Chapter 3

METHODOLOGY AND DATA COLLECTION

3.1 INTRODUCTION

In the present study, the researcher examines the possible role of technology to improve the reading and writing skills of the engineering students. This investigation is necessary due to the absence of data concerning use of technology to improve the language skills of Indian students. So, the following research questions were posed:

1. Is there a significant difference in students’ reading achievement due to TELL methodology?
2. Is there a significant difference in students’ writing achievement due to TELL methodology?
3. Is there a significant difference between TELL users’ and nonusers’ achievement in reading skills?
4. Is there a significant difference between TELL users’ and nonusers’ achievement in writing skills?
5. Does the use of TELL enhance users’ level of motivation and interest towards language learning?

Just as the groundwork for a descriptive study is laid in this chapter and it provides some explanations on the characteristic features of the study, the utmost effort has been devoted to obtain the data through the most reliable method. This chapter details the design of the research study undertaken with these goals and questions in mind. The setting of the study including the subjects/participants and materials is described. Then the methodology of the study is detailed including the instruments and procedures (general and statistical). The design section elaborates the process of the data analysis and its meaningful representation. The samples, the variables, the material, the procedure and instrumentation are precisely described in order to evoke the conclusion as exactly as possible. The descriptive part of this chapter demonstrates how teachers captivate the imagination of learners by providing real-world purposes for language while also answering important questions about how learning proceeds with new technologies.
Since validity and reliability are essential to the effectiveness of any data-gathering procedure, these two concepts must be explained thoroughly.

Validity and Reliability

Validity is that quality of the data-gathering instrument or procedure that enables it to measure what it intends to measure; i.e. a test is valid if it measures what it is supposed to measure. There are several types of validity:
1. Content validity measures the degree to which the test items represent the domain or universe of the trait or property being measured. It refers to the degree to which the test actually measures, or is specifically related to, the traits for which it was designed. The content of the test should be appropriate to what the examinees have learned. It shows how adequately the test samples the universe of knowledge and skills that a student is expected to master. Since it is not possible to have any statistical calculations or numerical method to express content validity; it is usually suggested that a panel of experts in the field to be studied be used to identify a content area. Content validity is particularly important for an achievement test but not very important for aptitude tests.

In the present research, the researcher used IELTS test to assess the proficiency level of the subjects. Although the IELTS test was a genuine, standard and valid test, a group of experts in the field of applied linguistics, education and psychology approved the validity of these tests.

2. Construct or trait refers to what is being measured in a test. Construct validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. Construct validity is particularly important for personality and aptitude tests. Computing construct validity involves complicated statistical calculations called Factor Analysis.

Concerning the current study, factorial analysis was run to prove the construct validity of the IELTS test.

3. Criterion-related validity refers to two different types of validity. It is expressed as the coefficient between test scores and scores on another test or measure of known validity.

   a. Predictive validity refers to the usefulness of a test in predicting some future performance.
   b. Concurrent validity refers to the usefulness of a test in closely relating to other measures.

In this study, the concurrent validity of the IELTS test was measured using the Pearson Coefficient of Correlation.

Reliability is the degree of consistency that the instrument or procedure demonstrates. The reliability of a research instrument concerns the extent to which the instrument yields the same results on repeated trials. In other words, a test is reliable
to the extent that it measures whatever it is measuring consistently, i.e., in case repeated, almost the same results are obtained. In tests that have a high coefficient of reliability, errors of measurement have been reduced to a minimum.

The reliability or stability of a test is usually expressed as a correlation coefficient. There are several types of reliability:

1. Stability over time (test-retest)
2. Stability over item samples (equivalent or parallel forms)
3. Stability of items (internal consistency) which is of two types:
   a. Split halves
   b. Kuder- Richardson formula
4. Stability over scores (inter-scorer reliability)
5. Standard error of measurement

Reliability is a necessity but not a sufficient condition for validity. That is, a test must be reliable for it to be valid, but a test can be reliable and still not be valid.

In the present study, the reliability of all tests was calculated by the use of the Kuder- Richardson formula.

3.2 SUBJECTS

The subjects for this study were first year students of an engineering college named Baba Banda Singh Bahadur Engineering College, Fatehgarh Sahib. It is an NBA accredited college which is affiliated to Punjab Technical University, Jalandhar. The college offers five branches of engineering i.e. Computer Sciences and Engineering, Electronics and Communication Engineering, Electrical Engineering, Information Technology and Mechanical Engineering. 120 students are admitted to each branch every year. The reason for selecting this college is mainly two fold: firstly, the researcher has been associated with the institution, as a faculty member in Communication Skills and English Language Teaching for a long time, this gives her a first hand experience of the students’ psychology and attitude towards the learning of English. Secondly, it makes her stance more credible by giving her an opportunity to access the students easily and comfortably.

Students undergo a course in communication skills in the first year (either I or II semester which is of six months) of their engineering. As per the course of the university, the subject comprises two parts i.e. theory and practical. There are sixty
students in a theory class but the class of sixty is divided into three groups of twenty each for the practical lab.

So, four practical groups with the total number of 80 were included in the study. As per the teaching load assigned, a Communication Skills teacher is assigned one complete subject (theory and practical) of sixty students and one practical group of twenty, eighty in all. Out of which two groups were taught for the complete semester with the use of TELL and the two groups studied without the use of any technology assisted instruction. They were males and females with diverse social classes—since it has been assumed that these variables don’t have any impact on the study. Although gender based learning differences are considered a possible moderating variable and gender differences have been shown to be significant in reading in terms of background knowledge of topics of more interest to one gender than the other (Bugel and Buunk); gender has not been shown to be a significant factor with regard to L2 reading and writing (Brantmeier; Grace; Paivio and Lambert). No gender differences were found on a measure of computer task self-efficacy among undergraduate and graduate students enrolled in various courses (Sam, H. 213; Hong 272). For this reason, it was not considered as a moderating variable in the present study.

Hong suggested, “Students who are going to participate in courses that require the use of the Internet would benefit if offered technology literacy courses prior to enrolling in courses that require its use” (271). Emphasizing the importance of computer competence in the students, Fox said, “If this aspect is not addressed properly, students will be quickly overwhelmed and frustrated by the complexity of computer and Internet usage.” Keeping Hong’s and Fox’s advice in the mind, the researcher undertook the project in the second semester as by that time the subjects had undergone the basic computer subject named Fundamentals of Computer Programming and Information Technology (FCPIT) in their first semester. Of the 80 students, 34 were female and 46 were male. The students’ average age was 18.67 years. They have received at least twelve years of formal instruction in the English language. They were majoring in a variety of technical disciplines, such as electronics, mechanical engineering, information technology, and computer sciences. These students tended to have relatively little exposure to English in their content-based classes.

