
3 Chapter 3: Methodology

3.1 Introduction-

Research is a scientific process. The methodology serves as a touchstone to assess whether the researcher has scrupulously followed scientific procedures in this investigation. A well-defined methodology provides right direction to the researcher without any deviation or distraction. Keeping this in mind, the researcher took utmost care to follow a scientific methodology in the present investigation

This study investigated the effectiveness of virtual laboratories in terms of class IX students' achievement in science. The research design selected for the study was single group pre-test-post-test experimental in that treatment condition was established to compare the effectiveness of instruction with and without virtual laboratories. The data was collected an objective type test developed by O-labs and feedback was collected with the help of feedback form.

3.2 Design of the study-

A research design is the set of approaches and procedure used in gathering and studying measures of variables quantified in the problem research .It is the framework of research methods and techniques chosen by a researcher. The design of the study labels the study type (descriptive ,experimental

,non-experimental ,historical),research problems, hypothesis, independent and dependent variables.

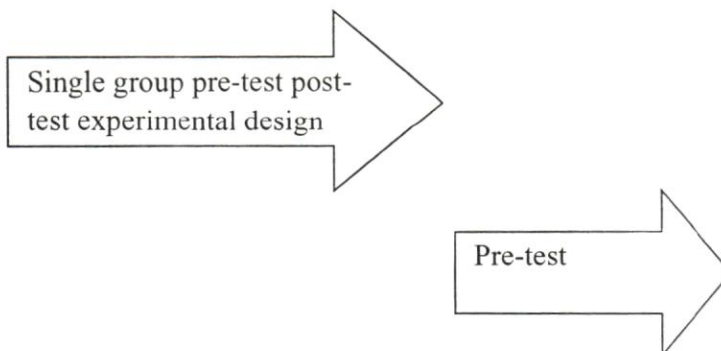
The present study investigation was carried out to study the effectiveness of virtual laboratory on the achievement in science. The design used for the study is single group pre-test-post-test design. In this design usually involves three steps.

1. Administering a pre-test measuring the dependent variable on sample.
2. Applying the experimental treatment X to the sample.
3. Administrating a post-test, again measuring the dependent variable on sample.

Difference attributed to application of the experimental treatment is then evaluated by comparing the pre-test and post-test scores.

Table 3.1: Single group pre-test post-test design

| Pre-test | Treatment | Post-test |
|----------|-----------|-----------|
| O1 | X | O2 |



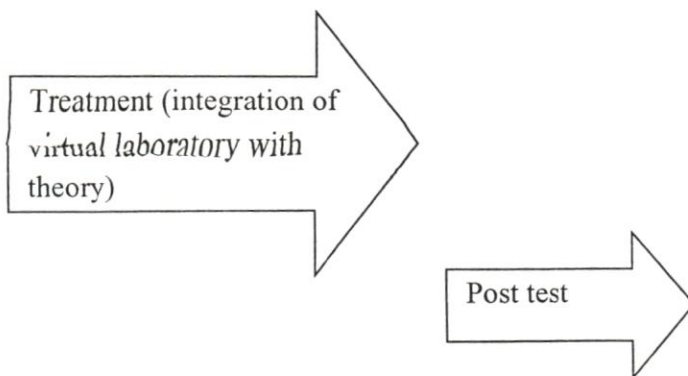


Figure 3.1: Research framework of single group pre-test-post-test experimental design

3.3 Operational definition-

1. Independent Variable-

Independent Variable which can bring change in another variable .It is also called *Manipulated Variable* as well *Treatment Variable*. In this study **Independent Variable** is integration of virtual laboratory with theory subject.

2. Dependent Variable-

Dependent Variable is one in which the variations are caused due to change in some other variable .In other words the values of the dependent variable depend upon another ,that is the Independent Variable. In the study the **dependent variable** is achievement of Student in one of the chapters of science.

3. Intervening Variable-

An intervening variable is that factor which affects the observed phenomenon but cannot be seen and measured or manipulated. Its effect must be inferred from the effects of the independent and moderator variables on the observed phenomena. In this research work students'

attitude towards science and students previous knowledge can be taken as an intervening variable.

4. Virtual Labs-

Virtual labs are popularized as a visual tool that could add advantages to students and instructors towards reducing the laborious procedures in a more effective manner. Virtual labs offer diverse analysis through different components like user- interactive animations, simulations, remote-triggering of real laboratory equipment and haptic devices to employ productive online laboratory. The actual feel and visualization of a real laboratory can be delivered through graphical animations to a greater extent. Animations provide a diagrammatic understanding of the concepts of an experiment in a better way that cannot be easily conveyed through text based or passive illustrations. Visualization techniques employed in virtual labs allow the student to freely experience the virtual world to strive to make learning science fun. In a traditional lab system, users may face certain problems such as limited access to laboratory facilities, equipment shortage, inadequate technical support, that may interfere with their curiosity for learning science. Virtual labs play a pivotal role in bridging the lack of lab facilities, and devising individual experience at a low cost and thus increase the chance of self-organized learning methods. This ultimately imparts analytical thinking skills among the learners. In this paper, we focus on the use of virtual laboratory as a new pedagogy for promoting school student's learning experience. The study analyses the effect of virtual labs on student users thereby assessing the relationship between their cognitive and social presence in active learning.

