the above factors might be attributed to improve the process skills in the students of experimental group. Earlier to this study Shirley Pasion Caday (2004) conducted a study which showed that effective use of multimedia increased process skill in science. The result of the present study supported the above finding.

**Hypothesis 2** There is no significant difference between process skills among the students belonging to different intellectual levels of experimental group in biology. Mean, SD, and t-values were computed and are presented in Table 2.
Table-2: N, Mean, Standard Deviation and F-values of Scores of Students of High, Moderate and Low Levels of Intelligence of Experimental Group in Process Skill in Biology

<table>
<thead>
<tr>
<th>Levels of intelligence</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
<th>Total Process Skill</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>7</td>
<td>4.0000</td>
<td>2.70801</td>
<td>Between Groups</td>
<td>48.272</td>
<td>2</td>
<td>24.136</td>
<td>0.621</td>
</tr>
<tr>
<td>Moderate</td>
<td>26</td>
<td>6.9231</td>
<td>8.411391</td>
<td>Within Groups</td>
<td>1852.703</td>
<td>37</td>
<td>50.073</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>7</td>
<td>5.8571</td>
<td>2.544485</td>
<td>Total</td>
<td>1900.975</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>6.2250</td>
<td>6.98162</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The obtained F-value for students of high, moderate, low intelligence groups are and total scores of process skill in biology 0.621. This value is lesser than the table F-value 3.13 for 2.37 degrees of freedom at 0.05 level of significance. This indicates that there is no significant difference in the attainment of process skill in biology among the students belonged to different intellectual level groups. From this it can be inferred that the students, irrespective of the intelligence groups to which they belonged to, have attained different process skill in biology equally and are benefitted by multimedia teaching. Hence, it can be concluded that multimedia teaching, if properly implemented, contributes for the development of process skill in biology among the students of different intellectual levels.

6 Major findings of the Study

1) Process skill was significantly increased in terms of observation, generalization, interpretation, inference, prediction and total scores in biology in experimental group rather than control group.

2) There was no significant difference in the attainment of process skill among the students of different intellectual level in biology. Hence multimedia teaching has equally improved process skill among the students of different intellectual levels in experimental group.

7 Educational Implications

The positive result obtained by the experimental group on the effectiveness of multimedia on achievement and process skill in biology at the high school level. This result leads to the following implications:

- There are many innovative teaching methods introduced to teach Biological Sciences and every method has its advantages and disadvantages. Therefore teacher should select methodology of teaching that suits the students for their effective learning method such as multimedia teaching.

- The results in terms of improvement in process skill indicates that the students of experimental group have acquired the process skills like observation, generalization, interpretation, inference and prediction better than the students of control group. This result clearly revealed that properly structured multimedia classes and use of multimedia materials can provide opportunities for the students to use their senses properly to gather and process the information, interact with one another, help one another in observation, generalization,
probe into the matter for inference and prediction etc., and would lead to the improvement of process skill in biology.

Pre-service and in-service teacher training programmes have to be organized to develop the skill of using modern technology in classroom teaching.

8 References