The demographic characteristics of the subjects are shown in Table 3.1.
Table 3.1 The subjects’ demographic characteristics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>34</td>
<td>42.5%</td>
</tr>
<tr>
<td>Male</td>
<td>46</td>
<td>57.5%</td>
</tr>
</tbody>
</table>

### 3.3 INSTRUMENTATION

Considering the purpose of the research, the following tests were developed to investigate the effectiveness of technology in teaching reading and writing skills to the engineering students. Three instruments were used in order to obtain as valid information as possible. The Computer Self Efficacy (CSE) scale was used to monitor the students’ ability to use computers. The validity and the reliability of the scale were already proven by the researchers (Sam, H. 210).

The second instrument was an IELTS test, a standardized and valid test as a measurement for English proficiency in the pre-test and the post-test was used. A pilot test was run to validate the test by the researcher herself.

Lastly, in order to collect data to determine student attitudes toward the use of technology in the language laboratory, the researcher used the online survey programme Surveymonkey.com, available for free for small-scale surveys and with monthly fees for more professional features (www. surveymonkey.com). This program allows users to create an online questionnaire quickly by following simple procedures. Once one survey is created, the survey can be renamed as a new survey with the same questions for replication or with any revisions made for improvement.

There were 28 items in total on the survey instrument, all rating scale items focusing on degree of agreement in a Likert Scale format. Students were asked to strongly agree (SA), agree (A), disagree (DA), strongly disagree (SD) or give no response (NR). These statements elicited information about students’ perceptions in three categories: a) attitude towards TELL, b) Perceptions Concerning Effect on Learning and on level of Interest, c) attitude towards TELL activities performed in the language lab.
**Proficiency Levels for Writing**

To categorize the subjects into three proficiency levels, the researcher used Jacob et al.’s scoring profile (qtd. in Weigle 116); the details for each level are given below:

**Elementary (Level 1)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
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</table>
| Content  | • Limited Knowledge of the subject  
          | • Inadequate development of the topic  
          | • Little substance |
| Organization | • Ideas confused or disconnected  
          | • Non-fluent  
          | • Lacks logical sequencing and development |
| Vocabulary | • Limited range  
          | • Frequent errors of word form  
          | • Meaning confused or obscured |
| Language Use | • Major problems in simple/complex constructions  
          | • Frequent errors of negation, agreement, word order, tense, articles, pronouns, prepositions |
| Mechanics | • Frequent errors of spellings, punctuation, capitalization, paragraphing  
          | • Poor handwriting  
          | • No mastery of conventions |

**Intermediate (Level 2)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
</table>
| Content  | • Some knowledge of the subject  
          | • Adequate range  
          | • Limited development of the topic  
          | • Relevant but lacks detail |
| Organization | • Somewhat choppy  
• Loosely organised but main ideas stand-out  
 • logical but incomplete sequencing |
|--------------|---------------------------------------------------------------|
| Vocabulary   | • Adequate range  
• Occasional errors of word /idiom form, choice  
• Meaning not confused |
| Language Use | • Effective but simple constructions  
• Minor problems in complex constructions  
 • Several errors of negation, agreement, word order, tense, articles, pronouns, prepositions but meaning seldom obscured |
| Mechanics    | • Occasional errors of spellings, punctuation, capitalization, paragraphing but meaning not obscured |

**Advanced (Level 3)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Content** | • Knowledgeable  
• Substantive  
• Thorough development of the topic  
• Relevant to assigned topic |
| **Organization** | • Fluent expression  
• Ideas clearly stated/supported  
• Logical sequencing  
• Cohesive  
• Succinct  
• Well-organized |
| **Vocabulary** | • Sophisticated range  
• Effective word /idiom form, choice and usage  
• Word form mastery  
• Appropriate register |
| **Language** | • Effective complex constructions |
Use
- Few errors of negation, agreement, word order, tense, articles, pronouns, prepositions

Mechanics
- Demonstrate mastery of conventions
- Few errors of spellings, punctuation, capitalization, paragraphing

Proficiency Levels for Reading

Level 1
At level 1, a student can:
- Recognize factual material explicitly presented in a reading passage.
- Understand the meanings of particular words or phrases in the context of a reading passage.

Level 2
At level 2, a student can:
- Synthesize material from different sections of a passage.
- Recognize valid inferences derived from material in the passage.
- Identify accurate summaries of a passage or of significant sections of the passage.
- Understand and interpret figurative language.
- Discern the main idea, purpose of focus of a passage or a significant portion of the passage.

Level 3
At level 3, a student can:
- Evaluate competing casual explanations.
- Evaluate hypotheses for consistency with known facts.
- Determine the relevance of information for evaluating an argument or conclusion.
- Recognize the salient features or themes in a work.
- Evaluate the appropriateness of procedures for investigating a question of causation.
- Evaluate data for consistency with known facts, hypotheses or methods.
- Recognize flaws and inconsistencies in an argument.
3.4 DATA COLLECTION AND ANALYSIS PROCEDURE

The procedure of the present research to collect data has been conducted in the following phases:

3.4.1 First Phase

In order to validate and standardize the IELTS test, a pilot study was run. An IELTS reading test with 25 items was administered to the First year engineering students. 40 students were selected to attend the research by the teacher-researcher. The following statistical analyses are employed in the pilot study to analyze the obtained data.

A- Item Analysis

Item facility and Item discrimination and the KR-21 reliability coefficient are the indices calculated to evaluate the items of the instruments employed in this study. This section includes a brief introduction to these concepts, their computation and interpretation.

1- Item Facility (IF)

Item facility refers to the degree of the easiness of the item. It is simply calculated by dividing the number of cases who have answered the item correctly by the total number of subjects.

\[
IF = \frac{X_C}{N}
\]

IF Item Facility

\[X_C\] Total number of correct answers

N Total number of subjects

Item facility ranges from 0 to 1. An IF of zero indicates that all of the subjects have missed the item and the item is absolutely difficult. On the other hand, an IF of 1 shows that all of the subjects have answered the item correctly. In other words, the item is rather easy.