3.4 Objectives of the research

- To compare mean scores of achievement of class IX students in physics at pre-test and post-test stages of group taught through integration of virtual laboratory with subject at government inter college Lalpur.
- To compare mean scores of achievement in physics of male and female students of class IX at pre-test stages of group taught through integration of virtual laboratory with subject at government inter college Lalpur.
- To compare mean scores of achievement in physics of male and female students of class IX at post-test stages of group taught through integration of virtual laboratory with subject at government inter college Lalpur.
- To compare mean scores of achievement in physics of male and female students of class IX at post-test and retention test stages of group taught through integration of virtual laboratory with subject at government inter college Lalpur.

3.5 Hypothesis

1. H01: There is no significant difference in mean scores of achievement in physics at pre-test and post-test stages of group taught through integration of virtual laboratory with subject at government Inter College Lalpur, Kotdwara Uttarakhand.
2. H02: There is no significant difference between pre-test achievement of boys and pre-test achievement of girls of 9th class students of government Inter College Lalpur, Kotdwara Uttarakhand.
3. H03: There is no significant difference between post-test achievement of boys and post-test achievement of girls of 9th class students of government Inter College Lalpur, Kotdwara Uttarakhand.

4. H04: There is no significant difference between post-test achievement and retention-test achievement of students of 9th class students of government Inter College Lalpur, Kotdwara Uttarakhand

3.6 Sampling-

Sample is a group of people, objects or items that are taken from a large population for measurement. It should be representative of the population to ensure that we can generalize the findings from the research sample to population as a whole.

25 students of class IX of Government Inter College Lalpur, Kotdwara were taken as a sample. The sample includes 13 girls and 12 boys in total.

The details of the school are as follow-

The Government Inter College Lalpur was selected for the study. The school is located at the foothills of Charekh Mountains in Kotdwara and follows the CBSE (Central Board of Secondary Education) syllabus and textbook prepared by NCERT (National Council of Educational Research and Training). School is affiliated to Uttarakhand board of education. The school follows the pattern of examination conducted by Uttarakhand board of education. School is located in urban area and mostly students don't have strong socio-economic background. Their parents are daily wages worker.

3.6.1 Sampling Technique-

Sampling is the process of drawing a sample from a population.

The purposive sampling technique was used to select the school for the study due to Covid pandemic. In the purposive sampling the researcher

specifies the characteristics of a population of interest and then tries to locate individual who have those characteristics.

3.7 Tool selected for the study-

An already developed objective type test was selected as a tool to take sample. This objective type test is developed by O-labs. This test contains 27 items which tests the different domain of bloom's taxonomy which includes knowledge, understanding, application and synthesis. Each right answer provides one mark to student and each wrong answer provides zero mark to students. Total mark of the objective test was 27.

Second tool was feedback form to collect feedback from students.

Feedback Form

After administering the achievement test a feedback form was given to students of experimental group.

Description of feedback form

It was a 5 point rating scale, with 7 items. Maximum points for single item were 5, in this way feedback form was having 35 points for a single student.

Point's description is given in table

| | | | | |
|-----------------------|--------------|----------------|--------------------------|-----------------|
| Strongly Agree | Agree | Neutral | Strongly Disagree | Disagree |
| '5' | '4' | '3' | '2' | '1' |

3.8 Data Collection Procedure-

Data Collection is the process of gathering and measuring information on variables of interest in an established systematic manner that enables one to answer stated research questions, test hypotheses, and evaluate outcome. The data was collected in 4 phases. First one was pre phase when no treatment was given to students, second one was when treatment was given and post-test was conducted and in third phase retention test was conducted after the conduction of post-test and in the last feedback was taken from students.

3.8.1 Phase 1 Pre testing-

Force and laws of motion is 9th chapter of science in class 9th. This deals with laws of motion. Regular science teacher of school just finished this chapter. The objective type test developed by O-labs was administered in class 9th to check the understanding of students. This test was considered as pre-test and the score of pre-test was evaluated.

3.8.2 Phase II Teaching-

Now, in this phase the teacher introduced and explained the new topic for about 10 minutes to the whole class by using digital mind maps that guided and supported students to achieve the learning objectives. In other words students under this conditions were instructed and reminded frequently to use the digital maps to facilitate their learning .During the learning process

,the teacher monitored each student and intervened by guiding students to the usage of the digital mind maps if necessary .Researcher repeat this same process for 10 days.

3.8.3 Phase III Post-test-

After the completion of the 10 days teaching which was considered as a treatment, the group was post tested on academic gain in science. The pre-test was conducted through offline mode. Treatment was given through online mode and then post-test was conducted through online mode.

3.8.4 Phase IV: Retention Test-

After 10 days of post-test, researcher conducted a retention test to examine the retention level of the students after learned through integration of virtual labs with theory subject.

3.8.5 Phase V: Feedback-

After the administration of retention test feedback was taken from students by filling up the feedback form.

3.9 Data Collection, Entry and Analysis-

This section explores the various aspects of obtaining and understanding quantitative data. Quantitative data was collected by administration of an objective type test. The marks of pre-test were collected in off-line mode and the score of post-test was collected in on-line mode. Marks of pre-test, post-test and retention were entered in Microsoft excel 2010 and by using statistical formulas mean, median, standard deviation and skewness of the data were calculated.

To analyze the data descriptive and inferential techniques were used and results were interpreted.

3.10 Conclusion-

This chapter explained the methodological details of evaluating the effectiveness of virtual laboratories in terms of students' achievement in science. The study used a single group pre-test-post-test design to compare students of class IX of Government Inter College Kotdwara before and after the engagement of virtual laboratories. The force and laws of motion, topic was selected to teach class IX students with virtual laboratory. The period of treatment was 10 days and after the treatment then post –test was administered.