An ideal item facility should be equal or higher than .37 and equal or lower than .63.

\[.37 \leq IF \leq .63\]

2- Item Discrimination (ID)

A good item should be able to differentiate between the weak and strong students. In other words an item enjoys discriminatory power if it is answered by the
strong students while the weak students miss it. In order to calculate the Item discrimination (ID) the following steps should be taken:

a. Compute the total score for each subject
b. Sort the subjects on their total scores.
c. Choose the upper and lower 25 percent students (In some references 33 and 37 percents are to be mentioned).
d. Tally the correct answers in both groups and plug them into in the following formula:

\[ ID = \frac{\sum CH - \sum CL}{N/2} \]

ID: Item Discrimination
\( \sum CH \): Total number of correct answers in the upper 25 percent
\( \sum CL \): Total number of correct answers in the lower 25 percent
N: Total number of subjects

Item discrimination can range from -1 to 1. An ID of -1 shows that all the weak students have answered the item correctly, while all the strong students have missed it. An ID of 1 shows the reverse case. That is, all the strong and none of the weak students have answered the item correctly. An ID of zero indicates that the item cannot differentiate between strong and weak students. In other words, the strong and weak students may choose the correct answer.

An ideal ID should be equal or higher that .40

\[ ID \geq .40 \]

3-Kunder-Richrdson Reliability Coefficient (KR-21)

The concept of reliability refers to the degree of the consistency of the test scores. In other words, a good test should yield the same results if it is replicated. A number of different formulas have been devised to compute the reliability coefficient. The KR-21 is one of the most widely used and easily calculated indices. All one needs are the mean, Variance and the number of the items in the test to calculate the index through the following formula:

\[ (KR - 21) = \left[ 1 - \frac{\overline{X} - (K - \overline{X})}{K \sigma^2} \right] \]

Kunder-Richrdson Reliability Coefficient (KR-21)
K: Number of items in the test
\( \overline{X} \): Mean Score
\( \sigma^2 \): Variance
Variance of the test scores

Reliability coefficient may range from 0 to 1, the former shows that the test is not reliable at all, while the latter shows perfect reliability of the test. For a teacher-made test, a reliability coefficient of .60 or more is good, while for a standardized test it should be .80 or more.

3.4.2 Second Phase

A standardized and valid IELTS test was administered as a proficiency test (Appendix 1) to the subjects of research in order to form three groups of subjects at three levels of proficiency, i.e., elementary, intermediate and advanced. Since, the reading process is involved in this research project; an IELTS test containing 25 items was used.

The answer sheets gathered were rated objectively according to the answer key provided. Hence, students were placed at three different levels of proficiency on the basis of their scores obtained from IELTS so that those with scores obtained between + 0.5 SD above the mean score and − 0.5 SD below the mean score were considered as the intermediate group. Those subjects who obtained beyond + 0.5 SD above the mean score and -0.5 SD below the mean score were considered as the advanced and elementary subjects respectively. Student’s t-test was run to compare the mean scores of the three groups and indicate their significant differences.

The t-Test

The t-test assesses whether the means of two groups are statistically different from each other. This analysis is appropriate whenever you want to compare the means of two groups.

![Figure 3.2 Idealized distributions for treatment and control group post-test values.](image-url)
Figure 3.2 shows the distributions for the treated (blue) and control (gray) groups in a study. Actually, the figure shows the idealized distribution -- the distribution would usually be depicted with a histogram or bar graph, which indicates where the control and treatment group means are located. The question test addresses is whether the means are statistically different.

What does it mean to say that the averages for two groups are statistically different? Consider the three situations shown in Figure 3.3. The first thing to notice about the three situations is that the difference between the means is the same in each of the three. But, one should also notice that the three situations don't look the same. They tell very different stories. The top example shows a case with moderate variability within each group. The second situation shows the high variability case, and the third shows the case with low variability, as there is relatively little overlap between the two bell-shaped curves. Clearly, one would conclude that the groups appear most different or distinct in the bottom or low-variability case. In the high variability case, the group difference appears least striking because the bell-shaped distributions overlap so much.

Figure 3.3 Three scenarios for differences between means.

This leads us to a very important conclusion that when one is looking for differences between scores for two groups, one has to judge the difference in the means relative to the spread or variability of the scores. The t-test does this for you automatically.
Statistical Analysis of the t-test

The formula for the t-test is a ratio. The top part of the ratio is just the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores. This formula is essentially another example of the signal-to-noise metaphor in research. The difference between the means is the signal that, in this case, one thinks the programme or treatment introduced into the data; the bottom part of the formula is a measure of variability that is essentially noise that may make it harder to see the group difference. Figure 3.4 shows the formula for the t-test and how the numerator and denominator are related to the distributions.

\[
\frac{\text{signal}}{\text{noise}} = \frac{\text{difference between group means}}{\text{variability of groups}} = \frac{\bar{X}_I - \bar{X}_C}{SE(\bar{X}_I - \bar{X}_C)} = t\text{-value}
\]

**Figure 3.4** Steps for the t-test.

The top part of the formula is easy to compute – one has to just find the difference between the means. The bottom part is called the standard error of the difference. To compute it, the variance for each group is taken and divided by the number of people in that group. Then these two values are added and their square root is taken. The specific formula is given in Figure 3.5:

\[
SE(\bar{X}_T - \bar{X}_C) = \sqrt{\frac{\text{var}_T}{n_T} + \frac{\text{var}_C}{n_C}}
\]

**Figure 3.5** Formula for the Standard error of the difference between the means.
Remember, that the variance is simply the square of the standard deviation. The final formula for the t-test is shown in Figure 3.6:

\[
t = \frac{\bar{X}_T - \bar{X}_C}{\sqrt{\frac{\text{var}_T}{n_T} + \frac{\text{var}_C}{n_C}}}
\]

**Figure 3.6 Formula for the t-test.**

**Interpretation**

The t-value will be positive if the first mean is larger than the second and negative, if it is smaller. Once the t-value is computed, one has to look it up in a table of significance to test whether the ratio is large enough to say that the difference between the groups is not likely to have been a chance finding. To test the significance, one needs to set a risk level (called the alpha level). In most social research, the "rule of thumb" is to set the alpha level at .05. This means that five times out of a hundred one would find a statistically significant difference between the means even if there was none (i.e., by "chance"). One also needs to determine the degrees of freedom (df) for the test. In the t-test, the degrees of freedom are the sum of the persons in both groups minus 2. Given the alpha level, the df, and the t-value, one can look the t-value up in a standard table of significance to determine whether the t-value is large enough to be significant. If it is, one can conclude that the difference between the means for the two groups is different (even given the variability).

**3.4.3 Third Phase**

**3.4.3.1 Project Design**

In this era of Information Technology, where the world is dynamically evolving into a Virtual Global Village, communicating effectively is the key to success. Language is very often a barrier in effective communication whether it is doing business with foreign nations, pursuing academic goals overseas or taking-up lucrative job offers where one's technical skills are ideally suited but the language skills are not.
Furthermore, “information technology literacy” has become the centerpiece of “professional literacy” and “workforce readiness” (Resnick and Wirt, 108). Workforce readiness includes communication skills, competencies in emerging technologies and critical thinking skills. These skills will not only improve one’s competence at professional platform but also enhance one’s level of confidence to adapt to new applications and environments.

Romiszowski and Mason conclude that higher education will expand academic computing resources not only for one’s pedagogical benefits but also “because it will be seen to be the duty of education to use such systems in order to prepare its graduates for the realities of a workplace where they will be obliged to use them” (449).

From an investigation of the experience of dozens of teachers around the world who have used the Internet in language teaching, a few common guidelines emerge that can assist teachers in successfully planning and implementing network-based learning projects.

Guidelines

Following are the guidelines outlined by Warschauer and Whittaker that provide some assistance to teachers attempting to optimally combine their own goals, their students' needs and the power of the technology-enhanced classroom (27-32).

#1: Consider Your Goals Carefully

There are several possible reasons for using the Internet in language teaching. One rationale is found in the belief that the linguistic nature of online communication is desirable for promoting language learning. It has been found, for example, that electronic discourse tends to be lexically and syntactically more complex than oral discourse (Warschauer Comparing 7-26) and features a broad range of linguistic functions beneficial for language learning (Chun 24; Wang, L 13). Another possible reason for using the Internet is that it creates optimal conditions for learning to write, since it provides an authentic audience for written communication (for example Janda 57). A third possible reason is that it can increase students' motivation. A fourth possible reason is the belief that learning computer skills is essential to students' future success; this reason suggests that it is not only a matter of using the Internet to learn English but also of learning English to be able to function well on the Internet.

None of these reasons are more or less legitimate than any of the others. However, since there are so many ways to integrate the Internet into classroom
instruction, it is important for the teacher to clarify his or her goals. If, for example, one of the teacher's goals is to teach students new computer skills, the teacher may want to choose Internet applications which will be most useful to them outside of the classroom, with activities structured so that students steadily gain mastery of more skills. If the immediate goal is to create a certain kind of linguistic environment for students, once again, the teacher should consider what types of language experiences would be beneficial and structure computer activities accordingly. If the goal is to teach writing, Internet activities should be structured so that they steadily bring about an increase in the types of writing processes and relationships essential to becoming a better writer (for example, seven activities by Janda 57-58).

As will be discussed further below, little is usually gained by just adding random online activities to a classroom. Clarifying course goals is, thus, an important first step towards the successful use of the Internet.

**#2: Think Integration**

Most teachers who have used the Internet have started out with some kind of simple key pal (computer pen pal) exchanges. And most teachers who have used these exchanges have felt something lacking. Simply put, there is no more reason to expect a significant educational outcome from simply creating a pen pal connection than there is from simply bringing two students into a room and asking them to talk. Over time, greater involvement on the teacher's part in creating learning activities that create sufficient linguistic and cognitive demands on the student is needed to get maximum benefit from Internet exchanges. And, as a number of people have noted, this teacher intervention is most successful when it brings about activities and projects that are well-integrated into the course curriculum as a whole.

Bruce Roberts, the coordinator of the Intercultural E-Mail Classroom Connections program, explained this point well:

There is a significant difference in educational outcome depending on whether a teacher chooses to incorporate e-mail classroom connections as (1) an add-on process, like one would include a guest speaker, or (2) an integrated process, in the way one would include a new textbook. The e-mail classroom connections seems sufficiently complex and time-consuming that if there are goals beyond merely having each student send a letter to a person at a distant school, the add-on approach can lead to frustration and expected academic results...
necessary time and resources come from other things that also need to be done. On the other hand, when the e-mail classroom connection processes are truly integrated into the ongoing structure of homework and classroom interaction, then the results can be educationally transforming (qtd. in Warschauer *E-mail* 95).

Of course there are many ways that Internet activities can be integrated into the overall design and goals of a course. The teacher can work with students to create research questions which are then investigated in collaboration with foreign partners. Students and long-distant partners can work collaboratively on publications. Or students can use exchange partners as experts to supply information on vocabulary, grammar, or cultural points which emerge in the class. Again, the choice has to be made by the classroom teacher, preferably in ongoing consultation with the students. Nevertheless, as Roberts suggests above, it behooves a teacher to think about how to integrate online connections into the class rather than adding these connections on top of the rest of the classroom activities in a disconnected fashion.

**#3: Don't Underestimate the Complexity**

Most English teachers, even those who consider themselves computer novices, have several relative advantages when learning to use the Internet. They are, in most cases, skilled at English, experienced at typing or keyboarding, and have some basic computer literacy (i.e., they probably have at least used a computer for word processing). ESL students, on the other hand, at least in some cases, may lack these basic prerequisites.

Beyond these issues of learner preparation, there are a number of other complexities in introducing Internet-based activities in the ESL classroom. Activities in a single class may be dependent on scheduling the computer lab, and on students finding computers outside the class time to continue their activities. Hardware and software can malfunction and computer systems can be down. Students' schedules might not permit them to return to the computer lab at a time when computers are available to complete their assignments.

These potential problems should not discourage a language teacher to use Internet based activities. But in attempting to integrate online teaching, it is best not to be overly ambitious in the beginning. A situation which overwhelms both students and teacher in technical difficulties is not likely to bring about the desired results. It is better to start small and to create the kinds of activities which have a direct purpose...
and are well-integrated into classroom goals. If these activities prove successful, one can build from there and attempt a more ambitious plan the following semester.

**#4: Provide Necessary Support**

Mindful of the complexities which can arise in Internet usage, teachers need to provide support sufficient to prevent students from being overwhelmed by difficulties. This kind of support can take numerous forms: creating detailed handouts that students can refer to when class is finished and the teacher's personal help is not accessible; building technology training sessions into the class schedule, not only in the beginning but on an ongoing basis; working with the computer center to set up log-on systems and other procedures which are as simple and intuitive as possible; assigning students to work in pairs or groups, both in and out of the lab, so that they can provide assistance to each other; providing details to the students about how and when they can get assistance from technology specialists or others on campus outside of class; and being available to help students at times when they are most likely to need it.

**#5: Involve Students in Decisions**

The concept of a learner-centered curriculum has broader significance and seems to be particularly important when considering technology-enhanced teaching.

First of all, as indicated above, network-based teaching involves a number of special complexities. It will be difficult, indeed, for a teacher to be fully aware of the impact of these complexities without regular consultation with students. This might involve anonymous surveys, class discussions, or similar means of involving students in expressing their opinions about the process of implementing technologies.

Notably favorable is that the nature of computer-mediated communication creates opportunities for more decentered interaction. To fully exploit these opportunities, a teacher must learn to become a ‘guide on the side’ rather than a ‘sage on the stage’ (Dreger 64). A situation which is based on communication between students but in which the students have little say over the topics or outcomes of that communication is not likely to lead to the kind of atmosphere optimal for language learning.

As pointed out by Fox, involving students in determining the class direction does not imply a passive role for teachers. Teachers' contributions in a learner-centered, network-enhanced classroom include coordinating group planning, focusing students' attention on linguistic aspects of computer mediated texts, helping students
gain meta-linguistic awareness of genres and discourses, and assisting students in
developing appropriate learning strategies. All of these reinforce the use of the
Internet and help students who are not technologically adept at refining these skills.

Keeping the above assertions and guidelines in mind, the researcher prepared a
project for 40 students of the experimental group. After taking the Pre-test of the
students, they were made to perform their practical performances using technological
tools.

Language professionals have embraced the world of collaborative
opportunities the Internet has introduced. Many tools -- e-mail, discussion forums,
chat -- are by now familiar to many language teachers. Recent innovations -- blogs,
wikis and RSS feeds -- may be less familiar but offer powerful opportunities for
online collaboration for both language professionals and learners. The underlying
technology of the new tools is XML ("extensible markup language") which separates
content from formatting, encourages use of meta-data, and enables machine
processing of Internet documents. The latter is a key in the ability to link
automatically disparate documents of interest to individuals or groups. The new
collaborative opportunities this enables have led some to consider the growing
importance of XML as the signal of the arrival of the second-generation Web.

3.4.3.2 Purpose of the Project

Research on the effect of using technological tools on education is still in its
infancy, and its effect on language learning and teaching has been studied even less. A
review of the literature reveals that no such study even exists in India. In view of
relatively little published research and with the role of technology and English
language in recent education reform efforts in India, the time is right to discover the
impact of technology integration into language courses and to examine the
participants’ perception of the learning experiences afforded by them.

In this regard, the researcher designed a project to introduce the students of an
engineering college to various technological tools like blogs, wikis and to find ways
to use them to supplement their learning experience. Integrating technologies into
language pedagogy has become a reality for language practitioners even as students
around the world increasingly need both English and technology skills for their future
careers in the workforce. The overall purpose of this study was to measure the
effectiveness of using technological tools in reading and writing activities and to
investigate (1) improvement in the performance of the engineering students and (2) How they perceived learning English through technology.

Research also suggests that educators help motivate students by using materials and implementing activities that students consider meaningful (Spratt, Humphreys and Chan 254). Due to the popularity of computer and Internet technology and the growing interest in the World Wide Web, it was expected that the group of learners would also find the use of technology in their English language study highly motivating.

Second, almost every student of the college, where the study was conducted, owns a computer/laptop and above all the campus has Wi-Fi internet connection; for students who do not have a computer, the college provides two 24-hour-accesses to computer centres with 30 and 40 computers respectively. The researcher believes that this availability of the required technology would make any plans for a technology-based course a promising effort.

Procedure

Researchers have proposed that in integrating computers in higher education, positive attitudes toward computers and high computer self-efficacy and lower computer anxiety levels could be important factors in helping students learn computer skills and use computers in education.

Dudeny and Nicky Hockly said, “you need to first find out about your learners' IT skills and degree of experience, for example by means of a questionnaire, and then start off by using technologies in the classroom” (11).

So, following the advice given by CALL experts, the researcher used the Computer Self Efficacy (CSE) scale to monitor the students’ attitudes toward computers. This scale was first developed by Murphy et al. and used by Harrison and Rainer; Torkzadeh and Koufteros (qtd. in Sam, H. 209). Prior research consistently indicates that computer self-efficacy (CSE) is positively correlated with an individual’s willingness to choose and participate in computer-related activities, expectations of success in such activities and persistence or effective coping behaviors when faced with computer-related difficulties (Compeau and Higgins 198). In short, CSE lends itself to meaningful measurement and has been demonstrated to be discriminative and informative in similar circumstances. Self-efficacy is believed to be the capability to perform a specific task. Kinzie, Delcourt, and Powers defined
self-efficacy as an individual’s confidence in his or her ability, which may impact the performance of tasks:

Self-efficacy reflects an individual’s confidence in his/her ability to perform the behavior required to produce specific outcome and it’s thought to directly impact the choice to engage in a task, as well as the effort that will be expended and the persistence that will be exhibited.(747)

Correspondingly, computer self-efficacy “…refers to a judgment of one’s capability to use a computer” (Compeau and Higgins 192). Computer self-efficacy was also found to be associated with attitudes toward computer technologies. Zhang and Espinoza reported that past enrollment in computer programming courses was found to be positively related to self-efficacy and computer self-efficacy positively related to plans to take more computer related courses (qtd. in Sam, H. 207). Woodrow claimed that students’ attitudes toward computers were critical issues in computer courses and computer-based curricula, if the computer is to be used as a teaching and learning tool (179).

CSE has 29 items, each item preceded by the phrase “I feel confident”. The subjects responded to a five-point Likert type scale (5=strongly agree, 4=agree, 3=disagree, 2=strongly disagree, and 1=no response). Total scores for CSE ranged from 29 to 145, with high scores indicating a high degree of confidence in a subject’s ability to use computers (Durmdell 1040).

The reliability for CSE was acceptable, with Cronbach alpha values of 0.9049. The results indicate the effects of computer self-efficacy and computer attitude are significant for the e-learning outcomes. The scale is appended in Appendix III.

**Table 3.2 Means and Standard Deviations for Computer Self Efficacy**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer self-efficacy (based on CSE)</td>
<td>3.8656</td>
<td>0.5955</td>
</tr>
<tr>
<td>(1=low computer self-efficacy, 5=high computer self-efficacy)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**3.4.3.3 Description of the Programme**

During the second week of January 2010 i.e. at the outset of the second semester, 40 students of the two experimental groups were introduced to the digital
language laboratory, where the access to internet and language learning software is available round the clock. Each group would attend the language laboratory sessions for two hours a week.

The experimental group was taught throughout the semester i.e. for 32 hrs using a variety of technological tools. Technology mainly provides two paths to optimal language learning conditions: software and Internet communications. So following is the description of the activities used by the researcher in her project:

Table 3.3 Description of the TELL activities done in the Language Laboratory

<table>
<thead>
<tr>
<th>S. No</th>
<th>Activity</th>
<th>Use of Technological Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor Project</td>
<td>Wiki</td>
</tr>
<tr>
<td>2</td>
<td>Maintaining record of their practical work</td>
<td>Blogs</td>
</tr>
<tr>
<td>3</td>
<td>Making an Oral Presentation</td>
<td>World Wide Web and LCD projector</td>
</tr>
<tr>
<td>4</td>
<td>Conducting a survey</td>
<td>Online Survey Tool</td>
</tr>
<tr>
<td>5</td>
<td>Webquest</td>
<td>World Wide Web and Wiki</td>
</tr>
<tr>
<td>6</td>
<td>Grammar Practice, Business Correspondence</td>
<td>Interactive audio-visual software. ESL websites</td>
</tr>
</tbody>
</table>

Describing authentic, collaborative tasks that involve learners in using and expanding their language and technology skills, the researcher is explaining three of the activities which were used during the project. Apart from adding supplementary language activities, the researcher used the above mentioned technological tools to conduct the practical given in the university curriculum.

Activity 1

As a part of the Communication Skills laboratory curriculum, the students have to collaboratively perform a minor survey based project and prepare a formal report of the same. One group comprises four students. So the researcher asked each group to perform their project and present its report on a self-composed wiki. A wiki is essentially a fully editable web site. It is a type of free on-line writing space that allows users to add, modify and update its pages. Regarding the use of wikis for writing instruction, Lamb refers to Joe Moxely who specifies the advantages of wikis:
(1) a wiki task pursues “writing as process” rather than “product oriented writing”; (2)
a wiki-related task makes the composition active; (3) a wiki is an effective way for
interaction and cooperation with a low price; (4) a wiki encourages reading, editing
and tracing of all versions; and (5) a wiki allows students to participate and learn from
publicly viewable composition processes and products (42). Like the potential
examples of using wikis among students discussed in the review of literature, the
students of the experimental group would be exposed to a space wherein they can
communicate with each other with the support of their teacher. When effective, the
students participate in and enjoy an interesting activity which leads to their ideas and
thoughts generated from this activity being published on a web page.

The students of each group created a wiki for their project report, gave it a
name and protected it with a password. When any member of the group finds
something missing or incorrect in a wiki and then he/she edits the wiki, adds the
thoughts or makes changes to the wiki. Wiki technology works great for the students
who have conflicting schedules and have problems getting together. As some of the
students in a group are day scholars and some are hostellers and had problems in
sitting together, discussing and writing their report; they earlier used to make excuses
for the timely submission of their project.

They did not receive feedback, updates, revisions or elaborations from anyone
other than their group mates, thus encouraging a sense of responsibility. In the
beginning of their project, they were given a simple set of instructions to guide them
to participate:

“Please remember that this wiki belongs only to your course and will allow
you to collaboratively integrate all the elements of your minor project into a cohesive
idea. You can edit, delete, add and alter information. Remember there will be a record
of the changes you make so try to be constructive. You should also strive for accuracy
both in content and language.”

Wiki technology is configured as a tool that enables the teacher
(1) To follow the evolution of the acquisition and generation of the
knowledge of the group and of each of its members and
(2) To efficiently evaluate each student in terms of group and individual work
done.

In the case of online group activity, some members do not acclimate to the
activities, or even can give up. Consequently, a wiki activity or project can result in
limited student participation. To deal with this problem Lee and Bonk (23) suggest that a teacher could facilitate the students’ participation using some method, for example, assigning them roles. So following the advice, the teacher-research facilitator assigned roles to the students; monitored and encouraged the active students while they wrote their project report on the wiki. Moreover, information related to the students’ activities can be efficiently checked through the history function of wikis that preserves the changes of the wiki content. So it was helpful for the teacher to evaluate each participant’s participation and performance.

But before using wikis in a class or project, students wanted enough time to get to know the wiki tool. Of course, some research suggests that users need time to understand the wiki tool, and that it is possible to introduce how to use a wiki in simple instructions using e-mail (Lamb, 44). At the same time, other research indicates that most students who participate in wiki research need more time to fully know the wiki tool or environment (Notari 131). Familiarity appears to be a factor in the success (Lee and Bonk, 23).

Figure 3.7 Home page of a student’s Wiki project

Activity 2

Two practical groups comprising of 20 each were instructed to put their class activities in their blogs rather than writing them in the form of a report.
their practical files. At the outset of the project, the groups were given a 50-
training session at the digital language laboratory. The students worked in pairs
computers at the digital laboratory. The training session aimed to introduce s
to blogs so that learners could create their own blogs and afterwards post and
the written assignments on them. Before the training session started, the studen
ted to fill out an anonymous questionnaire asking about their computer usage
(experience using the web, frequency of web usage) and their familiarity w
latest web 2.0 tools offered by the World Wide Web.

Pedagogical relevance is an important driving force that can both rr
students to undertake an activity and maintain their interest in it (Barr 26). S
language courses would be more likely to engage in blogging if they f
maintaining a regular target language blog could enhance their language prof
that improved blog-based performance could improve their course grade.

**Figure 3.8** Home page of a student’s blog

### Activity 3

**Language Lab Software**

During the semester-long research project, they attended weekly self
computer laboratory sessions in their tutorials to carry out computer activity the Clarity English Teaching Software program that the Faculty of Engineeri
installed in its computer based language laboratory in order to help engineering
students improve their English skills.

The extensive exercises and drills required in second language instruction
place significant demands on class time and students must wait for feedback on their
exercises until the instructor corrects them. But computer-assisted language software
holds out the promise of unlimited, immediate feedback pinpointed to the specific
grammatical errors made by the student (Nagata 69). To realize the full potential of
this technology and to ensure its pervasiveness in language learning and training, a
long-term, large-scale effort to research, develop, test and disseminate tools for
building advanced learning systems was made.

Here are some of the examples of software used during the project in the
language laboratory by the students:

<table>
<thead>
<tr>
<th>Title</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Writing</td>
<td>Intermediate to</td>
<td>Any effective business writing course nowadays requires a strong ICT element, with learners actually at the keyboard.</td>
</tr>
<tr>
<td></td>
<td>Advanced</td>
<td>Business Writing takes an interactive approach to helping course participants produce effective emails, letters, SMS and reports.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It focuses on the writing process, clarity, appropriacy, vocabulary and grammar.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presentation and practice activities include working on model business documents, listening to short talks, attempting quizzes and writing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>responses to authentic business texts such as advertisements. The topic matter is always up-to-date and relevant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Each of the ten units then leads on to extensive writing activities, where learners write a report, an email, or another business document based</td>
</tr>
<tr>
<td><strong>Active Reading</strong></td>
<td>Elementary to Advanced (Six levels)</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------------</td>
<td></td>
</tr>
<tr>
<td>The program comes at six levels from Elementary to Advanced, with ten units in each level. Each unit starts with a video introduction, moves through controlled practice and comprehension exercises and concludes with a freer activity which expands on the topic. The starting point is to present texts which are relevant, stimulating and lively. Topics range from advertisements for diets, to Internet posts on wireless gaming, to ecotourism. Text types include newspaper and magazine articles, emails, poems, recipes, stories and press releases. There’s lots of variety, and topics to appeal to every learner. The program integrates with Results Manager enabling teachers to track student progress and generate reports.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Tense Buster</strong></th>
<th>Elementary to Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tense Buster</strong> helps learners improve their understanding of key grammar areas from some/any at Elementary level to phrasal verbs at Advanced level. The program is ideal as a self-access resource for extension or remedial work, or integrated into a course of study and used for classwork or homework. Each unit begins with a presentation based on a dialogue, newspaper article or radio broadcast, where learners are encouraged to form theories about how the grammar works. Next comes a grammar rule where they confirm or correct their theories. Learners then move on to practice</td>
<td></td>
</tr>
</tbody>
</table>
### Beat the Clock

**Elementary to Advanced**

This is a game designed to boost students' vocabulary levels by giving a definition of a word, which they must type in the box. However, they don't have time to sit and think forever about the word, because they're playing against the clock. The quicker they can guess the word, the better the score.

The program is divided into six levels, from Beginner to Advanced, and tests all parts of English vocabulary: nouns, verbs, adjectives, phrasal verbs and idioms.

### Study Skills Success

**Upper Intermediate to Advanced**

The eight units of **Study Skills Success** are: Reading, Writing, Speaking, Listening, Research, Visuals, Grammar and Vocabulary. Each unit begins with presentation and input activities and progresses to practice exercises. Most units include extension activities on the integrated website.

There are over 100 activities, including:
- listening to a lecture and completing notes;
- planning and writing a discussion essay;
- going online to develop an evaluation checklist for websites.
3.4.4 Fourth Phase

Since the purpose of the study is to investigate the efficacy of technology teaching reading and writing skills to the engineering students, the research post-test to the students of the control and the experimental group. For the post-test, the researcher again administered a standard IELTS reading and writing test to both the groups (Appendix II). They took this test at the end of their semester. During the semester, the control group was taught the reading and writing skills using a traditional method only, but the experimental group made extensive use of technology to learn the language skills.

3.4.5 Fifth Phase

In this phase of the study, the mean scores of the students in the pre-post test were compared in order to explore whether there is an improvement in the reading and writing skills of the participants. Then, the mean scores of the control group and the experimental group were compared to discover the effectiveness of technology to improve the reading and writing skills of the participants. The purpose of comparison, the researcher used a t-test.
3.4.6 Sixth Phase

Learner factors have been gaining increasing attention, among which the importance of attitude is highlighted among various learners’ affective variables. “...the crucial variables concerning its effectiveness may be those associated with cognition and attitudes toward language study” and “attitudinal variables must be examined” (Stevens 31). So, in the last phase of the current study, the subjects of the experimental group were asked to appear in an interview with the researcher and to fill in an anonymous questionnaire. The questionnaire contained 28 statements with an idea to collect data to determine student attitudes toward the use of technology in language laboratory. In the 5-item Likert scale questionnaire (Appendix IV), 1 stood for ‘no response’ and 5 indicated ‘strongly agree’. These statements elicited information about students’ perceptions in three categories: a) attitude towards TELL, b) Perceptions Concerning Effect on Learning and on level of Interest, c) attitude towards TELL activities performed in the language lab.

This step also recalls the fifth principle of Warschauer and Whittaker (371): Soliciting student feedback on the CALL activities that have been implemented. It was in this context that a classroom-based research project was initiated, a survey instrument was developed and administered and data was collected.

The writer analyzed the questionnaire through the following steps:

(a) Grading the Items of the Questionnaire.
(b) Determining the Grade Score.
(c) Tabulating the Data of Questionnaire.
(d) Finding the Mean.

The formula used for computing the mean is as follows:

\[
M = \frac{\sum x}{N}
\]

Where, 
\[
M = \text{the mean}
\]
\[
\sum x = \text{the sum of the item score, and}
\]
\[
N = \text{the number of the students}
\]
3.5 THE DESIGN OF THE STUDY

Much contemporary social research is devoted to examining whether a program, treatment, or manipulation causes some outcome or result. For example, a researcher might wish to know whether a new educational program causes subsequent achievement score gains, whether a special work release program for prisoners causes lower recidivism rates, whether a novel drug causes a reduction in symptoms, and so on. Cook and Campbell argue that three conditions must be met before one can infer that such a cause-effect relation exists:

1. **Covariation.** Changes in the presumed cause must be related to changes in the presumed effect. Thus, if we introduce, remove, or change the level of a treatment or program, we should observe some change in the outcome measures.

2. **Temporal Precedence.** The presumed cause must occur prior to the presumed effect.

3. **No Plausible Alternative Explanations.** The presumed cause must be the only reasonable explanation for changes in the outcome measures. If there are other factors which could be responsible for changes in the outcome measures we cannot be confident that the presumed cause-effect relationship is correct. (qtd. in Trochim 1).

3.5.1 Experimental Research Design

**Experimental Research** - An attempt by the researcher to maintain control over all factors that may affect the result of an experiment. In doing this, the researcher attempts to determine or predict what may occur. The aim of the experimental research is to investigate the possible cause-and-effect relationship by manipulating one independent variable to influence the other variable(s) in the experimental group, and by controlling the other relevant variables, and measuring the effects of the manipulation by some statistical means. By manipulating the independent variable, the researcher can see if the treatment makes a difference on the subjects.

**Experimental Design** – It is a blueprint of the procedure that enables the researcher to test his hypothesis by reaching valid conclusions about relationships between independent and dependent variables. It refers to the conceptual framework within which the experiment is conducted.
Steps involved in conducting an experimental study

- Identify and define the problem.
- Formulate hypotheses and deduce their consequences.
- Construct an experimental design that represents all the elements, conditions, and relations of the consequences.

1. Select sample of subjects.
2. Group or pair subjects.
3. Identify and control non experimental factors.
4. Select or construct, and validate instruments to measure outcomes.
5. Conduct pilot study.
6. Determine place, time and duration of the experiment.
   - Conduct the experiment.
   - Compile raw data and reduce to usable form.
   - Apply an appropriate test of significance.

Experimental control attempts to predict events that will occur in the experimental setting by neutralizing the effects of other factors.

Methods of Experimental Control

**Pre-Test** - The pre-test, or measurement before the experiment begins, can aid control for differential selection by determining the presence or knowledge of the experimental variable before the experiment begins. It can aid control of experimental mortality because the subjects can be removed from the entire comparison by removing their pre-tests.

However, pre-tests cause problems by their effect on the second measurement and by causing generalizability problems to a population not pre-tested and those with no experimental arrangements.

**Control Group** - The use of a matched or similar group which is not exposed to the experimental variable can help reduce the effect of History, Maturation, Instrumentation and Interaction of Factors. The control group is exposed to all conditions of the experiment except the experimental variable.

**Randomization** - Use of random selection procedures for subjects can aid in control of Statistical Regression, Differential Selection, and the Interaction of Factors. It greatly increases generalizability by helping make the groups representative of the populations.
Additional Groups - The effects of Pre-tests and Experimental Procedures can be partially controlled through the use of groups which were not pre-tested or exposed to experimental arrangements. They would have to be used in conjunction with other pre-tested groups or other factors jeopardizing validity would be present.

Types

Different types of experimental research can be conducted depending on the nature of subjects and the instruments, and the way data are collected and analyzed. Answers to the following questions would determine what type of experimental design to follow:
- Will there be a control group?
- How many subjects will there be?
- Will the subjects be randomly selected?
- Will each group be pretested?
- How will the obtained data be analyzed?
- What factors may affect the internal validity?
- What factors may affect the external validity

Experimental investigations can be conducted on groups or individuals. Accordingly, the structure of the design changes as group experimental design, or single-subject experimental design.

Group Experimental Design

Group experimental designs can be of different forms. If there is only one independent variable that can be manipulated, then a single-variable design is used. If there are two or more independent variables, and at least one can be manipulated, then a factorial design should be chosen.

Single-variable designs. These studies are classified under three main headings depending on the degree of control maintained on other variables:
1. Pre-experimental designs (low degree of control)
2. True experimental designs (high degree of control)
3. Quasi-experimental designs (medium degree of control)

True experimental designs have the highest level of control among the three single-variable experimental designs because the subjects within the groups are randomly assigned for each group. When subjects are randomly assigned, there is higher control of the internal validity as well as the external validity. Moreover, there
is always a control group to compare the results of the subjects in the experime
other subjects of similar status that have not been exposed to the treatment.
True experimental research may be designed with or without a pretest on at le
groups of randomly assigned subjects. The classification of true experimental
is made accordingly:
1. The post test-only control group design
2. The pretest-post test control group design
3. Solomon four-group design

**Pretest-Posttest Control Group Design**

Perhaps the easiest way to understand how these four basic elements inte
integrated into a design structure is to give several examples. One of th
commonly used designs in social research is the two-group pre-post design wh
be depicted as:

```
N O X O
N O O
```

There are two lines in the design indicating that the study comprised gr
groups. The two groups were non-randomly assigned as indicated by the "N
groups were measured before the program or treatment occurred as indicated
first "O" in each line. Following this pre observation, the group in the fi
received a program or treatment while the group in the second line did not.
between groups were measured subsequent to the program.

**Table 3.5 Steps involved in Pretest-Posttest Control Group Design**

<table>
<thead>
<tr>
<th>STEPS</th>
<th>PROCEDURE</th>
<th>AIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Random assignment for Control Group</td>
<td>Random assignment for Experimental Group</td>
</tr>
<tr>
<td>Step 2</td>
<td>PRE-TEST</td>
<td>PRE-TEST</td>
</tr>
</tbody>
</table>
Basic Steps

Drawing upon the ideas of Van Dalen, Isaac and Michael report the seven steps in experimental research (25):

1. Survey the literature relating to the problem.
2. Identify and define the problem.
3. Formulate a problem hypothesis, deducing the consequences, and defining basic terms and variables.
   a. Identify all non-experimental variables that might contaminate the experiment, and determine how to control them.
   b. Select a research design.
   c. Select a sample of subjects to represent a given population, assign subjects to groups, and assign experimental treatments to groups.
   d. Select or construct and validate instruments to measure the outcome of the experiment.
   e. Outline procedures for collecting the data, and possibly conduct a pilot or "trial run" test to perfect the instruments or design.
   f. State the statistical or null hypothesis.
5. Conduct the experiments.
6. Reduce the raw data in a manner that will produce the best appraisal of the effect which is presumed to exist.
7. Apply an appropriate test of significance to determine the confidence one can place in the results of the study.